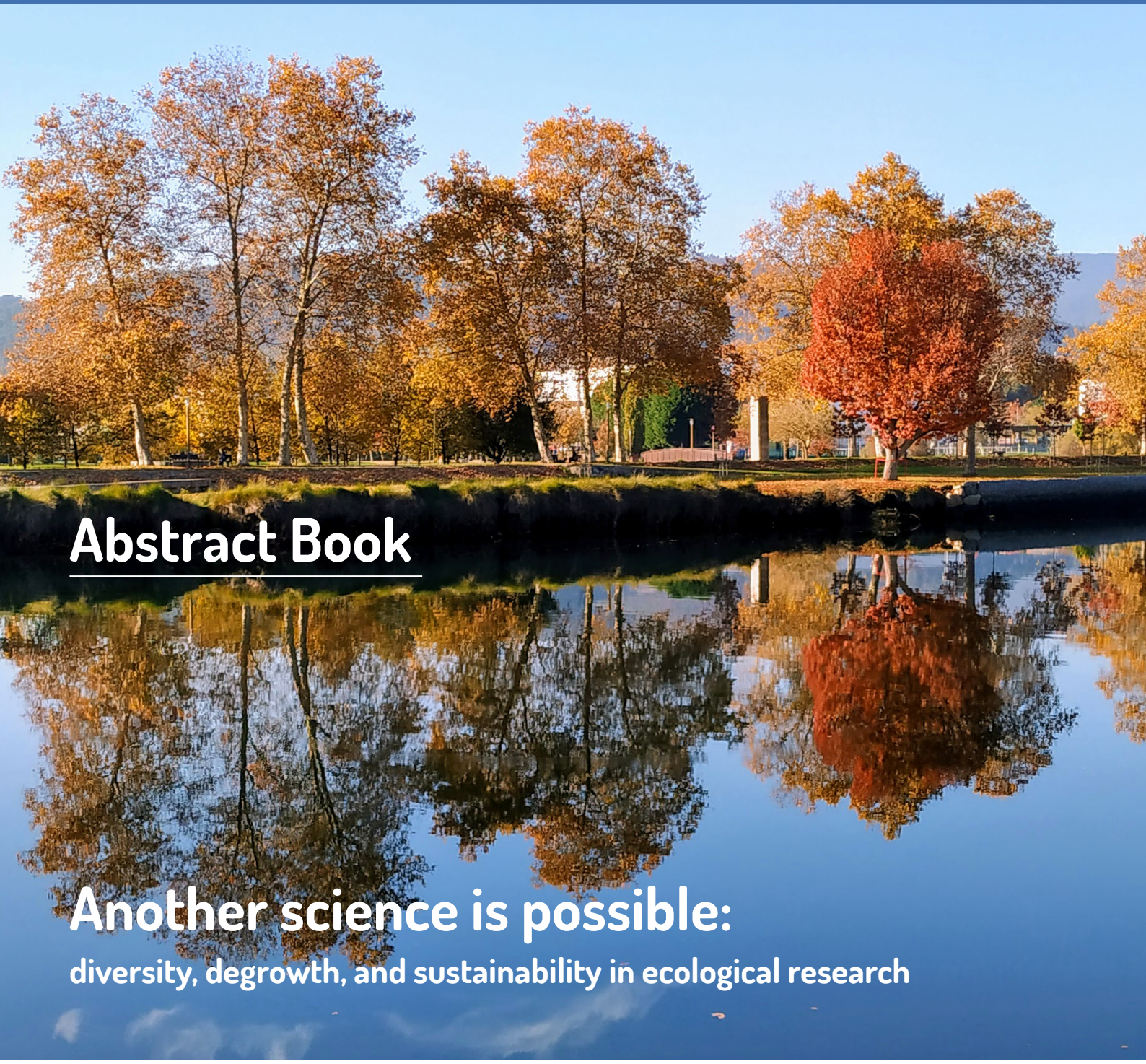
PONTEVEDRA 2025

III SIBECOL & XVII AEET MEETING

2nd - 6th June. Pontevedra, Galicia, Spain



Abstract Book

Another science is possible:

diversity, degrowth, and sustainability in ecological research

SIBECOL

aeet

ASOCIACIÓN ESPAÑOLA DE ECOLOGÍA TERRESTRE

III SIBECOL & XVII AEET Meeting 2025

2nd - 6th June 2025
Pazo da Cultura, Pontevedra, Galicia (Spain)

Edited by: Asociación Española de Ecología Terrestre (AEET)
C/ Tulipán s/n, 28399, Móstoles, Madrid, Spain

DOI: 10.7818/IIISIBECOL-XVIIAEET-Meeting.2025

28th May of 2025

Layout: Perfil Gráfico

WELCOME

We welcome all participants to the III SIBELCOL & XVII AEET Meeting, which will take place from June 2nd to 6th, 2025, at the Pazo da Cultura in Pontevedra, Galicia, Spain.

The III meeting of the Iberian Ecological Society (SIBECOL) is held jointly with the XVII National Conference of the Spanish Association of Terrestrial Ecology (AEET). This event is highly anticipated by both associations, expecting participation from over 850 people. Many of these attendees are early-career researchers who will have the opportunity to present their work, network with peers, and establish professional connections that will be valuable for their scientific careers.

The conference will take place in Pontevedra from June 2nd to 6th, 2025. Pontevedra is a city known for its commitment to urban pedestrianization and has received various awards for its sustainable mobility policies. Leveraging the unique location, the conference has adopted a theme that encourages reflection on our profession and the tasks ahead to improve our daily practices: "**Another science is possible: diversity, degrowth, and sustainability in ecological research**". This theme underscores the importance of fostering a diverse scientific community and adopting sustainable practices within ecological research. It invites participants to explore how ecological science can evolve by embracing principles of diversity and sustainability. The conference aims to inspire discussions and collaborations that will drive positive change in the field of ecology, promoting a more inclusive and sustainable future for scientific research.

Promoting societies

The Iberian Society of Ecology groups together professionals who are dedicated to the study of all areas of the science of Ecology (theoretical, terrestrial, marine, continental waters and border ecosystems). Established in July 2018, SIBECOL also includes the members of the Iberian Association of Limnology (AIL), the Spanish Association of Terrestrial Ecology (AEET), the Portuguese Society of Ecology (SPECO) and the Spanish Society of Ethology and Evolutionary Ecology (SEEEE), as well as professionals in marine ecology.

The Spanish Association of Terrestrial Ecology (AEET) is a society founded in 1989, at the dawn of scientific production in ecology in Spain. Its field of work is ecology *sensu lato*. Although the association originally focused on terrestrial ecosystems, it currently brings together scientists from different areas of ecology and environmental study into a society with a significant critical mass that covers research of broad geographical scope and great thematic diversity. It counts with more than 1,000 members, including researchers, teachers, students, technicians, ecology professionals, and natural space managers. Our ranks include 4 *Alejandro Malaspina* National Research Awards, 7 *Rei Jaume I* Environmental Protection Awards, 3 Ramon Margalef Ecology Awards, and a BBVA Foundation Award for biodiversity conservation.

COMMITTEES

Organiser Committee:

Co-chairs: **Alexandra Rodríguez**, Misión Biolóxica de Galicia (MBG-CSIC) & **Sara Varela González**, Universidade de Vigo (UVigo) / AEET board.

- **Mar Sobral**, Universidade de Santiago de Compostela (USC).
- **Luis Sampedro**, Misión Biolóxica de Galicia (MBG-CSIC).
- **Ainhoa Magrach**, Basque Centre for Climate Change (BC3) / President of AEET.
- **Jordi Martínez Villalta**, CREAF, Universitat Autònoma de Barcelona (UAB) / AEET board.
- **Isabel Reche**, Universidad de Granada (UGR) / President of SIBECOL.
- **Isabel Ferrera**, Centro Oceanográfico de Málaga, Instituto Español de Oceanografía (COM-IEO) / Secretary of SIBECOL.
- **Núria Bonada**, Universitat de Barcelona (UB) / President of AIL.
- **Maria Amelia Martins-Louçao**, Centre for Ecology, Evolution and Environmental Changes (cE3c), Universidade de Lisboa / President of SPECO.
- **María Pilar López**, Museo Nacional de Ciencias Naturales (MNCN-CSIC) / President of SEEEE.

Local Committee:

Coordinator: **Luis Sampedro**, Misión Biolóxica de Galicia (MBG-CSIC).

- **Adrián Castro Ínsua**, Universidade de Vigo (UVigo).
- **Jorge Durán**, Misión Biolóxica de Galicia (MBG-CSIC) .
- **Sofia Galván**, Universidade de Vigo (UVigo).
- **Sara Gamboa**, Universidade de Vigo (Uvigo)
- **Margarita Lema Márquez**, Misión Biolóxica de Galicia (MBG-CSIC).
- **María Losada**, Universidade de Santiago de Compostela (USC).
- **Lucia Martín-Cacheda**, B Misión Biolóxica de Galicia (MBG-CSIC).
- **Irene Martínez Virseda**, Misión Biolóxica de Galicia (MBG-CSIC) .
- **Marta Matamala-Pagès**, Universidade de Vigo (UVigo).
- **Eduardo Méndez**, Universidade de Vigo (UVigo).
- **Adriana Oliver**, Universidade de Vigo (UVigo).
- **Iván Rey-Rodríguez**, Universidade de Vigo (UVigo).
- **Andrea Serodio**, Universidade de Vigo (UVigo).
- **Graciela Sotelo**, Universidade de Vigo (UVigo).
- **Carla Vázquez**, Misión Biolóxica de Galicia (MBG-CSIC) .
- **Carmen Vega**, Misión Biolóxica de Galicia (MBG-CSIC) .

Thecnical Secretariat:

- **Leyre Jiménez-Eguizábal**, Asociación Española de Ecología Terrestre (AEET) [info.sibecol-aeet-meeting2025@aeet.org]
- **Maribel Reviriego**, Asociación Española de Ecología Terrestre (AEET/ SIBECOL) [registration.sibecol-aeet-meeting2025@aeet.org]

Scientific Committee

Coordinator: **Mar Sobral**, Universidade de Santiago de Compostela (USC)

- **David Álvarez Fernández**, Universidad de Oviedo (UniOvi)
- **Jose Manuel Álvarez-Martínez**, Universidad de Oviedo (UniOvi)-CSIC-Princ. Asturias
- **Romina Álvarez Troncoso**, Universidade de Vigo (UVigo)
- **Pedro Anastácio**, Universidade de Évora (Uevora)
- **Salvador Arenas-Castro**, Universidad de Córdoba
- **Eneko Arrondo**, Universidad de Granada (UGR)
- **Rafael Barrientos**, Universidad Complutense de Madrid (UCM)
- **Raquel Benavides**, Universidad Politécnica de Madrid (UPM)
- **Susana Bernal**, Centre d'Estudis Avançats de Blanes (CEAB-CSIC)
- **Adrián Castro-Insua**, Universidade de Vigo (UVigo)
- **José Climent,** Instituto Nacional de Investigación y Tecnología Agraria y Alimentaria (INIA-CSIC)
- **Elena D. Concepción**, Museo Nacional de Ciencias Naturales (MNCN-CSIC)
- **Adolfo Cordero**, Universidade de Vigo (UVigo)
- **Francesco de Bello**, Centro de Investigaciones sobre Desertificación (CIDE-CSIC)
- **Eduardo de la Peña**, Instituto de Hortofruticultura Subtropical y Mediterránea "La Mayora" (IHSM-CSIC)
- **Lea del Nascimiento**, Universidad de La Laguna (ULL)
- **Jorge Durán**, Misión Biolóxica de Galicia (MBG-CSIC)
- **Guillermo Fandos**, Universidad Complutense de Madrid (UCM)
- **Verónica Ferreira**, Universidade de Coimbra (UC)
- **Isabel Ferrera**, Instituto Español de Oceanografía (COM-IEO)
- **Andrea Galmán**, Montana State University (MSU)
- **Sara Gamboa**, Universidade de Vigo (UVigo)
- **Graciela Gil Romera**, Instituto Pirenaico de Ecología (IPE-CSIC)
- **Teresa Gimeno**, Centre de Recerca Ecològica i Aplicacions Forestals (CREAF-UAB)
- **María Gómez Brandón**, Universidade de Vigo (UVigo)
- **Luis González**, Universidade de Vigo (UVigo)
- **Eva Graciá Martínez**, Universidad Miguel Hernández (UMH)
- **Rubén Heleno**, Universidade de Coimbra (UC)
- **Laura Hernández Mateo**, ICIFOR-INIA, CSIC
- **Paola Laiolo**, Instituto Mixto de Investigación en Biodiversidad (IMIB-CSIC-UniOvi)
- **Carlos Lara**, Instituto de Investigación en Cambio Global (IICG), Universidad Rey Juan Carlos (URJC)
- **Margarita Lema**, Misión Biolóxica de Galicia (MBG-CSIC)
- **Martí March Salas**, Goethe-Universität Frankfurt
- **Irene Mendoza**, Estación Biológica de Doñana (EBD-CSIC)
- **Daniel Montesinos**, James Cook University
- **Dani Montoya**, Basque Centre for Climate Change (BC3)
- **Teresa Morán López**, Instituto Mixto de Investigación en Biodiversidad (IMIB-CSIC-UniOvi)
- **Alejandra Morán-Ordóñez**, University of Bern (UNIBE)
- **Beatriz Mouriño**, Universidade de Vigo (UVigo)
- **Isabel Muñoz**, Universitat de Barcelona (UB)
- **Sandra Nogué**, Centre de Recerca Ecològica i Aplicacions Forestals (CREAF-UAB)
- **Alice Nunes**, Universidade de Lisboa
- **Adriana Oliver**, Universidade de Vigo (UVigo)
- **Irene Pérez Ibarra**, Universidad de Zaragoza (UNIZAR)
- **Javier Puy**, Estación Biológica de Doñana (EBD-CSIC)
- **Henrique Queiroga**, Universidade de Aveiro (UA)
- **Celestino Quintela-Sabarís**, Universidade de Vigo (UVigo)
- **Rodrigo R. Granjel**, Basque Center for Climate Change (BC3)
- **Adrián Regos**, Misión Biolóxica de Galicia (MBG-CSIC)
- **Iván Rey Rodríguez**, Universidade de Vigo (UVigo)
- **Pablo Rodríguez Lozano**, Universitat de les Illes Balears (UIB)
- **David S. Pescador,** Universidad Complutense de Madrid (UCM)
- **Ana Sanz Aguilar**, Universitat de les Illes Balears (UIB)
- **Esther Sebastián-González**, Universidad de Alicante (UA)
- **Netfali Sillero,** Universidade do Porto (UP)
- **Cristina Sobrino**, Universidade de Vigo (UVigo)
- **Anna Traveset**, Instituto Mediterráneo de Estudios Avanzados (IMEDEA-CSIC-UIB)
- **Carla Vázquez-González**, Misión Biolóxica de Galicia (MBG-CSIC)
- **Guillermo Velo-Antón**, Universidade de Vigo (UVigo)
- **Montse Vilá**, Estación Biológica de Doñana (EBD-CSIC)
- **Jordi Voltas**, Universitat de Lleida (UDL)

TABLE OF CONTENTS

III SIBECOL & XVIIAEET Meeting at a glance

MONDAY 2nd June 2025										
	Auditorio	Salón de actos	Balconada	Cova dos libros	Restaurante	Seminario 1	Seminario 2	Seminario 3	Seminario 7	Seminario 6
10:00-12:00		Workshop 4		Workshop 5	Workshop 9	Workshop 1	Workshop 6	Workshop 7	Workshop 8	
12:00-14:00	Workshop 10									Workshop 3
14:00-15:00	ECRs Scientific Speed Dating									
15:30-16:30	OPENING CEREMONY									
16:30-16:40	SURPRISE TALK 1*									
16:40-17:50	Plenary talks: **Elena Ojea & Mario Pansera**									
	BREAK									
18:00-19:30	TSD-4	TSB-6	TSC-3	TSB-8	TSB-5	TSA-2	TSE-12	TSB-1	TSE-1	TSC-4
	BREAK									
19:40-20:20	Plenary talk: **Carlos M. Herrera**									
20:20-22:00	WELCOME COCKTAIL									

TUESDAY 3rd June 2025										
	Auditorio	Salón de actos	Balconada	Cova dos libros	Restaurante	Seminario 1	Seminario 2	Seminario 3	Seminario 7	Seminario 6
9:00-9:10	SURPRISE TALK 2*									
9:10-10:20	Plenary talks: **Carlos Pérez Carmona & Andrea Sánchez Messeguer**									
10:20-11:00	COFFE BREAK									
11:00-12:30	GSE	GSB	GSF	GSD	GSC	TSA-2	TSE-12	TSB-1	TSE-1	TSD-4
	BREAK									
12:45-14:15	GSE	GSB	TSE-1	GSA	TSF-2	TSB-11	TSB-10	TSB-1	TSD-2	TSC-5
14:15-15:30	LUNCH									
15:30-16:30	AEET GENERAL ASSEMBLY									
16:30-16:40	SURPRISE TALK 3*									
16:40-17:50	Plenary talks: **Silvia Matesanz & Sara Palacio**									
18:00-19:30	DISCUSSION POSTER CORNER									

WEDNESDAY 4th June 2025										
	Auditorio	Salón de actos	Balconada	Cova dos libros	Restaurante	Seminario 1	Seminario 2	Seminario 3	Seminario 7	Seminario 6
9:00-9:10	SURPRISE TALK 4*									
9:10-10:20	Plenary talks: **Beatriz Mouriño & Rafael Marcé**									
10:20-11:00	COFFE BREAK									
11:00-12:30	GSE	GSB	GSF	GSD	GSC	TSB-4	TSF-1	TSB-9	TSE-8	TSE-2
	BREAK									
12:45-14:15	GSE	GSB	TSB-2	GSA	TSB-3	TSB-4	TSD-1	TSB-9	TSB-15	TSE-9
14:15-15:30	LUNCH									
15:30-16:30	SIBECOL GENERAL ASSEMBLY									
16:30-16:40	SURPRISE TALK 5*									
16:40-17:50	Plenary talks: **Silvia Castro & Bernardo Quintella**									
18:00-19:30	DISCUSSION POSTER CORNER									

THURSDAY 5th June 2025										
	Auditorio	Salón de actos	Balconada	Cova dos libros	Restaurante	Seminario 1	Seminario 2	Seminario 3	Seminario 7	Seminario 6
9:00-9:10	SURPRISE TALK 6*									
9:10-10:20	Plenary talks: **Cristina Richards & Iván Gómez Mestre**									
10:20-11:00	COFFE BREAK									
11:00-12:30	GSE	GSB	TSE-4	GSA	GSC	TSD-3	TSE-7	TSF-3	TSB-12	TSE-10
	BREAK									
12:45-14:15	GSE	GSB	TSE-4	TSA-1	TSC-1	TSD-3	TSE-7	TSF-4	TSB-7	TSE-5
14:15-15:30	LUNCH									
15:30-17:00	TSE-11	TSB-13	TSE-3	TSA-1	TSC-2	TSB-7	TSE-6	TSB-16	TSB-14	TSC-1
17:00-18:30	DISCUSSION POSTER CORNER									
	BREAK									
18:45-19:30	CLOSING CEREMONY									
19:30-21:00	FREE TIME									
21:00	GET TOGETHER CLOSURE									

FRIDAY 6th June 2025	
9:00-18:00	TECHNICAL FIELD TRIPS

PLENARY TALKS

Elena Ojea

Monday 2, 16:40-17:50. Room: Auditorio

Oportunius Research Professor at the Future Oceans Lab, CIM-University of Vigo (Spain).

"Advancing adaptation to climate change in marine social-ecological systems"

Oceans are warming faster than terrestrial systems due to climate change, compromising marine life and dependent human livelihoods across the globe. We know that ecological impacts are closely intertwined with social ones due to the clomplex and interactive nature of social-ecological systems, such as fisheries or marine protected areas. However, little is know about how such systems can adapt to climate change impacts, confering resilience to the system and avoiding maladaptation outcomes. This presentation addresses how climate change is impacting key marine systems such as global fisheries, highlighting the equity and climate justice questions that arise when looking at the distribution of impact burden. Then it introduces a framework to test adaptation and transformation to climate change impacts that is tested in a series of case studies across regions. The aim is to illustrate the range of responses that individuals perform when confronting different impact levels, and what drives such responses. From coping responses that maintain the system status to adapting and transforming responses that change the structure and dynamics of the systems, we discuss the implications of response pathways. General patterns arise from the cross case study comparisons that allows to derive a general understanding of what drives adaptation and transformation changes in marine systems. Final remarks discuss how to better prepare marine systems to face climate change.

Mario Pansera

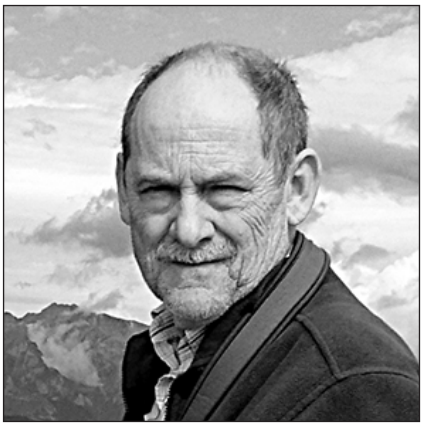
Monday 2, 16:40-17:50. Room: Auditorio

Oportunius Research Professor affiliated to the University of Vigo and affiliated Researcher at theAutonoma University of Barcelona (UAB) .

"What stands between us and a post-growth science and technology era?"

In an era defined by ecological collapse, deepening inequalities, and persistent techno-optimism, the idea of infinite economic growth has become increasingly untenable. In his keynote, *What Stands Between Us and a Post-Growth Science and Technology Era?*, Mario Pansera challenges the mainstream belief that science is neutral and technological innovation alone can solve our most pressing global problems. Drawing on his research in post-growth innovation and responsible research practices, Pansera argues that science is deeply embedded in political and economic structures that prioritize growth over sustainability and equity. He critiques the dominant narrative that positions technological fixes as panaceas for crises like climate change, insisting instead that these crises are rooted in social and political dynamics. Thus, any meaningful response must also be social and political. Pansera calls for a radical rethinking of how we do science and for whom, advocating for a post-growth approach that embraces democratic, inclusive, and context-sensitive forms of knowledge production. Only by questioning the values and power structures that shape science and technology can we begin to imagine—and build—a more just and sustainable future.

PLENARY TALKS



Carlos M. Herrera Maliani

Monday 2, 19:40-20:20. Room: Auditorio

Emeritus Professor of Research at the Doñana Biological Station (EBD-CSIC).

¨Subindividual variation, epigenetics and the melting of individuality in plants"

Elucidating the causes and mechanisms involved in natural variation has historically provided a guiding thread in ecological science, and ecology has diversified into subdisciplines associated with the different, nested spatial scales at which variation occurs. The scale of variation least frequently investigated is the one which takes place within individual plants (= "subindividual variation"). Plant construction is based on the reiteration of homologous structures (e.g., leaves, flowers) which are not identical. Organ trait variance within plants often exceeds variance among individuals and subindividual variation has manifold ecological implications in terms of use of limiting resources (water, light, nitrogen), tolerance to environmental fluctuations, interactions with animals (pollinators, herbivores), and breadth of individual niches. While considerable information has accumulated on the extent and correlates of subindividual variation, a sufficiently general conceptual and mechanistic framework has been not yet agreed upon. The recent epigenetic mosaicism hypothesis postulates that the concerted action of transient, metastable and stable epigenetic differences among modules of the same plant can ultimately account for all forms of subindividual variation in plants. Epigenetics offers a mechanistic framework for transforming information on subindividual variation (recognition, description, measurement) into knowledge (mechanisms, hypotheses, predictions). The three major epigenetic explanatory layers, along with the respective mechanisms involved, will be introduced and illustrated with empirical examples. Particular emphasis will be placed on the ecological significance of random epimutations arising from the regular 'epigenetic clock' operating in plants. Taken together, epigenetic mosaicism creates dynamic, transient epigenetic individualities nested within genetic individuals.

PLENARY TALKS

Carlos Pérez Carmona

Tuesday 3, 9:10-10:20. Room: Auditorio

Professor of Functional Ecology, University of Tartu.

"Towards a unified trait space: integrating above- and belowground plant functional diversity"

A multitude of traits interact to determine how plants grow, reproduce, and survive in a given environment. Different adaptive solutions in this struggle for existence have resulted in extraordinary trait diversity among vascular plants. Indeed, even standardized trait-measurement protocols, which are far from exhaustive, already encompass dozens of distinct traits. Consequently, understanding precisely which traits and trait interactions are crucial for ecological dynamics and ecosystem functioning—and under what circumstances—is challenging. A powerful approach to address this complexity is to exploit strong patterns of trait–trait coordination and trade-offs, reducing the dimensionality of trait variation into fewer independent functional dimensions.

In this talk, I will present our recent efforts to combine above- and belowground plant traits into a single unified plant functional space. These analyses have shown that, at a global scale, plants' aboveground traits provide little information about their fine-root economic strategies; notably, similar aboveground strategies can coincide with vastly different fine-root characteristics, and vice versa. Interestingly, these analyses also demonstrate a robust global coupling between plant size above- and belowground, indicating strong consistency in resource allocation patterns across plant organs.

Establishing this unified trait space provides a common framework for comparing species and communities, enabling a deeper exploration of how global environmental changes affect ecosystem functioning. Ongoing developments in methodological approaches to quantify functional structure—the way species occupy the functional space—and international initiatives expanding global trait coverage promise significant advances in ecological understanding.

Andrea Sánchez Messeguer

Tuesday 3, 9:10-10:20. Room: Auditorio

Researcher at the Real Jardín Botánico (RJB-CSIC).

"Deep-time paleoclimate legacies on biodiversity: from biomes to genetic-level patterns"

Over the past ~100 million years, the Earth has undergone a long-term global cooling trend, punctuated by episodes of warming and abrupt temperature declines, that transformed the planet from a greenhouse to an icehouse state.

These ancient environmental changes profoundly influenced the evolutionary trajectories of life. This presentation explores how ancient long-term environmental changes shaped current biodiversity patterns across genetic, species, and spatial scales. Using a cross-taxonomic perspective, I investigate the evolutionary responses of tetrapods and plants to Cenozoic climate fluctuations, integrating phylogenies of thousands of species, fossil records, and cutting-edge macroevolutionary models. I will present three case studies in which I explore the role of climate in shaping: (1) the origin of Neotropical diversity; (2) the emergence of the Latitudinal Diversity Gradient; and (3) the spatial and temporal distribution of ancient whole-genome duplications through angiosperm history. Together, these studies reveal how deep-time climate dynamics have structured global biodiversity through a combination of ecological filtering, neutral processes, and intrinsic evolutionary mechanisms. I finally highlight how integrating phylogenetic, paleontological, and genomic data provides a richer understanding of the forces that have shaped—and continue to shape—life on Earth.

PLENARY TALKS

Silvia Matesanz

Tuesday 3, 16:40-17:50. Room: Auditorio

University Professor and Academic Secretary of the Global Change Research Institute (IICG), Rey Juan Carlos University (URJC) .

"Phenotypic plasticity and adaptive evolution in Mediterranean gypsum endemics: insights into climate change response"

Climate change is a major threat to plant populations, especially in the Mediterranean. For gypsophiles—species restricted to gypsum soils—migration is a limited response due to specific edaphic needs, low dispersal, and fragmented distributions. Consequently, *in situ* processes like adaptive evolution and phenotypic plasticity are essential for their persistence. Future adaptive responses to climate change depend not only on historical evolutionary dynamics but also on the strength of selection and the evolutionary potential of functional traits and their plasticity. Our research investigates: i) the evolutionary potential of key functional traits and their plasticity; ii) whether past selection has shaped population phenotypes and plasticity patterns; and iii) the ability of gypsophiles to express adaptive transgenerational plasticity to drought. Using a quantitative genetics approach, our research shows that gypsophiles exhibit adaptive phenotypic plasticity to drought, sometimes aligned with selection patterns. High genetic variation for plasticity within populations supports their capacity to further evolve adaptive plasticity in response to climate change. This plasticity may have contributed to maintaining high genetic variation, enabling adaptation to contrasting climatic conditions. Populations of several Iberian gypsophiles display similar drought responses, likely shaped by natural selection in heterogeneous environments, and suggesting independent evolution of functional traits and their plasticity. Furthermore, gypsophiles express adaptive transgenerational plasticity to drought, though its extent varies among species. Our findings emphasize that, together, phenotypic plasticity and adaptive evolution (both past and future) play a key role in shaping population responses to changing conditions, particularly in stressful and spatially constrained habitats like gypsum outcrops.

Sara Palacio

Tuesday 3, 16:40-17:50. Room: Auditorio

Tenured scientist at the Instituto Pirenaico de Ecología, Spanish Research Council (IPE-CSIC).

"Plant life in extreme environments: how extreme environments can help advance ecological theory"

Extreme environments pose a significant challenge to the survival of most organisms. While the majority of living biomass is concentrated in relatively benign habitats, extreme environments account for a substantial proportion of the Earth's surface. Arid regions cover approximately one-third of the land coverage, and polar regions comprise around 20% of the oceanic expanse. Even within seemingly benign environments, microenvironments can create extreme local conditions (e.g., salt marshes, geothermal vents, cliffs, urban heat islands). Thus, planetary conditions are more extreme than commonly assumed. This situation is exacerbated by global change, as climate shifts and habitat destruction intensify the harshness of many regions. Today, extreme environments are more severe than ever before.

In this context, identifying the diversity that colonizes these environments and the evolutionary mechanisms developed to survive under such conditions has become an urgent challenge. These environments host highly specialized organisms that constitute a unique and often narrowly distributed biodiversity, rendering them particularly vulnerable. This diversity encompasses not only singular taxa but also unique metabolic, physiological, anatomical, and ecological adaptations. Understanding these mechanisms is essential not only for conserving this invaluable biodiversity but also as a source of technological advances and solutions to some of the most pressing environmental challenges.

PLENARY TALKS

Beatriz Mouriño

Wednesday 4, 9:10-10:20. Room: Auditorio

Researcher at the Biological Oceanography group of the CIM-UVigo and Professor at the University of Vigo.

"Tiny but mighty: The challenge of powering life in the ocean as microscopic algae"

Photosynthetic organisms such as land plants, algae, and bacteria form the foundation of food webs by producing organic matter while regulating atmospheric CO2. This presentation explores the challenges phytoplankton — responsible for nearly half of global photosynthesis — face in the ocean to power life. Unlike terrestrial plants, phytoplankton live in water, where higher density and viscosity slow physical processes and tightly couple them with biological variability. Their rapid biomass doubling times (within days) make them sensitive to short-term hydrodynamic fluctuations. Moreover, while light is available near the surface, nutrients often lie below the pycnocline, a barrier that limits upward transport. Turbulence can enhance nutrient delivery but may also displace cells into deeper, darker waters. Ramón Margalef's 1978 mandala hypothesized that turbulence and nutrient availability control microphytoplankton succession: high turbulence and nutrient favor large diatoms, while stratified, nutrient-poor conditions support motile or efficient nutrient users like dinoflagellates and coccolithophores. However, the model originally excluded small-sized phytoplankton and relied on indirect estimates. A recent multidisciplinary dataset—from tropical, subtropical, Mediterranean, and Galician upwelling regions—has enabled the first empirical validation of Margalef's mandala. Findings confirm the central role of nutrient supply over static concentration, and show diatoms dominate across wider turbulence ranges thanks to nitrogen-fixing symbioses and thin-layer proliferation. Finally, organisms themselves can create turbulence. In 2018, bioturbulence generated by spawning fish in the Ría de Pontevedra was shown to enhance water-column mixing, with potential implications for nutrient supply and productivity—an insight that earned the 2023 Ig Nobel Prize in Physics.

Rafael Marcé

Wednesday 4, 9:10-10:20. Room: Auditorio

Research Scientist at the Centre for Advanced Studies (CEAB-CSIC), Blanes, Spain.

"A blind spot in terrestrial carbon inventories: when water matters more than land"

Abstract: Many lakes around the world, particularly those in endorheic basins in arid and semi-arid regions, are shrinking. This poses a significant risk to the sedimentary carbon sink, as organic matter that has accumulated over thousands of years could be exposed to atmospheric oxygen, making it susceptible to remobilization. However, the current IPCC Guidelines for National Greenhouse Gas Inventories primarily account for land-use and land-cover change (LULCC) transitions from land to flooded land, and from flooded land that remains flooded. As a result, the regional estimates of the impact of LULCC on net carbon fluxes overlook areas that have transitioned from flooded land to land, even though this shift has become one of the most significant LULCC processes in many basins over the past few decades. In this study, we use data from the Aral Sea, the world's largest disappearing lake, to assess the impact of incorporating this overlooked carbon flux into existing net carbon exchange models for the Aral Sea basin. Our findings highlight a critical gap in terrestrial carbon inventories, which, if addressed, could significantly refine our understanding of carbon dynamics in these regions.

PLENARY TALKS

Silvia Castro

Wednesday 4, 16:40-17:50. Room: Auditorio

Assistant Professor at the Department of Life Sciences and Centre for Functional Ecology, University of Coimbra (UC.

"PolinizAÇÃO: Advancing Pollinator Conservation through Science–Policy–Society Integration in Portugal"

Sílvia Castro, Eva Monteiro, Andreia Miraldo, Carolina Caetano, Cândida Ramos, João Loureiro

Pollinators are key components of biodiversity, essential to ecosystem functioning, agricultural productivity, and food security, yet they are experiencing widespread declines driven by habitat loss, pesticide use, invasive species, and climate change. The PolinizAÇÃO project, developed in Portugal, contributes to national and international efforts for pollinator conservation through the co-construction of a National Action Plan for the Conservation and Sustainability of Pollinators. The project integrates ecological research with participatory processes to inform public policy and territorial management. Core activities include the collection of ecological data on pollinator diversity and abundance, and the development of a national pollinator monitoring programme—an essential step towards structured, long-term biodiversity observation. This programme is being collaboratively designed, incorporating input from both researchers and practitioners, and serves as a tool for tracking population trends and supporting adaptive management. A central feature of PolinizAÇÃO is its multi-stakeholder engagement strategy, involving researchers, land managers, farmers, policymakers, NGOs, and citizens. The project fostered dialogue and co-creation through thematic and participatory workshops, gathering local knowledge, values, and perceptions, and aligning them with empirical evidence on pollinator ecology and threats. This approach enabled the identification of conservation priorities and the formulation of context-specific actions. By linking ecological knowledge with societal needs and governance mechanisms, PolinizAÇÃO provides a model for effective science–policy–society interfaces. Its participatory governance framework strengthens stakeholder ownership and fosters long-term commitment to pollinator-friendly practices and biodiversity conservation.

Bernardo Quintella

Wednesday 4, 16:40-17:50. Room: Auditorio

Assistant Researcher at MARE – Marine and Environmental Sciences Centre, University of Lisbon, Faculty of Sciences.

"Fish Migrations: An Integrated Approach"

Some fish migrate while others are resident, performing spatially restricted movements. This variability in behavior occurs among species, but also within the same population. The co-existence of distinct migratory phenotypes within populations, a phenomenon often referred to as 'partial migration', is an opportunity to examine the consequences of contrasting life history strategies among individuals and to understand the proximate and ultimate causes of migrations. Different life-history strategies associated with distinct migratory phenotypes occur in all types of migrations: for fish that migrate only in the same aquatic ecosystem, oceanodromous when movements are only performed at sea, potamodromous along rivers, and for diadromous fish that swim between the river and the sea for reproductive and feeding purposes. A truly integrative approach to studying fish migrations must be inclusive in terms of the characteristics of the fish that embrace (marine, freshwater, diadromous), and multidisciplinary in terms of the tools used -artificial tags combined with natural markers - to analyze movements at different spatial and temporal scales. A holistic approach would not be complete if it focused only on the scientific aspects of fish migrations, neglecting the importance of migratory fish as living resources, and the relevance of contributing solid information to the promotion of their sustainable exploitation. Several case studies will be presented to emphasize the importance of an integrated approach to study fish migrations: from the river to the sea, from natural to artificial markers, from fundamental to applied science.

PLENARY TALKS

Christina Richards

Thursday 5, 9:10-10:20. Room: Auditorio

Researcher at the University of South Florida & University of Tübingen.

“Shifts in ecological strategy of a global plant invader”

Japanese knotweed is a robust plant invading many habitats across North America and Europe. Originally from East Asia, it was introduced and rapidly colonized many areas becoming one of the most invasive species in the world. Knotweeds provide a compelling example of the invasive species paradox : they have colonized new habitats and become dramatic invaders with very little genetic diversity. We present the results of a range of experimental approaches that have clarified the evolutionary history of this complex, revealing its introduction history from Japan to China and beyond. We also provide evidence of evolution of increased clonality and local adaptation in the introduced range. To do so, we integrate 15 years of data across common gardens and field surveys in the native and introduced ranges. This work is the product of an ongoing research collaborative comprised of experts across three continents that investigates how genetic, epigenetic, and phenotypic variation mediate variation in performance of this species across its global distribution. We aim to integrate plant genomics and microbiome studies with assessments of eco-evolutionary feedback along latitudinal gradients in the native and introduced ranges to answer questions about the functional importance of intra- and interspecific biodiversity in the process of invasion.

Iván Gómez-Mestre

Thursday 5, 9:10-10:20. Room: Auditorio

Researcher at the Doñana Biological Station (EBD-CSIC)..

“Phenotypic responses of amphibian larvae to multiple environmental cues and their carry-over post-metamorphic effects”

Many amphibians have complex life cycles and are consequently exposed to variation in multiple factors, both in aquatic and terrestrial environments. Amphibians have the ability to respond to such environmental fluctuations by adjusting their physiology, behaviour, morphology and life histories. For instance, risk of pond drying may trigger developmental acceleration in amphibian larvae, allowing them to reach metamorphosis precociously. Such plastic responses, however, often come at a cost like reduced size at metamorphosis and depletion of their fat reserves. Moreover, environmental heterogeneity usually comes from simultaneous variation in multiple factors simultaneously, both biotic and abiotic. We are studying the plastic responses of spadefoot toad tadpoles to risk of pond drying, which is a complex combination of reduced water level, increased temperature, increased larval density and reduced food availability, and the phenotypic responses to these factors can be additive or even antagonistic. In addition, the plastic responses produced during a life stage may have consequences that carry-over to subsequent life stages, and amphibians are no exception. Small metamorphs that have experienced developmental acceleration during their larval stage reduce their survival odds, especially if they metamorphose onto a harsh environment. Current climate change, especially in Mediterranean areas, is translating not only in shorter pond hydroperiods, but also in increased temperature and drought of the terrain to which amphibian metamorphs emerge. We are consequently also studying carry-over effects of juvenile spadefoot toads, especially when they face drier and warmer environments, monitoring juvenile survival, growth, activity pattern, hormonal levels and thermal tolerance.

Session tipe codes: GS= General Session; TS= Technical Session
Presentation tipe codes: O= Oral; P= Poster

GENERAL SESSION

GSA. Enhancing Inclusivity, Ethics, and Societal Impact in Science

Tuesday, 3 (12:45-14:15) • Wednesday, 4 (12:45-14:15) • Thursday, 5 (11:00-12:30)

Room: Cova dos libros

This session will explore the imperative need for inclusivity and ethics in academia. Discussions will center around strategies to ensure diverse representation and participation (all genders, racialized people, etc.) in scientific endeavors, fostering an environment where multiple perspectives and backgrounds contribute to richer, more holistic ecological research. The session will also address ethical considerations in research practices, emphasizing transparency, a respectful work environment, and making science and knowledge accessible to everyone. Additionally, it will highlight ways in which ecological science can directly benefit society, focusing on community engagement, policy influence, and practical applications that solve real-world environmental problems.

Key Questions:

• How can we create a more inclusive and diverse scientific community?

• What ethical guidelines should be prioritized in ecological research?

Coordinators:

• **Irene Pérez Ibarra,** Universidad de Zaragoza (UNIZAR)

• **Susana Bernal,** Centre d'Estudis Avançats de Blanes (CEAB-CSIC)

GSA. Orals

[GSA-O-1]

Tuesday 3, morning (second): 12:45
Room: Cova dos libros

Blood Work: Exploring Menstruation's Impact on Natural Science Fieldwork

Gamboa, Sara[1]; Cuesta, Elena[2]; Domínguez-García, Virginia[3]; García-Muñoz, Ana[4]; Gómez Cano, Ana Rosa[5]; López-Guerrero, Paloma[6]; Menéndez, Iris[7]; Oliver, Adriana[8]; Velado-Alonso, Elena[9]; Carro-Rodríguez, Patricia María[10]; Sanz-Pérez, Dánae[11]

(1) Universidade de Vigo; (2) Ludwig-Maximillians Universitat; (3) Estación Biológica de Doñana; (4) Universidad Rey Juan Carlos; (5) Transmitting Science; (6) Mujeres con los Pies en la Tierra; (7) Museum für Naturkunde; (8) Universidade de Vigo; (9) Wageningen University; (10) Mujeres con los Pies en la Tierra; (11) Universidad Complutense de Madrid

Correspondence e-mail: [sara.gamboa@uvigo.es]

In this work, we examine the frequently ignored issue of menstruation and its impact on field research within various scientific fields including ecology, geology, biology, palaeontology, and archaeology. This research highlights the challenges faced by menstruating researchers, which are often overlooked in the planning stages of academic fieldwork. Through a survey of 429 individuals, this study delves into the logistical, social, and health challenges encountered by those who menstruate while conducting fieldwork.

The combined quantitative and qualitative survey results reveal key findings. A significant portion of the respondents, 86%, have dealt with menstruation in the field, with nearly half (48%) experiencing considerable menstrual pain during these periods. It was also commonly reported that logistical preparations for fieldwork typically overlook the need for menstrual health provisions, and 85.5% of participants pointed out that menstrual products were absent from first aid kits. Additionally, discussing menstruation, especially with male supervisors, was often described as awkward or uncomfortable, which left many without necessary support while working remotely.

These insights underscore the critical need for academic institutions to integrate menstrual health into their fieldwork planning protocols. Implementing straightforward yet impactful measures such as stocking menstrual products in first aid kits, fostering open conversations about menstrual health among all genders, revising productivity expectations that overlook disabilities, and ensuring diverse participation in planning sessions can greatly enhance inclusivity. By adopting these improvements, academic settings can offer better support, enabling every researcher, regardless of gender or physiological differences, to contribute fully and fairly to the advancement of science.

[GSA-O-2]

Tuesday 3, morning (second): 13:00
Room: Cova dos libros

Embolism "por soleá". A dialog between humans and trees about climate change through flamenco

Bruna Pérez, Paula[1]; Martínez Vilalta, Jordi[2]; Lérida Bermejo, Juan Carlos[3]; Jiménez de Cisneros Puig, Bernat[4]; Mora, Karen[5]; Muñoz Jiménez, Carmen[6]; Sánchez Sánchez, Salvador[7]; Mayr, Stefan[8]; Beikircher, Barbara[9]; Rosner, Sabine[10]; Hietz, Peter[11]

(1) CREAF, Autonomous University of Barcelona, University of Barcelona, BAU; (2) CREAF, Autonomous University of Barcelona; (3) Laboratorio de Investigación desde el Flamenco, Institut del Teatre; (4) Laboratorio de Investigación desde el Flamenco, Institut del Teatre; (5) Laboratorio de Investigación desde el Flamenco, Institut del Teatre; (6) Laboratorio de Investigación desde el Flamenco, Institut del Teatre; (7) Laboratorio de Investigación desde el Flamenco, Institut del Teatre; (8) Universität Innsbruck/University of Innsbruck; (9) Universität Innsbruck/University of Innsbruck; (10) BOKU University, Vienna; (11) BOKU University, Vienna

Correspondence e-mail: [pbp1278@gmail.com]

Introduction. Moving towards ecological coexistence requires a radical change in human subjectivities that involves abandoning our hegemonic protagonism and incorporating non-humans' realities (Haraway, Guattari, Morton).

Flamenco, from its telluric nature, contains a universal language through which we can listen to the Earth and those who inhabit it.

Climate change enhances drought, which may cause tree death through embolism formation and hydraulic failure. Embolism formation produces ultrasounds which can be recorded.

In Embolism "por soleá", a transdisciplinary group of artists, scientists, flamenco professionals and trees, explored embolism not only as scientific data but as an expression of tree's sentiments; a cry that comes from the depths of the tree that, like a flamenco moan, vindicates life.

Material and methods. Taking flamenco as a common language, dialogues between humans and trees were established. Rhythm was given by trees' embolisms, registered by means of an ultrasonic sensor and a sound analysis system. Humans accompanied them with flamenco singing and dancing in a transformative collective ritual.

Results and discussion. A form of accompaniment between species undergoing climate change was experienced and shared, and effects of drought in forests were transmitted through facts and emotions.

Flamenco showed to be a catalyst for eco-social change through the collective vindication and celebration of life in all its facets (joy, sorrow and even death) and in all its forms (beyond humans).

This project implements a co-production of knowledge through a cross-disciplinary and cross-species approach, reconfiguring research on effects of climate change from an ecocentric worldview.

[GSA-O-3]

Tuesday 3, morning (second): 13:15
Room: Cova dos libros

Art-science residencies at CREAF: lessons learned and prospects

collective, ECOTONS[1]; Broekman, Annelies[2]; Bruna, Paula[3]; de la Casa Sánchez, Javier[4]; Ciot, Laura[5]; Filella, Iolanda[6]; Galiano, Lucía[7]; Johnson, Kate[8]; Lloret, Francisco[9]; Martínez-Vilalta, Jordi[10]; Muñoz, Estefanía[11]; Serral, Ivette[12]; Vives Ingla, Maria[13]; de la Vega, Diego[14]

(1) CREAF; (2) CREAF; (3) CREAF-UAB; (4) CREAF; (5) CREAF-UAB; (6) CREAF; (7) CREAF; (8) CREAF; (9) CREAF-UAB; (10) CREAF-UAB; (11) CREAF; (12) CREAF; (13) CREAF; (14) CREAF

Correspondence e-mail: [ecotons@creaf.uab.cat]

Art-science residencies aim to generate new knowledge by connecting artists and scientists and fostering a creative and cross-fertilizing dialogue between their respective disciplines. At CREAF, we have hosted three artistic residencies between 2021 and 2023, in close collaboration with La Escocesa Art Factory in Barcelona. We used this experience to design a new art residency program launched in late 2024 with annual editions planned for 2025-2027. Based on the lessons learned, and to promote real, bidirectional dialogue and ensure mutual benefit, key improvements include the introduction of specialized personnel supervising the process. Before the start of the residency, a curator will help to design and formalize the process, ensuring a good match between the selected CREAF research group and the artist(s). Later, a facilitator will provide continued support to the artist(s), maintaining a fluid dialogue with the scientists and the institution and promoting an appropriate exhibition of the residency's process and outcomes. In this communication, we will introduce our new program and share the lessons we have learned throughout its development, many of which are relevant to art-science residencies in general. We will also open a space for reflection on the overall potential and limitations of art-science initiatives in ecology.

[GSA-O-4]

Tuesday 3, morning (second): 13:30
Room: Cova dos libros

How Ecology Is Defining Today and Building Tomorrow

Martins-Loução, Maria Amélia[1]; Oliveira, Rúben[2]

(1) Center for Ecology, Evolution and Environmental Changes; (2) Center for Ecology, Evolution and Environmental Changes

Correspondence e-mail: [maloucao@ciencias.ulisboa.pt]

Today, ecology plays a vital and increasingly acknowledged role as both a distinct scientific discipline and a bridge linking biology and sustainability. While biology explores the mechanisms of life and sustainability focuses on long-term environmental and societal resilience, ecology establishes the foundation for their integration. By examining how organisms interact with each other and their environments – now under unprecedented pressures – ecology offers a unique ability to model scenarios across temporal and spatial scales, providing crucial insights into dynamic ecosystem processes. This interdisciplinary and transdisciplinary nature places ecology at the core of emerging frameworks such as Planetary Health and One Health, underscoring that human well-being and lifestyles are inextricably connected to the broader ecological system.

Ecology must, however, be made more accessible, tangible and visible to society, establishing clear and effective communication of evidence-based findings, and placing itself at the forefront of public discourse and policy-making, beyond the academic sphere. By offering practical, science-driven solutions that balance ecological integrity with human development, these capabilities are critical for tackling complex global issues and ongoing crisis and shape robust economic, social, and public health strategies. Ecologists should lead efforts to identify sustainability challenges, assess their causes and impacts, and work collaboratively with stakeholders across disciplines to design, implement, and monitor viable solutions.

Here, we'll address how ecology is integrating and breaking into different areas of knowledge, from established fields to more creative ones, gaining ground and due recognition in the 21st century.

[GSA-O-5]

Tuesday 3, morning (second): 13:45
Room: Cova dos libros

Exploring power in Sustainability Transition Research: an overview

Alonso Rodríguez, Aitor[1]; Suárez Eiroa, Brais[2]; Alves Pereira da Cunha Ferreira, António Carlos[3]

(1) Post-growth innovation lab; (2) Post-growth innovation lab - Universidade de Vigo; (3) CITTA

Correspondence e-mail: [aitor.alonso.rodriguez@uvigo.gal]

Due to the current ecological emergency, societies today urgently need to move towards socio-ecological systems that protect the environment without leaving anyone behind. At the same time, power has been considered the 'energy to physics' (Boonstra, 2016) of social sciences, a fundamental concept for understanding social dynamics. A deep understanding of power and power relations is needed to understand how access to a more sustainable, just and resilient world. Following this line, in Sustainability Transition Research (STR) power has gained prominence. This article examines how power has been studied and conceptualised in this literature. Following a transformative paradigm, a literature review was conducted to examine how power has been conceptualised and how its research can be further developed to better capture the necessities of a just transition. This article presents a categorisation of the themes examined in their relation with power and highlights the successes and limitations of the main perspectives of power in STR. The focus on power has mainly been on the influence and capacity of actors to promote or hinder the sustainability transition, or on the structures that articulate such relationships and create limited room for action to change the status quo. However, a strategic-relational approach that links action and structure is emerging. Following this perspective, we suggest that the redistribution of power should be accompanied by mechanisms that prevent its accumulation, as well as changes in the strategic resources that lead to the accumulation of power.

[GSA-O-6]

Wednesday 4, morning (second): 12:45
Room: Cova dos libros

A network analysis of ecological restoration communities to facilitate knowledge exchange

de Llanos, Celia[1]; Baeza, Jaime[2]; Bautista, Susana[3]; Bonet, Andreu[4]; Ferri-Yáñez, Francisco[5]; Torres, Aurora[6]; Fuentes, David[7]; Cortina-Segarra, Jordi[8]

(1) University of Alicante; (2) University of Alicante; (3) University of Alicante; (4) University of Alicante; (5) University of Alicante; (6) University of Alicante; (7) University of Alicante; (8) University of Alicante

Correspondence e-mail: [celia.dellanos@ua.es]

Restoration efforts have multiplied globally in response to the global and local environmental challenges. The surge has been accompanied by a growing diversity of actors holding different perspectives and employing varied approaches to ecological restoration. However, a significant obstacle hindering effective implementation of restoration projects, both locally and regionally, is the lack of communication among these stakeholders. Addressing this issue requires a comprehensive understanding of the community of actors involved in ecological restoration and their interactions. Network analysis has emerged as a powerful tool for examining social dynamics, revealing underlying structures, and delineating the roles of different actors or nodes within the network.

In our study, we applied network analysis techniques to represent the community of actors engaged in ecological restoration in Spain, Czech Republic, Germany and Norway. Using criteria aligned with the Quadruple Helix of Innovation framework –encompassing the private sector, public sector, academia, and civil society/NGOs– we identified representatives from each sector. 40 per country, 160 in total. Subsequently, through an online survey, we characterized these actors and their interactions, resulting in a semi-quantitative four-partite network.

Then, we will leverage network and node metrics to identify opportunities for enhancing knowledge exchange among diverse stakeholders. In next steps, selected representatives from the Quadruple Helix will be engaged to provide insights and contribute to the establishment of a regional advisory panel for ecological restoration. We conclude that network analysis has potential to strengthen collaboration and inform strategic decision-making within the field.

[GSA-O-7]

Wednesday 4, morning (second): 13:00
Room: Cova dos libros

Fostering Collective Action: Social perceptions and participatory strategies to combat soil degradation in Abla (Almería)

Hernández Maqueda, Rafael[1]; Lopez-Rodriguez, María Dolores[2]; Quintas-Soriano, Cristina[3]; Castro Martínez, Antonio Jesús[4]; del Moral Torres, Fernando[5]

(1) Engloba, Universidad de Almería. La Cañada de San Urbano, 04120, Almería (España); (2) CEMyRI, Universidad de Almería, La Cañada de San Urbano, 04120, Almería, Spain.; (3) Engloba, Universidad de Almería, La Cañada de San Urbano, 04120, Almería, Spain.; (4) Engloba, Universidad de Almería, La Cañada de San Urbano, 04120, Almería, Spain.; (5) CIEMBITAL, Universidad de Almería, La Cañada de San Urbano, 04120, Almería, Spain

Correspondence e-mail: [rafahm@ual.es]

Introduction. One of the main limitations in addressing the challenge of soil degradation at the local level is the involvement of different social actors in finding solutions. Factors such as lack of knowledge, disinterest or conflict between actors from different sectors usually hinder the development of collaborative approaches to deal with soil degradation.

Material and Methods. This work presents a participatory action research (PAR) project carried out in the municipality of Abla, located in the Río Nacimiento region, in Almería, Spain. Methodologically, 24 interviews and two workshops were held with the participation of representatives of different social actors that conform the “quadruple hélix”: institutions, academics, entrepreneurs and civil society.

Results and discussion. As a result, social perceptions associated with soil health, including ecosystem services provided by soil and threats to it, were identified. In addition, an action plan to combat soil degradation was co-created, ensuring the active participation of the actors. The study highlights the main enabling/disabling factors encountered during the PAR project. Ultimately, the findings provide guidance to foster collective action in tackling soil degradation in a semi-arid region in rural Spain

[GSA-O-8]

Wednesday 4, morning (second): 13:15
Room: Cova dos libros

Contributions from the Interreg Euro-MED Natural Heritage Mission towards ecological research impact on society

Broekman, Annelies[1]; Vives-Ingla, Maria[2]

(1) CREAF; (2) CREAF

Correspondence e-mail: [a.broekman@creaf.uab.cat]

High expectations are set around ecological science to deal with pressing environmental challenges. Yet, while science can have very profound societal impacts, they are not adequately nor widely considered in conventional research processes and activities. To solve real-world problems, ecological science needs to be accompanied by a series of complementary approaches that put people, land and communities at the centre of the whole research process, from goals definition until result adoption and implementation.

For this reason, funding programmes are increasingly requiring ecological research projects to involve the stakeholders affected by the challenges addressed or responsible for implementing the results developed. To amplify their impact, funding organisms are also starting to integrate these multistakeholder research perspectives within wider networks of projects covering similar areas. However, all these networks and communities rely on trust building, which requires time, resources and adequate governance structures, conditions rarely offered by these same funding schemes.

The Natural Heritage Mission is a rare opportunity that contributes to overcome these barriers and provides a promising setting to increase the impact of ecological research for conserving and restoring nature and adapting communities to climate change in the Mediterranean. As a 7-year network of projects funded by the Interreg Euro-MED programme, the Natural Heritage Mission connects hundreds of diverse institutions over the Mediterranean, creating a comprehensive and multidisciplinary community. The Mission fosters innovation in research community governance and project cross-fertilisation, transfers results into new contexts, and joins forces to reach wider audiences and high-level political institutions.

[GSA-O-9]

Wednesday 4, morning (second): 13:30
Room: Cova dos libros

Lessons learned from 40 years of educational experiences and social change on environmental and ecological challenges

Benayas, Javier[1]

(1) Universidad Autónoma de Madrid

Correspondence e-mail: [javier.benayas@uam.es]

Introduction: Most of the environmental problems we face today have their origin in social behaviour, for this reason solutions must be based on applying strategies of educational and social change. Since the first Environmental Education Conferences were held in Spain in 1982 (Sitges, Barcelona), many successful initiatives and experiences have been carried out.

Methodology: Since 1981, my professional career has been closely associated, both in research and teaching, with the application of various communication and education strategies on the main environmental problems affecting today's society. These more academic approaches have been reinforced by their direct application in various management scenarios arising from the various positions of responsibility that I have assumed as Vice-Chancellor of the Autonomous University of Madrid or as Deputy Mayor of a medium-sized municipality (10,000 inhabitants) for more than 16 years. All this accumulated experience has allowed me to identify some effective proposals for action that are interesting to present.

Results: Some of the lessons learned are based on identifying motivation as a trigger for learning, the involvement of all senses in communication processes, the diversification of educational intervention strategies, the integrating power of the landscape, the revealing role of the educator, the incorporation of educational interventions in the problem management process or the involvement in experiential and participatory activities.

[GSA-O-10]

Wednesday 4, morning (second): 13:45
Room: Cova dos libros

Non-native and invasive plant species in urban streams of Coimbra: effects of urbanization and potential impacts for One Health

Dias, Marcos[1]; Marchante, Elizabete[2]; Calapez, Ana Raquel[3]; Feio, Maria João[4]

(1) MARE - Marine and Environmental Sciences Centre and ARNET - Aquatic Research Network; (2) Centre for Functional Ecology and Associate Laboratory TERRA; (3) MARE - Marine and Environmental Sciences Centre and ARNET - Aquatic Research Network; (4) MARE - Marine and Environmental Sciences Centre and ARNET - Aquatic Research Network

Correspondence e-mail: [marcos.dias@uc.pt]

Alien and invasive plants (AIPs) threaten global biodiversity and ecosystem services, especially in urban areas, where socio-ecological factors promote plant introductions. Here, in the context of project OneAquaHealth, we aimed to understand how urbanization influences the emergence and prevalence of AIPs in urban stream ecosystems and their effects on ecosystem services and human health.

To study this, the AIPs in the riparian vegetation of 20 urban stream ecosystems in Coimbra, Portugal, and covering an urbanization gradient, were characterized (richness and relative abundance) over 100 meters stretches. We identified 58 non-native species, representing 30% of the flora and covering 8 to 59% of the riparian corridor. Among these, 18 species were listed as invasive under the National List of Invasive Species (LNEI), and 6 species were identified as potential future inclusions in this list, due to their invasive behavior. The most prevalent AIPs were Oxalis pes-caprae, Tradescantia fluminensis, and Arundo donax, found in 18, 16, and 15 streams, respectively, with average riparian coverage up to 11.01%. Several AIPs found can act as vectors for plant pathogens, reduce carbon sequestration (potentially exacerbating cardiovascular and pulmonary problems), cause allergic reactions, skin damage, and even toxicity. Furthermore, by disrupting ecosystem services, AIPs generate countless socioeconomic, cultural, and health impacts.

This study highlights the urgent need to understand the patterns and pathways of AIP invasions in urban freshwater ecosystems. Improved knowledge is essential to balancing urban development with biodiversity conservation and safeguarding public health.

[GSA-O-11]

Wednesday 4, morning (second): 14:00
Room: Cova dos libros

Learning activities for Vet students: livestock grazing for wildfire prevention

Jofre Rodriguez, Berta[1]; Adelantado Portolés, Lourdes[2]; Gómez Barreras, Marta[3]; Berges Masegosa, Nerea[4]; Barrantes Díaz, Olivia[5]

(1) Facultad de Veterinaria. Universidad de Zaragoza; (2) Facultad de Veterinaria. Universidad de Zaragoza; (3) Facultad de Veterinaria. Universidad de Zaragoza; (4) Facultad de Veterinaria. Universidad de Zaragoza; (5) Facultad de Veterinaria. Universidad de Zaragoza

Correspondence e-mail: [849338@unizar.es]

Introduction. Knowledge on the potential negative environmental impacts, but also positive ecosystems services of livestock farming agroecosystems, are needed for future Veterinarians in order to appropriately assess and manage this food production sector. Particularly, it is known that livestock grazing can reduce wildfire risk, and there are current Programmes which are operating in this direction in several Spanish Autonomous Communities. Materials and Methods. Among 147 Vet students in groups of around 12, a group of 4 students was offered to work with the topic 'livestock grazing and control of the risk of wildfires' within a seminar where students learnt how to: prepare their written essay and present results to student colleagues and tutor; search high-quality bibliography in the Web of Science. They were also encouraged to perform interviews with several stakeholders to provide new knowledge. Results and Discussion. This team of students designed a questionnaire with 11 questions including information on gender, age, residence and profession (farmers, rural agents, teachers, firefighters, students…) and opinion questions to gather the degree of knowledge of society on this issue. They conducted 79 enquiries by means of Google forms and identified a current pilot project with the 'Albera' breed cow, financed by the Department of Climate Action of the 'Generalitat de Cataluña', whose objective is to control the fuel biomass to reduce the risk of fire in some mountains of Catalonia. Conclusion. The students demonstrated they had significantly improved their knowledge on one of the main ecosystem service provided by extensive livestock farming systems.

[GSA-O-12]

Thursday 5, morning (first): 11:00
Room: Cova dos libros

Make visible the invisible obstacles: 10 steps to raise awareness and promote actions towards gender equity through scientific societies.and droughts as a fundamental component in river ecology

Bernal, Susana[1]; Sánchez Montoya, María Mar[2]; Rodríguez-Lozano, Pablo[3]; Poblador, Sílvia[4]; Bartrons, Mireia[5]; Lecina-Diaz, Judit[6]; Hernández del Amo, Elena[7]; Anton-Pardo, María[8]; Catalán, Núria[9]; Pastor, Ada[10]; Genua-Olmedo, Ana[11]; Cañedo-Argüelles, Miguel[12]; Freixa, Anna[13]

(1) Centro Estudios Avanzados Blanes, CEAB-CSIC; (2) Complutense University of Madrid; (3) Universidad Autónoma de Madrid; (4) Universitat de Barcelona; (5) Universitat de Vic; (6) Technical University of Munich; (7) Universitat Autònoma de Barcelona; (8) Institut Cavanilles de Biodiversitat i Biologia Evolutiva, Universitat de València; (9) Centro Estudios Avanzados Blanes, CEAB-CSIC; (10) University of Girona; (11) Tragsatec; (12) Institute of Environmental Assessment and Water Research, IDAEA-CSIC; (13) Catalan Institute for Water Research, ICRA-CERCA

Correspondence e-mail: [sbernal@ceab.csic.es]

The gender gap in Science, Technology, Engineering, and Mathematics (STEM) disciplines remains a persistent and widespread global issue. Scientific societies can play a pivotal role in addressing this gap in academia by driving transformative change towards a more gender-inclusive environment and fostering gender equity initiatives. However, the positive impact that scientific societies can have on reducing gender biases is poorly assessed. The main objective of this study is to encourage scientific societies to take proactive measures to raise awareness and implement strategies that promote gender equity within academia.

First, we analyzed gender gaps on executive boards and the presence of gender groups, focusing on freshwater scientific societies. These two elements respectively represent top-down and bottom-up organizational tools for promoting transformative change. Second, we share insights from over a decade of experience addressing gender biases as members of the Gender and Science group within the Iberian Association of Limnology (AIL).

Drawing from this experience, as well as the work of other gender and inclusivity groups, we propose 10 actionable steps supported by specific examples to empower scientific societies and their members to make meaningful progress in advancing gender equity. Finally, we discuss key obstacles to implement these actions and explore future opportunities to foster gender equity within scientific societies and the broader academic community.

[GSA-O-13]

Thursday 5, morning (first): 11:15
Room: Cova dos libros

Well-being of Early- career researchers in ecology

Hurtado, María[1]; Martínez-Núñez, Carlos[2]

(1) Universidad de Cádiz; (2) Estación Biológica de Doñana (CSIC-EBD)

Correspondence e-mail: [maria.hurtado.m.r@gmail.com]

Recent studies have highlighted concerns about the mental health and well-being of early-career researchers in academia. In December 2023, the Early Career Researchers (ECR) Commission of the Spanish Association of Terrestrial Ecology (AEET) conducted a survey to assess the well-being of predoctoral researchers in ecology-related fields.

The survey garnered 99 responses from researchers across Spain, offering preliminary insights into this collective's working and personal conditions. Most respondents were in their third year of PhD studies, with a majority expressing overall satisfaction. However, 22% reported significant dissatisfaction with their working conditions. Additionally, 41% stated that their PhD work notably impacted their quality of life, and 78% deemed their salaries insufficient for the work performed. Mental health emerged as a critical issue, with 75% reporting mental health struggles related to their doctoral work and 30% seeking professional help. Alarmingly, 18% of those seeking support were unable to access it due to financial barriers.

Social isolation was another notable concern, with 30% of respondents feeling isolated during their doctoral journey, although 46% felt well-supported. These findings underscore the urgent need to improve the conditions of predoctoral researchers and to foster community-building initiatives, such as those organized by the ECR group. Enhanced networking opportunities could provide crucial support and positively influence the well-being of early-career researchers.

[GSA-O-14]

Thursday 5, morning (first): 11:30
Room: Cova dos libros

LGTBIQA+ inclusivity in science: The role of PRISMA association and the situation in SIBECOL

González Ximénez de Embún, Miguel[1]; Martín Vélez, Víctor[2]; Rodríguez Lozano, Pablo[3]

(1) Museo Nacional de Ciencias Naturales CSIC; (2) Institut de Ciències del Mar CSIC; (3) Universidad Autonoma de Madrid

Correspondence e-mail: [miguelgxe@hotmail.com]

Several groups, including LGTBIQA+ collective, have been historically excluded from the scientific community. Still now, LGTBIQA+ people face numerous barriers during their scientific and academic careers which hampers the achievement of justice, equity, diversity, and inclusion in academia. For instance, a study done in the United Kingdom revealed that only 14% of bisexual people working in sciences are out of the closet at work and one out of three trans workers in sciences suffer workplace harassment. While we do not have this kind of data for Spain or Portugal, yet more and more cases of barriers, bias, and harassment do not stop appearing. In Spain, 14% of the population is LGTBIQA+, while within SIBECOL, a recent survey done among its members (N=316) showed that 12,7% belong to the LGTBIQA+ collective (5.7% gays, 4.4% bisexual, 1.3% lesbian, 1.3% asexual, 1.9% are non-binary, 0.6% agender). We know that universities and research centers are still not always a safe, diverse and welcoming space for all its members. In this vein, PRISMA association (the Spanish association for sexual-affective and gender diversity in Science, Technology, and Innovation) proposes 10 measures for research institutions to make science a safer place for the LGTBIQA+ collective. In this talk we will introduce the PRISMA association and its work, and we will reflect on how the Ecology science has some particularities compared to other scientific disciplines, as field work and travelling to other countries (that might be not LGTBIQA+ friendly) that may require specific measures.

[GSA-O-15]

Thursday 5, morning (first): 11:45
Room: Cova dos libros

Application of living labs in restoration ecology: a systematic map

Ibáñez Rodríguez, Andreu[1]; Torres, Aurora[2]; Cortina Segarra, Jordi[3]

(1) University of Alicante; (2) University of Alicante; (3) University of Alicante; (4)

Correspondence e-mail: [andreuibanezrodriguez@gmail.com]

Top-down approaches have sometimes proven inefficient in addressing the socio-ecological interactions that are critical for the success of a restoration project. Bottom-up strategies, involving social participation, are recommended. Likewise, living labs have emerged as a methodology that aims to foster collaborative innovation and engage stakeholders from different social backgrounds. In the last decade, they have been promoted in many different areas. Yet, it remains unknown to what extent they have been applied in the context of restoration ecology, and what are the results of their implementation. To shed some light on this situation, we conduct a reproducible systematic map of evidence describing the literature published over the last 30 years. We searched multiple bibliographic databases for relevant research using keywords "living lab" and "restoration ecology" and synonyms. We screened articles at two stages (title and abstract, and full text) according to a predetermined set of inclusion criteria. We extracted data relating to the characteristics of the living labs implemented, the expected outcomes, and the results and success indicators given by the case studies, along with descriptive information about the studies. It will include case studies and conceptualization articles of the topic. The data extraction will consist of the different elements of the living labs proposed or applied, and the data availability about the outcomes of the case studies. This presentation will provide an overview of the extent of the use of living lab approaches in the field of ecological restoration, indicate the main knowledge gaps and give recommendations.

[GSA-O-16]

Thursday 5, morning (first): 12:00
Room: Cova dos libros

Promoting open and equitable research for one of the most imperiled animal groups through the Amphibian Genomics Consortium

Torres-Sánchez, María[1]; na, The Amphibian Genomics Consortium[2]

(1) Universidad Complutense de Madrid; (2) na

Correspondence e-mail: [torressanchez.maria@gmail.com]

Amphibians are at risk worldwide due to the threats that the Anthropocene poses to this vertebrate group. With their unprecedented decline, we are losing species that play key roles in their ecosystems, as well as opportunities to understand traits and adaptive processes that the genomes of these ancient and diverse animals could reveal. Understanding genomic variation and function is important to uncover how species can overcome emerging infectious diseases and other global change stressors. The need for amphibian genomic resources is more urgent than ever due to these increasing threats. For this reason and due to the huge gap in amphibian genomic data, the Amphibian Genomics Consortium (AGC) was launched in March 2023 and currently has over 300 members from more than 40 countries (https://mvs.unimelb.edu.au/amphibian-genomics-consortium). The AGC is an international initiative that strives to bring together people interested in using genomic tools to understand amphibian ecology, evolution, and conservation. The AGC aims to support amphibian sequencing initiatives, with a particular emphasis on taxonomic groups lacking representation. Our burgeoning community is committed to increasing resources that are not evenly available to scientists, impairing underrepresented groups. We promote equitable research by fostering knowledge and skills transfer to emerging scientists worldwide, and we actively encourage early-career researchers to join the initiative and participate in governance and cooperation. Our collaborative projects proceed from finding shared interests, developing ideas, realizing the shared benefits from research outputs, and focusing on capacity-building to unite efforts in pursuit of the advancement of amphibian research and conservation.

GSA. Posters

[GSA-P-1]

Tuesday 3
Discussion corner: Room 1

Women's empowerment through science

Reyes, Otilia[1]; Mareque, Laura[2]; López, Paula[3]; Bouso Posada, Maria[4]; Mourente, Roberto[5]; Cruz, Óscar[6]; F. Riveiro, Sheila[7]

(1) Biology. USC; (2) Biology. USC; (3) Biology. USC; (4) Biology. USC; (5) Biology. USC; (6) EPSE. USC; (7) Biology. USC

Correspondence e-mail: [otilia.reyes@usc.es]

Traditionally, home education was linked to women and early years teachers were also female but as the educational level rose male dominated among both trainers and students.

Currently, one of the fronts on which science and specifically Ecology are fighting is to give women a leading role in education, both as recipients and transmitters, and in caring for the planet from a female perspective.

The objective of this work is to value the work of women scientists and is aligned with SDG 4 and 5.

Through a campaign of the USC's Gender Equality Office two ecologists we carried out a scientific workshop for primary school students, focused on the ecological effects of forest fires. We set up a narrative about a woman forest agent, then present the scientific knowledge through two women ecologists and after the forest agent is linked to care and management of the environment, so these two areas can also be seen from a female perspective and thirdly the pupils played a game to find all the clues leading to the solution of the problem.

Students will remember that two ecologists came to their school to talk about science, which makes it easier for them to associate scientific studies with women and not exclusively with men. The character of the forest agent is linked to care and management of the environment, thus, the two areas can be observed from a female perspective.

[GSA-P-2]

Wednesday 4
Discussion corner: Room 1

Inequitable participation of local researchers in English-language research on protected areas in the Amazon

Mustin, Karen[1]; Carvalho Gomes, Gleyce[2]; dos Santos Facundes, Alessandra[3]; Rodrigues dos Santos, Eduardo[4]

(1) Universidad Complutense de Madrid; (2) Universidade Federal do Amapá; (3) Universidade Federal do Amapá; (4) Universidade Federal do Amapá

Correspondence e-mail: [kmustin@ucm.es]

Introduction. Diverse perspectives are vital for implementing equitable and effective conservation practices. However, the dominance of English in scientific communication presents a significant barrier to this, especially in regions where English is not the primary language. Allied to this, scientific practice has long excluded local perspectives from scientific endeavour, as a result of what is often referred to as "parachute", "helicopter" or "neo-colonial" science.

Material and methods. Here we present an analysis of research on protected areas in the Amazon between 1980 and 2023, based on literature searches in four databases (Google Scholar, Web of Science, Scopus and Scielo) and three languages (English, Spanish and Portuguese).

Results and discussion. Significantly larger numbers of papers have been published in English than in either Spanish or Portuguese in every decade since the 1980s, though the overall increasing trend is the same in all languages. Until the 2010s, the majority of publications in English were published without the participation of authors with a declared affiliation in countries in the Amazon basin, and while the trend is for increasing participation of such authors in papers in all three languages, in English the proportion of first, last and sole authors has only recently crept above 50% and remains low, which suggests that research published in English is still being led by authors outside of the Amazonian countries. These disparities underscore the need for systemic changes in scientific publication practices and funding structures, which could facilitate more inclusive participation of in-country researchers.

[GSA-P-3]

Thursday 5
Discussion corner: Room 1

Equality in Action: Get to know the AEET Equality Commission

Dominguez Garcia, Virginia[1]; Gamboa, Sara[2]; García-Muñoz, Ana[3]; Velado-Alonso, Elena[4]

(1) Estación Biológica de Doñana - CSIC; (2) Centro de Investigación Mariña. Universidade de Vigo. MAPAS Lab; Vigo, 36310, Spain; (3) Universidad Rey Juan Carlos, e Instituto de Investigación en Cambio Global (IICG-URJC), Spain; (4) Plant Ecology & Nature Conservation Group, Environmental Science Department, Wageningen University

Correspondence e-mail: [domgarvir@gmail.com]

In this poster, we present an overview of the activities that the Equality Commission has developed since its creation. During these 5 years, the commission has promoted equality in the field of Ecology, pointing out injustice in Academia and offering solutions like the AEET Code of Conduct. Moreover, it has spread the vision of a fairer scientific environment through various channels, such as podcasts, surveys, interviews, videos, Twitter threads, scientific articles, etc. We want this contribution to be an opportunity to meet the commission, suggest new activities, and get involved in advancing towards a more fair scientific environment.

[GSA-P-4]

Tuesday 3
Discussion corner: Room 1

IIISIBECOL-XVIIAEET conference in numbers

Varela, Sara[1]

(1) Universidade de Vigo

Correspondence e-mail: [sara.varela@uvigo.gal]

The scientific career in ecology faces pressing challenges that are actively debated within the academic community. Key issues include precarious working conditions for pre- and postdoctoral researchers, gender inequality—manifested through disparities in grant success rates for early-career researchers and recognition for senior scholars—and colonial practices, such as imbalanced scientific collaboration in research based on fieldwork conducted in the Global South. Additionally, concerns arise around the publication industry, where public funding often supports the pursuit of prestige through costly publication in high-impact journals.

To address these issues, I will conduct a community survey designed to assess the importance of each of these four challenges, using a Google Form distributed to ecologists attending to the IIISIBECOL-XVIIAEET conference. The survey will gather data offering valuable insights into the collective priorities of our ecological research community, aiming to foster a healthy discussion on potential solutions.

[GSA-P-5]

Wednesday 4
Discussion corner: Room 1

A worker's protocol to align research activities with decolonial practices

Independent CREAF workers, Decolonial Protocol Comitee[1]

(1) CREAF

Correspondence e-mail: [delacasa.snchz@gmail.com]

Society is urging science to abandon their ivory tower and contribute to global efforts to address emerging socioenvironmental challenges and geopolitical conflicts emerging. However, while science's beneficial impacts to solve real-world problems are increasingly acknowledged, little has been discussed about their potentially negative role in reinforcing ongoing conflicts. Universities and research centres are often institutionally constrained to provide top-down initiatives that tackle the issue. However, researchers have the right to frame their work within guidelines that prevent violations of human and environmental rights, such as incorporating intersectionality into their research or declining collaboration with partners that are accomplices of human and environmental rights violations. Bottom-up organization is often needed to achieve common goals. For this reason, we present a voluntary affiliation protocol directly designed by the centre's researchers and through which they can access the necessary resources to align their work with a decolonial perspective. Particulary, we present the protocol created by CREAF workers initially to boycott alignments with zionist partners, but now extended for a wider spectrum of decolonial practices; that we hope serve as inspiration for other institutions.

[GSA-P-6]

Thursday 5
Discussion corner: Room 1

Caring for elderly people generates a major gender gap in academic teaching and research staff in Spain

Sánchez Montoya, María Mar[1]; Suárez, María Luisa[2]; Poblador, Silvia[3]; Antón-Pardo, María[4]; Lupon, Anna[5]; Nicolás-Ruiz, Néstor[6]; Martín-López, Berta[7]; Rodríguez-Lozano, Pablo[8]; Catalán, Núria[9]; Freixa, Anna[10]; Sala-Bubare, Anna[11]; Vidal-Abarca, María Rosario[12]

(1) Universidad Complutense de Madrid; (2) Universidad de Murcia; (3) Universidad de Barcelona; (4) Universidad de Valencia; (5) CEAB-CSIC; (6) Universidad de Murcia; (7) Leuphana University of Lüneburg; (8) Universidad de las Islas Baleares; (9) CEAB-CSIC; (10) ICRA-CERCA; (11) Universidad Ramón Llul; (12) Universidad de Murcia

Correspondence e-mail: [msanch70@ucm.es]

Although caring for the elderly is becoming an issue in Western societies, there are hardly any studies investigating gender roles and prejudices in academia. The aim of the paper is to explore how caring for older people affects the professional and personal lives of professors and researchers from a gender perspective, by interviewing 24 women and 12 men researchers in Spain who are or have been carers of older people. The interviews focused on four aspects: i) Who cares for the elderly; ii) Implications of caring for the elderly; iii) How the costs of caring for the elderly are borne; and iv) Responses from academia. The results indicate that elderly care is basically borne by women, although some of them questioned this as a socially imposed role. Half of the respondents (18/36) have experienced physical health problems, but the proportion of women (63%) is twice that of men (25%). 78% of respondents have suffered from mental health problems, but the proportion of women (23/24) outnumbered the one of men (5/12). 83% of women interviewed said that their professional life had been affected by caring for the elderly, compared to 58% of men. Respondents rarely turn to medical professionals to solve their physical or psychosomatic problems. Four women reported the use of antidepressant drugs. On the positive side, some say that this care has helped them to learn new skills or to have positive experiences useful for coping with life. At the institutional level, elderly care is an 'invisible' problem. These findings will allow advancing toward a better mental health and well being for professors and researchers in academia.

[GSA-P-7]

Tuesday 3
Discussion corner: Room 1

Diversity and inclusion on scientific societies: the case of the Iberian Society of Ecology

Rodríguez Lozano, Pablo[1]; Martín-Vélez, Víctor[2]; Abdallah, Mohamad[3]; Bernal, Susana[4]; Cano-Díaz, Concha[5]; Capdevila, Pol[6]; Fernandes, Isabel[7]; Figuerola, Blanca[8]; Gil-Martínez, Marta[9]; Gionchetta, Giulia[10]; León-Palmero, Elizabeth[11]; M. Ricart, Aurora[12]; Poblador, Sílvia[13]; Ximénez-Embún, Miguel G.[14]; Lupon, Anna[15]

(1) Universidad Autónoma de Madrid; (2) Institut de Ciències del Mar (ICM-CSIC); (3) Université de Rouen Normandie; (4) Centre d'Estudis Avançats de Blanes (CEAB-CSIC); (5) Instituto Politécnico de Viana do Castelo; (6) Universitat de Barcelona; (7) University of Minho; (8) Institut de Ciències del Mar (ICM-CSIC); (9) Universidad de Sevilla; (10) Institute of Environmental Assessment and Water Research (IDAEA-CSIC); (11) Princeton University; (12) Institut de Ciències del Mar (ICM-CSIC); (13) Universitat de Barcelona; (14) Museo Nacional de Ciencias Naturales, CSIC; (15) Centre d'Estudis Avançats de Blanes (CEAB-CSIC)

Correspondence e-mail: [pablo.rodriguezlozano@uam.es]

The Iberian Society of Ecology (SIBECOL), founded in July 2018, groups professionals dedicated to the study of all areas of Ecology (theoretical, terrestrial, marine, and inland waters). The Commission on Diversity and Inclusion is one of the SIBECOL working groups, which aims to celebrate, protect, and raise awareness about diversity within SIBECOL members. The priority of this commission is the inclusion of those groups that have been historically excluded from the scientific community, namely due to their ethnicity/racial identity, sex, sexual orientation, gender identity, gender expression, physical or mental difference, national origin, ideology, religion, family situation, age or socio-economic status. The Commission's specific objectives include: 1) to act as an observatory of the diversity within SIBECOL; 2) to propose and develop activities and policies that improve the visibility and inclusion of minority groups in SIBECOL; 3) to develop studies on diversity and inclusion directly or indirectly related to the field of Ecology; and 4) to collaborate with other scientific societies, professionals, groups, and entities to achieve these objectives. Here, we present the different initiatives, activities and actions that the Diversity and Inclusion Commission of SIBECOL has carried out since 2020. This communication aims to start a debate and exchange of ideas on how we can improve diversity and inclusion within scientific societies to learn from different experiences in order to avoid the perpetuation of discriminatory situations for future generations, so they can be personally and professionally successful through a supportive environment.

TECHNICAL SESSIONS

TSA.1. Ecology in education: ecological literacy as a tool to face global change

Thursday, 5 (12:45-14:15); (15:30-17:00)

Room: Cova dos libros

In the current scenario of global change and climate crisis, it is essential to have accurate information about the functioning of the ecosystems and to be able to integrate and apply this information to make rational decisions on relevant ecosocial issues. In addition, several studies reveal that students of different ages, as well as citizens and decision makers, present conceptual errors and difficulties in understanding the functioning of ecosystems and the causes of the ecological and social crisis. Furthermore, it is equally crucial to promote critical and systemic thinking, which are at the core of the Ecological Science. Given the magnitude and complexity of the challenge, it is key to build bridges of collaboration between academia and education at all levels, in order to lay common foundations on which to work towards the same goal: to recognize that human well-being is deeply linked to that of the rest of nature and, consequently, to commit to act to ensure a fair world on a safe planet. This symposium aims to promote a dialogue between the different agents involved in the ecological literacy of citizens, in a broad sense, to enable the co-creation of solutions from an integral vision.

Organizers:

• **Cristina Fernández Aragón,** Universidad a Distancia de Madrid, Facultad de Educación, Área de Didáctica de las Ciencias Naturales

• **Marcos Méndez Iglesias,** Universidad Rey Juan Carlos, Área de Biodiversidad y Conservación

• **Daniela Barría Díaz,** Universidad de Vigo, Área de Educación.

TSA.1. Orals

[TSA.1-O-1]

Thursday 5, morning (second): 12:45
Room: Cova dos libros

Learning about Climate Change impacts on inland waters and women's roles through art

Lupon, Anna[1]; Carrau, Laura[2]; Anton-Pardo, Maria[3]; Bartrons, Mireia[4]; Bernal, Susana[5]; Catalán, Núria[6]; Cañedo-Argüelles, Miguel[7]; Hernandez del Amo, Elena[8]; Feio, Maria Joao[9]; Fernandes, Isabel[10]; Franco-Cisterna, Belen[11]; Freixa, Anna[12]; Genua-Olmedo, Ana[13]; Lecina-Diaz, Judit[14]; León-Palmero, Elizabeth[15]; Mendoza-Lera, Clara[16]; Olid, Carolina[17]; Poblador, Sílvia[18]; Rodríguez-Lozano, Pablo[19]; Romaní, Anna Maria[20]; Sánchez-Montoya, María Mar[21]; Solórzano, Ana[22]; Suárez-Alonso, Maria Luisa[23]; Valencia-Leguizamón, Juliana[24]; Vidal-Abarca, Maria Rosario[25]; Pastor, Ada[26].

(1) Centre d'Estudis Avançats de Blanes (CEAB-CSIC); (2) Mileva Films; (3) University of Valencia; (4) University of Vic (UVic-UCC); (5) Centre d'Estudis Avançats de Blanes (CEAB-CSIC); (6) Centre d'Estudis Avançats de Blanes (CEAB-CSIC); (7) Instituto de Diagnóstico Ambiental y Estudios del Agua (IDAEA); (8) Autonomous University of Barcelona; (9) University of Coimbra & Marine and Environmental Sciences/ARNET; (10) Centre of Molecular and Environmental Biology (CBMA), University of Minho; (11) Netherlands Institute of Ecology (NIOO-KNAW); (12) Catalan Institute for Water Research (ICRA); (13) Tragsatec; (14) Technical University of Munich; (15) Princeton University; (16) iES,RPTU, University of Kaiserlautern-Landau; (17) Universitat de Barcelona; (18) Universitat de Barcelona; (19) Universidad Autónoma de Madrid; (20) Universitat de Girona; (21) Complutense University of Madrid; (22) Instituto de Diagnóstico Ambiental y Estudios del Agua (IDAEA); (23) Universidad de Murcia; (24) Universitat de Girona; (25) Universidad de Murcia; (26) Universitat de Girona.

Correspondence e-mail: [anna.lupon@gmail.com]

Climate change is threatening inland waters globally, exacerbating inequalities and discrimination against women. However, there is a general lack of awareness about these gender biases in global forums on Climate Change and Water Crisis, as well as an undervaluation of women's roles as environmental erudites, activists, scientists and leaders. To reflect upon the effects of climate change on inland waters and women's dual role as vulnerable group and agents of change, we created the exhibition #MUAC and an illustrated book aimed at university and primary school students, respectively.

Over the past two years, a group of scientists and artists co-created the exhibition and the illustrated book, both centered on eight pressing environmental issues related to the Water Crisis. By integrating augmented reality (serving as a metaphorical ecofeminist lens to reimagine our perception of reality) alongside scientific research, artistic expression, and audiovisual elements, the artworks and illustrated narratives offer an innovative, multidisciplinary approach to address these critical issues.

The exhibition, launched in October 2023, has been hosted by 22 European universities, reaching nearly 3,000 viewers. The book, published in April 2024, has been sent to 25 Spanish schools and read by 1,000 students. Both projects have had a positive impact, increasing the audience's awareness and concern for the Water Crisis and related gender inequality. Overall, our results suggest that these science-in-art projects are effective tools for understanding the social-environmental impacts of the climate emergency from an ecofeminist perspective.

[TSA.1-O-2]

Thursday 5, morning (second): 13:00
Room: Cova dos libros

Women, Ecology, and Justice: Bridging Academia and Social Movements

Pistón, Nuria[1]; Starosky, Míriam[2]; Souza, Ana[3]; Vale, Mariana[4]

(1) University of Granada; (2) Federal University of Rio de Janeiro; (3) Federal University of Rio de Janeiro; (4) Federal University of Rio de Janeiro

Correspondence e-mail: [nuriapiston@gmail.com]

Introduction. In 2020, we initiated a course on women, science, and the environment at the Federal University of Rio de Janeiro, Brazil. Designed for ecology students, the course explored the intersections of gender, ecology, and social justice. Inspired by a 2019 event that highlighted the overlooked contributions of female scientists, the syllabus combined perspectives from academia and social movements to emphasize the integral role of women in environmental action and knowledge production.

Material and Methods. The course featured 16 speakers, equally divided between academics from diverse fields (e.g., mathematics, philosophy, neurobiology) and women leading social movements. Initially offered face-to-face, it shifted to an online format due to the COVID-19 pandemic, prioritizing speakers from social movements. These speakers addressed topics such as sustainable farming, recycling initiatives in informal settlements, and the environmental and social impacts of mining. Classes encouraged dialogue between speakers and students, facilitating interdisciplinary discussions and fostering connections between technical and lived experiences.

Results and Discussion. The course highlighted the intersection of environmental challenges with gender inequities, such as women's vulnerability to food insecurity and climate change impacts. It underscored the interconnectivity between the struggle for ecological and environmental rights, human rights, and sustainable development. Post-course evaluations revealed increased awareness and collective action among participants, as reflected in the creation of support networks and ongoing collaborations. Despite the online limitations, the course demonstrated the potential of transdisciplinary and inclusive education to inspire sustainable practices and democratize science.

[TSA.1-O-3]

Thursday 5, morning (second): 13:15
Room: Cova dos libros

Synergistic Approaches to Reduce School Segregation: Integrating Research and Education for Greater Inclusivity

Fernández-López, Pol[1]; Lupon, Anna[2]; F. Pagès, Jordi[3]; Alacid, Elisabet[4]; Genovart, Meritxell[5]; Pardo-Araujo, Marta[6]; Torras, Xavier[7]; Molina, Quique[8]; Simón, Marta[9]; Agell, Gemma[10]

(1) Centre d'Estudis Avançats de Blanes (CEAB-CSIC); (2) Centre d'Estudis Avançats de Blanes (CEAB-CSIC); (3) Centre d'Estudis Avançats de Blanes (CEAB-CSIC); (4) Centre d'Estudis Avançats de Blanes (CEAB-CSIC); (5) Centre d'Estudis Avançats de Blanes (CEAB-CSIC); (6) Centre d'Estudis Avançats de Blanes (CEAB-CSIC); (7) Centre d'Estudis Avançats de Blanes (CEAB-CSIC); (8) Institut Rocagrossa; (9) Departament d'Educació i Formació Professional; (10) Centre d'Estudis Avançats de Blanes (CEAB-CSIC)

Correspondence e-mail: [pfernandez@ceab.csic.es]

Introduction. School segregation is pervasive both in Europe and the United States, hindering equitable access to high-quality and diverse education. As participants of the Aliances Magnet program in Catalunya, our research center partnered with a high school characterized by a complex sociodemographic profile. Our objective was to strengthen the school's educational project while reshaping its social perception.

2) Material and methods

Teachers and researchers co-designed four interdisciplinary science projects in the field of ecology, tailored to the specific educational objectives for each grade. The project spanned four years, during which the researchers closely monitored and directly engaged with the entire school ecosystem, assisting with experiments, fieldwork, data analysis, and reflection. By integrating key scientific skills (i.e. curiosity, critical thinking, evidence-based knowledge), into daily school practices, we contributed to making science accessible to a broader, more diverse community.

3) Results and discussion

Our approach fostered a deeper interest in science, ignited curiosity, and enhanced students' understanding of their local environment. Additionally, it improved the school's perception within the community, attracting interest from local families and increasing enrollment demand. This growth promoted greater social heterogeneity within the school, creating a more diverse and culturally rich environment. Finally, the partnership amplified researchers' societal contributions and enhanced their ability to communicate science to non-scientific audiences, thereby creating more inclusive and impactful research. Overall, this methodology represents a meaningful step toward promoting desegregation, inclusivity, and diversity within the school system.

[TSA.1-O-4]

Thursday 5, morning (second): 13:30
Room: Cova dos libros

Empowering Teachers to Bring Students Closer to Nature a Collaborative Approach to Ecology Education

Force, Laura[1]; Sanuy, Alba[2]; Sánchez-Plaza, Anabel[3]

(1) CREAF; (2) CREAF; (3) CREAF

Correspondence e-mail: [l.force@creaf.uab.cat]

Secondary school teachers play a vital role in connecting students to the natural world, fostering recognition and deeper understanding of ecological issues through critical thinking.

The Catalan Government's Department of the Environment, through its Environmental Education Network (XEV), is collaborating with CREAF to enhance science and ecology literacy through capacity building of secondary school teachers. The goal was to equip teachers with the knowledge and skills necessary to incorporate ecological topics and methodologies into the curriculum, addressing global environmental challenges with evidence-based insights.

The project "Make Your Students Become a Scientific Team" focused on biodiversity and ecosystem functioning in the context of global environmental changes. Activities were designed around environmental challenges, allowing students to engage with their local natural context. Resources, competencies, and values were tailored for both fieldwork and classroom activities, including aspects of citizen science. Since 2021, the program has involved 23 secondary schools across three cohorts.

Teachers participated in a training programme, with CREAF providing customized resources based on each school's natural context and the teachers' expertise, starting with the development of a Learning Situation underpinning a meaningful ecological challenge for each participant school.

Awareness of ecological issues has grown significantly in the educational community. Teachers have learned new concepts and methods for incorporating Ecology, overcoming challenges related to fieldwork and data gathering, and becoming motivated by their own experiences and students' engagement. This initiative has positively impacted both schools and educators, contributing to bridge the gap between nature and students.

[TSA.1-O-5]

Thursday 5, morning (second): 13:45
Room: Cova dos libros

Education for a changing world: integrating sustainability into teacher training

Villén-Pérez, Sara[1]; Granda Fernández, Elena[2]; Rodríguez-Rey, Marta[3]; Saldaña, Asunción[4]; Martínez de Baroja, Loreto[5]; Gómez Sal, Antonio[6]

(1) Universidad de Alcalá; (2) University of Alcalá; (3) University of Alcalá; (4) University of Alcalá; (5) University of Alcalá; (6) University of Alcalá

Correspondence e-mail: [sara.villen@uah.es]

Introduction. Global change will shape the lives of future generations. To address the planet's pressing needs, future citizens must develop a sense of responsibility and awareness. Tackling the unpredictable challenges of a changing world will also require resilience, adaptability, and innovative thinking. The United Nations' Sustainable Development Goals emphasize the critical role of education in achieving sustainability. Future teachers equipped with a strong foundation in ecological knowledge and sustainability are better positioned to inspire their students to actively engage with socio-environmental issues, ensuring that education remains aligned with global priorities.

Materials and Methods. In 2019, professors from the Ecology Area at the University of Alcalá introduced a course titled "Local and Global: Education for Sustainability". It was designed for pre-primary and primary education students and aimed to provide future teachers with knowledge on ecological processes, landscape interpretation, global change, and sustainability. By doing so, the proposal sought to indirectly foster environmentally committed citizens from early childhood stages.

Results and Discussion. The course has consistently drawn significant interest, with approximately 25 students enrolling annually. Teaching has three main goals: (i) interpreting local socio-ecosystems and their challenges, (ii) reflecting on globalization and global change, and (iii) exploring the principles of sustainability and the skills required for teaching sustainability. Learning activities include three fieldtrips and the development of pedagogical materials on sustainability topics. Our experience has demonstrated that teaching ecology for sustainability to future teachers is about more than imparting knowledge—it is about cultivating a mindset that prioritizes planetary health and the well-being of future generations.

[TSA.1-O-6]

Thursday 5, after lunch (third): 15:30
Room: Cova dos libros

Representations of the Fungi Kingdom in Primary School Children: Implications for the Natural Sciences Curriculum

Barría-Díaz, Daniela[1]; Lucha, Pedro[2]; Bueno, Guillermo[3]

(1) Universidad de Zaragoza; (2) Universidad de Zaragoza; (3) Instituto Pirenaico de Ecología

Correspondence e-mail: [dbarriadiaz@gmail.com]

The Fungi Kingdom comprises species of fungi with ecological and nutritional importance. These species play key roles in ecosystems, decomposing organic matter, parasitism, or forming symbiotic associations with plants (mycorrhizae), which enhance water and nutrient absorption and help plants withstand environmental stresses. However, despite their ecological importance, fungi remain insufficiently addressed in natural sciences education at the primary school level.

Previous research has highlighted that decomposers and parasites are often excluded from representations of trophic relationships in textbooks and other resources, which limits students' understanding of the ecological roles of the Fungi Kingdom. In this context, the objective of the present study is to analyze the mental models expressed by 5th- and 6th-grade primary school children in the province of Huesca regarding the Fungi Kingdom.

We conducted a qualitative investigation in a school in Jaca with students aged 10 to 12 years. The methodology included the use of drawing as a technique to know their initial mental models, followed by a dialogical phase to delve deeper into these representations. The analysis employed a coding system that combined both deductively developed categories and those emerging from the data.

Our preliminary findings suggest that primary school students often hold biased initial perceptions of the Fungi Kingdom. In response, we will discuss pedagogical and didactic strategies designed to enhance scientific competence, deepen students' understanding of the ecological roles of fungi, and promote values linked to conservation and sustainability.

[TSA.1-O-7]

Thursday 5, after lunch (third): 15:45
Room: Cova dos libros

Biodiversity Between the Tale's Pages: Children's Literature as a Tool for Ecological Literacy

de Torre Ceijas, Rocío[1]; de Frutos Tena, Ángel[2]; Martínez Aznar, Javier[3]; Salamanca Villate, Annabella[4]

(1) Universidad de Zaragoza; (2) Universidad de Zaragoza; (3) Universidad de Zaragoza; (4) Universidad de Zaragoza

Correspondence e-mail: [rtorre@unizar.es]

Biodiversity loss is one of the most critical environmental problems of today. As the drastic decline in biodiversity severely affects the balance and resilience of ecosystems, threatening the well-being and survival of all living organisms on the planet. Biodiversity is a complex but key concept in ecology that goes beyond a simple list of species. Reflective and critical reading of children's books about nature provides a motivating experience for understanding and awareness of the conservation status and degradation of ecosystems and the species that inhabit them. This study proposes a content analysis of ten children's books: five fictional and five non-fictional, that deal directly or indirectly with the concept of biodiversity. A transdisciplinary approach was adopted for the selection of criteria, with the analysis being carried out by pairs of experts from different areas of educational science: the didactics of language and children's literature, and the didactics of experimental science. The results support the idea that the analyses of experts from different disciplines are complementary and deepen the interpretation of literary works in a systematic and holistic way. Furthermore, omissions and inaccuracies regarding biological concepts in the analysed books have been identified, which can be addressed by educators through their mediation. This work contributes to strengthening the role of literature in building knowledge about ecology and biodiversity, generating useful material to raise awareness, inform with scientific rigour and motivate students, while promoting an ecocritical perspective and a commitment to the conservation of biodiversity and the sustainability of the planet for future generations.

[TSA.1-O-8]

Thursday 5, after lunch (third): 16:00
Room: Cova dos libros

From talk to thought: The power of dialogic interactions in science education

Fernández Aragón, Cristina[1]; Cano Pérez, Lidia[2]

(1) Universidad a Distancia de Madrid; (2) Universidad del País Vasco

Correspondence e-mail: [mariacristina.fernandez.a@udima.es]

Science education often disproportionately emphasizes the transmission of concepts and the development of technical skills, while undervaluing the importance of dialogic interactions between teachers and students, as well as among students themselves. These interaction-based teaching strategies, centered on argumentation, deliberation, and both guided and unguided exchange of ideas, are crucial for fostering scientific thinking and constructing meaningful knowledge.

In this presentation, we underscore the significance of dialogic strategies in the classroom as fundamental tools for enriching the learning experience and promoting scientific literacy, and specifically, ecological and evolutionary literacy. We present results from educational initiatives spanning different levels, from primary school to university. For instance, in primary education, we observed that engaging students in dialogic processes fostered collective sensemaking and co-construction of core ideas about the living organisms. Additionally, these dialogic strategies enhanced the understanding of scientific practices and the emergence of aspects of the nature of science in children's discourse, compared to a control group. At the university level, a game-based initiative focused on learning biological evolution revealed that students participating in collaborative activities emphasizing argumentation and deliberation exhibited greater conceptual understanding than those who worked individually.

These findings highlight that dialogic interactions not only improve the comprehension of biological concepts but also enhance critical skills such as reasoning and collaborative problem-solving. Practical cases will be presented to illustrate how these dynamics can be effectively integrated into diverse educational contexts, emphasizing their role in cultivating scientific citizenship from early childhood to advanced academic stages.

[TSA.1-O-9]

Thursday 5, after lunch (third): 16:15
Room: Cova dos libros

Nestled in plastic: public perceptions and the conservation of white storks

Varela, Zulema[1]; Vila Tojo, Sergio[2]

(1) CRETUS, University of Santiago de Compostela; (2) CRETUS, University of Santiago de Compostela

Correspondence e-mail: [zvarelario@gmail.com]

Plastic pollution is a widespread problem affecting ecosystems around the globe and poses a serious threat to biodiversity and the sustainability of countless species. Understanding how society perceives this problem is crucial to developing effective species conservation strategies. Significant evidence of plastic pollution was identified in white stork nests. This finding underlines the detrimental impact of plastic pollution on birds and highlights the urgent need for society to commit to addressing this challenge. To better understand public attitudes and perceptions towards this environmental problem, an online survey was conducted using the snowball sampling method (n = 198). The main results indicate strong positive attitudes towards storks, with participants describing them as good, necessary, beneficial and nice. While awareness of the problem of plastic pollution in stork nests was high, personal responsibility was perceived as relatively low. Participants also expressed strong negative emotional reactions to this plastic pollution, such as anger, worry and sadness. Most respondents were willing to support plastic regulations to protect birds and to adjust their daily behaviour for better plastic management. However, there was less willingness to donate money to stork conservation organisations. When survey respondents were asked to allocate hypothetical funds to help different species, storks were preferred to gulls and cormorants but ranked lower than iconic species such as wolves and oak trees. All of this leads to the need to increase personal responsibility for plastic pollution and channel negative emotions into responsible plastic use in order to have a greater impact on species conservation.

[TSA.1-O-10]

Thursday 5, after lunch (third): 16:30
Room: Cova dos libros

Using science to understand the environment: an experiment on vegetation recovery after fire

Fagúndez, Jaime[1]; Vázquez, Iago[2]; Fagúndez, Diego[3]; Fagúndez, Antón[4]

(1) Universidade da Coruña; (2) CEIP Roxos, Santiago de Compostela; (3) IES Rosalía de Castro, Santiago de Compostela; (4) IES Rosalía de Castro, Santiago de Compostela

Correspondence e-mail: [jaime.fagundez@udc.es]

Forest fires are a social and environmental issue in rural and peri-urban areas of Galicia, one of the European regions with higher numbers of wildfires. A large fire in neighbouring areas can have a strong impact in children´s emotions which should be adressed in school. In 2019, the sixth grade class of Roxos primary school performed an experiment on plant regeneration from the soil seedbank after fire. The experiment continued in fifth grade the following year. The project aimed to improve the understanding of the scientific method, ecological dynamics and the risks of wildfires.

Soil samples collected at a nearby field were subjected to four levels of heat shock treatment including 100ºC, 150ºC, 200ºC and control. Afterwards, the samples were watered regularly and the emergence of plantules were recorded for several months. Number of plantules increased with higher treatment temperatures. The following year, the fifth grade class continued the experiment by subjecting all samples to a new heat shock at 200ºC. A higher number of plantules emerged from the control trays than those previously subjected to the heat shock, but no differences were found between treatments. This suggests a depletion of the seedbank in recurrent wildfires, what poses a risk of soil loss due to lack of vegetation cover.

The 2018-19 class achieved second prize in the “Luis Freire” science-at-school prize. They got to explain their research in different media, including a visit to a radio station and publishing an article in a wildlife national journal. Everyone involved described the activity as very positive, but the experiment of the 2019-20 class was interrupted due to the pandemia.

TSA.1. Posters

[TSA.1-P-1]

Tuesday 3
Discussion corner: Room 1

The plant kingdom and its diversity in education. A systematic review

Martos Núñez, Eva Gloria[1]

(1) University of Granada

Correspondence e-mail: [eva-martos@hotmail.com]

The invisibility of plants in society is a phenomenon that has been described for decades and is defined as: people's inability to notice the plants in their environment, and the tendency to underestimate their ecological importance and the role they play in our daily lives. With the systematic review that is carried out, we aim to analyze the scientific production on didactic experiences that, in one way or another, give visibility to plants from an ecosystemic point of view.

Thus, 35 articles investigating didactic experiences about plants were selected, from early Childhood education to university education. Publications from the period 2014-2024 were reviewed in the Web of Science database, identifying 134 documents, of which 35 were included in the study, following the PRISMA methodology.

The results reveal that scientific production in this area of research is limited, although growing. The least investigated stage is early Childhood education, and the least studied aspect is plant anatomy. Spain is the country where the most studies on the subject have been conducted.

In conclusion, it is necessary to grant greater visibility to plants in the didactics of experimental sciences to promote a sustainable future. The integration of botany into education is essential to raise awareness about the importance of plant biodiversity and its impact on the stability of ecosystems and the environment in the long term.

[TSA.1-P-2]

Wednesday 4
Discussion corner: Room 1

Tools in ecological education from the education section of the Spanish Socity of Soil Science. Soil Vermicomposting Practical Booklet

Orts, Carmen[1]

(1) UPV

Correspondence e-mail: [orts.mca@gmail.com]

Education about soil ecology is vital for children and young people, as it helps them understand the role of soil in supporting life, knowing its properties and soil life, its biological activity and the role of microbial communities on soil. plant growth, water, nutrients, carbon storage, climate regulation, etc.

The Soil Education and Awareness Section of the Spanish Soil Science Society (SEPAS-SECS) aims to raise awareness of the essential role of soils for life and raise awareness about the need to guarantee their sustainable development, especially among school and university students. Among the activities carried out by SEPAS-SECS are workshops with primary and secondary school children.

The SEPAS-SECS participates, among other educational projects, in the IUSS "THE IUSS GOES TO SCHOOL" by developing educational materials for young people, and in the children's book competition organized by the IUSS and the FAO on the occasion of the WSD. On the SEPAS-SECS website, teachers at educational centers have information related to the minimum teachings for Primary Education regarding land (Royal Decree 157/2022).

Each year, SEPAS-SECS produces a brochure to help teachers introduce students to a specific topic. Along these lines, different educational materials have been prepared, among which are brochures such as Vermicomposting for schoolchildren, where teachers are encouraged to explain to students the importance of soils, including associated activities. Some of these brochures have been submitted to contests launched by the FAO, and are integrated into the IUSS educational project "THE IUSS GOES TO SCHOOL" SEPAS-SECS website (https://edafoeduca.es).

[TSA.1-P-3]

Thursday 5
Discussion corner: Room 1

Educating on Wildfire at the USC Faculty of Biology

Mourente, Roberto[1]; Cruz, Óscar[2]; F. Riveiro, Sheila[3]; Mareque, Laura[4]; López, Paula[5]; Reyes, Otilia[6]

(1) Universidade de Santiago de Compostela; (2) EPSE, USC; (3) Biology, USC; (4) Biology, USC; (5) Biology, USC; (6) Biology, USC

Correspondence e-mail: [roberto.mourente@rai.usc.es]

Forest fires accelerate climate change and climate change increases the severity and frequency of forest fires. Many of the forest fires are of anthropic origin, therefore, the objective of this work is to raise awareness in society of the need to take preventive measures to prevent the occurrence of fire.

Under the auspices of a teaching innovation project, for several courses, students from the Faculty of Biology participated voluntarily in education campaigns at primary and secondary schools. The students of the subjects Ecology II and Conservation Biology, tutored by their teacher, gave talks, led field trips and designed participatory games to sensitize the youngest of ...

Since the 2020-21 academic year, students of the Degree in Biology have carried out 14 outreach activities in a total of 2 primary schools and 4 secondary schools. The teachers addressed the problem of forest fires within their programme. Both teachers and students were very satisfied, the reception in the schools visited was very good and all were willing to repeat in the coming years. In future editions we have proposed to try and get pupils from primary and secondary schools to send us some of their own work (a drawing, a text) and make them reflect.

[TSA.1-P-4]

Tuesday 3
Discussion corner: Room 1

Exploring high school students' understanding and epistemic reasoning in organic matter decomposition: Insights from the OrgWASTE citizen science project

Morillas, Lourdes[1]; Zuazagoitia, Daniel[2]; Eugenio-Gozalbo, Marcia[3]; Ortega-Cubero, Inés[4]; Alcántara Rubio, Lucía[5]; Domínguez, María Teresa[6]; Homet-Gutiérrez, Pablo[7]; Gil-Martínez, Marta[8]

(1) Universidad de Sevilla; (2) Universidad del País Vasco; (3) Universidad de Valladolid; (4) Universidad de Valladolid; (5) Universidad de Sevilla; (6) Universidad de Sevilla; (7) Universidad de Cádiz; (8) Universidad de Sevilla

Correspondence e-mail: [lmorillas@us.es]

Introduction. The "We Are Students Tackling Environmental WASTE" (OrgWASTE) citizen science project integrates organic waste recycling with sustainability education through a socio-constructivist teaching and learning sequence. This initiative aims to deepen students' understanding of organic waste management and decomposition processes while fostering environmental awareness and leadership skills.

Materials and Methods. The project was implemented in six high schools in Seville, Spain, utilizing three accessible recycling methods: vermicomposting, maintaining chicken coops, and creating terrariums. These methods transform organic waste into resources such as nutrient-rich compost and livestock feed. Students actively engaged in these activities, combining theoretical knowledge with practical applications in dynamic learning settings. Pre- and post-project questionnaires were administered to assess their conceptual understanding of organic matter decomposition. Responses were analyzed using two complementary methodologies: a phenomenographic approach to classify definitions and a storyboard analysis of labeled drawings.

Results and Discussion. The analysis revealed two primary perspectives among students. One group conceptualized decomposition as a process yielding specific end products (e.g., compost, soil, nutrients), while the other perceived it as a degradation process without a defined endpoint. Additionally, students displayed varying epistemic reasoning about the agents driving decomposition. Some emphasized biotic factors, including macro- (e.g., worms, insects) and micro-organisms (e.g., fungi, bacteria), while others focused exclusively on abiotic factors such as oxygen, air and temperature.

These findings highlight the potential of citizen science initiatives like OrgWASTE to enhance students' epistemic understanding of ecological processes and promote critical thinking about environmental sustainability.

[TSA.1-P-5]

Wednesday 4
Discussion corner: Room 1

It is a community work: using Service-Learning projects in the detection of relevant ecosocial issues and citizen literacy needs

Servia, María J.[1]; R. Lueje, Yaiza[2]; Pazos, Tamara[3]

(1) Faculty of Science, University of A Coruña; (2) Faculty of Science, University of A Coruña; (3) Centro Interdisciplinar de Química e Bioloxía (CICA)

Correspondence e-mail: [maria.servia@udc.es]

Service-Learning (SL) is a pedagogical methodology that connects the goals of higher education with the needs of society through the participation of students in structured activities that address community needs. This popular definition highlights a primary characteristic of SL projects, which is their role as connectors between higher education and society. In this work, we present the organic growing and the outcomes of a decade of SL projects with undergraduate Biology students and an array of local organizations in the NW of A Coruña province (NW Spain). We present the ecosocial issues tackled, that range from the management of pet abandonment, the need to mitigate the impact of invasive species or the connection between the fear to animals and the management of urban green spaces. In addition, we highlight the mutual benefits of SL projects for both students and the organizations involved, as well as the citizen literacy needs detected. However, one of the most notable outcomes has been the opportunity to blend teaching and research, as SL projects favour a deeper knowledge of the issues explored and foster an environment of trust between academia and organizations. We advocate for the promotion of this type of formal educational projects as catalysts of enriching collaborations into the community in the context of university education and research.

[TSA.1-P-6]

Thursday 5
Discussion corner: Room 1

Beyond outreach: how collaboration between agroecology researchers and teachers can contribute to the transformation needed for sustainable rural development

Pizarro Carbonell, Elisa[1]; Schöb, Christian[2]

(1) Estación Experimental Aprisco; (2) E.S. CC. Experimentales y Tecnología

Correspondence e-mail: [elisa@asociacionaprisco.org]

Taking advantage of research in ecology carried out in a territory to present it as an educational scenario for the citizens of that territory and facilitating this interaction, can be the beginning of a new way of understanding science and its impact. In the case of agroecology, which is directly related to rural contexts, bringing science into everyday life is an opportunity for sustainable rural development, helping to improve several socio-ecological aspects in a single movement.

At the Asociación Aprisco we propose to streamline and optimise the flow of information from academia to citizens, by building spaces where all actors meet to co-create learning experiences together. Thus, we are taking the first steps towards an educational innovation inspired by the Living Lab methodology (co-creation, user-centred and multi-actor approach).

Specifically, through the European projects LegumES and COUSIN, we are working with the primary schools CEIP San Martín (Garganta la Olla), CEIP Virgen de Monfragüe (Torrejón el Rubio) and Siglo XXI (Madrid) in Spain. We are also working with the Royal Highland Education Trust (Scotland) to exchange activities co-created in Scotland with those co-created in Spain, including video calls between both students (in Spain it will be included in the 'English language' time).

By creating these connections between science and education, we aim to contributing to citizens' ecological literacy, while i) improving the quality of education, ii) helping teachers to adjust to new educational trends, iii) helping researchers to disseminate their work, and iv) linking the population to the territory.

[TSA.1-P-7]

Tuesday 3
Discussion corner: Room 1

Enhancing public perceptions of urban rivers through immersive citizen science

Vogel, Friederike[1]; Soria, Maria[2]; Argelich, Roger[3]; Fortuño, Pau[4]

(1) University of Barcelona; (2) University of Vic; (3) University of Barcelona; (4) Centre de Recerca Ecològica i Aplicacions Forestals

Correspondence e-mail: [frvogelv9@alumnes.ub.edu]

Urban rivers are valuable socioecological resources but are often heavily modified, limiting their ecological functions and disminishingpublic appreciation. Research shows that immersive citizen science projects can transform public perceptions by fostering engagement, ecological awareness and stewardship of these misunderstood ecosystems. Tools such as RiuNet App enable participants to take on the role of scientists, directly assessing the hydrological and ecological status of rivers through outdoor activities. However, the effectiveness of this tool in fostering medium- to long-term knowledge retention remains untested.

The app was evaluated in 2024 as part of the Llegim el riu project (Let's read the river) conducted across seven municipalities in Catalonia, Spain. We assessed the effectiveness of the RiuNet App in transforming users' perceptions of urban rivers by analyzing participants' drawings of a river in healthy and degraded ecological conditions before, immediately after, and two months after using the app (medium-term). A survey was conducted five months later (long-term) to identify participants' challenges with macroinvertebrate identification and evaluate their long-term retention of macroinvertebrate families.

Drawings created immediately after the activity highlighted an increased awareness of biodiversity, riverbed complexity and anthropogenic impacts on rivers' functionality. However, simplified representations observed for two months (medium-term) indicated challenges in long-term retention of knowledge.

Survey results indicated that participants relied on anatomical features such as head shape, limb structure, and abdomen shape, to aid in macroinvertebrate identification. However, findings also showed limitations in long-term memory of macroinvertebrate families.

Immersive citizen science tools, such as the RiuNet App, hold the potential to enhance public perceptions and foster sustained engagement in urban river conservation. To maximize their impact, we are currently working to incorporate localized narratives and supplementary educational materials in both the app and website of the project to encourage long-term knowledge retention

[TSA.1-P-8]

Wednesday 4
Discussion corner: Room 1

Small is beautiful: Educating on the biodiversity value of temporary ponds in a changing world

Tomás-Martín, Marina[1]; Alcorlo, Paloma[2]; Christian, Arnanz[3]; Soto-García, Pablo[4]; López-Archilla, Ana Isabel[5]; García-Camargo, María[6]; Corral-García, Lara Silvia[7]; Rico, Eugenio[8]; Fernández Martínez, Miguel Ángel[9]; Baltanás, Ángel[10]; Florencio, Margarita[11]

(1) Universidad Autónoma de Madrid; (2) Universidad Autónoma de Madrid; (3) Universidad Autónoma de Madrid; (4) Universidad Autónoma de Madrid; (5) Universidad Autónoma de Madrid; (6) Universidad Autónoma de Madrid; (7) Universidad Autónoma de Madrid; (8) Universidad Autónoma de Madrid; (9) Universidad Autónoma de Madrid; (10) Universidad Autónoma de Madrid; (11) Estación Biológica de Doñana, Centro Superior de Investigaciones Científicas

Correspondence e-mail: [marina.tomas@uam.es]

Introduction. Temporary ponds are among the most sensitive continental aquatic ecosystems, threatened by global change factors such as land use alterations, climate change, and invasive species. Despite their high biodiversity and crucial ecological roles—providing ecosystem services like water purification, flood control, and supporting biodiversity and landscape heterogeneity—these systems face rapid degradation. To address these challenges, raising awareness about their importance and fostering ecological literacy are essential steps in promoting their conservation and sustainable management.

Material and Methods. The I-WET research group and the ClimaRiskinPond project have implemented a series of outreach and educational initiatives targeting diverse audiences, with a particular focus on primary school students. Activities carried out included interactive events such as the European Researchers' Night, Science and Innovation Week, and the International Day of Women and Girls in Science. Hands-on experiences were offered through school visits to university laboratories supported by UAM's Scientific Cultural Unit (UCC-UAM). Additionally, we organized two editions of a citizen science-based pond photography contest, developed an interactive web platform incorporating citizen-contributed metadata, and designed educational tools like a gymkhana, macroinvertebrate identification guides, and videos.

Results and Discussion. Our initiatives enhanced participants' understanding of ecosystem functions and the value of temporary ponds, fostering critical and systemic thinking. Feedback from students, teachers, and citizens highlighted the effectiveness of hands-on and participatory approaches in bridging the gap between ecological science and education. These efforts underscore the importance of integrating ecological literacy into education to empower individuals to address global change challenges.

[TSA.1-P-9]

Thursday 5
Discussion corner: Room 1

The educational dimension in the conservation of habitats in common land communities: the case of the RURALtXA! project

Lagos Abarzuza, Laura[1]; Penín González, Jose Ángel[2]; Laborda Bartolomé, Rafael Alfonso[3]; Blanco Árias, Cesar Agustín[4]; Díaz Varela, Emilio Rafael[5]; Díaz Varela, Ramón Alberto[6]; Fagúndez Díaz, Jaime[7]

(1) Universidade da Coruña, CISPAC; (2) Universidade da Coruña; (3) Universidade de Santiago de Compostela. Escola Politécnica Superior; (4) Universidade de Santiago de Compostela. Escola Politécnica Superior.; (5) Universidade de Santiago de Compostela. Escola Politécnica Superior.; (6) Universidade de Santiago de Compostela. Escola Politécnica Superior.; (7) Universidade da Coruña. Facultade de Ciencias. CISCPAC

Correspondence e-mail: [laura.lagos@udc.es]

Environmental education constitutes an essential component of biodiversity conservation strategies, playing a crucial role in generating knowledge and improving attitudes toward ecosystem protection. This approach is indispensable for addressing contemporary environmental challenges, like climate change and biodiversity loss.

RURALtXA! is a project focused on the conservation of mountain habitats, particularly heathlands and bogs, by promoting traditional agro-pastoral activities that contribute to their preservation. The project emphasizes local knowledge while also incorporating elements to foster favourable attitudes toward conservation among the common land communities that own and manage the territories where the project is implemented in Galicia.

To achieve this, the project includes educational initiatives targeted at various key sectors of local communities: 1) commoners; 2) local schoolchildren (future commoners and farmers); 3) conservationist groups and land managers, who could replicate conservation practices; 4) general public.

The educational actions carried out include different strategies: a) presentations in schools; b) land stewardship agreements with commoners, incorporating educational components in their design and dissemination; c) participatory processes for habitat restoration; d) citizen science tools for results monitoring; e) pull information serving as educational material through dissemination channels.

This work presents the training strategies implemented at each level of intervention, emphasizing the adaptation of the educational discourse and the use of contextualized ecological concepts as key elements.

The project RURALtXA! is supported by the Biodiversity Foundation of the Ministry for the Ecological Transition and the Demographic Challenge (MITECO) of the Government of Spain, within the framework of the Recovery, Transformation and Resilience Plan (PRTR), funded by the European Union - NextGenerationEU.

[TSA.1-P-10]

Tuesday 3
Discussion corner: Room 1

GREENCOOP: Driving the Green Transition through Cooperative Models

Rodríguez-Rigueiro, Francisco Javier[1]; Ferreiro-Domínguez, Nuria[2]; Couso-Viana, Ana[3]; Vázquez-Miramontes, Diego[4]; Santiago-Freijanes, José Javier[5]; Mosquera-Losada, María[6]

(1) High Polytechnic School of Engineering; (2) High Polytechnic School of Engineering; (3) High Polytechnic School of Engineering; (4) High Polytechnic School of Engineering; (5) High Polytechnic School of Engineering; (6) High Polytechnic School of Engineering

Correspondence e-mail: [fj.rodriguez.rigueiro@usc.es]

The EU's socio-economic challenges—such as land abandonment, an aging population, limited access to technology, and rural depopulation—necessitate the development of new Rural Community Business Models (RCBMs). These models aim to enhance rural businesses by integrating innovative and cost-effective agroecological and digital solutions, boosting ecosystem services, improving farmers' quality of life, and revitalizing rural areas. The GREENCOOP project aims to establish 15 Living Labs (LLs) in the EU and 3 in China to co-create Agroecological and Digital Innovations (ADIs) through 12 demonstrations that promote social economy. This initiative enhances farmers' prosperity, supports rural entrepreneurs, optimizes resource use, reduces environmental damage, improves working conditions, and fosters inclusion (e.g., youth, women). By integrating ADIs into various farming systems (farm ideotypes) identified by the GREENCOOP LLs, the project will develop RCBMs that actively engage farmers and rural entrepreneurs in food systems. This will increase ecosystem services, improve food security, and help adapt farming systems to climate change, boosting market resilience. Over four years, GREENCOOP will (i) create and evaluate 12 ADIs using a multidisciplinary approach, (ii) analyze the integration of ADIs with industries in rural businesses to develop RCBMs, (iii) benchmark existing business models against RCBMs, assessing their economic, environmental, and social impacts, and (iv) optimize RCBMs to enhance sustainability, productivity, rural-urban connectivity, and resilience to climate and market challenges.

TSA.2. Beyond the Lab: Citizen Science as a Catalyst for Ecological Research and Community Involvement

Monday, 2 (18:00-19:30) • Tuesday, 3 (11:00-12:30)

Room: Seminario 1

Citizen science has become an increasingly valuable approach in ecological research, allowing for large-scale data collection, encouraging public involvement, and boosting scientific literacy. By shifting away from the traditional model where research was confined to universities and research institutions, it has opened up new ways of engaging with the scientific method without compromising its rigour. Today, citizen science plays a crucial role across various scientific disciplines, achieving particular success in areas like biodiversity monitoring, environmental assessment, and ecosystem management. In ecology, public involvement has become essential, spanning not only data collection and interpretation but also other stages of the research process, including the implementation of results.

This thematic session, the first to specifically highlight citizen science within an Iberian scientific ecology conference, aims to present key projects, share practical strategies, and discuss both the opportunities and challenges that citizen science brings. The session will tackle common issues like the changing roles of researchers, ethical considerations, coordination across different scales, and ensuring data accuracy. Through case studies and practical insights, participants will gain useful tools to effectively integrate citizen science into their own research, making this session an important resource for those seeking to enrich their ecological studies with participatory methods.

Organizers:

• **Anabel Sánchez Plaza,** CREAF; Laura Force Seguí, CREAF

• **María Soria,** UVIC-BETA

• **Meritxel Abril Cuevas,** UVIC-BETA.

TSA.2. Orals

[TSA.2-O-1]

Monday 2, evening: 18:00
Room: Seminario 1

Observadores del mar, the marine citizen science platform enhancing science-based decisions for ocean conservation

Lopez-Sendino, Paula[1]; Marambio, Macarena[2]; Agell, Gemma[3]; Chic, Oscar[4]; Espeja, Sandra[5]; García, María[6]; Hermoso, María Isabel[7]; Velasco, Eva[8]; Vilanova, Martí[9]; Vicioso, María[10]; Garrabou, Joaquim[11]

(1) Institut de Ciències del Mar; (2) Institut de Ciències del Mar (ICM- CSIC); (3) Centre d'Estudis Avançats de Blanes (CEAB-CSIC); (4) Institut de Ciències del Mar (ICM- CSIC); (5) Fundación Marilles; (6) Centre d'Estudis Avançats de Blanes (CEAB-CSIC); (7) Institut de Ciències del Mar (ICM-CSIC); (8) Centro Oceanográfico de Santander (COS-IEO); (9) Institut de Ciències del Mar (ICM- CSIC); (10) Institut de Ciències del Mar (ICM- CSIC); (11) Institut de Ciències del Mar (ICM- CSIC)

Correspondence e-mail: [plopez@icm.csic.es]

Observadores del Mar is the marine citizen science platform reference in Spain devoted to ocean conservation. The platform, with more than 10 years of activity, is focused on collecting quality data on 5 main issues: biodiversity, climate change, vulnerable species, exotic species, and marine litter.

Although the main activity started in Catalonia and the Balearic coast, collaboration has enabled the expansion to the rest of the Mediterranean and the Atlantic Spanish coasts and it is currently coordinated by most marine CSIC Research centres.

Through more than 10 years, the platform has expanded in the number of projects, the membership of scientific teams (+100 members from 40 research institutions and universities) and has consolidated a community of +5,000 observers and +500 organizations (NGOs, diving clubs and centres).

The main pillars of Observadores del Mar to contribute to ecological research are:

i) scientists address specific research questions ii) most of the observations are collected following standardized protocols adapted for citizen science (including trainings) iii) data are validated by expert scientific teams iv) building large-scale long-term data citizen science observatories v) collaboration between key stakeholders (e.g. research institutions, public administrations) vi) enhancing community engagement strategies.

For these reasons, Observadores del Mar is a key player in marine citizen science for Iberian marine ecological research, providing rigorous data to assess the conservation status of our marine environment, raising awareness about the pressures, expanding ocean literacy, and providing scientific data to the stakeholders responsible for the management of marine ecosystems.

[TSA.2-O-2]

Monday 2, evening: 18:15
Room: Seminario 1

Twenty years of studying catalan river ecosystems through citizen science

Codina, Marina[1]; Soria, Maria[2]; Fortuño, Pau[3]

(1) Associació Hàbitats - Projecte Rius; (2) University of Vic; (3) Centre de Recerca Ecològica i Aplicacions Forestals

Correspondence e-mail: [marina.codina@associaciohabitats.cat]

At the end of the 20th century, citizen science was still a little-known concept. However, the UB Department of Ecology, in collaboration with civil society, launched Projecte Rius, an initiative that exemplifies what we now define as citizen science, environmental education, service learning, land stewardship and citizen participation. Since 2004, the project has mobilized 697 volunteer groups to monitor the ecological state of rivers in Catalonia twice a year. These groups, trained to self-organize, have conducted 5894 inspections of 729 river sections, distributed throughout Catalonia. The data collected through Projecte Rius offers an alternative and complementary perspective to official sources, such as the Catalan Water Agency. This dataset provides valuable insights into changes in Catalan river ecosystems over the last two decades, aligning with the implementation of the European Water Framework Directive. It has also contributed to the refinement of hydrological regulations for this 3rd cycle of the river basin management plans, and driven public engagement in restoration and renaturalization projects for degraded rivers. Beyond the numerical results, Projecte Rius has succeeded in the dissemination of scientific concepts such as bio-indicators, riparian forests and the hydrological regime to thousands of people, empowering them to actively participate in river conservation efforts.

[TSA.2-O-3]

Monday 2, evening: 18:30
Room: Seminario 1

Using citizen science platforms for biodiversity conservation efforts and co-management in Côa Valley Archaeological Park

Pinto, Mónica[1]; Varandas, Simone[2]; Sarmento, Sandra[3]; Cabecinha, Edna[4]

(1) CITAB, University of Trás-os-Montes and Alto Douro; (2) CITAB, University of Trás-os-Montes and Alto Douro; (3) ICNF; (4) CITAB, University of Trás-os-Montes and Alto Douro

Correspondence e-mail: [monicapinto@utad.pt]

Citizen science platforms play a key role as a tool for biodiversity assessment in protected areas like the Côa Valley (Portugal). These initiatives engage the public, efficiently gathering diverse ecological data and pinpointing potential biodiversity hotspots. Citizen-driven surveys provide essential baseline insights into key species and ecosystems as a starting point for biodiversity characterization and ecosystem restoration planning in a vast target area. These platforms promote community engagement, gathering nature and culture heritage.

The data gathered through GBIF for the Côa Valley, with 20000 hectares, allowed to identify key biodiversity areas and target species with IUCN Conservation status like Pleurodeles waltl, Falco peregrinus and Gyps fulvus. Also, invasive species like Procambarus clarkii, Neogale vison and Acacia spp. were identified. It was possible to infer that are at least 451 species of flora and 523 species of fauna at Côa Valley.

This data will be used to create a baseline for biodiversity surveys, assess ecosystem services, define priority intervention areas within the Côa Valley Park and where to implement Nature-based Solutions to increase climate change resilience, increase biodiversity (mainly pollinators) and halt soil erosion. Inaturalist platform will be used to add more data during environmental education activities with schools and with groups of various citizens, in actions or events organized by the Côa Parque Foundation.

Acknowledgement: The present study was co-financed by the National Funds by FCT–Portuguese Foundation for Science and Technology, through the FCT/MCTES (PIDDAC), under the project UIDB/04033/2020 (CITAB). Mónica Pinto thanks to FCT funding PRT/BD/154865/2023.

[TSA.2-O-4]

Monday 2, evening: 18:45
Room: Seminario 1

Contextualized urban green space management enhances butterfly functional diversity

Guzmán Martín, Pau[1]; Rodríguez Soriano, Juan Daniel[2]; Melero Cavedo, Yolanda[3]

(1) Centre for Ecological Research and Forestry Applications (CREAF); (2) University of Barcelona (UB); (3) Univ. of Barcelona, Biodiversity Research Institute (IRBio) & centre of ecological research CREAF

Correspondence e-mail: [p.guzman@creaf.uab.cat]

As urban areas expand, protecting and promoting biodiversity has become a priority. Many cities are implementing greening strategies to improve green spaces by increasing their quality, connectivity and extent. While this is a great starting point, often management strategies lack scientific research to validate their effectiveness. To address this issue, we evaluated how urban green space management affects species functional syndromes. We used butterfly data collected in Barcelona from 2018 to 2023 by the citizen science project urban Butterfly Monitoring Scheme (uBMS, ubms.creaf.cat). We then tested the effects of different management strategies (e.g. greening, naturalizing) on the occurrence and abundance of three previously identified functional butterfly groups (C2, C3 and C4), using generalized lineal models. Results showed a positive effect of management on the occurrence of all functional groups, but distinct effects and strengths on abundance depending on the functional group and on the management action. For example, naturalized sites increased the presence of all three butterfly groups but only led to higher abundances for forest specialist species (C3 functional group). This highlights the need of contextualized management to boost the presence and the abundance of taxonomical and functional diversity in the cities and encourages further research on the role of green spaces management to avoid community homogenization and hence increase biodiversity in urban areas.

[TSA.2-O-5]

Monday 2, evening: 19:00
Room: Seminario 1

Biocultural Diversity in rural Spain: an inventory and perspectives from two contrasting regions

Otamendi Urroz, Irene[1]; Quintas-Soriano, Cristina[2]; Requena-Mullor, Juan Miguel[3]; Garau, Enrica[4]; Alba-Patiño, Daniela[5]; El Ghafraoui, Youssra[6]; Castro Martínez, Antonio J.[7]

(1) Social-Ecological Research Lab, Andalusian Center for Global Change - Hermelindo Castro (ENGLOBA); (2) Social-Ecological Research Lab, Andalusian Center for Global Change - Hermelindo Castro (ENGLOBA); (3) Social-Ecological Research Lab, Andalusian Center for Global Change - Hermelindo Castro (ENGLOBA); (4) Social-Ecological Research Lab, Andalusian Center for Global Change - Hermelindo Castro (ENGLOBA); (5) Social-Ecological Research Lab, Andalusian Center for Global Change - Hermelindo Castro (ENGLOBA); (6) Social-Ecological Research Lab, Andalusian Center for Global Change - Hermelindo Castro (ENGLOBA); (7) Social-Ecological Research Lab, Andalusian Center for Global Change - Hermelindo Castro (ENGLOBA)

Correspondence e-mail: [ireneota@ual.es]

Introduction. Biocultural diversity (BCD) represents the intricate relationship between biological and cultural diversity, encompassing local knowledge, practices, and values. This study explores BCD in two contrasting rural areas of Spain—Arazuri (Navarra) in the north and Felix (Almería) in the south. We aim to inventory and analyze BCD focusing on the generational transmission of knowledge and assessing the role of rural villages as 'biocultural refugia'. These refugia serve as repositories of traditional knowledge offering communities valuable resilient and historical solutions for sustainability challenges.

Material and methods. Between March and May 2024, we conducted 109 face-to-face surveys with local actors (59 in Arazuri and 50 in Felix). The surveys addressed: (1) connection to nature, (2) plants and animals presence, (3) practices and cultural traditions, (4) knowledge transmission, and (5) current rural challenges. Descriptive analyses examined temporal changes and generational differences in BCD and BCD knowledge.

Results and discussion. Our findings show a significant change in BCD compared to the past, driven by land use changes, urbanization, and lifestyle shifts. Changes in BCD are particularly evident in these villages near urban centers because of the lack of traditional ecological knowledge (TEK) transmission and the increasing disconnection from nature in younger generations. These results highlight the pressures that rural villages face as "biocultural refugia" in the Anthropocene. Bridging generational gaps, recontextualizing TEK for modern challenges, and fostering stronger human-nature connections are essential to preserving BCD and leveraging its value for sustainability and resilience.

[TSA.2-O-6]

Tuesday 3, morning (first): 11:00
Room: Seminario 1

Collaborative initiatives in the study of the health status of Catalan forest ecosystems

Banqué Casanovas, Mireia[1]; Fraile Moreno, Laura[2]; Fortuño Estrada, Pau[3]

(1) CREAF; (2) CREAF; (3) CREAF

Correspondence e-mail: [m.banque@creaf.uab.cat]

Forests are so extensive, varied and dynamic that they constitute an ideal ecosystem to apply citizen science methodologies, with the aim of collaboratively expanding and improving information on their characteristics, their state and the natural or anthropogenic dynamics that affect them. However, there are very few cases and projects that have focused on this line of work on an Iberian and European scale. This contribution aims to exemplify how citizen science can be applied to forest ecology with two initiatives arising from CREAF that monitor the effects on the forests of Catalonia: DeBosCat and Alerta Forestal. DeBosCat, launched in 2012, has the collaboration of the Rural Agents Corps, which generate observations of forest areas affected by events of forest decline or mortality caused by drought, and carry out an annual monitoring. Since 2016, AlertaForestal has involved citizens in the observation and detection of forest areas with visible phenomena that affect the health of the ecosystem, such as pests, drought or violent weather phenomena. In this communication, in addition to presenting the descriptive results of both initiatives, products derived from them will be presented, such as drought susceptibility models of the main tree species that make up the forests of Catalonia.

[TSA.2-O-7]

Tuesday 3, morning (first): 11:15
Room: Seminario 1

OdM Climate: Citizen Science Monitoring Climate Impacts on Mediterranean Marine Ecosystems

Hermoso Beltran, Maria Isabel[1]; Marambio, Macarena[2]; Vilanova, Martí[3]; Azzurro, Ernesto[4]; Cecapolli, Enrico[5]; Martinelli, Michela[6]; Albalat, Balma[7]; Tomas, Fiona[8]; López-Sendino, Paula[9]; Espeja, Sandra[10]; Agell, Gemma[11]; García, María[12]; Vicioso, María[13]; Garrabou, Joaquim[14]

(1) Institut de Ciències del Mar (ICM-CSIC); (2) Institut de Ciències del Mar (ICM-CSIC); (3) Institut de Ciències del Mar (ICM-CSIC); (4) CNR-IRBIM; (5) CNR-IRBIM; (6) CNR-IRBIM; (7) Instituto Mediterráneo de Estudios Avanzados (IMEDEA-UIB-CSIC); (8) Instituto Mediterráneo de Estudios Avanzados (IMEDEA-UIB-CSIC); (9) Institut de Ciències del Mar (ICM-CSIC); (10) Fundación Marilles; (11) Centre d'Estudis Avançats de Blanes (CEAB-CSIC); (12) Centre d'Estudis Avançats de Blanes (CEAB-CSIC); (13) Institut de Ciències del Mar (ICM-CSIC); (14) Institut de Ciències del Mar (ICM-CSIC

Correspondence e-mail: [mihermoso@icm.csic.es]

Introduction. In 2024, Observadores del Mar, Spain's leading marine citizen science platform, launched OdM Climate under the motto "Joining views towards climate change." This initiative assesses climate change impacts on Mediterranean marine ecosystems through a standardized monitoring network. Covering the Spanish Mediterranean coast, it involves 33 diving centers from Cap de Creus to Ceuta, including key areas such as the Balearic Islands and Andalusia. Participants received theoretical and practical training via the OdM Climate Tour, which implemented standardized protocols for four projects:

Coral Alert: Assessing mortality in gorgonians, sponges, and bryozoans caused by marine heatwaves.

Jellyfish Alert: Monitoring blooms, distribution shifts, and phenological changes.

Climate Fish: Tracking changes in temperate and thermophilic fish species.

Marine Seagrasses: Observing mass flowering events in Posidonia oceanica.

Results. Over 500 divers contributed more than 300 surveys, reflecting strong community engagement. Under Coral Alert, 88 censuses documented over 5,000 specimens across 10 species, highlighting the impact of marine heatwaves on benthic ecosystems. In Climate Fish, 105 censuses recorded over 13,000 individuals. Jellyfish Alert completed 111 censuses reporting 4 different species. Data collection for Marine Seagrasses is ongoing, and results are not yet available. Further data are being analyzed to draw conclusions about observed phenological and ecological changes.

Conclusion. OdM Climate showcases the power of citizen science to address climate challenges, foster public awareness, and provide critical data for conservation and adaptation strategies.

[TSA.2-O-8]

Tuesday 3, morning (first): 11:30
Room: Seminario 1

The role of public engagement in science in sustainability transitions

Suárez Eiroa, Brais[1]; Míguez González, Cristina[2]

(1) Universidade de Vigo; (2) Universidade de Vigo

Correspondence e-mail: [brsuarez@uvigo.gal]

Sustainability transitions research (STR) currently faces epistemological and methodological-political limitations that hinder the pursuit of truly sustainable and just transitions. This study explores how public engagement in science (PES) can help bridge this gap. Essentially, we analyse a co-creative citizen science project carried out between July 2023 and November 2024 in Pontevedra, Spain, involving over 200 secondary school students engaged in the sustainable transformation of the municipality.

The research followed a dual approach. Firstly, we led scientific research with citizen participation structured around several case studies related to a just sustainability transition. Secondly, we conducted a meta-investigation of the participation process itself through participant observation and surveys to understand the interaction between PES and STR.

The results show that co-creative citizen science democratises knowledge production, challenges existing power structures and promotes the inclusion of diverse perspectives and local knowledge. By involving citizens in all stages of the scientific process, context-specific challenges and solutions are identified that can lead to grassroots innovations that disrupt established regimes and promote more equitable and sustainable transitions. The study also identifies methodological and practical limitations, such as the need to increase face-to-face interaction, improve educational materials and ensure the long-term continuity of such initiatives. We conclude that co-creative citizen science can be a powerful tool to advance just sustainability transitions, provided that the identified challenges are addressed. By democratising knowledge and empowering communities, we lay the foundation for transformative change that meets the needs and aspirations of society as a whole.

[TSA.2-O-9]

Tuesday 3, morning (first): 11:45
Room: Seminario 1

Beyond cleanup campaigns: "Plastic Pirates - Go Europe!" a Citizen Science project for monitoring and raising awareness of plastic residues in fluvial ecosystems

López-Doval, Julio C.[1]; Gignac, Florence[2]; Canepa-Oneto, Antonio[3]; De La Fuente, Patricia[4]; Proia, Lorenzo[5]; Abril, Mertixell[6]

(1) Centre Tecnòlgic BETA-Universitat de Vic; (2) Centre Tecnòlgic BETA-Universitat de Vic; (3) Escuela Politécnica Superior, Universidad de Burgos; (4) Escuela Politécnica Superior, Universidad de Burgos; (5) Centre Tecnòlgic BETA-Universitat de Vic; (6) Centre Tecnòlgic BETA-Universitat de Vic

Correspondence e-mail: [juliocesar.lopez@uvic.cat]

Plastic pollution is a significant and pressing issue. Campaigns involving citizens in cleanup activities within river ecosystems are crucial for raising awareness about plastic pollution and removing long-lasting residues. However, substantial knowledge gaps remain regarding the real sources, fluxes and impacts of plastics in freshwater ecosystems, as well as the lack of standardized protocols for monitoring their presence and abundance from both scientific and managerial perspectives. Citizen science can serve as a tool to bridge this gap by enabling the collection of data across large spatial and temporal scales. When young people participate through of schools and youth organizations, citizen science engages them with local environmental problems, enhance their understanding of the scientific process, and encourages positive behavioral changes to address these problems. This is the aim of the EU-funded project "Plastic Pirates - Go Europe!", which engages young people in sampling campaigns and data collection to address plastic pollution in freshwater ecosystems. This project uses standardized methods to quantify and characterize plastic and microplastic litter in rivers, and to identify potential sources of plastic sources. In Spain, this project has been implemented between 2022-25 in schools and youth organizations from Castilla y León and Catalonia. Over 1,000 students from 38 schools and organizations are sampling 37 sections of 10 different rivers. The collected data is then analyzed by researchers to identify the most impacted sites within the studied rivers, the types of plastic residues contributing most significantly to this impact, and the potential sources or behaviors responsible for this pollution.

[TSA.2-O-10]

Tuesday 3, morning (first): 12:00
Room: Seminario 1

Bridging education and research to investigate biodegradable packaging materials' impact on aquatic health: A citizen science approach

Borrego Ramos, Maria[1]; Blanco, Saúl[2]; García Llamas, Paula[3]; Feuchter, Michael[4]; Resch-Fauster, Katharina[5]; Tischberger-Aldrian, Alexia[6]; Passarella, Marinella[7]; Laviale, Martin[8]; Bermejo, Laura[9]; Corona, Laura[10]; Martín, Anne[11]; Taboada, Ángela[12]

(1) University of León; (2) Diatom Lab, University of León, E-24007 León, Spain; (3) Department of General and Specific Didactics and Educational Theory, University of León; (4) Materials Science and Testing of Polymers, Montanuniversitaet Leoben; (5) Materials Science and Testing of Polymers, Montanuniversitaet Leoben; (6) Department of Environmental and Energy Process Engineering, Montanuniversitaet Leoben; (7) Resources Innovation Center (RIC), Montanuniversitaet Leoben; (8) Laboratoire Interdisciplinaire des Environnements Continentaux, University of Lorraine, Metz; (9) Diatom Lab, University of León, E-24007 León, Spain; (10) Diatom Lab, University of León, E-24007 León, Spain; (11) Diatom Lab, University of León, E-24007 León, Spain; (12) Institute of Environmental Research (IMA), University of León, E-24007 León, Spain

Correspondence e-mail: [mborr@unileon.es]

The environmental impact of biodegradable and compostable packaging materials on aquatic ecosystems' health remains critically understudied. To address this gap, the 'CiDIA-micro' project engages 111 high school students and 7 teachers, 9 researchers, and 3 universities in a collaborative citizen science initiative within EURECA-PRO 'The European University on Responsible Consumption and Production'. The project investigates the ecotoxicological effects of biodegradable packaging materials on diatom algae, which serve as key bioindicators of water quality. By integrating experimental research into classrooms, the initiative fosters meaningful learning and develops green competences for sustainability, environmental stewardship, and scientific inquiry, while generating valuable data for ecological research.

Experimental microcosms simulating aquatic environments and climate change conditions were established in six high schools in León province and at university laboratories. Participants received hands-on training in diatom sampling, environmental monitoring, and research methodologies. Monthly assessments evaluate diatom population growth, community composition, ecophysiology, and teratologies, alongside water quality analysis. Advanced chemical and physical analyses of the packaging materials pre- and post-exposure investigate heavy metal release, microplastic generation, and material degradation.

Preliminary findings reveal significant interactions between biodegradable packaging materials and aquatic ecosystems, raising concerns about heavy metal additives and microplastic fragmentation. By aligning with SDG12 and EU regulatory standards, this project provides key insights to inform packaging policy and promote a circular economy. Additionally, the initiative demonstrates the power of citizen science in uniting education, research, and community engagement, offering a scalable model for fostering meaningful learning and equipping participants with green competences to address sustainability challenges.

[TSA.2-O-11]

Tuesday 3, morning (first): 12:15
Room: Seminario 1

Citizen contributions to phenology monitoring: the RitmeNatura and FenoCat networks

Prat, Ester[1]; Gaya, Gerard[2]; Busto, Montserrat[3]; De Yzaguirre, Xavier[4]; Domingo-Marimon, Cristina[5]; Cunillera, Jordi[6]

(1) CREAF; (2) CREAF; (3) SMC; (4) SMC; (5) CREAF; (6) SMC

Correspondence e-mail: [e.prat@creaf.cat]

When we see a flowering plant, we rarely consider whether its blooming is typical for that time of year, unless we are farmers or phenology scientists. As citizens, we simply snap a photo, share it on social media and enjoy its colours and fragrance. But what happens when scientists gather and analyse all the information shared by citizens? We now know that 214 plant species bloomed outside their usual seasons last year in Catalonia, or that fruit ripening occurs 20 to 40 days earlier than in the last 50 years.

RitmeNatura and FenoCat, two citizen observatories dedicated to monitoring phenology in Catalonia, are making significant discoveries thanks to the observations provided by their participants. While RitmeNatura really began collecting social media posts from Twitter in 2015, it now uses the iNaturalist platform to gather and record contributions from citizens passionate about sharing their phenology findings. Observers from the FenoCat network are devoted to observing 2 or 3 times a week at the same place.

Overall, citizens can observe in multiple places in different moments and provide a much broader range of observations than a team of scientists could collect. This extensive monitoring is important in phenology, where long and widely geographically distributed time series are needed to identify changes over time. Citizen observations have allowed long historical time series databases for specific species and locations developed by the FenoCat network in Catalonia since 1932. In the PhenoTandem project, RitmeNatura observations were also used to validate local phenology information derived from remote sensing.

TSA.2. Posters

[TSA.2-P-1]

Wednesday 4
Discussion corner: Room 1

Testing the use of eBird data to describe seasonal patterns of abundance of waterbirds: the case of the greater flamingo

Sánchez Sáez, Sara[1]; Sebastián González, Esther[2]; López Iborra, Germán M.[3]

(1) University of Alicante; (2) University of Alicante; (3) University of Alicante

Correspondence e-mail: [sara.san.sa17@gmail.com]

Introduction. Citizen science projects like eBird provide valuable biological data for research, complementing standardized bird monitoring to identify trends and fill information gaps. While often used to study patterns at large scales, their potential for local-scale analyses, especially in vulnerable ecosystems like wetlands, remains underexplored despite their importance for understanding global change impacts.

This study compares trends in bird abundances using eBird data and institutional censuses from a wetland in southeastern Iberian Peninsula. Its main aim is to evaluate the applicability of citizen science data in describing monthly variation of abundance of waterbird species.

Material and methods. Bird observation data from eBird, (2018-2023) in La Mata-Torrevieja Natural Park were processed using the R package auk. Greater flamingo was selected as study species due to its ease of detection and recognition. Generalized additive models (GAMs) were fitted to the number of flamingos reported in La Mata lagoon using as covariates month/year, hour and the length of each observer's checklist as fixed effect and the number of observers as random effect. We used monthly bird censuses conducted by technicians from the regional environmental authorities as reference data to compare with predictions from GAM models.

Results and discussion. The monthly abundance index generated by the GAM aligns approximately with standardized flamingo censuses, providing a good representation of seasonal pattern of abundance fluctuation. However, this result may differ for less detectable species or wetlands less visited by birdwatchers. Therefore, we are testing the applicability of this approach to other species and study sites.

[TSA.2-P-2]

Thursday 5
Discussion corner: Room 1

Making the invisible visible: participatory methods to study soil biodiversity

Morillas, Lourdes[1]; Roales Batanero, Javier[2]; Homet-Gutiérrez, Pablo[3]; Sánchez Moreno, Sara[4]; Morales Salmerón, Laura[5]; Lillo Aparici, Paula[6]; Domínguez Begines, Jara M.[7]; Matias Resina, Luis[8]; Gil-Martínez, Marta[9]

(1) University of Seville; (2) Universidad de Sevilla; (3) Universidad de Cádiz; (4) Museo Nacional de Ciencias Naturales (CSIC); (5) Instituto de Ciencias Forestales (CSIC); (6) Instituto Nacional de Investigación y Tecnología Agraria y Alimentaria (CSIC); (7) Instituto de Educación Secundaria Beatriz de Suabia; (8) Universidad de Sevilla; (9) Universidad de Sevilla

Correspondence e-mail: [lmorillas@us.es]

Introduction. Citizen science projects are valuable instruments to increase social literacy on soil fauna and its role in soil functioning. We conducted two citizen science projects on this topic: the first one delved into the relationship between soil fauna and the soil's capacity to decompose organic matter, while the second project focused on analyzing the abundance and diversity of soil organisms (micro, meso and macrofauna). The goal of both projects was to raise awareness about soil processes and conservation, providing them with a new and accessible tool to assess soil quality.

Materials and Methods. Both projects were implemented in ten high schools of Spain in 2024. Methodologies used involved simple protocols, easily accessible materials and learning tools adapted to the age of the participants. Students actively engaged in most of the research stages: hypothesis formulation, fieldwork, sample analysis, drafting of the final report and presentation of their results at the project´s final meetings. Students were subjected to pre- and post-project questionnaires to assess their conceptual understanding of soil fauna's role on edaphic functioning, as well as the success of the methodologies applied in each project.

Results and Discussion. Despite both projects notably increased the students´ knowledge on the addressed topics, the project that included experimental organic matter decomposition had the best results. Our finding suggested that activities that promote complementarity of processes and concepts, and which are further supported by practical experiences are particularly powerful learning tools and should be highlighted as the best practice in participatory projects.

GENERAL SESSION

GSB. Ecology Across Scales

Tuesday, 3 (11:00-12:30); (12:45-14:15) • Wednesday, 4 (11:00-12:30); (12:45-14:15) • Thursday (11:00-12:30); (12:45-14:15)

Room: Salón de actos

Environmental and global change drivers influence the functioning of life at all levels, from molecular to ecosystemic or global processes. These factors affect both individual species and entire biomes. Conversely, the functioning of the biosphere also impacts the environment at different spatial and temporal scales. Understanding environment-life relationships is crucial to anticipate future changes and thus preserve life and ecosystems. A global understanding is essential to mitigate the negative impacts of human activities, enhance the resilience of ecosystems against disturbances, and develop more effective conservation and environmental management strategies.

Key Questions:

• How do ongoing climate change, chemical pollution, and landscape transformation impact life at all levels?

• How can a global understanding help mitigate the negative impacts of human activities?

Coordinators:

• **Romina Álvarez Troncoso,** Universidade de Vigo (UVigo)

• **Eneko Arrondo,** Universidad de Granada (UGR)

• **Elena D. Concepción,** Museo Nacional de Ciencias Naturales (MNCN-CSIC)

• **Jorge Durán,** Misión Biolóxica de Galicia (MBG-CSIC)

• **Teresa Morán López,** Instituto Mixto de Investigación en Biodiversidad (IMIB-CSIC-UniOvi); Beatriz Mouriño, Universidade de Vigo (UVigo)

• **Isabel Muñoz,** Universitat de Barcelona (UB).

GSB. Orals

[GSB-O-1]

Tuesday 3, morning (first): 11:00
Room: Salón de actos

Identifying areas vulnerable to climate change for benthic fauna across the Southern Ocean through niche marginality and species distribution modeling

González López, Celia[1]; González, Rosvita[2]; Díaz, Angie[3]; R. Pertierra, Luis[4]; C. Guerrero, Pablo[5]

(1) National Museum of Natural Sciences (MNCN-CSIC), Madrid, Spain; (2) Institute of Ecology and Biodiversity, Concepción, Chile; (3) University of Concepción, Chile; (4) National Museum of Natural Sciences (MNCN-CSIC), Madrid, Spain; (5) Millennium Institute Biodiversity of Antarctic and Subantarctic Ecosystems (BASE), Concepción, Chile

Correspondence e-mail: [celia.gonzalez@mncn.csic.es]

The Antarctic region of the Southern Ocean harbors an outstanding nursery of life on Earth, yet it stands amongst some of the most vulnerable ecosystems to the effects of global change. Rising temperatures, expected to intensify in the coming decades, prompt marine wildlife to redistribute in order to maintain homeostasis. This climate-induced shifts in distribution may push species toward the edges of their environmental tolerances. Populations inhabiting marginal habitat conditions tend to be less resilient and are thus exposed to higher extinction risk. Predicting changes in habitat suitability is therefore of importance for acknowledging and mitigating biodiversity loss and focussing conservation efforts.

Species Distribution Models (SDMs) offer insights into species biogeographical responses to environmental changes. While massive SDMs lack the fine detail of single species models, they present some opportunities for comparison of large groups and inclusion of rare taxa. In this study, we examine the foreseeable future range shifts of a large set of species and families of marine fauna of the Southern Ocean. We also implement a novel methodology approach for assessing niche marginalization in order to estimate functional groups and geographic areas more at risk under future climatic scenarios.

Preliminary results show the paradoxical effects of temperature rise in extreme climates which puts some taxa at risk by increasing their marginality, while expanding potential distribution ranges for others, as abiotic factors' influence diminishes its significance on these regions. For this reason, we urge policy-makers to take this ambiguity into account when designing conservation plans for polar regions.

[GSB-O-2]

Tuesday 3, morning (first): 11:15
Room: Salón de actos

Native biocrust bacteria enhances germination of Mediterranean plants under climate change conditions

Vargas-Ordóñez, Antonio[1]; Macis, Silvia[2]; Álvarez-Cansino, Leonor[3]; Cantón, Yolanda[4]; Pajuelo-Domínguez, Eloísa[5]; Muñoz-Rojas, Miriam[6]

(1) University of Seville; (2) University of Cagliari; (3) University of Seville; (4) University of Almeria; (5) University of Seville; (6) Instituto de Recursos Naturales y Agrobiología de Sevilla (IRNAS-CSIC

Correspondence e-mail: [avargas7@us.es]

Introduction. Biodiversity loss threatens ecosystems globally, particularly in drylands. This can be exacerbated by increased temperatures caused by climate change, that may hinder the recruitment of native plants. Indigenous soil bacteria have shown potential as biofertilizers, promoting seed germination and seedling growth even in reconstructed soils. Here, we used bioinoculants derived from locally sourced biocrust bacteria to assess germination and growth of native Mediterranean plants used in dryland restoration.

Materials and Methods. Nine bacterial strains were isolated from biocrust samples collected from SE Spain and selected for their plant-growth-promoting (PGP) properties. Three bacterial consortia were formulated using combinations of 2–3 strains. Seeds of Thymus hyemalis and Genista umbellata were bioprimed with each consortium and incubated at 25ºC (normal) or 30ºC (global warming scenario). Controls were bioprimed with Milli-Q water. Germination rates and radicle lengths were assessed.

Results and Discussion. For T. hyemalis, Treatment 1 (Fredinandcohnia onubensis, Peribacillus frigoritolerans and Bacillus mojavensis) improved germination significantly, with rates of 68?±?4.3% at 25ºC vs. 54.5?±?3.6% in the control, and 60.4%?±?7.6% at 30ºC vs. 27.5?±?3.2% in the control. Treatment 3 (Bacillus halotolerans and Bacillus licheniformis) enhanced radicle length by 66.2% at 25ºC and 214.38% at 30ºC. In G. umbellata, only Treatment 2 (Streptomyces lateritius, Bacillus foraminis and Kushneria indalinina) improved germination at 25ºC (75.3?±?7% vs. 50.3?±?9.4% in the control), with no enhancements at 30ºC. Our results evidence that biopriming seeds of Mediterranean plants with biocrust bacteria can assist dryland restoration under warming scenarios. We are currently testing this approach for other Mediterranean species, i.e. Anthyllis cytisoides and Stipa tenaccisima.

[GSB-O-3]

Tuesday 3, morning (first): 11:30
Room: Salón de actos

Soil biota responses to simulated drought in Mediterranean ecosystems

Morales-Salmerón, Laura[1]; Gea-Izquierdo, Guillermo[2]; Gómez-Aparicio, Lorena[3]; Sánchez-Moreno, Sara[4]; Ogaya, Romà[5]; Domínguez-Núñez, María Teresa[6]; Panettieri, Marco[7]; Pérez-Ramos, Ignacio[8]; Martin-Benito, Darío[9]; Cañellas, Isabel[10]; Aranda, Ismael[11]; Peñuelas, Josep[12]; Moya-Laraño, Jordi[13]; Madejón, Engracia[14]; Querejeta, José Ignacio[15]; Goberna, Marta[16]

(1) Instituto Nacional de Investigación y Tecnología Agraria y Alimentaria, INIA-CSIC; (2) Instituto de Ciencias Forestales (ICIFOR-INIA-CSIC); (3) Instituto de Recursos Naturales y Agrobiología (IRNAS-CSIC); (4) Museo Nacional de Ciencias Naturales (MNCN-CSIC); (5) Centro de Investigación Ecológica y Aplicaciones Forestales (CREAF); (6) Universidad de Sevilla; (7) Instituto de Ciencias Agrarias (ICA-CSIC); (8) Instituto de Recursos Naturales y Agrobiología (IRNAS-CSIC); (9) Instituto de Ciencias Forestales (ICIFOR-INIA-CSIC); (10) Instituto de Ciencias Forestales (ICIFOR-INIA-CSIC); (11) Instituto de Ciencias Forestales (ICIFOR-INIA-CSIC); (12) Centro de Investigación Ecológica y Aplicaciones Forestales (CREAF); (13) Estación Experimental de Zonas Áridas (EEZA-CSIC); (14) Instituto de Recursos Naturales y Agrobiología (IRNAS-CSIC); (15) Centro de Edafología y Biología Aplicada del Segura (CEBAS-CSIC); (16) Instituto Nacional de Investigación y Tecnología Agraria y Alimentaria (INIA-CSIC)

Correspondence e-mail: [laura.morales@inia.csic.es]

Mediterranean ecosystems are challenged by more intense and recurrent droughts under current climate change. Because soil biota has traits that confer tolerance to desiccation, drought might lead changes in microbial community composition promoting drought-tolerant lineages. Conversely, local adaptation and acclimation to drought may result in minimal changes in community composition. Lower levels of soil moisture might reduce biological process rates both through the direct effects of reduced water availability and the limited physical access of soil biota to resources, as well as through indirect effects such as changes in soil community composition.

We studied the response of soil biota—bacteria, fungi, and nematodes—and respiration to drought across 12 manipulative experiments in Mediterranean ecosystems, including 5 forests, 3 shrublands, and 4 croplands. We compared rainfall exclusion (median exclusion of 30% over 8 years) against control conditions. We collected topsoil samples, measured soil abiotic parameters, extracted DNA, and sequenced the prokaryotic 16S rRNA gene and fungal ITS region. We also extracted soil nematodes and sequenced the eukaryotic 18S rRNA gene. We evaluated the effects of drought and land-use on soil biodiversity and functioning.

Experimental drought did not alter surface radiation or soil temperature, but significantly decreased soil volumetric water content. Despite reduced water availability, drought conditions only marginally diminished respiration, and thus CO2 emissions from soils to the atmosphere across different land uses. We discuss these results on the effects of drought on the diversity of soil biota, contributing to our understanding of soil biological responses to climate change.

[GSB-O-4]

Tuesday 3, morning (first): 11:45
Room: Salón de actos

Effect of drought on new carbon incorporation in the soils of a Mediterranean forest

Muñoz Hoyos, Estefanía[1]; Ogaya, Romà[2]; Carnicer, Jofre[3]; Mampel, Guillem[4]; Peñuelas, Josep[5]; Sierra, Carlos[6]

(1) CREAF, Max-Planck Institute for Biogeochemistry; (2) CREAF; (3) CREAF, Universidad de Barcelona; (4) Universidad de Barcelona; (5) CREAF; (6) Max-Planck Institute for Biogeochemistry

Correspondence e-mail: [e.munoz@creaf.uab.cat]

Climate change models predict increasingly drier conditions, particularly in the Mediterranean region, which is already prone to frequent droughts. While it is well-established that drought reduces gross primary production in forests, there is still uncertainty about its effect on the time carbon remains within forest ecosystems. Resolving this knowledge gap is critical for understanding forests' potential to mitigate global warming and inform future climate adaptation strategies. We studied timescales of carbon dynamics at a long-term drought experiment site in a Mediterranean holm oak forest in Prades, Catalonia. The experiment, ongoing since 1999, includes four plots with partial rainfall exclusion and four control plots. Our research involved: i) collecting soil samples at 5 cm intervals from 0-20 cm depth in all plots, ii) collecting air samples of in situ soil respiration, iii) incubating soil from 0-10 cm depth and sampling the resulting respiration, iv) analyzing all samples for radiocarbon content, and v) measuring carbon content in solid soil samples. Drought plots showed lower carbon percentages in the top 10 cm of soil compared to control plots ($p<0.05$), with approximately a 20 ton/ha difference in carbon stocks. Radiocarbon analyses revealed: i) surface layers (0-5 cm) contain mostly modern carbon, with faster cycling in drought plots, ii) field soil respiration is primarily from autotrophic sources or recent labile soil organic matter, iii) incubation respiration reflects decomposition of post-bomb carbon, and iv) no significant differences in soil respiration between drought and control plots were observed, except for higher variance in field respiration radiocarbon in drought plots. Overall, the results suggest that drought may reduce soil organic matter stabilization, accelerating carbon's return to the atmosphere.

[GSB-O-5]

Tuesday 3, morning (first): 12:00
Room: Salón de actos

Ecological perspectives of global change in polar regions: trends and knowledge

Pertierra, Luis R.[1]

(1) National Museum of Natural Sciences (CSIC-MNCN)

Correspondence e-mail: [luis.pertierra@gmail.com]

Polar regions are not unaffected to global change disturbances. In this talk the synthesis of biological affections, from the individual to the community and biome level, are explored first. These include, among others, homeostatic budget changes, genetic shifts, spatial range redistributions, variation of the functional trait expresion, of community assamblages, network state equilibriums up to whole-biome transformations. These are quite numerous changes happening that are extremely difficult to explore without robust interdisciplinary data. Yet the paucity of polar biodiversity knowledge discovery varies among ecological disciplines and taxonomic groups. This causes substantial challenges for having conciousness, inclusion and representation of all components of the polar biodiversity. This in turn hampers establishing an optimal strategic conservation planning. Recognition of such shortfalls is paramount as it allows effectively driving future research towards addressing matters of urgency. The present communication presents the first complete assessment of the status of ecological knowledge at a continental level across all living components. This scan involved the participation of many experts through elicitation processes and vast indicator data compilation. Ultimately we observe substantial gaps for cryptic and diverse groups of microfauna and microorganisms, whilst macrofauna and vegetation are best studied. Identification of phylogenetically diverse species with substantial data across disciplines help setting up functional study cases that alleviate areas of ignorance. The last frontier of ecological science ignorance mitigation remains in the identification of the specific value of information (VOI), this is, how much benefit can tentatively achieved per effort for filling an specific knowledge gap. The VOI for different conservation applications such as aliens biosecurity or climate change action are discussed last.

[GSB-O-6]

Tuesday 3, morning (first): 12:15
Room: Salón de actos

Carbon and oxygen isotopes in tree rings unveil species-specific response to drought in monospecific and mixed forests

Ureña Lara, Carmen[1]; Vitali, Valentina[2]; Saurer, Matthias[3]; Pérez-Corona, M. Esther[4]; Gessler, Arthur[5]; Andivia, Enrique[6]

(1) University Complutense of Madrid; (2) Swiss Federal Institute for Forest, Snow and Landscape Research WSL; (3) Swiss Federal Institute for Forest, Snow and Landscape Research WSL; (4) University Complutense of Madrid; (5) Swiss Federal Institute for Forest, Snow and Landscape Research WSL; (6) University Complutense of Madrid

Correspondence e-mail: [marurena@ucm.es]

Diversifying monospecific stands can enhance the resilience of forest ecosystems to extreme droughts. However, the effects of plant-plant interactions on water and carbon-related physiological processes in response to droughts remain unclear. We assessed carbon-13 (d13C) and oxygen-18 (d18O) in tree rings over a period of 20 years in monospecific and mixed forests of Pinus sylvestris and Quercus pyrenaica. Drought intensity increased d18O and reduced growth in both species, while increased d13C only in oaks. Oaks showed overall higher d13C in monospecific than in mixed stands. In addition, pines showed less growth reduction in response to drought in mixed stands, while oaks showed the opposite trend. When analysing isotopic ratios across periods with different drought frequency, pines showed an increase in d18O in response to more frequent droughts in monospecific stands, indicating reduced stomatal conductance, while oaks showed slightly higher d13C in mixed stands, suggesting enhanced water use efficiency. These results suggest that species mixing might decrease water stress in the isohydric pine while increasing water use efficiency in the anisohydric oak in response to more frequent drought events. Overall, these findings emphasize the complex interplay among species water use strategies, plant-plant interactions, and climate on canopy functioning and growth providing new insights for the improvement of vegetation models.

[GSB-O-7]

Tuesday 3, morning (second): 12:45
Room: Salón de actos

A global perspective on West Nile Virus host range and reservoir competence

Richter-Boix, Alex[1]; Rodriguez, Julia[2]; Bogdanovic, Nina[3]; Cerecedo, Catuxa[4]; Bartumeus, Frederic[5]

(1) CEAB-CSIC; (2) CEAB-CSIC; (3) CEAB-CSIC; (4) CEAB-CSIC; (5) CEAB-CSIC

Correspondence e-mail: [alex.richter@ceab.csic.es]

West Nile virus (WNV) is the most globally widespread arbovirus. It is characterized as a multi-host pathogen primarily maintained in a bird-to-mosquito-to-bird transmission cycle, with mammals playing a more limited role. The contribution of vertebrate hosts to viral transmission is governed by (1) their reservoir competence and (2) their contact rates with mosquito vectors.

To investigate WNV host dynamics, we conducted a comprehensive systematic literature review evaluating exposure (WNV prevalence in wild populations) and reservoir competence (infection experiments) across vertebrates and the role of host phylogeny on these. Exposure data were obtained from 551 studies spanning 93 countries, compiling information on 532,792 individuals representing 1,873 vertebrate species. Reservoir competence was analyzed in 104 studies covering 98 species.

Our findings reveal differences in WNV prevalence among species, identifying the most exposed vertebrate host groups. Additionally, the results indicate a phylogenetic signal in reservoir competence, suggesting that WNV is more effectively amplified by competent reservoirs exhibiting a clear phylogenetic relationship. These results provide a foundational framework for mechanistically understanding multi-host disease dynamics, offering insights into how shifts in host species composition could alter disease prevalence and outbreak risk through processes of dilution or amplification due to species differences in disease competence. This is critical as biodiversity loss aligns with increased disease outbreaks, indicating a potential link between the two trends.

[GSB-O-8]

Tuesday 3, morning (second): 13:00
Room: Salón de actos

Functional trait variability along an aridity gradient in Mediterranean woody plant communities at intraspecific and community levels

Muñoz Gálvez, Francisco Javier[1]; Prieto Aguilar, Ivan[2]; García de la Riva, Enrique[3]; González Barberá, Gonzalo[4]; Querejeta Mercader, José Ignacio[5]

(1) CEBAS-CSIC; (2) Universidad de León; (3) Universidad de Leon; (4) CEBAS-CSIC; (5) CEBAS-CSIC

Correspondence e-mail: [fjmunoz@cebas.csic.es]

A better understanding of the diversity of plant water and nutrient use strategies in native plant communities could help predict species adaptability to climate change, especially in Mediterranean environments where water scarcity is limiting to plant form and function. The use of functional traits to address this issue is a powerful tool at the individual species level, but less is known about vegetation trait variability along aridity gradients at community level. We sampled 6 plant communities along an aridity gradient from southeastern to central Spain. We measured leaf morphological traits (LMA, LDMC), nutrient contents, leaf gas exchange (A, gs, WUEi), and plant isotopic composition as proxies for water use efficiency (?13C), stomatal conductance (?18O) and water uptake depth (xylem water ?18O) in all the most abundant species present in each community (42 in total). We assessed functional diversity among coexisting species at each community and the dominance of different plant resource use strategies along an acquisitive-conservative spectrum, based on community weighted means. We also assessed intraspecific trait variability along the aridity gradient in two common species present at all study sites (Pinus halepensis and Rosmarinus officinalis). We found a tendency towards higher predominance of resource-acquisitive strategies with increasing aridity at both community and intraspecific levels. Pinus halepensis showed a more conservative resource use strategy than Rosmarinus officinalis at all sites. Understanding how plant resource use strategies shift with aridity at community level is fundamental to design and implement more effective vegetation conservation and restoration plans under a climate aridification scenario.

[GSB-O-9]

Tuesday 3, morning (second): 13:15
Room: Salón de actos

Linking Microhabitats and Biogeography: A Look at Soil Biodiversity of Mountain Wetlands

Lecegui, Víctor[1]; S. Wangensteen, Owen[2]; Osorio, Víctor[3]; Pladevall-Izard, Eulàlia[4]; Jiménez-Alfaro, Borja[5]; Ventura, Marc[6]; Pérez-Haase, Aaron[7]

(1) Universitat de Barcelona; (2) Universitat de Barcelona; (3) Centre d'Estudis Avançats de Blanes (CEAB-CSIC); (4) Universitat de Barcelona; (5) Universidad de Oviedo-CSIC-Principado de Asturias; (6) Centre d'Estudis Avançats de Blanes (CEAB-CSIC); (7) Universitat de Barcelona

Correspondence e-mail: [lecegui@ub.edu]

Mountain wetlands, or mires, are unique habitats that sustain high levels of microbial biodiversity in their soils. Understanding the ecological drivers of this diversity is crucial for predicting how these communities respond to environmental changes and biogeographic gradients. Here, we aimed to uncover soil biodiversity in mires and to identify their ecological drivers, using elevational gradients as natural laboratories to disentangle local and regional factors influencing these systems.

We sampled 53 mires across five mountain national parks in the Iberian Peninsula, with each park containing 10–12 mires arranged along an elevational gradient. Within each mire, we established 10 plots. For each plot, we documented vegetation and moss cover, recorded multiple environmental parameters, and collected topsoil samples (including the moss layer). We then used a metabarcoding approach targeting the 18S rRNA gene to characterize eukaryotic communities. 274 out of the 530 plots yielded satisfactory eukaryotic reads to perform ecological analyses.

Our results indicate a strong biogeographic signal, as both the national park and the specific mire system influenced community composition. While vegetation composition per se was less crucial, pH was an important variable. Differences between Sphagnum-dominated plots and those with higher bryophytes and vascular plants cover shaped assemblage structure. In addition, higher water table depth, indicating wetter conditions, increased eukaryotic diversity.

These findings provide a predictive framework for understanding soil biodiversity in mire ecosystems, highlighting the importance of biogeographic structure for soil eukaryote communities. Also, we offer a valuable insight into how such communities may shift under changing environmental conditions.

[GSB-O-10]

Tuesday 3, morning (second): 13:30
Room: Salón de actos

Seedling establishment as an ecosystem function composed of multiple ecological networks

Moreno-Colom, Patricia[1]; Baixauli Ferriols, Alejandra[2]; Pascual Tudanca, María P.[3]; Santos, Micaela[4]; Vázquez, Diego P.[5]; Pilosof, Shai[6]; Fedriani Laffitte, Jose María[7]; Montesinos Navarro, Alicia[8]

(1) Desertification Research Center; (2) Desertification Research Center; (3) Instituto Argentino de Investigaciones de Zonas Áridas, CONICET-Universidad Nacional de Cuyo; (4) Instituto Argentino de Investigaciones de Zonas Áridas, CONICET-Universidad Nacional de Cuyo; (5) Instituto Argentino de Investigaciones de Zonas Áridas, CONICET-Universidad Nacional de Cuyo; (6) Ben-Gurion University of the Negev; (7) Desertification Research Center; (8) Desertification Research Center

Correspondence e-mail: [patri7.mc@gmail.com]

Introduction. Fleshy-fruit seedling establishment results from a sequence of interconnected processes, including co-fructification, mammal dispersion, seed arrival in a microhabitat, and recruitment. While these processes have been studied in isolation, we studied their interdependencies to search for emergent community properties that contribute to ecosystem functioning. We expect that 1. species with long fructification periods show higher functional redundancy and 2. carnivore mammals have a higher contribution to the establishment than herbivore

Materials and Methods. We sampled two Mediterranean forests to assess the overlap in fruiting phenology, mammal-mediated seed dispersal, seed deposition microhabitats, and juvenile recruitment of fleshy-fruited plant species. We also evaluated species-specific effects of digestion on seed germination. To assess the interdependencies of processes, we built a multilayer network, where each layer represents an ecological process, and connections between layers depict transitions between these processes. We examined modularity, connectivity, and the role of the species in the establishment of fleshy-fruit plants through this multilayer network.

Results and Discussion. Our multilayer network approach allowed us to identify mammal species roles and modules (i.e. indicating groups of species that intract similarly across the processes) that drive plant establishment in this system. Also, we found that herbivores and omnivores have similar connectivity within the multilayer network, indicating that both groups could play significant roles in the establishment. Thus, studying the interdependencies between processes gives a more complete understanding of the communities' dynamics and structure.

[GSB-O-11]

Tuesday 3, morning (second): 13:45
Room: Salón de actos

Body mass biogeographical patterns in forests: what drives the distribution structure in different taxa in the Mediterranean Basin?

Silva Morales, Elysa[1]; Soliveres Codina, Santiago[2]; Pinguet, Yoann[3]

(1) Universidad de Alicante; (2) Universidad de Alicante; (3) The Mediterranean Institute of marine and terrestrial Biodiversity and Ecology IMBE

Correspondence e-mail: [elysilvam@ua.es]

Body mass is an effective surrogate of biological and ecological information such as metabolic rate, energy fluxes, reproductive strategies and population dynamics. The structure of the distribution of body mass within an ecosystem—characterized by metrics such as skewness (rarity) and kurtosis (evenness)—can serve as a significant indicator of ecosystem functioning, capturing multiple processes simultaneously. Here, we explore the geographic patterns and possible drivers that explain the body mass distribution structure of trees, butterflies, reptiles, birds and mammals in the Mediterranean forest. For this, we measure how far the body mass distributions of the species observed in a 50x50 km grid are from the optimal evenness based on the skewness-kurtosis relationship. Our results have shown shared commonalities in the body mass distribution structure between trees, butterflies, birds and flying mammals, presenting a more even distribution than expected by chance and a peakier distribution for reptiles and terrestrial mammals. Drivers differ between taxa, but abiotic and anthropogenic pressure are the more common. These results could contribute to identifying hot spots of highly functional ecosystems for conservation, and provide clues for possible actions for its recovery.

[GSB-O-12]

Tuesday 3, morning (second): 14:00
Room: Salón de actos

Species functional traits affect regional and local dominance across western Amazonian forests

Matas Granados, Laura[1]; Fortunel, Claire[2]; Cayuela, Luis[3]; G. de Aledo, Julia[4]; Ben Saadi, Celina[5]; Kraft, Nathan J.B.[6]; Baraloto, Christopher[7]; Wright, S. Joseph[8]; Vleminckx, Jason[9]; Garwood, Nancy C.[10]; Hietz, Peter[11]; Metz, Margaret R.[12]; Draper, Frederick C.[13]; Baker, Timothy R.[14]; Phillips, Oliver L.[15]; Honorio Coronado, Eurídice N.[16]; Ruokolainen, Kalle[17]; García-Villacorta, Roosevelt[18]; Roucoux, Katherine H.[19]; Guèze, Maximilien[20]; Valderrama Sandoval, Elvis[21]; Fine, Paul V.A.[22]; Amasifuen Guerra, Carlos A.[23]; Zarate Gomez, Ricardo[24]; Stevenson, Pablo R.[25]; Monteagudo-Mendoza, Abel[26]; Vasquez Martinez, Rodolfo[27]; Terborgh, John[28]; Disney, Mathias[29]; Brienen, Roel[30]; Núñez Vargas, Percy[31]; del Aguila Pasquel, Jhon[32]; Malhi, Yadvinder[33]; Socolar, Jacob B.[34]; Cornejo-Valverde, Fernando[35]; Flores Llampazo, Gerardo[36]; Vega Arenas, Jim[37]; Galiano Cabrera, Darcy[38]; Silva Espejo, Javier[39]; Talbot, Joey[40]; Vinceti, Barbara[41]; Reyna Huaymacari, José[42]; Davila Cardozo, Nallarett[43]; Ballón Falcón, Cecilia[44]; Feldpausch, Ted R.[45]; Swamy, Varun[46]; Grandez Rios, Julio M.[47]; Macía, Manuel J.[48]

(1) Autonomous University of Madrid; (2) AMAP, University of Montpellier, CIRAD, CNRS, INRAE, IRD; (3) Universidad Rey Juan Carlos; (4) Universidad Autónoma de Madrid; (5) Universidad Autónoma de Madrid; (6) University of California; (7) Florida International University; (8) Smithsonian Tropical Research Institute; (9) Université Libre de Bruxelles; (10) Southern Illinois University; (11) University of Natural Resources and Life Sciences, Vienna; (12) Lewis & Clark College, Portland, Oregon; (13) University of Liverpool; (14) University of Leeds; (15) University of Leeds; (16) University of St Andrews; (17) University of Turku; (18) Centro de Innovación Científica Amazónica (CINCIA), Tambopata, Madre de Dios, Perú; (19) University of St Andrews; (20) UNESCO, Paris, Île-de-France; (21) Universidad Nacional de la Amazonía Peruana; (22) University of California Berkeley; (23) Universidad Nacional Toribio Rodríguez de Mendoza de Amazonas (UNTRM); (24) Instituto de Investigaciones de la Amazonía Peruana; (25) Universidad de los Andes; (26) Universidad Nacional de San Antonio Abad del Cusco; (27) Estación Biológica del Jardín Botánico de Missouri, Oxapampa, Perú; (28) University of Florida; (29) University College London; (30) University of Leeds; (31) Universidad Nacional de San Antonio Abad del Cusco; (32) Instituto de Investigaciones de la Amazonía Peruana, Iquitos, Perú; (33) University of Oxford; (34) NCX, 2443 Fillmore St. #380-1418 San Francisco, CA 94115; (35) Andes to Amazon Biodiversity Program, Madre de Dios, Madre de Dios, Peru; (36) Instituto de Investigaciones de la Amazonía Peruana, Iquitos, Perú; (37) Universidad Nacional de la Amazonía Peruana; (38) Universidad Nacional de San Antonio Abad del Cusco; (39) Universidad Nacional de San Antonio Abad del Cusco; (40) University of Leeds; (41) Bioversity International, Rome, Italy; (42) Instituto de Investigaciones de la Amazonía Peruana, Iquitos, Perú; (43) Instituto de Investigaciones de la Amazonía Peruana, Iquitos, Perú; (44) Universidad Nacional Agraria La Molina; (45) University of Exeter; (46) San Diego Zoo Institute for Conservation Research, Escondido, California, USA; (47) Instituto de Investigaciones de la Amazonía Peruana, Iquitos, Perú; (48) Universidad Autónoma de Madrid.

Correspondence e-mail: [matas.granados.l@gmail.com]

Dominance patterns in contrasting forest habitats in Amazonia have revealed that dominant species tend to be either locally abundant (local dominants) or regionally frequent (widespread dominants) but rarely both. However, the mechanisms underlying dominance remain unclear. Here, assuming that species traits relate to ecological processes that can lead to dominance, we asked across different habitat types whether: (i) dominance is defined by specific functional profiles and (ii) dominance patterns are associated with different functional traits.

We combined census data of 503 forest inventory plots across four lowland forest habitats in western Amazonia with trait information for ~2600 tree species, encompassing data collected in the focal plots and data from published sources. We considered traits that relate to leaf, wood, seed and whole-plant strategies.

Our results reveal that dominant species display different trait combinations depending on the habitat type where they dominate. Larger dominant species exhibit higher regional frequency, associated with higher dispersal ability, and lower local abundance, likely due to negative density dependence. Greater seed mass contributes to higher regional frequency of dominant species via greater dispersal ability. Finally, traits related to conservative resource strategies favor higher local densities across most habitats, while the opposite pattern was linked to higher regional frequency. Our study reveals the potential of trait-based approaches in the study of the ecological mechanisms underlying dominance in tropical forests. Accounting for both local abundance and regional frequency when studying dominance can improve our understanding and forecasting of species responses to global change drivers in western Amazonia.

[GSB-O-13]

Wednesday 4, morning (first): 11:00
Room: Salón de actos

From shredders to microbes: drying shifts biotic controls of leaf litter decomposition in river networks

del Campo González, Rubén[1]; Angulo, Amaia[2]; Szloboda, Anita[3]; Künne, Annika[4]; Vilmi, Annika[5]; Foulquier, Arnaud[6]; Móra, Arnold[7]; Pernecker, Bálint[8]; Loskotová, Barbora[9]; Boóz, Bernadett[10]; Cunillera-Montcusí, David[11]; Hárságyi, Dorottya[12]; Estévez, Edurne[13]; Peñas, Francisco J.[14]; Barquín, José[15]; Chalmandrier, Loïc[16]; Polovic, Luka[17]; Polášek, Marek[18]; Soria, Maria[19]; Miliša, Marko[20]; López-Rojo, Naiara[21]; Bonada, Núria[22]; Paril, Petr[23]; Sarremejane, Romain[24]; Mykrä, Heikki[25]; Henna, Snåre[26]; Csabai, Zoltán[27]; Datry, Thibault[28]; Singer, Gabriel[29]

(1) Universidad de Murcia; (2) IHCantabria; (3) University of Pécs; (4) Friedrich Schiller University Jena; (5) SYKE; (6) University Grenoble-Alpes; (7) University of Pécs; (8) University of Pécs; (9) Masaryk University; (10) University of Pécs; (11) HUN-REN Centre for Ecological Research; (12) University of Pécs; (13) University of Innsbruck; (14) IHCantabria; (15) IHCantabria; (16) University Grenoble-Alpes; (17) University of Zagreb; (18) Masaryk University; (19) University of Barcelona; (20) University of Zagreb; (21) INRAE; (22) University of Barcelona; (23) Masaryk University; (24) Nottingham Trent University; (25) SYKE; (26) SYKE; (27) University of Pécs; (28) INRAE; (29) University of Innsbruck.

Correspondence e-mail: [rubendel.campo@um.es]

Under the current global change, river drying is becoming a widespread phenomenon, altering both communities and ecosystem functioning in river networks. Drying not only has local effects, but it also disrupts the distribution of resources and consumers at the regional scale through changes in the spatiotemporal connectivity of the network. Leaf litter decomposition, a key ecosystem function, is highly sensitive to changes in composition and diversity of decomposer communities. Drying can have different effects on microbial and detritivore communities. While microbial communities generally exhibit greater resistance to drying, macroinvertebrates can rely on active dispersal for resilience. As part of the H2020 DRYvER project, we investigated how drying alters the biodiversity controls of leaf litter decomposition in six European river networks across different hydrological phases. We assessed decomposition rates using leaf litter bag experiments, and monitored macroinvertebrate, bacterial, and fungal communities via traditional methods and eDNA analysis. Our results reveal that spatiotemporal connectivity governs decomposition rates through distinct mechanisms depending on flow regime. In perennial reaches, decomposition was primarily driven by shredder abundance, while in non-perennial reaches, microbial community composition became the dominant controlling factor. These findings suggest that drying fundamentally shifts the biotic controls of leaf litter decomposition, transitioning from a detritivore-mediated process in perennial reaches to a microbially-dominated process in non-perennial ones. Considering the expected global increase in river drying, an overarching shift towards microbial decomposition could profoundly impact carbon cycling and disrupt energy transfer across food web levels in and out freshwater ecosystems.

[GSB-O-14]

Wednesday 4, morning (first): 11:15
Room: Salón de actos

River hydrology impacts on coastal fisheries: commercial and ecological benefits of Ebro River

Alcaraz, Carles[1]; Ruhí, Albert[2]

(1) IRTA - La Ràpita; (2) University of California, Berkeley

Correspondence e-mail: [carles.alcaraz@gmail.com]

Over the last years, the Ebro River faces scrutiny and debate whenever heavy rainfall events lead to significant water discharge into the sea. These events are often perceived by the public as a missed opportunity to capture water for human benefit, oversimplifying the intricate relationship among flow dynamics, ecosystem functioning, ecosystem services, and societal demands. However, river discharge pulses represent a crucial yet often overlooked component of river-coastal coupled ecosystem dynamics. The aim of this study is to determine the relationship between meteorological forcing (e.g. rainfall, storms, temperature) and fluctuations in Ebro River nutrients concentration and flow on fish landings -- a critical ecosystem service in coastal waters surrounding the Ebro Delta. We gathered data from the five main ports differentiating by fishing method (small-scale, towed and encircling nets), over a span of 22 years that encompassed seasonal and interannual fluctuations in river flows. Our analysis revealed clear evidence of the influence of riverine nutrient enrichment and meteorological processes on total fish landings, independently of the fishing gear considered. This study illustrates that river outflow benefits to fish landings can be significant in oligotrophic seas such as the Mediterranean, while meteorological phenomena like wind and storms enhance the productivity of surface layers through mixing and upwelling. We contend that it is crucial to include river discharge in coastal management plans, recognizing its key role not only in the sustainability and resilience of coastal ecosystems but also in the provisioning of key ecosystem services.

[GSB-O-15]

Wednesday 4, morning (first): 11:30
Room: Salón de actos

Upwelling-induced hydrological perturbation shape seasonal transitions of small eukaryotic plankton

Varela, Marta M[1]

(1) IEO_CSIC

Correspondence e-mail: [marta.varela@ieo.csic.es]

Eukaryotic plankton is a core component of marine ecosystems with exceptional taxonomic and ecological relevance. Yet, how the interplay of their ecology and the environment drive its distribution pattern remains poorly understood. Here, we characterized the seasonal patterns of small eukaryotic diversity and community composition in a coastal Iberian upwelling time-series station (E2CO, RADIALES A Coruña) by high-throughput sequencing (HTS). The V4 region of the 18S rRNA was amplified and sequenced using Illumina, and amplicon sequencing variants (ASVs) were differentiated. Upwelling and relaxation conditions were characterized by enhanced vertical stratification and a marked hydrographic variability, including a community less diverse with abundant phylotypes proliferating (such as Bacillariophyta and Dynophyceae). Downwelling conditions, characterized by a deeper mixed layers and a homogeneus water column, favoured a more diverse community including marine alveolate lineages, diferent stramenopiles groups, cryptophyta and ciliophora among others. Seasonal changes in community composition significantly correlated with abiotic (T, Sal or inorganic nutrients) and community function-related (biomass or primary production) factors. Network analysis showed that eukaryotic community depends more on positive relationships for its cohesion and functioning; whereas negative interactions play a more limited role. Overall, seasonal hydrography forcing govern transitional changes in eukaryotic diversity and community composition that influence ecosystem functioning and biogeochemical cycles.

[GSB-O-16]

Wednesday 4, morning (first): 11:45
Room: Salón de actos

Quantifying the CO2 system in a seagrass-dominated coastal shallow embayment

Ricart, Aurora M[1]; Tamarit Castro, Elena[2]; Asplund, Maria E.[3]; Gullstrom, Martin[4]; Serrano, Oscar[5]; Mateo, Miguel Angel[6]; Oikawa, Patty[7]; Serrano, Edu[8]; Pelejero, Carles[9]

(1) Institut de Ciències del Mar; (2) University of Gottenburg, Sweden; (3) University of Gottenburg, Sweden; (4) University of Södertörn, Sweden; (5) Centre d'Estudis Avançats de Blanes, CEAB-CSIC; (6) Centre d'Estudis Avançats de Blanes, CEAB-CSIC; (7) California State University, United States; (8) Biosfera; (9) 6. Institució Catalana de Recerca i Estudis Avançats (ICREA)

Correspondence e-mail: [amricart@icm.csic.es]

Introduction. Seagrass ecosystems influence seawater chemistry through their intense metabolic activity and might modulate inorganic carbon fluxes in shallow coastal environments. Understanding the carbon sequestration potential of blue carbon ecosystems is crucial for developing nature-based solutions to combat climate change, however, inorganic carbon (i.e., the carbonate system) is an often-overlooked component, especially in seagrass meadows.

Material and methods. In this study, we investigated how warm-temperate seagrass (Cymodocea nodosa) meadows inhabiting a shallow embayment affected seawater carbonate chemistry (measured parameters pH, alkalinity, temperature, salinity, dissolved oxygen) during the low and high productivity seasons by using autonomous multiparametric sensors and incubation chambers. We compared the seawater carbonate chemistry of different habitats (seagrass patches, unvegetated areas, and macroalgal beds interspersed with seagrass) and also assessed its spatial variability in seagrass patches across the embayment.

Results and discussion. Average pH values and daily pH fluctuations for all habitats were higher during the high productivity season (~0.15 and ~0.4 pH units, respectively). For both seasons, the highest pH values were shown by the seagrass patches (8.73 spring/summer, and 8.21 fall/winter) although spatial variability among patches was exhibited likely owing to its location within the embayment. A strong positive correlation between pH and dissolved oxygen concentrations pointed to the role of seagrass metabolism processes in driving pH changes. Alkalinity was enhanced in all habitats, especially in the seagrass patches during both seasons, which contributes to the carbon sequestration potential and warrants consideration in future investigations. Overall, this study highlights the need to include seasonality and spatial variability of carbonate dynamics in assessing the role of seagrass ecosystems in carbon sequestration.

[GSB-O-17]

Wednesday 4, morning (first): 12:00
Room: Salón de actos

Determinants of island complexity in the context of global change

Traveset, Anna[1]

(1) IMEDEA (CSIC-UIB)

Correspondence e-mail: [atraveset@csic.es]

Biodiversity is declining globally at an unprecedented rate, and much faster in island ecosystems. Representing ~30% of the biodiversity hotspots, islands are particularly vulnerable to anthropogenic activities, indeed c. 80% of reported extinctions are island species. Yet, unique island biodiversity is still greatly unknown. It is thus urgent to describe it and forecast the consequences of its annihilation so we can mitigate the effect of further losses. Multilayer network analyses provide hope to understand island complexity and to predict their fragility to global change drivers, such as biological invasions. In this study, which encompasses different archipelagos worldwide, we combine direct observations with cutting-edge molecular techniques to build quantitative multilayer networks, each layer representing a different ecological function. We will present initial findings demonstrating how invasive species on anthropized islands significantly reshape community structures compared to uninhabited islands.

[GSB-O-18]

Wednesday 4, morning (first): 12:15
Room: Salón de actos

Niche modelling of Iberian ants: Where to look for them when we hardly know them?

Leconte, Sónika[1]; Arcos, Javier[2]; García, Fede[3]; M. Azcárate, Francisco[4]; Seoane, Javier[5]

(1) Autonomous University of Madrid; (2) Iberian Myrmecological Association; (3) Iberian Myrmecological Association; (4) Autonomous University of Madrid; (5) Autonomous University of Madrid

Correspondence e-mail: [sonikaleconte@gmail.com]

Niche modelling has been fruitfully used to understand current geographical distributions and potential ranges of a number of species of several taxa . However, these models suffer from a well-known bias in research activity, which devotes little effort to invertebrates not in proportion to their prevalence on Earth. Ants (Formicidae) are eusocial insects with a great impact on inland ecosystems, but except for pest and invasive species, relatively little is known about them. Although Iberian Peninsula keeps near 50% of European ant species, other arthropod taxa have traditionally aroused more interest among researchers and the general public.

This work applies three modelling methods (GAP analysis, Generalized models and MaxEnt) to the mapping of the realized niche of six ant species in the Iberian Peninsula to a 1km2 grain. The species have different ecological characteristics and data properties, although they share a scarcity of previous information. Additionally, we intended to disentangle the main drivers of their distribution in the Iberian Peninsula, which can be widely variable between species. To do that, we sketched an approach to identifying relevant predictor subsets. Model performance was evaluated by the AUC and the BIC metrics, and through a spatial cross validation to account for spatial correlation.

Preliminary results underline the usefulness of these techniques to identify niche determinants, to reveal underlying biogeographical patterns, and to guide future sampling efforts to complete our knowledge of the distributions of Formicidae and other poorly-known arthropods.

[GSB-O-19]

Wednesday 4, morning (second): 12:45
Room: Salón de actos

Fine-scale ensemble Species Distribution Modelling of the endangered octocoral Corallium rubrum using combined approaches to reduce uncertainty

Figuerola-Ferrando, Laura[1]; Linares, Cristina[2]; Amblas, David[3]; Arosio, Riccardo[4]; Moscat, Laura[5]; Lastras, Galderic[6]; Canals, Miquel[7]; Garrabou, Joaquim[8]

(1) Universitat de Barcelona (UB), Barcelona, Spain; (2) Universitat de Barcelona (UB), Barcelona, Spain; (3) Universitat de Barcelona (UB), Barcelona, Spain; (4) University College Cork (UCC), Cork, Ireland; (5) Universitat de Barcelona (UB), Barcelona, Spain; (6) Universitat de Barcelona (UB), Barcelona, Spain; (7) Universitat de Barcelona (UB), Barcelona, Spain; (8) Institut de Ciències del Mar (ICM-CSIC), Barcelona, Spain

Correspondence e-mail: [lfiguerola@ub.edu]

Understanding species distribution and the main drivers shaping them is a major challenge for effective conservation so that management strategies aiming at safeguarding marine biodiversity could be optimized. Species Distribution Models are increasingly applied at diverse geographical scales to address this challenge. However, disentangling the key elements influencing model outputs remains a matter of debate.

We employed a fine-scale ensemble model that explicitly accounts for uncertainties, combined with a substrate (rock vs sediment) map obtained by the application of object-based image analysis and random forest techniques on multibeam echosounder data to refine predictions in rocky habitats potentially hosting the modelled species, the precious red coral Corallium rubrum. Such a combined approach reduced uncertainties and ameliorated model predictions. The modelled species, which plays a highly relevant ecological role in benthic rocky substrata as habitat provider, is one of the most endangered in the Mediterranean Basin mostly due to overfishing and the ongoing effects of climate change. Local coral fishermen provided data on the species occurrence at high spatial resolution. These data were groundtruthed by ad hoc surveys, thus ensuring their trustworthiness.

Model outputs yielded highly promising results for the C. rubrum populations over rocky substrata off northern Catalonia, framed within the red coral fishing ban in force since 2018. The results achieved suggest that the investigated area meets the conditions required for the recovery of overfished red coral populations. Our approach illustrates the benefits of combining robust spatial modelling with high-quality in situ data to support the conservation of endangered species.

[GSB-O-20]

Wednesday 4, morning (second): 13:00
Room: Salón de actos

Genomic connectivity and adaptation signals of the freshwater sponge Ephydatia muelleri across its distribution

Cassidy, Robert[1]; de la Cruz, Laura[2]; Mitsi, Konstantina[3]; Galià-Camps, Carles[4]; Benítez-López, Ana[5]; Gracia-Sancha, Carlota[6]; Lorente-Sorolla, Jose[7]; Álvarez, Almudena[8]; Mozo, Rocío[9]; Kolomyjec, Stephen H.[10]; Nichols, Scott A.[11]; Manconi, Renata[12]; Pereira, Raquel[13]; Evans, Karen[14]; Itskovich, Valeria[15]; Horton, April L.[16]; Leys, Sally P.[17]; Taboada, Sergi[18]; Riesgo, Ana[19]

(1) Museo Nacional de Ciencias Naturales (CSIC); (2) Museo Nacional de Ciencias Naturales (CSIC); (3) Museo Nacional de Ciencias Naturales (CSIC); (4) Museo Nacional de Ciencias Naturales (CSIC); (5) Museo Nacional de Ciencias Naturales (CSIC); (6) Museo Nacional de Ciencias Naturales (CSIC); (7) Museo Nacional de Ciencias Naturales (CSIC); (8) Museo Nacional de Ciencias Naturales (CSIC); (9) Universidad Autónoma de Madrid; (10) Lake Superior State University; (11) University of Denver; (12) University of Sassari; (13) Uppsala University; (14) Unassociated; (15) Limnological Institute SB RAS; (16) Bates College; (17) University of Alberta; (18) Museo Nacional de Ciencias Naturales (CSIC); (19) Museo Nacional de Ciencias Naturales (CSIC)

Correspondence e-mail: [robertdylancassidy@gmail.com]

Freshwater sponges play significant ecological roles, yet their dispersal and genetic connectivity remain poorly understood, complicating conservation assessments. To address this, we examined genetic connectivity and genetic adaptation to local environmental conditions in Ephydatia muelleri across its distribution using ddRADseq-derived SNPs from 106 individuals collected from 11 geographic regions spanning North America, Europe, and Asia. Analysis of 3,182 neutral SNPs revealed low connectivity and strong genetic structure among regions within two main genetic clusters of North America and Eurasia, as well as considerable evidence for differentiated, polygenic adaptation to variables such as light and temperature conditions across sampled locations. These findings align with the “monopolization hypothesis” (De Meester et al., 2002), suggesting that historical climatic and geological conditions of the Last Glacial Maximum, including habitat expansion, contraction, and natural barriers, have contributed more to the current genetic structure of E. muelleri populations than contemporary gene flow, which is restricted by monopolistic habitat colonization by this species. These results provide novel support for ecological theory on dispersal in aquatic invertebrates, as well as insights into the plasticity of E. muelleri in the face of varying environmental conditions that are fundamentally important for freshwater ecosystem conservation.

[GSB-O-21]

Wednesday 4, morning (second): 13:15
Room: Salón de actos

Movements of yellow-legged gulls (Larus michaellis) during the breeding season: between marine and terrestrial environments and between natural and anthropogenic areas

Jiménez Franco, María Victoria[1]; Martínez-Ródenas, Jacinto[2]; Nicolás, Miriam[3]; Calvo, José F.[4]; Robledano-Aymerich, Francisco[5]

(1) Universidad Miguel Hernández de Elche; (2) Universidad de Murcia; (3) Universidad de Murcia; (4) Universidad de Murcia; (5) Universidad de Murcia

Correspondence e-mail: [victoria_jimenez680@hotmail.com]

Monitoring the movements of seabirds that use terrestrial trophic resources, alternating between natural and anthropized habitats, is relevant for wildlife management. A first study, funded by the Port Authority of Cartagena (APC), focused on the movement of the yellow-legged gull (Larus michahellis) in the surroundings of that port. This species is key for biodiversity conservation, being perceived as a nuisance species for human activities, a predator in the port area and a disperser (sentinel) of pollutants and pathogens. Eight individuals breeding on Escombreras Island (4 males and 4 females) were equipped with GPS devices to track their locations during a breeding period.

Despite their colonial nature, the individuals exhibited individualistic behavior using a variety of food sources and habitats. A main use of the harbour area was reported, followed by seas and oceans (fish farms, for food). On land, they moved to irrigation ponds in agricultural areas and to landfills (3 individuals). The ability to move away from the colony during breeding was also examined, with an average of between 1.6 and 21.1 km.

This study has improved our understanding of how the movements of gulls are affected by landscape heterogeneity and resource availability, a key aspect for a species that has implications for biodiversity, quality and environmental health. A new contract with the APC on “MONITORING AND RESEARCH ON BIODIVERSITY IN THE ENVIRONMENT OF THE PORT OF CARTAGENA: TERRESTRIAL FAUNA” has begun to monitor the use that other colonies of gulls develop in the port for management conservation.

[GSB-O-22]

Wednesday 4, morning (second): 13:30
Room: Salón de actos

Early-life conditions affect natal dispersal decisions in a highly specialized colonial breeding falcon

García Roldán, Rebeca[1]; S.Viana, Duarte[2]; Gangoso, Laura[3]

(1) Complutense University of Madrid; (2) Estación Biológica de Doñana, CSIC; (3) Estación Biológica de Doñana, CSIC

Correspondence e-mail: [rebgar06@ucm.es]

Natal dispersal is a key process in population dynamics and species’ adaptation to environmental changes. It can be expected that early-life conditions may influence the probability and distance of dispersal, potentially increasing under less favourable environments. Understanding drivers of dispersal decisions is essential to predict how species might adjust their ranges under global change.

We analysed how natal environment (climate-dependent food availability, competition, ectoparasite load) and individual traits (sex, morph) affect dispersal probability and distance. Data were collected over two decades of monitoring a polymorphic colonial raptor, the Eleonora’s Falcon (Falco eleonorae), in the Canary Islands.

Dispersal patterns differed between sexes and were independent of morph. Females were less philopatric, and dispersal was only linked to natal and recruitment colonies. In contrast, male dispersal was influenced by natal environmental conditions, particularly food availability. Poorer conditions, characterized by lower food availability and annual mean productivity, resulted in greater dispersal distances and higher probabilities of dispersing to a different breeding colony. In both sexes, dispersal was guided towards colonies where alternative food supplies are more abundant. These findings highlight how environmental stress during early development shapes natal dispersal patterns, providing a clear adaptive mechanism in the face of environmental changes.

[GSB-O-23]

Wednesday 4, morning (second): 13:45
Room: Salón de actos

The importance of greylag geese as seed dispersers of dry-fruited plants, and the impacts of global change

Green, Andy J.[1]; Jiménez-Martín, Iciar[2]; Navarro-Ramos, María J.[3]; MONREAL RODRIGUEZ, Adrian[4]; Martín-Vélez, Victor[5]; Lovas-Kiss, Adam[6]

(1) Estación Biológica de Doñana - CSIC; (2) Estación Biológica de Doñana - CSIC; (3) Estación Biológica de Doñana - CSIC; (4) Estación Biológica de Doñana - CSIC; (5) ICM-CSIC; (6) Institute of Aquatic Ecology, Debrecen, Hungary

Correspondence e-mail: [ajgreen@ebd.csic.es]

Introduction. Migratory geese populations are important dispersal vectors for a range of dry-fruited plants by non-classical endozoochory. The dispersal services they provide are changing in response to land-use modifications, the water crisis, and climate change. Migration routes, wintering and breeding distributions have already undergone major changes in recent decades.

Methods. We studied greylag goose monitored with GPS tags at both ends of the flyway population. Faecal sampling allowed us to study endozoochorous seed dispersal by greylag geese in different habitats in the breeding range in Sweden, and on wintering grounds in Doñana. We compared agricultural lands with natural wetlands. Intact seeds were identified and their viability tested.

Results and discussion. Intact seeds from 41 and 24 plant species respectively were dispersed by geese in the two separate studies, providing a major advance in our understanding of the value of these birds as plant vectors. In Sweden, the greylag geese provided high connectivity between wetland and agricultural habitats, but also dispersed numerous weed species between different crops. An expanding breeding population is increasing the impacts these vectors have on plant population dynamics at northern latitudes. In Doñana, greylag geese provide much longer dispersal distances than those provided by abiotic dispersal mechanisms, and geese can allow plant species currently limited to southern Europe to expand northwards in response to climate change. However, a rapid ongoing decline in the Doñana goose population and an ongoing change in migration phenology puts these interactions at risk.

[GSB-O-24]

Wednesday 4, morning (second): 14:00
Room: Salón de actos

Modeling Ecological Succession and Time of Surface Exposure in Extreme Environments: First Findings in the Pyrenees

Estorninho, Mariana[1]; Munzi, Silvana[2]; Branquinho, Cristina[3]; Oliveira, Maria Alexandra[4]

(1) CE3C-CentreForEcology,EvolutionAndEnvironmentalChanges/ CHANGE- GlobalChange&SustainabilityInstitute; (2) Centro Interuniversitário de História das Ciências e da Tecnologia; (3) CE3C-CentreForEcology,EvolutionAndEnvironmentalChanges/ CHANGE- GlobalChange&SustainabilityInstitute; (4) CE3C-CentreForEcology,EvolutionAndEnvironmentalChanges/ CHANGE- GlobalChange&SustainabilityInstitute

Correspondence e-mail: [meramos@fc.ul.pt]

The accelerating retreat of glaciers over the past decades indicates increasing temperatures, with projections of near-total disappearance this century. Glacial deposits serve as natural archives, revealing the timing and extent of glacial advances and retreats. Dating methods like cosmogenic isotopes and lichenometry are costly or face challenges, including species identification, incompatible lifespans and ecological influences compromising accuracy. As glacier deposits age, cryptogamic colonization evolves, with community traits reflecting ecological succession, indicating shifts in time and environmental factors. This project aims at modelling cryptogamic succession across deposits of varying ages and conditions to provide new approaches for dating exposed surfaces. For that, a deep understanding of community assembly patterns at local and regional scales is crucial.

The first field campaign took place in the Pyrenees, using a sampling strategy with three environmental scales: satellite imagery, boulder-level data, and plot-level measurements. Eleven boulders, including known exposure ages, were sampled. Variables such as surface potential solar radiation, derived from orientation and inclination, and surface roughness (microtopography) were considered. An RGB camera was used to generate boulder's digital elevation models and extract microtopographic variables. Plot sampling (20x20cm) focused on species identification, traits, and biodiversity metrics.

The results aim to clarify the roles of environmental factors and exposure time in shaping cryptogamic communities. This will refine sampling methods for other glacier deposits and contribute to a robust surface exposure model, enhancing our understanding of climate change impacts on vulnerable ecosystems and past climate dynamics.

[GSB-O-25]

Thursday 5, morning (first): 11:00
Room: Salón de actos

Can natural systems curb human impacts? The case of N in a small Mediterranean river basin

Romero, Estela[1]; Deu, Susana[2]; Bernal, Susana[3]

(1) CREAF; (2) CREAF; (3) Centre d'Estudis Avançats de Blanes (CEAB-CSIC)

Correspondence e-mail: [estela.romero@creaf.uab.cat]

Human activities have significantly altered the biogeochemical cycle of nitrogen (N). The substantial quantities currently applied to terrestrial systems have huge relevance for numerous environmental issues, including the health of rivers and aquifers. We utilise a Mediterranean intermittent river basin (La Tordera, 900 km2), mostly forested and with intermediate levels of agricultural, cattle, and urban activities, as a functional unit to characterise the flows of N across various terrestrial and aquatic compartments, from land to sea. La Tordera is a suitable case study for two reasons: (1) despite the prevalence of intermittent rivers across most biomes, few nutrient budgets have been performed in this type of system; (2) it is an excellent representative of many small coastal basins that stretch along the Mediterranean rim.

This work combines the application of Geographic Information Systems with the collection and analysis of basin-scale environmental, agronomic, and social statistics. We focused on the year 2020, an exceptionally wet year when the river did not dry out (Mean Annual Precipitation (MAP) = 1172 mm). Results obtained were compared with those of a dry year (2021, MAP = 510 mm) to examine how changes in precipitation influence basin N flows. Our findings indicate an excess of N coming mainly from croplands and livestock activities that is difficult to mitigate with the existing natural sinks within the basin. We therefore explore the potential effectiveness of additional measures – such as those proposed in the EU Farm2Fork strategy – to prevent N accumulation and its environmental impact.

[GSB-O-26]

Thursday 5, morning (first): 11:15
Room: Salón de actos

The role of short rotation plantations in landscape connectivity across Natura 2000 networks

Pineda Zapata, Sara[1]; Morán Ordóñez, Alejandra[2]; Mola Yudego, Blas[3]; Duflot, Rémi[4]

(1) University of Eastern Finland; (2) University of Basel, Switzerland; (3) University of Eastern Finland; (4) University of Jyväskylä

Correspondence e-mail: [sapineza@gmail.com]

As the European Union progresses toward carbon neutrality and energy independence, the demand for biomass is projected to increase substantially in the coming decades. Short Rotation Plantations (SRP) have emerged as a viable strategy due to their capacity for high biomass production within short cycles (2–20 years). However, large-scale deployment of SRP may negatively impact biodiversity by promoting landscape homogenization and reducing species diversity. Conversely, SRP established on marginal lands or highly agricultural areas present opportunities to improve ecological connectivity and diversify local land uses.

This study examines the role of SRP in enhancing connectivity for generalist forest birds across three sub-watersheds in France, Spain and Sweden. We analyzed forest connectivity changes at the landscape scale under four scenarios, each with varying SRP and forest coverage. Connectivity was estimated using the Conefor command line in R, employing the Probability of Connectivity Index (PC) and the Equivalent Connected Area (ECA) indices.

Preliminary findings suggest that SRP can enhance connectivity, particularly for species with long dispersal distances. Additionally, several SRP patches intersecting Natura 2000 areas were identified as highly important for maintaining connectivity within the selected landscapes. In Spain, connectivity increased around 10% when SRP where added to existing forested habitats within Natura 2000. In contrast, France and Sweden showed lower improvements of connectivity when plantation patches were included (around 2%). These results suggest that SRP, when strategically integrated, can play a complementary role in biodiversity conservation, depending on species and the configuration of habitat patches.

[GSB-O-27]

Thursday 5, morning (first): 11:30
Room: Salón de actos

The importance of initial soil organic carbon values in designing farming practices to ameliorate soils in the Mediterranean arable fields

Bragg, Daniel[1]; Romanyà, Joan[2]; Blanco-Moreno, José M.[3]; Sans, F. Xavier[4]

(1) Universitat de Barcelona; (2) Universitat de Barcelona; (3) Universitat de Barcelona; (4) Universitat de Barcelona

Correspondence e-mail: [dbragg@ub.edu]

Organic farming has been proposed as a farming system which can enhance soil quality, notably through soil organic carbon (SOC). SOC contributes to soil structure, water retention, microbial activity, and nutrient availability. In practice, organic farming encompasses a variety of agricultural practices that affect SOC, including crop rotation and its composition, the use of different tillage machinery and the application of farmyard manure at varying doses and frequencies. Therefore, understanding the impact of management decisions in SOC can help improving soil quality, particularly in the Mediterranean region, which is characterized by lower SOC concentrations.

The present study analyzes SOC changes in 19 pilot fields managed by farmers monitored since the transition from conventional to organic farming in Gallecs (Catalonia, Spain). SOC levels were measured at the beginning of the transition, in 2005 (or 2006 for some fields), 2010, 2015 and 2022. We evaluated the effects of initial SOC concentration and agricultural management (such as amount of organic manure application, tillage frequency and proportion of legumes in crop rotation) on SOC concentration changes.

After 17 years, significant increases in SOC were observed on average, and larger increases of SOC occurred in fields with lower initial SOC. This highlights the importance of considering initial soil condition when selecting farming practices to improve soil quality.

[GSB-O-28]

Thursday 5, morning (first): 11:45
Room: Salón de actos

Influence of mixed stands on the defensive investment of adult Pinus sylvestris L.

Aldea Mallo, Jorge[1]; del Río, Miren[2]; Bravo, Felipe[3]; Zas, Rafael[4]; Ordóñez, Cristóbal[5]; Sampedro, Luis[6]

(1) Instituto de Ciencias Forestales (ICIFOR-INIA), CSIC; (2) Instituto de Ciencias Forestales (ICIFOR-INIA), CSIC; (3) Universidad de Valladolid; (4) Misión Biológica de Galicia (MBG-CSIC); (5) Universidad de Valladolid; (6) Misión Biológica de Galicia (MBG-CSIC)

Correspondence e-mail: [jorge.aldea@inia.csic.es]

Mixed forests may provide several benefits compared to monocultures, including enhanced productivity, resilience to biotic and abiotic stresses, and provisioning of several ecosystem services. However, little is known about how mixtures affect defensive investment of focal trees. Our aim is to study at what extent defensive allocation in Pinus sylvestris L. may be conditioned by the identity of neighbour species in mixed forest. For that purpose, we measured resin flow and the concentration of terpenes and non-structural carbohydrates in the phloem of adult trees growing in pure and mixed stands with Pinus pinaster Ait. and Fagus sylvatica L. We use of a long term monitored stands in the northern Iberian mountain range, sampling 120 trees present in pure and mixed forest replicated 3 times. Both resin flow and terpene profile of Scots pine, was significantly, although not deeply, affected by the identity of the co-dominant species in mixed compared to pure stands. Growing in mixtures with maritime pine increased the resin flow and the concentration of a specific diterpenes of Scots pine, and mixed with beech reduced the amount of free sugars in the phloem. Our results show the potential relevance of the species identity on adult tree defensive allocation, an understudied trait when considering mixed forest management.

[GSB-O-29]

Thursday 5, morning (first): 12:00
Room: Salón de actos

Effect of Soil Extracts of Maytenus senegalensis Shrubs on Seed Germination Under Contrasting Climatic Conditions

Hurtado Martínez, Miguel[1]; Sadio, Thiaba D[2]; Diéme, Joseph S[3]; Manrique, Esteban[4]; Díaz-Santiago, Elena[5]; Kindler, Christian[6]; Pugnaire, Francisco Ignacio[7]

(1) Estación Experimental de Zonas Áridas - CSIC; (2) Université Assane Seck, Ziguinchor, Sénégal; (3) Université Assane Seck, Ziguinchor, Sénégal; (4) Consejo Superior de Investigaciones Científicas, Madrid, Spain; (5) Estación Experimental de Zonas Aridas-CSIC; (6) Estación Experimental de Zonas Aridas-CSIC; (7) Estación Experimental de Zonas Aridas-CSIC

Correspondence e-mail: [hurtado@eeza.csic.es]

Introduction. Plant-soil interactions significantly mediate plant community respond to environmental factors, such as climate change. These interactions have an important role for ecosystem structure and function. However, little is known on how the climate change may affect these relationships and its impacts on plant performance.

Materials and Methods. We focused on the effects of climate change on the germination of Maytenus senegalensis seeds. Soil samples were collected under M. senegalensis and in gaps in a dry ecosystem (Almeria, Spain) and a humid ecosystem (Casamance, Senegal). Soils were analysed for nutrients, pH and organic matter. A soil extract was prepared from each soil sample, and seeds were sowed on sterilised vermiculite with the different soil extracts. We used a control in which seeds were showed with sterile demineralised water as inoculum. To see if there are differences in the microbial community between experimental conditions, qPCR for bacteria and fungi were performed.

Results and Discussion. Our results show that environmental factors influence the amount of microorganisms in each system. There were more microorganisms in the understory than in gaps in both countries, and more in the dry condition (Spain) than in the wet conditions (Senegal). Seeds germinated significantly more in the understory than in gaps in Senegal, but not in Spain. These results show a plant-soil microbial community coevolution modulated by climate. Thus, climate change could affect the fine-tuning of this interaction, changing microbial composition with potential important effects on ecological processes such as germination.

[GSB-O-30]

Thursday 5, morning (first): 12:15
Room: Salón de actos

Contrasting the ecological value of non-perennial streams for terrestrial vertebrate fauna across different hydrological phases

Rodríguez Lozano, Pablo[1]; Sanz Amor, Alejandro[2]; Calvo, Jose F.[3]; Gómez, Rosa[4]; Sempere Bru, Laura[5]; Carlson, Stephanie M.[6]; Moidu, Hana[7]; Leidy, Robert A.[8]; Sánchez-Montoya, María Mar[9]

(1) Universidad Autónoma de Madrid; (2) Universidad Complutense de Madrid; (3) Universidad de Murcia; (4) Universidad de Murcia; (5) Universidad de Murcia; (6) University of California, Berkeley; (7) Environment and Climate Change Canada; (8) University of California, Berkeley; (9) Universidad Complutense de Madrid

Correspondence e-mail: [pablorodriguezlozano@gmail.com]

Non-perennial streams are dynamic ecosystems that form spatiotemporal mosaics of lotic (flowing water), lentic (disconnected pools), and terrestrial systems (dry riverbeds). Despite growing knowledge of these ecosystems, their ecological significance for terrestrial vertebrate fauna remains underexplored. This study evaluates the ecological importance of non-perennial streams for terrestrial vertebrates across hydrological phases, by analysing their presence and behaviour (as a proxy for ecological functions). Camera traps were installed in two Mediterranean non-perennial streams (eight cameras per site): Coyote Creek (California, USA) and Rambla de La Rogativa (Murcia, Spain). In Coyote Creek, cameras were placed in disconnected pools and dry reaches, while in Rogativa, they were installed in flowing and dry reaches. The results revealed that vertebrate abundance and richness were primarily influenced by hydrological phase, recreational and grazing pressures, and riparian slope. In Coyote Creek, community composition varied significantly between hydrological phases (the community in dry reaches was a subset of that in disconnected pools), whereas no significant differences were observed in Rogativa. From a functional perspective, a diversity of behaviors by terrestrial vertebrates was recorded in both study areas across different hydrological phases, demonstrating that non-perennial streams provide numerous ecological functions. Among these, the ecological functions of serving as corridors (longitudinal movement) and crossings (transverse movement) were particularly notable. These findings underscore the ecological importance of non-perennial streams for supporting terrestrial vertebrate fauna and highlight the need for more integrative management and conservation policies that address how terrestrial species both use and benefit from non-perennial streams across different hydrological phases.

[GSB-O-31]

Thursday 5, morning (second): 12:45
Room: Salón de actos

The vagrant lichen Cladonia rangiformis as a key driver of herbaceous plant assemblages in central Iberian Peninsula

Madrigal González, Jaime[1]; Calatayud Ortega, Joaquín[2]; L. Luzuriaga, Arantzazu[3]; Ferrandis Gotor, Pablo[4]; Escudero Alcántara, Adrián[5]

(1) Universidad de Valladolid; (2) URJC; (3) URJC; (4) UCLM; (5) URJC

Correspondence e-mail: [jaime.madrigal@uva.es]

Introduction. The interaction between vagrant lichens and the herbaceous vegetation in dry Mediterranean ecosystems is poorly understood. This study explores the effects of Cladonia rangiformis on the abundance, composition, and diversity of annual plants, focusing on patterns and the potential underlying mechanisms.

Materials and Methods. We analysed 15 years (2010–present) of monitoring data to assess trends in the abundance, cover, richness, and composition of herbaceous plant assemblages relative to lichen cover next to a 6 years lichen removal experiment using paired plots with and without lichens. We investigated the impact of C. rangiformis on soil nitrogen (N) and phosphorus (P), their assimilable forms (nitrates, phosphates and ammonium), enzymatic activities (glucosidase, phosphatase, urease), and soil pH.

Results and Discussion. Herbaceous plant abundance and cover displayed a unimodal response to lichen cover, peaking at ~50%. Species richness showed no significant relationship with lichen cover although significant differences in species composition were observed. Experimental results confirmed positive effects of lichens on herbaceous plant abundance and cover, particularly at intermediate lichen cover levels. Soil beneath lichens had higher total and available N (nitrates and ammonium), increased phosphatase activity, and reduced pH. These findings suggest that C. rangiformis drives herbaceous plant assemblages likely due to enhanced nutrient availability. However, the peak abundance at ~50% lichen cover and reduced pH indicate that high lichen acid concentrations (phenolic acids) may limit these benefits at nearly 100% cover.

[GSB-O-32]

Thursday 5, morning (second): 13:00
Room: Salón de actos

Plant spatial configuration and pollinator behavior, alongside neutral processes, are key to predicting plant–pollinator network structure

Arroyo-Correa, Blanca[1]; Bartomeus, Ignasi[2]; Jordano, Pedro[3]; Castro, Mario[4]; Galeano, Javier[5]

(1) Estación Biológica de Doñana (EBD-CSIC); (2) Estación Biológica de Doñana (EBD-CSIC); (3) Estación Biológica de Doñana (EBD-CSIC); (4) Institute for Research in Technology (IIT), Universidad Pontificia Comillas; (5) Complex System Group, Universidad Politécnica de Madrid

Correspondence e-mail: [blanca.arroyo.correa@gmail.com]

Mutualistic interactions between species give rise to complex networks within ecological communities, influencing both evolutionary and ecological processes. Traditionally, several hypotheses explaining non-random structures exhibited by those networks have been evaluated assuming species are the interacting units. The species-level approach often overlooks the fine-scale processes shaping interactions between individuals, which are the foundational elements of species-based networks. Here, we shift the focus from species to individuals to gain a deeper understanding of the mechanisms shaping plant–pollinator networks. Specifically, we assessed the contribution of species abundances, the spatial configuration of the plant community, and the foraging behavior of pollinators to the emergent properties of observed networks, and evaluated the temporal variation in these contributing processes. To this end, we integrated empirical data on plant–pollinator interactions and agent-based models (ABMs) using a flexible Bayesian approach. We found that species abundances contributed to effectively explaining network structure (i.e., degree distribution) only when considering distinct types of pollinator species based on their foraging behavior. Besides, the observed spatial configuration of the plant community was key in shaping the interaction networks. Finally, we found that the relative contribution of species abundances, spatial configuration and pollinator foraging was highly variable across phenological stages (early, peak and late flowering). By combining individual-based field data and simulation modeling to predict network structure, this study sheds light on how fine-scale processes shaping individual interactions drive macro-level structural patterns, advancing our understanding of the mechanisms driving the emergence of ecological networks.

[GSB-O-33]

Thursday 5, morning (second): 13:15
Room: Salón de actos

Climatic Disequilibrium and Canopy-Recruit Plants Interaction

Margalef-Marrase, Jordi[1]; Montesinos, Alicia[2]; Lloret, Francisco[3]; Alcántara, Julio[4]; Garrido, José Luis[5]; Verdú, Miguel[6]

(1) CIDE (CSIC-UV-GVA); (2) CIDE (CSIC-UV-GVA); (3) CREAF - UAB; (4) UJA; (5) EEZ (CSIC); (6) CIDE (CSIC-UV-GVA)

Correspondence e-mail: [jmargalefmarrase@gmail.com]

Canopy service is defined as the extent to which established (canopy) plants promote the recruitment of new individuals in the community. This service, when positive, is known as facilitation, and is mainly driven by the modification of the microenvironment that plants induce under their canopies, often by buffering the macroclimate. The importance of canopy service in maintaining diversity may increase in the context of climate change. However, climate change may also push species away from their niche optima, increasing their so-called climatic disequilibrium (CD). This process can provoke poorer performance, defoliation, and decay of the canopy species, jeopardizing the canopy service they provide. Therefore, CD is expected to modulate canopy service under current climate conditions. In this study, we test (1) whether canopy species experiencing greater CD will exhibit diminished canopy services, and (2) whether the negative impact of CD on canopy service will be more pronounced under increasing abiotic stress conditions (i.e. aridity and continentality). To address these questions, we used a database of 54 communities, mainly distributed across the Mediterranean basin, which includes a total of 316 canopy species involved in 35,941 recruiting interactions. Overall, canopies with higher CD tend to provide less canopy service. The loss of canopy service with increased CD is more pronounced in drier regions. Moreover, continentality amplifies the effects of aridity reducing the canopy service across a broad geographic context. Our results indicate that CD, combined with abiotic stressors modulate the canopy service. Consequently, under future climate change scenarios, that may increase CD in canopy species, key ecosystem functions, such as canopy service, could be disrupted, even before the local extinction of any specific canopy species.

[GSB-O-34]

Thursday 5, morning (second): 13:30
Room: Salón de actos

The amphibian holobiont after the impact of Batrachochytrium fungi

Torres-Sánchez, María[1]

(1) Universidad Complutense de Madrid

Correspondence e-mail: [torressanchez.maria@gmail.com]

Symbionts can influence the evolutionary trajectories of their hosts through selection and changes in demography. An example of this interaction is the impact on amphibian species of Batrachochytrium fungi, causal agents of the emerging infectious disease called chytridiomycosis. These pathogens infect the amphibian skin, interacting with other amphibian symbionts of the skin microbiome. I explored the genomic variation of an amphibian species to find evidence of evolutionary pressures driven by two skin symbionts: the fungal pathogen B. dendrobatidis and an antifungal bacterium. Demographic modelling showed a decrease in the effective population size upon the impact of the pathogen. Infected frogs presented lower nucleotide diversity, resulting in a potential heterozygote advantage to recruit the candidate beneficial symbiont and fight infections. In light of these results, I expanded the study framework to further explore the trans-kingdom communication during amphibian-Batrachochytrium interactions and the role of the pathogen in changing the host epigenome (i.e., methylation landscape). I aim to elucidate the consequences of host-pathogen interactions at different evolutionary levels, predicting individual infection histories and estimating population pressures related to infection.

[GSB-O-35]

Thursday 5, morning (second): 13:45
Room: Salón de actos

Evidence that seagrass presence increases benthic organic carbon, pollutant retention and biodiversity: A metanalysis of studies that presented paired control data

Piñeiro Juncal, Nerea[1]; de los Santos, Carmen B.[2]; Dahl, Martin[3]; Gagnon, Karine[4]; Lafratta, Anna[5]; Marco-Mendez, Candela[6]; Mazarrasa, Inés[7]; Njoroge Githaiga, Michael[8]; Rahayu, Yusmiana P.[9]; Samper-Villarreal, Jimena[10]; Stankovic, Milica[11]; Potouroglou, Maria[12]

(1) Universidade de Vigo; (2) Centre of Marine Sciences (CCMAR)- University of Algarve; (3) Södertörn University; (4) Norwegian Institute of Marine Research; (5) Edith Cowan University; (6) Center for Advanced Studies of Blanes (CEAB, CSIC); (7) Instituto de Hidráulica Ambiental de la Universidad de Cantabria; (8) University of Embu; (9) 11Research Center for Conservation of Marine and Inland Water Resources; (10) Centro de Investigación en Ciencias del Mar y Limnología (CIMAR); (11) 13Excellence Center for Biodiversity of Peninsular Thailand; (12) Alma Group

Correspondence e-mail: [nerea.pineiro.juncal@uvigo.gal]

Seagrasses are amongst the most productive marine ecosystems on Earth, providing habitat for many species and a wide range of ecosystem services (ES), such as carbon accumulation, water purification and biodiversity support. However, these services are generally quantified based on a variety of biophysical variables, yet global studies commonly lack comparisons with unvegetated areas, limiting our understanding of seagrasses' attributable benefits. Using a systematic review and metanalysis of 234 studies, including only studies that provided paired control (unvegetated sediment) data, we examined the effect of seagrass presence on three key sediment-related services: organic carbon (OC) content accumulation, water purification (pollutant burial), and biodiversity support. The analyzed dataset contained 5191 comparisons, primarily focusing on Zostera meadows and the services of OC accumulation and biodiversity support. The response ratio was calculated for each data pair and random effect model was used to estimate the global effect size. The meta-analysis showed that seagrass presence led to higher concentration of OC in the sediment. Further, in high OC areas, meadows with lower shoot densities may lower sediment OC content due to the diminished retention of fine particles. Results also indicate that seagrasses act as filters for pollutants, although, in oligotrophic environments, they may deplete the sediment nutrient stock to cover their physiological needs and promote nutrient export. Our findings also identified that seagrass presence increased abundance, density and diversity of benthic organisms at a global scale. This study provides clear evidence on how sediment biogeochemical processes shape and enhance ES provision in seagrass meadows.

[GSB-O-36]

Thursday 5, morning (second): 14:00
Room: Salón de actos

A global atlas of respiration rates in the mesopelagic ocean

Gómez Letona, Markel[1]

(1) Instituto de Investigacións Mariñas (IIM), CSIC

Correspondence e-mail: [mgletona@iim.csic.es]

At ~50 Pg C yr–1, marine net primary production is comparable to its terrestrial counterpart. Each year, 4–12 Pg of C of that production are transferred out of the euphotic zone into the mesopelagic layer by the biological carbon pump. There, a large fraction is respired by microbes, consuming O2 and releasing CO2 and inorganic nutrients (e.g., NO3–, PO43–). Mesopelagic respiration is thus a key process regulating the biogeochemical cycles of many elements and influences C sequestration. We used public databases of marine biogeochemical measurements to estimate oxygen utilisation rates (OURs) in the mesopelagic layer of the global ocean. Deriving apparent ages of water samples using tracer gases (CFC-11, CFC-12 and SF6), we regressed ages against O2 within 10°×10° pixels, separately per individual water mass (while correcting for mixing). Relationships with relevant environmental variables were subsequently evaluated. This analysis yielded global distributions of OURs across 30 water masses, encompassing three main density ranges (approximately s? < 27.0, 27.0–27.5, and > 27.5 g kg–1). Preliminary results showed that OURs spanned between 0.6–36.7 µmol kg–1 yr–1 (decreasing with depth), with clear differences between water masses and a significant relationship with the inverse temperature, yielding activation energies of 85.7–96.6 kJ mol–1. Our approach provides an oceanographically informed assessment of the variability in the spatial patterns of mesopelagic respiration, which can help us to better understand an important part of the biospheric C cycle and provide valuable information for modelling in a warming ocean.

GSB. Posters

[GSB-P-1]

Tuesday 3
Discussion corner: Room 11

A Late Winter's Tale: Environmental effects on dormant carbon reserves and earlywood formation in Quercus robur

Irimia Yáñez, Daniel[1]; Pérez de Lis, Gonzalo[2]; Fernández de Uña, Laura[3]; García González, Ignacio[4]

(1) Universidade de Santiago de Compostela; (2) Universidade de Santiago de Compostela; (3) Universidade de Vigo; (4) Universidade de Santiago de Compostela

Correspondence e-mail: [daniel.irimia.yanez@usc.es]

Non-structural carbohydrates (NSC) are known to play a key role in wood formation, which is a complex process controlled by various internal and external factors. In deciduous species, NSCs accumulate during the vegetative period and are later used to maintain metabolic respiration during dormancy and support radial growth and canopy development in early spring. Overwintering NSC concentrations may be particularly relevant for ring-porous species, such as Quercus robur L., as they rely on overwintering reserves to build the large earlywood vessels that ensure an efficient water transport to the leaves. Although there have been notable efforts on deciphering how climate conditions modulate NSCs and growth, it is unclear how warmer conditions in winter due to climate change will affect the timing of carbohydrate mobilization to wood formation in early spring.

In this study, we monitored soluble sugar (glucose, fructose, saccharose, raffinose) and starch concentrations in winter and spring in the stemwood of Q. robur trees during two consecutive years. Study trees were growing under contrasting climate conditions at six study sites in Northwest Iberian Peninsula. Earlywood formation was monitored on transverse microsections obtained from microcores collected from the same trees. We also measured the leaf area index at the stand level and recorded key leaf phenology events in each tree.

We observed marked differences in leaf and earlywood phenology across study sites, compatible with differences in NSC content. In all sites and dates, starch concentrations were higher than soluble sugar ones. The oceanic sites had the lowest NSC concentrations.

[GSB-P-2]

Wednesday 4
Discussion corner: Room 11

Acorn desiccation differences in European oaks: relation to species ecology and acorn structure

García, Olivia[1]; Mompean Asís, Eliot[2]; Cruz Alonso, Verónica[3]; Villar Salvador, Pedro[4]

(1) Universidad de Alcalá; (2) Universidad de Alcalá; (3) Universidad Complutense de Madrid; (4) Universidad de Alcalá

Correspondence e-mail: [olivia.garcia@uah.es]

Introduction. Evergreen Quercus (oaks) species usually have higher colonization capacity than their deciduous counterparts in Mediterranean environments where both coexist. These differences may be linked to varying seed dispersion and seedling establishment, with the water economy of acorns potentially playing a fundamental role. Despite acorns are recalcitrant seeds, comparative studies on their desiccation are scarce. This study compares the differences in acorn desiccation rates among European oak species to assess whether the differences are linked to species ecology and acorn structural traits. Methods. We measured acorn desiccation rate in three evergreens (Quercus ilex, Q. suber, Q. coccifera), and five deciduous (Q. faginea, Q. pyrenaica, Q. pubescens, Q. robur, and Q. petraea) oaks. For most species, two provenances were included. Desiccation rates was measured using 30 acorns per species and analyzed in relation to acorn morphological and structural traits, such as relative size of the cupule scar, specific pericarp mass, and the acorn area/volume ratio. Results & Discussion. Preliminary results show that the evergreen, xeric Q. ilex showed lower desiccation rates than the deciduous, mesic Q. faginea. This difference was associated with smaller relative cupule scars and a pericarp with a higher specific pericarp mass, likely more impermeable. Our results suggest that more frequent, intense and longer hotter droughts forecasted for the next decades, could enhance the colonization of evergreen oaks in areas currently dominated by deciduous oaks.

[GSB-P-3]

Thursday 5
Discussion corner: Room 11

Comparative Analysis of Airborne Phytopathogenic Spores in Olive Groves Across the North and South of the Iberian Peninsula

Tenor Ortiz, María José[1]; Morales, Thalia[2]; Oteros, Jose[3]; Sánchez Espinosa, Kenia C[4]; Fernández-González, María[5]; Galán, Carmen[6]; Rodríguez-Rajo, Javier[7]

(1) University of Cordoba; (2) University of Cordoba; (3) University of Cordoba; (4) University of Vigo; (5) University of Vigo; (6) University of Cordoba; (7) University of Vigo

Correspondence e-mail: [b52teorm@uco.es]

The olive crop is highly vulnerable to attack by several phytopathogens, including diseases associated with aerial propagules, such as Pseudocercospora cladosporoides (leaf spot), Venturia oleaginea (leaf scab) and Alternaria spp. (leaf spot). This study monitored in real time the concentrations of airborne spores of these species in two regions, with different biogeographical ranges, of the Iberian Peninsula, i.e., Atlantic in northwest (Toén, Orense) and Mediterranean the south (Priego de Córdoba and Baena, Córdoba), during 2024. Hirst-type volumetric samplers were used in olive groves to identify and quantify daily fungal spore concentrations and monitoring the different phenological stages in the surrounding olive groves to observe their floral development and fruiting following the BBCH scale. The results showed differences in the predominance of spores according to the region. In the northwest, P. cladosporoides was the predominant species, which is associated with conditions of high relative humidity (above 80 %) and average temperatures of 21-22.5 ºC; with highest concentration recorded in June, coinciding with flowering and fruit ripening. On the other hand, Alternaria spp. was recorded as the predominant spore in the south, which is characterized by tolerating lower relative humidity (25-30 %) and temperatures of 24-28 ºC, with maximum prevalence in October, during the phase of full fruiting.

These findings highlight the influence of environmental conditions on spore distribution and abundance and providing key information for olive phytosanitary management in different climatic regions.

[GSB-P-4]

Tuesday 3
Discussion corner: Room 11

Desiccation risk in recalcitrant seeds of Quercus species in the fall: does dispersal timing matter?

Mompeán Asís, Eliot[1]; García Cámara, Olivia[2]; Cruz Alonso, Verónica[3]; Villar Salvador, Pedro[4]

(1) Universidad de Alcalá; (2) Universidad de Alcalá; (3) Universidad Complutense de Madrid; (4) Universidad de Alcalá

Correspondence e-mail: [eliot.mompean@uah.es]

Seed dispersal timing may influence plant colonization success. Compared to evergreen oaks, deciduous oaks tend to disperse acorns earlier in the autumn. Due to acorns' sensitivity to desiccation, dispersal timing can potentially affect seed viability if dispersers cache acorns into dry soils. We predict that early dispersal in deciduous oaks increases the risk of acorn desiccation and viability loss in regions with late, warm autumns. Conversely, the latter dispersal of evergreen oaks could reduce acorn desiccation risks by benefiting from cooler conditions and increased soil moisture due to mid-late autumn rains. This study assess whether acorn dispersal timing affects its viability. A factorial sowing experiment was conducted with two deciduous oak species (Q. faginea and Quercus pyrenaica), and the evergreen Q. ilex. Acorns were sown at three times in the fall, mimicking each species´ peak dispersal timing. Regular watering simulated the average rainfall regime in Alcalá de Henares, central Spain. Over five sampling dates, acorns were collected to measure their moisture content and germination capacity. Contrary to predictions, acorns sown earliest showed no significant reduction in content or germination capacity. These results suggest that soil moisture during the dispersal periods of the earliest species is already sufficient to prevent desiccation impairing germination. Therefore, acorn dispersal timing seems to not hold significant ecological importance under the average rainfall conditions in the studied site.

[GSB-P-5]

Wednesday 4
Discussion corner: Room 11

Effects of winter conditions on the functional lifespan of xylem conduits in evergreen and deciduous oaks

Pérez de Lis Castro, Gonzalo[1]; Jacobsen, Anna L.[2]; Fernández de Uña, Laura[3]; Pratt, R. Brandon[4]; García-González, Ignacio[5]

(1) Universidade de Santiago de Compostela; (2) California State University, Bakersfield; (3) Universidade de Vigo; (4) California State University, Bakersfield; (5) Universidade de Santiago de Compostela

Correspondence e-mail: [gonzalo.perezdelis@usc.es]

Climate change scenarios predict rising winter temperatures and more frequent droughts in the Iberian Peninsula, with uncertain effects on evergreen and deciduous oaks (Quercus spp.), which are characteristic of the region's temperate and Mediterranean woodlands. These species not only differ in their leaf habit but also in their wood anatomy, with deciduous species showing a ring-porous structure and evergreen species a more diffuse-porous structure. These features influence their resistance to cavitation. While evergreen oaks can rely on previous-year vessels to support growth in early spring, ring porous species need to build new large vessels because older vessels embolize due to drought and/or frost. Our objective was to assess the effects of winter temperatures on the functional lifespan of xylem conduits of evergreen and deciduous oaks, as well as possible predisposing effects on their responses to summer drought.

We analyzed the loss of conductivity in micro-sections of Q. robur (deciduous, ring porous) and Q. suber (evergreen, diffuse porous) saplings subjected to control (freezing) and greenhouse (non-freezing) conditions from December 2023 to May 2024. Anatomical distinction between functional and embolized vessels was enabled by application of active xylem staining. To test predisposing effects of prior-winter conditions on drought-induced loss of conductivity, a drought/irrigation treatment and additional micro-sections were performed in both species during August-September 2024.

Preliminary observations showed that both evergreen and deciduous oaks subjected to winter warming had a larger contribution of previous-ring conduits during spring, with larger differences between treatments for the ring-porous Q. robur than for Q. suber.

[GSB-P-6]

Thursday 5
Discussion corner: Room 11

Evaluation of temporal trends in the ecological status of Iberian rivers

Sáez, Clara[1]; Sánchez-Fernández, David[2]; Gutiérrez-Cánovas, Cayetano[3]

(1) University of Murcia; (2) University of Murcia; (3) University Rey Juan Carlos (URJC)

Correspondence e-mail: [Clara.s.g@um.es]

Freshwater ecosystems are essential for global biodiversity and ecosystem services but face anthropogenic pressures such as agricultural intensification, pollution, and climate change, which impact their ecological health. This study evaluates the temporal trends of the ecological status of Iberian rivers using the IBMWP index, a bioindicator based on aquatic macroinvertebrates, and analyzes the influence of environmental and spatial factors. Data from 35 sampling stations across four physioclimatic regions (Western Andalucía, Southern Duero, Middle Tajo, and Segura) over the last 15 years were analyzed. Linear mixed models and multiple regressions were used to identify temporal trends and explanatory factors, considering variables such as aridity, land use, and region. The results do not show significant temporal trends across the study area, but regional variability was observed: negative trends in Western Andalucía, positive trends in Southern Duero and Middle Tajo, and heterogeneous trends in Segura. Region was the only factor significantly associated with these trends, while land use and aridity showed no relevant effects. These findings highlight the importance of multi-scale studies and long-term monitoring programs to understand the resilience of fluvial ecosystems. Additionally, they emphasize the need to design adaptive management strategies tailored to local conditions to address changing environmental pressures.

[GSB-P-7]

Tuesday 3
Discussion corner: Room 11

Light-dependence of seagrass performance and upper thermal limits

De Pablo Tobajas, Pilar[1]; Anton, Andrea[2]; Marbà, Nuria[3]

(1) Universidade do Algarve - Mediterranean Institute for Advanced Studies IMEDEA (CSIC-UIB); (2) Mediterranean Institute for Advanced Studies IMEDEA (CSIC-UIB), Esporles, Illes Balears, Spain; (3) Mediterranean Institute for Advanced Studies IMEDEA (CSIC-UIB), Esporles, Illes Balears, Spain

Correspondence e-mail: [pilardepablotobajas@gmail.com]

In warming scenarios, many primary producers tend to migrate vertically to cooler habitats. However, light-limited conditions in deeper ecosystems can impact on their thermal tolerance.

This study examines three key Mediterranean seagrass species (Cymodocea nodosa, Posidonia oceanica and Zostera noltei). Three mesocosm experiments exposed the plants to various temperature treatments for 10 - 20 days. Light intensity was used as a proxy of depth, applying two light treatments: High Light (191 µmol m-2 s-1) and Low Light (55 µmol m-2 s-1), simulating environmental conditions near upper and lower depth limits. We measured growth and survival rates to calculate thermal thresholds (optimum, upper critical and lethal temperatures), and deactivation energy from thermal performance curves. Additionally, metabolic rates (Net Primary Production, Gross Primary Production and Respiration) were measured for Z. noltei. We tested whether plants at different light intensities have similar thermal thresholds, along with similar growth and metabolic responses.

Upper thermal thresholds and deactivation energies were unaffected by light intensity; however, significant differences were observed in growth and metabolic responses, particularly in the transition to heterotrophy, with lower performance under shade conditions. Among the species, C. nodosa demonstrated a higher capacity to thrive under warmer conditions and deeper environments. Moreover, unexpectedly high upper thermal limits were observed for P. oceanica when compared to previous studies, suggesting possible clonal thermal adaptation to recent rising temperatures. Our findings indicate a habitat contraction of seagrass species is expected under future climate change scenarios, in which deep meadows may also be vulnerable to warming conditions.

[GSB-P-8]

Wednesday 4
Discussion corner: Room 11

Lost in space: When spatial scale terms blur actual study size in plant ecology

Perez Navarro, Maria Angeles[1]; Hung, Chung-Yi[2]; Brian, Josh[3]

(1) King's College London; (2) King's College London; (3) King's College London

Correspondence e-mail: [m.angeles582@gmail.com]

Introduction: The detection and interpretation of ecological processes is strongly influenced by the spatial scale at which studies are conducted. For studies to be comparable, they should be carried out at the same scale. Scale terms (e.g., 'local' or 'regional') are frequently used to denote study spatial scale. The implication is that studies using the same scale term should be directly comparable. However, whether the area encompassed by particular scale terms is consistent across studies remains unclear.

Methods: We performed a systematic literature review of 385 papers in plant ecology, compiling 963 instances of spatial scale terms alongside their associated study areas. We examined whether the variation in use of scale term could be explained by habitat type, study type, or geographic region. Additionally, we simulated a virtual plant community to evaluate the consequences of scale-term variability for commonly used biodiversity metrics such as Shannon index.

Results and discussion: Single scale terms covered areas that vary by an average of 4.7 orders of magnitude, with significant overlap between distinct scale terms. Surprisingly after accounting for differences in habitat type, we still found high overlap between scale terms within determined habitat types, highlighting the lack of consistency in use of spatial terminology. Geographic region and study type showed lower variability in the spatial area encompassed by scale terms. Our simulations demonstrated that biodiversity metrics are highly sensitive to scale-term variation, particularly at finer scales. We highlight the critical importance of transparent and consistent spatial scale reporting to accurately interpret ecological processes.

[GSB-P-9]

Thursday 5
Discussion corner: Room 11

Recent water cycle changes in Spanish forests are driven by stand structure more than climatic changes

Sánchez Dávila, Jesús[1]; De Cáceres Ainsa, Miquel[2]; Vayreda Duran, Jordi[3]; Retana Alumbreros, Javier[4]

(1) CREAF; (2) CREAF; (3) CREAF; (4) CREAF

Correspondence e-mail: [jesus.sanchez.davila0@gmail.com]

The water cycle in forests of many regions is being impacted by climatic changes, often including a decrease in precipitation and an increase in temperature, leading to an increase in green water and a decrease in blue water. Additionally, forest expansion and development are prevailing processes in many rural areas due to the abandonment of traditional land uses. The increase in stand leaf area that occurs with forest development further enhances green water and reduces blue water availability. However, the interaction between climate change and changes in stand structure is not well understood at large scales. In this study, we modelled the water cycle in Spanish forests using forest inventories from across the country over the past few decades (1990–2020). We analyzed changes in climate and forest structure over time at plot level using three repeated national forest inventory surveys, along with trends in green and blue water across different forest functional types. We also examined differences in water cycle changes between managed and unmanaged forests. Our results show that green water increased and blue water decreased over time across Spanish forest types. The increase in leaf area index (LAI) of both shrubs and trees had a greater influence on green water than climatic changes. These factors also significantly impacted blue water availability, in combination with the decrease in precipitation observed during the last decade (2010–2020). Forest management improved blue water yield, but only in the short- midterm, as stand LAI tended to recover over time. This study demonstrates that changes in stand structure can be as important, if not more so, than climatic changes in influencing the water cycle at the regional level. Moreover, our results support the idea that effective forest management can enhance blue water production, but only if management practices are consistently maintained.

[GSB-P-10]

Tuesday 3
Discussion corner: Room 11

Understanding the uniqueness of macroinvertebrate communities in alpine lakes from a multidimensional niche perspective: the ALPINEPONDS project

Abellán, Pedro[1]; Jiménez-Ruiz, Marina[2]; Carbonell, José A.[3]; Pallarés, Susana[4]

(1) Universidad de Sevilla; (2) Universidad de Sevilla; (3) Universidad de Sevilla; (4) Universidad de Murcia

Correspondence e-mail: [pabellan@us.es]

Understanding species responses to environmental gradients is a key topic in ecology. Species assemblages result from various processes, including environmental filters, biotic interactions, and dispersion, often displaying complex interactions. Elevation gradients provide powerful study systems to investigate how communities are structured by the environment, as environmental conditions change rapidly within short distances, offering insights into the potential effects of global climate change on biodiversity. High-mountain habitats, at the extreme of such gradients, are characterized by harsh living conditions, including very low temperatures, long periods of snow or ice cover, low atmospheric oxygen pressure and extremely high levels of damaging UV radiation. Using high-altitude water bodies as model system, the ALPINEPONDS project aims to explore the relative role of environmental conditions and biotic interactions in the assembly of their very distinct communities of aquatic insects. Throughout an experimental approach, we compare the fundamental thermal niche of five alpine species to those of other potential competing species currently occurring in lower altitude areas in southern Iberia. We also explore other dimensions of the fundamental niche (UV radiation, low oxygen and desiccation) and their interactions with temperature, as well as the role of biotic interactions, in explaining the altitudinal segregation of species. Because climate change is altering conditions in high-elevation water bodies worldwide, with largely unknown effects on resident communities of aquatic insects, a better understanding of the multivariate physical and biotic challenges in alpine lakes and ponds is crucial to predict potential future changes as a consequence of global warming.

[GSB-P-11]

Tuesday 3
Discussion corner: Room 4

Community assembly patterns across butterfly species in urban populations

Suárez, Marta[1]; Garcia Callejas, David[2]; Dalmasso, Giovanni[3]; Melero, Yolanda[4]

(1) Universidad de Granada; (2) University of Graz, Austria.; (3) Universitat Ramon Llull; (4) Universidad de Barcelona

Correspondence e-mail: [martasuarez01@correo.ugr.es]

Ecological communities are assembled depending on environmental, spatial, and biotic constraints. The importance of these constraints varies for different communities, and their link to population outcomes and their temporal trends is poorly explored. We studied butterfly assembly and its temporal variability in a natural and an urban community. Further, we analysed temporal changes in relative abundances at the species and community levels to understand the processes underlying urban population dynamics. We gathered abundances for ca. 40 species across 130 sites in Barcelona and its conurbation during seven years. Species-abundance distributions were analysed across years for both communities using regression models. Then, we compared species-specific abundance trends per urban site. Specifically, we analysed differences 1) across time per species, and 2) across species using regression models. Our preliminary results show that species-abundance distributions of the urban butterfly community are driven by a directional filtering favoring generalist mobile species and excluding ca. 30% of the species from the natural community. Further, species varied in relative abundance patterns within the urban community. A few dominant species constantly occurred in all patches with varying abundances, but most species showed low abundances and appeared only in a subset of patches and years. Overall, the assembly of butterfly communities in our urban area follows a mostly deterministic filtering based on species population abundances and, predominantly, on species traits. However, abundance patterns inside the city showed a stronger stochastic signal for most species, suggesting a lack of established urban populations.

[GSB-P-12]

Wednesday 4
Discussion corner: Room 5

Floristic composition and diversity of Galician lowland hay meadows (EU Habitat 6510) in relation to management and conservation

Martínez Veiga, Eva[1]; Fagúndez Díaz, Jaime[2]

(1) Universidade de A Coruña; (2) Universidade de A Coruña

Correspondence e-mail: [eva.martinez.veiga@udc.es]

The northwest of the Iberian Peninsula hosts one of the largest representations of lowland hay meadows (EU Habitat 6510). However, profound changes in land use and management practices have reduced their extension and conservation status. The lack of detailed floristic knowledge, particularly regarding geographical heterogeneity and constraining environmental factors, severely hinder the definition of targets, and thus the implementation of effective conservation measures.

To assess the floristic identity and understand the decline of the habitat, this study focuses on the detailed characterization of the floristic community of lowland hay meadows in Galicia, NW Iberian Peninsula. We have examined the edaphic, topographic, and climatic factors that determine their floristic composition and diversity, and identified management practices related to the conservation status of the habitat.

Our results show clear relationships between diversity, species dominance patterns, and factors such as soil characteristics, climate, and geography. Additionally, there is a marked trend toward reduced species richness in coastal areas, where land use intensification has changed meadows into improved pastures with low diversity and dominance of commercial species such as raygrass (Lolium spp.).

TECHNICAL SESSIONS

TSB.1. The impact of Global Change on Plant-based species interaccions

Monday, 2 (18:00-19:30) • Tuesday, 3 (11:00-12:30); (12:45-14:15)

Room: Seminario 3

Plant-based interactions are fundamental to ecology because they determine community structure, nutrient cycling, biodiversity, ecosystem productivity, resilience to climate change and, ultimately, the provision of ecosystem services. Importantly, these interactions are being altered by various abiotic and biotic global change drivers. In this session, we are interested in studies on:

1. Plant-plant interactions: Plants often interact with each other through competitive suppression, tolerance, avoidance or facilitation, which are key mechanisms for the assembly of plant communities. Global change drivers can modify such interactions by altering resource availability and climatic conditions.
2. Plant-animal interactions: These interactions are vital for the survival and reproduction of many species. Animals often consume plants or act as pollinators or seed dispersers. However, global changes like climate change can alter plant phenology, affecting plant-animal interactions.
3. Plant-microorganism interactions: Microorganisms, like bacteria and fungi, play a crucial role in plant health and ecosystem productivity. They can form symbiotic relationships with plants or cause diseases through pathogenic functions. However, global changes, like pollution or the appearance of exotic microorganisms, can alter these interactions by changing the composition of the microbiota.

Organizers:

• **Álvaro Gaytán,** Instituto de Recursos Naturales y Agrobiología de Sevilla (IRNAS-CSIC)

• **Blanca Gallego-Tévar,** Universidad de Sevilla.

TSB.1. Orals

[TSB.1-O-1]

Monday 2, evening: 18:00
Room: Seminario 3

Effect of priming and PGP-bacterial inoculation on salt stress tolerance in halophytes

Valle-Romero, Pedro[1]; Martín-Peláez, María Rocío[2]; Flores-Duarte, Noris Jarleny[3]; Redondo-Gómez, Susana[4]; Rodríguez-Llorente, Ignacio David[5]; Pajuelo, Eloísa[6]; Mateos-Naranjo, Enrique[7]

(1) University of Seville; (2) University of Seville; (3) University of Seville; (4) University of Seville; (5) University of Seville; (6) University of Seville; (7) University of Seville

Correspondence e-mail: [pvalle@us.es]

Between 2020 and 2050, the global population is expected to increase by 1.3 billion people, representing a 17% rise compared to 2020. Concurrently, agro-food productivity is declining due to climate change, land use practices, and biotic and abiotic factors. Soil salinization, a global environmental and socioeconomic challenge, necessitates sustainable strategies to enhance agricultural productivity. In this context, halophytes, which are plants adapted to saline environments, possess specialized mechanisms that allow them to endure and thrive under various stress conditions. Techniques such as priming and inoculation with plant growth-promoting rhizobacteria (PGPR) emerge as viable solutions to address this issue. Priming strengthens the plant immune system, enhancing acclimation to future stresses. Meanwhile, PGPR inoculation promotes plant growth, reduces oxidative stress, and bolsters systemic defenses, increasing plant resilience.

This study aimed to evaluate the combined effects of thermal priming (40-28 °C) and PGPR inoculation on the response of halophyte species Atriplex portulacoides and Arthrocaulon macrostachyum under saline stress conditions (1030 mM NaCl). Five treatments were assessed: a control (171 mM NaCl), priming with or without inoculation, and no priming with or without inoculation.

The results showed that priming improved root biomass compared to non-primed plants, particularly in conjunction with PGPR inoculation. Moreover, PGPR enhanced physiological parameters such as photosynthesis and PSII efficiency compared to non-inoculated plants, regardless of priming. These combined techniques could enhance the tolerance of halophytes to soil salinization and rising temperatures, offering a sustainable alternative for agriculture and an innovative strategy to test on other crops.

[TSB.1-O-2]

Monday 2, evening: 18:15
Room: Seminario 3

Unveiling the impact of a complex environmental matrix predicted by climate models, implementing plant-endophyte interaction on the halophyte Sarcocornia perennis

Martín-Peláez, María Rocío[1]; Valle-Romero, Pedro[2]; Flores-Duarte, Noris Jarleny[3]; Redondo-Gómez, Susana[4]; Rodriguez-Llorente, Ignacio David[5]; Pajuelo, Eloisa[6]; Mateos-Naranjo, Enrique[7]

(1) Facultad de Biología, Universidad de Sevilla; (2) Facultad de Biología, Universidad de Sevilla; (3) Facultad de Farmacia, Universidad de Sevilla; (4) Facultad de Biología, Universidad de Sevilla; (5) Facultad de Farmacia, Universidad de Sevilla; (6) Facultad de Farmacia, Universidad de Sevilla; (7) Facultad de Biología, Universidad de Sevilla

Correspondence e-mail: [mmartin10@us.es]

Climate change models predict an increase in atmospheric CO2 concentration, daily temperatures, and soil salinity, all of which are expected to significantly impact the structure and plant composition of the ecosystems. However, some plants, such as halophytes, have developed natural resistance mechanisms that position them as key models of tolerance to extreme conditions. Meanwhile, recent studies highlight the role of endophytic plant growth-promoting bacteria (PGPB) in the tolerance of these plants, although the underlying mechanisms remain largely unknown. Considering all this, a study was designed to understand the impact of a complex environmental matrix characterized by atmospheric CO2 concentration, daily temperature, salt concentration variations, and endophyte interaction on the growth and key photosynthetic parameters on the halophyte Sarcocornia perennis subs. perennis. After 60 days, a reduction in both net photosynthetic rate and stomatal conductance were observed under high CO2 concentrations and high daily temperature conditions, especially accentuated in high saline conditions. Additionally, chlorophyll fluorescence measurements showed a small reduction in the maximum efficiency of photosystem II (Fv/Fm) revealing photosynthetic damage. Despite this, total biomass was not affected by any combination of these stress factors. Inoculation with endophytes showed a higher intrinsic water-use efficiency in high saline conditions, achieving this by decreasing the stomatal conductance. Also, inoculation mitigated photochemical damage in a high daily temperature scenario, as Fv/Fm ratio was preserved, by showing higher quantum yield of the non-photochemical reactions. These preliminary results highlight the natural stress tolerance mechanisms of S. perennis, while also demonstrating endophyte's role in climate change scenarios.

[TSB.1-O-3]

Monday 2, evening: 18:30
Room: Seminario 3

Plant-mycorrhizal fungi association outcomes across climatic disequilibrium scenarios

Prieto-Rubio, Jorge[1]; Margalef-Marrasé, Jordi[2]; Gómez-Górriz, Leticia[3]; Rodríguez-Ginart, Daniel[4]; Goberna, Marta[5]; Rincón, Ana[6]; Verdú, Miguel[7]

(1) Centro de Investigaciones sobre Desertificación (CIDE, CSIC-UV-GVA); (2) Centro de Investigaciones sobre Desertificación (CIDE, CSIC-UV-GVA); (3) Centro de Investigaciones sobre Desertificación (CIDE, CSIC-UV-GVA); (4) Centro de Investigaciones sobre Desertificación (CIDE, CSIC-UV-GVA); (5) Instituto Nacional de Investigación y Tecnología Agraria y Alimentaria (INIA, CSIC); (6) Instituto de Ciencias Agrarias (ICA, CSIC); (7) Centro de Investigaciones sobre Desertificación (CIDE, CSIC-UV-GVA)

Correspondence e-mail: [jorge.prieto@ext.uv.es]

Mycorrhizal symbioses are mutualistic associations occurring between plants and soil fungal groups inhabiting the root systems, and are essential for ecosystem functions like carbon sequestration, soil fertility, and terrestrial biodiversity maintenance, while also helping host plants cope with environmental stress. The performance of plants and their mycorrhizal fungal partners can be filtered by climatic conditions, leading to potential negative effects when climate becomes environmentally disruptive. To investigate this, we hypothesized that increasing climatic disequilibrium—defined as the mismatch between current and optimal climatic conditions for plants—would alter the composition of mycorrhizal fungal communities. We analyzed arbuscular mycorrhizal (AM), ectomycorrhizal (EcM), and ericoid mycorrhizal (ErM) fungal communities by high-throughput sequencing underneath 150 vegetation patches and in adjacent open grounds across ten plant communities in the Iberian Peninsula. At each plant community and vegetation patch, we also inferred the climatic disequilibrium, ranging from sites and patches near climatic optima to those under pronounced climatic disequilibrium. Our results revealed that mycorrhizal fungal communities were influenced by vegetation composition and climatic disequilibrium. EcM fungi were dominant in plant communities closer to climatic optima, while AM and ErM fungi became more prevalent under greater climatic disequilibrium. These patterns suggest that mycorrhizal fungi respond adaptively to climatic mismatches, with potential implications for plant-microbial interactions, and underscores their importance in understanding the impacts of ongoing climate change on terrestrial ecosystem functioning.

[TSB.1-O-4]

Monday 2, evening: 18:45
Room: Seminario 3

Root-associated fungal communities in small islands around the world

Rodríguez Echeverría, Susana[1]; Morillo, José Antonio[2]; Correia, Marta[3]; Hervías-Parejo, Sandra[4]; Heleno, Ruben[5]; Nogales, Manuel[6]; Traveset, Anna[7]

(1) University of Coimbra, Centre for Functional Ecology, Associate Laboratory TERRA; (2) Estación Experimental de Zonas Áridas (EEZA-CSIC); (3) Mediterranean Institute for Advanced Studies (IMEDEA, CSIC-UIB); (4) Mediterranean Institute for Advanced Studies (IMEDEA, CSIC-UIB); (5) University of Coimbra, Centre for Functional Ecology, Associate Laboratory TERRA; (6) Instituto de Productos Naturales y Agrobiología (IPNA-CSIC); (7) Mediterranean Institute for Advanced Studies (IMEDEA, CSIC-UIB)

Correspondence e-mail: [srecheverria@uc.pt]

Root-associated fungi (RAF) are important components of terrestrial ecosystems as they can influence plant germination, growth, survival, reproduction and coexistence, as well as the flow of nutrients and water from soil to plants and plant response to environmental stress. Unravelling their diversity and the drivers that regulate RAF community structure is required to understand their role in the ecosystem functions mentioned above, more so under the current scenario of global change. Here, we explore the diversity, community composition and biogeographical patterns of root-associated fungal communities in small islands from five archipelagos with different climate and island characteristics. Islands are natural laboratories that allow addressing central questions in ecology about the mechanisms that structure communities and regulate biodiversity. Moreover, the communities of plant-associated microbes in islands are little studied. We found that island root-associated fungal communities had a clear biogeographic pattern with distinct local diversity that could not be explained by island size or isolation. Soil N and mean annual precipitation emerged as the most important abiotic factors determining island RAF diversity, but we also detected a clear biotic filtering determined by plant diversity and phylogenetic diversity. Our data also confirm the worldwide distribution of wind-dispersed Ascomycota genera with large ecological niches and reveal unexpected hotspots of wild reservoirs for taxa related to important plant pathogens.

[TSB.1-O-5]

Monday 2, evening: 19:00
Room: Seminario 3

Assembly of Soil Microbial Communities Under Maytenus senegalensis Shrubs Across Contrasting Habitats in Its Native Range

Díaz Santiago, Elena Dolores[1]; Díaz-Santiago, Elena[2]; Sadio, Thiaba D[3]; Diéme, Joseph S[4]; Hurtado-Martínez, Miguel[5]; Kindler, Christian[6]; Manrique, Esteban[7]; Pugnaire, Francisco I.[8]

(1) Estación Experimental Zonas Áridas - CSIC; (2) Estación Experimental Zonas Áridas - CSIC; (3) Université Assane Seck, Ziguinchor; (4) Université Assane Seck, Ziguinchor; (5) Estación Experimental Zonas Áridas - CSIC; (6) Estación Experimental Zonas Áridas - CSIC; (7) Real Jardín Botánico - CSIC; (8) Estación Experimental Zonas Áridas - CSIC

Correspondence e-mail: [elenad@eeza.csic.es]

Introduction: Plant-plant and plant-soil interactions modulate plant community responses to environmental clues, but their role in a scenario of global change remains unclear. These interactions, particularly the relationships between plants and soil microorganisms, are vital for ecosystem structure and function, influencing nutrient cycling, plant performance, and ecosystem stability. Although the importance of these interactions is becoming increasingly recognized, we still need to gain more insights about them, especially under field conditions and how they are affected by climate change.

Materials and Methods: We addressed plant-soil interactions in Maytenus senegalensis, a shrub spreading from Spain to the Sahel, the Middel East and Asia which is of high relevance in Senegal. We sampled soil under M. senegalensis and in gaps in a dry ecosystem (Almeria, Spain) and a humid ecosystem (Casamance, Senegal) to test for the presence of a core microbiota using high throughput metagenomics techniques.

Results and Discussion: Our results show that environmental factors influence the composition and diversity of soil microbial communities. However, a subset of microbial taxa appeared consistently associated with M. senegalensis across such disparate ecosystems, suggesting the presence of a core microbiota common to all individuals of the same species. These data imply that plants may select specific microorganisms from the surrounding soil community, potentially establishing positive feedbacks. Our data provide insights into the assembly of microbial communities, their coevolution with plants, and potential effects of climate change.

[TSB.1-O-6]

Monday 2, evening: 19:15
Room: Seminario 3

Leaf damage by insects and pathogens change with aridity in Mediterranean forests

Rodríguez, Ginés[1]; Gaytán, Álvaro[2]; Salazar-Zarzosa, Pablo C.[3]; C. Bastias, Cristina[4]; Diaz Herraiz, Aurelio[5]; Quero Pérez, José Luis[6]; Villar, Rafael[7]

(1) University of Cordoba; (2) Institute of Natural Resources and Agrobiology of Seville (IRNAS-CSIC); (3) University of Cordoba; (4) University of Cordoba; (5) Instituto Federal de Ciência e Tecnologia do Amazonas (IFAM); (6) University of Cordoba; (7) University of Cordoba

Correspondence e-mail: [b52rocag@uco.es]

In the Mediterranean region, climate change is leading to a higher aridity due to increased temperatures and decreased rainfall. These climatological alterations can lead to changes in leaf traits and forest structure, which in turn affect leaf damage by herbivory and pathogens. However, the impact of aridity on leaf damage levels is poorly understood. We selected 66 plots dominated by one of these species: Pinus pinaster, P. halepensis, Quercus ilex and Q. faginea along an aridity gradient on the Iberian Peninsula. In each forest, we collected leaves to estimate leaf damage caused by insect herbivores and foliar pathogens. We assessed how leaf damage varied with aridity, along with foliar traits and forest structure variables. Our findings showed that leaf damage generally increased with forest aridity, although the intensity of this effect varied depending on the tree species. Additionally, leaf damage was influenced by forest structure, with higher incidence observed in forests with denser understories. Nevertheless, these structural effects were unrelated to aridity. Moreover, our results were consistent for all the species. This study provides valuable insights into how climate change is expected to increase biotic damage in Mediterranean forests. Our research highlights the importance of considering both environmental and structural factors when assessing the vulnerability of forests to biotic damage. Understanding these dynamics is crucial for predicting future impacts and developing strategies to mitigate the negative effects of climate change on forest ecosystems.

[TSB.1-O-7]

Tuesday 3, morning (first): 11:00
Room: Seminario 3

Effects of global warming and atmospheric pollution on Mediterranean high mountain pastures: searching for new risk indicators to help their conservation

Prieto Benítez, Samuel[1]; Ruiz Checa, Raquel[2]; González Fernández, Ignacio[3]; Dötterl, Stefan[4]; Campos Saelices, Sara[5]; Alonso del Amo, Rocio[6]; Bermejo Bermejo, Victoria[7]

(1) CIEMAT; (2) CIEMAT; (3) CIEMAT; (4) Salzburg University; (5) CIEMAT; (6) CIEMAT; (7) CIEMAT

Correspondence e-mail: [samuel.prieto@ciemat.es]

Plants pollinated by animals have floral traits focused on attracting pollinators to ensure seed production and maintenance of populations. However, what if these traits are altered by Global Change factors? Among the floral traits essential for plant-insect communication, petal color and size, floral phenology, nectar production or the composition and production of flower scents can be modifying by warming and air pollution. Tropospheric ozone (O3) is one of the most important atmospheric pollutant affecting ecosystems due to its wide distribution in natural areas and its impact on plant metabolism, growth and yield. During reproductive seasons, Mediterranean high mountain grasslands face high temperatures and levels of O3 well above the O3-protection thresholds for vegetation (EU/Air Quality Directives).

The present study addresses the effects of temperature and O3-increases in oromediterranean grasslands, focusing on floral traits response of seven representative species of this vulnerable community. The assay was carry out in the CIEMAT-OTC facility, growing plants under four O3-treatments ranging from preindustrial background to expected future values.

The study also aims to define O3-risk indicators for this type of community, following the UNECE Air Convention methodology, to optimize O3-risk analysis. These indicators, scarce for Mediterranean communities, are generally based on growth/yield effects. However, based on the results, it is the floral traits that should be considered as response variables to O3 due to their high sensitivity. Considering floral traits involved in pollinator attraction in O3-risk assessments will also contribute to pollinators conservation, essential to maintaining the valuable diversity of these grassland communities.

[TSB.1-O-8]

Tuesday 3, morning (first): 11:15
Room: Seminario 3

Recruits climatic disequilibrium is determined by adult resilience after drought-induced dieback in Mediterranean shrublands

Díaz Borrego, Raquel[1]; Pérez Navarro, María Ángeles[2]; Lloret Maya, Francisco[3]

(1) Centre de Recerca Ecològica i Aplicacions Forestals (CREAF); (2) King's College London; (3) Centre de Recerca Ecològica i Aplicacions Forestals (CREAF)

Correspondence e-mail: [r.diaz@creaf.uab.cat]

Climate change drives thermophilization (replacement of cold-adapted species by warm-adapted ones) while extreme climatic events such as droughts operate as filters, eliminating less drought-tolerant species and accelerating community shifts. This process will lead to legacy effects, becoming the community more arid-prone after every drought. In this context, climatic resilience reflects the community's ability to recover or maintain its climatic characteristics, and climatic disequilibrium (CD) reflects the difference between species or communities climatic optimum and macroclimate. Here, we aim to (i) analyze how canopy features modify microclimatic buffering, in terms of temperature and vapor pressure deficit (VPD), and determines recruits CD; and (ii) to assess the legacy effects of droughts on recruit CD, in relation to the adult community CD and climatic resilience – that is, maintenance of the climatic characteristics of the community after drought – , comparing the CD of recruit subcommunities growing under canopy and in open gaps.

First, we found that less defoliated and shorter canopies provided better climatic amelioration, by buffering climate extremes. However, recruits with higher CD were found under taller and most defoliated and dead canopies, likely because their competitive ability is lower. Also, CD of recruit communities growing under the canopy was positively related to post-drought adults CD, showing little variation with climatic resilience. In contrast, in gaps the CD of recruit communities increased with adult CD and with climatic resilience. So, under-canopy conditions act as shelter for species with high CD only in communities with high climatic stress (i.e. when climatic resilience remains low).

[TSB.1-O-9]

Tuesday 3, morning (first): 11:30
Room: Seminario 3

Trait dissimilarities and hierarchies in crop-weed competition: Effects on crop productivity under experimental drought

Elangovan Vennila, Elansurya[1]; Izquierdo, Jordi[2]; Hernández Plaza, Eva[3]

(1) Universitat Politècnica de Catalunya (UPC); (2) Universitat Politècnica de Catalunya (UPC); (3) Instituto Nacional de Investigación y Tecnología Agraria y Alimentaria (INIA-CSIC)

Correspondence e-mail: [elansurya.elangovan@upc.edu]

Understanding the mechanisms underlying competitive interactions between crops and weeds is essential for predicting agroecosystem dynamics and crop responses to challenging environmental conditions. Differences in functional traits, trait dissimilarities, between crops and weeds can allow for coexistence, reducing the negative effects of weeds on crops. However, phenotypic differences can also lead to strong competitive effects if trait hierarchy exists. We conducted a greenhouse experiment investigating how trait dissimilarities and hierarchies mediate crop-weed competition under varying water availabilities. Crop plants (winter wheat; Triticum aestivum L.) were grown with different combinations of weed species, under two water conditions: well-watered and drought. We measured crop and weed traits, including height, Specific Leaf Area (SLA), Leaf Dry Matter Content (LDMC), flowering onset, seed weight, and assessed crop biomass and yield. The results showed that both trait dissimilarities and hierarchies influenced crop-weed competition outcomes, with water availability altering the intensity of these effects. Differences in flowering time reduced competition, which enhanced crop biomass and yield. Similarly, greater differences in LDMC also positively affected crop yield and enhanced crop biomass, with this effect being more pronounced under well-watered conditions. Considering trait hierarchies, taller crop plants reduced the competitive effects of weeds and increased yield, although this effect was less pronounced under well-watered conditions. Overall, our findings indicate that trait distances in LDMC, flowering timing, and height were primary drivers of competition outcomes. This underscores the importance of examining crop-weed interactions in the context of global climate change, particularly regarding the challenges posed by drought.

[TSB.1-O-10]

Tuesday 3, morning (first): 11:45
Room: Seminario 3

Soil water availability shape competitive interactions in a diploid-polyploid complex

Rodríguez Parra, Alba[1]; López-Jurado, Javier[2]; Mateos-Naranjo, Enrique[3]; Balao, Francisco[4]

(1) University of Seville; (2) University of Tasmania; (3) University of Seville; (4) University of Seville

Correspondence e-mail: [arodriguez13@us.es]

Polyploidy is an important mechanism in plant evolution. However, even within those polyploid plant species that become established initially, only a few persist in the long term. One possible explanation for this is the competitive interactions between polyploids and their ancestral cytotypes in secondary contact zones, which can contribute to local extinctions of polyploids. This competitive dynamic may be influenced by abiotic factors, with water availability being particularly important, as severe droughts are expected to increase in the Mediterranean region in the coming years. Therefore, this study examines the competitive interactions between cytotypes in the Dianthus broteri complex, focusing on the role of water availability in shaping these interactions.

We conducted a greenhouse competition experiment with four cytotypes (2x, 4x, 6x, and 12x) of Dianthus broteri under two contrasting water regimes, high and low availability. Based on modern coexistence theory, we predict the potential for cytotype coexistence by evaluating two key parameters: niche differentiation and fitness differences across water regimes.

Our results revealed that soil water availability modifies the competitive dynamics between cytotypes and predominantly predicts competitive exclusion. Under high water availability, lower ploidy levels (2x and 4x) outcompeted higher ploidy cytotypes (12x and 6x), while under low water availability the opposite pattern is observed, with high ploidy levels (6x and12x) dominating the competition. Our findings offer valuable insights into how environmental conditions and ploidy levels interact to shape ecological relationships and cytotype distributions, enhancing our understanding of the long-term establishment and persistence of polyploids.

[TSB.1-O-11]

Tuesday 3, morning (first): 12:00
Room: Seminario 3

Using directed multilayer networks to unravel keystone species in perturbation gradients

Perea Martos, Antonio Jesús[1]; Bastida, Jesús M.[2]; Garrido, José L.[3]; López-García, Alvaro[4]; Pajares-Murgó, María[5]; Cano, Domingo[6]; Pérez-Milla, Antonio J.[7]; González-Robles, Ana[8]; Tarifa, Ruben[9]; Varela, Francisco[10]; Rey, Pedro[11]; Alcántara, Julio M.[12]

(1) Universidad de Jaén; (2) EEZ-CSIC; (3) EEZ-CSIC; (4) EEZ-CSIC; (5) Universidad de Jaén; (6) Universidad de Jaén; (7) Universidad de Jaén; (8) Universidad de Jaén; (9) Universidad de Jaén; (10) EEZA-CSIC; (11) Universidad de Jaén; (12) Universidad de Jaén

Correspondence e-mail: [antoniojesuspereamartos@gmail.com]

Ecological interactions depend positively on the abundance of resource-species, and on the population size of partner-species. However, species that provide few resources may yet interact with lot of partners, providing a service disproportionally large relative to its abundance ("Keystone-species"). The extinction of these species could promote, directly and indirectly, cascading effects that transfers multidimensionally to the rest of ecological networks. Since this may alter the ecosystem dynamics, detecting these keystone-species should receive special attention; not exclusively under a bipartite-, rather under a multilayer-approach.

In three semi-arid plant communities, we recording along a year; facilitative interactions (woody-woody and woody-herb), pollination interactions (woody-pollinator and herb-pollinator), resources of each plant-species (cover and number of flowers), and population size of each partner (woodies, herbs and pollinators). By using this information, we simulated 999 Supra-Adjacency-Matrices (SAMs), and for each simulation we depleted each plant-species to estimate the expected number of cascading-extinctions. If observed cascading-extinctions were higher than the 25th highest value of the expected ones, we consider the extinctic-species as keystone ($p < 0.05$).

We detected 6 keystone-species in each community, and some of them were common across communities, with equal seasonal and permanent patterns, suggesting the presence of a Keystone-species-core. However, some species were not permanent-keystone, just seasonal-Keystone; a pattern that was exclusively manifested in the most perturbed community, same as the lack of an indirect extinction cascade. Here, we present a tool that may help the management and conservation of ecological systems.

[TSB.1-O-13]

Tuesday 3, morning (first): 12:15
Room: Seminario 3

How many plants are dispersed by animals worldwide?

Quintero, Elena[1]; Ramos-Gutiérrez, Ignacio[2]; Rodríguez-Sánchez, Francisco[3]

(1) Universidad de Sevilla; (2) Universidad de Sevilla; (3) Universidad de Sevilla

Correspondence e-mail: [equintero1@us.es]

Despite significant scientific advances and the vast generation of knowledge and data, many fundamental questions in ecology remain unanswered. One such question is the extent to which the approximately 370,000 seed-bearing plant species (spermatophytes) depend on animals for the dispersal of their seeds. In this study, we present a global evaluation of the prevalence of biotic seed dispersal, examining how dispersal modes vary across different plant groups and biogeographical regions.

Using data on dispersal mode for approximately 60,000 plant species distributed worldwide, we perform a global assessment of the importance of animal-mediated dispersal for plants. Although our dataset continues to expand, our preliminary results reveal that more than half of plant species rely entirely or partially on biotic dispersal. Among the most common dispersal mechanisms are anemochory (wind dispersal) and endozoochory (animal-mediated dispersal). Our results reveal the existence of families and hotspot regions where biotic dispersal is particularly prevalent.

Unprecedented declines in the number of animals and their populations in recent decades highlight the risk of losing this critical biotic dispersal service, threatening natural plant regeneration.

[TSB.1-O-14]

Tuesday 3, morning (second): 12:45
Room: Seminario 3

Long-term changes in pollinator visitation and pollination success in Mediterranean montane plants

Gegunde, Julia[1]; Alonso, Conchita[2]; Herrera, Carlos M.[3]

(1) Centro de Investigaciones sobre Desertificación, Consejo Superior de Investigaciones Científicas; (2) Estación Biológica de Doñana, Consejo Superior de Investigaciones Científicas; (3) Estación Biológica de Doñana, Consejo Superior de Investigaciones Científicas

Correspondence e-mail: [gegundejulia@gmail.com]

Pollination by animals is essential for sexual reproduction in many plant species. Recent studies on pollinators of economic value in anthropogenic ecosystems of mid-latitude temperate regions have revealed declines in pollination and pollinator populations, yet information on long-term pollinator variation in undisturbed and well-preserved habitats from lower latitudes is still scarce. In addition, when long-term pollinator changes are assessed, their possible consequences in plant reproduction are rarely assessed. This paper analyses long-term changes in pollination visitation in permanent plots in undisturbed and well-preserved Mediterranean montane habitats in SE Spain, and possible consequences in terms of variation in pollination success for two dominant plant species with contrasting floral features, Helianthemum appeninum (Cistaceae) and Thymus orospedanus (Lamiaceae). We compare data on pollinator visitation, pollen loads in stigmas, and pollen tubes in styles obtained in 2019 with similar data obtained previously in 2010. A total of 559 pollinator censuses were carried out and 686 styles were analysed. Results of this investigation indicate that pollinator visitation increased between 2010 and 2019 in the study area, but changes were inconsistent among major pollinator groups and study sites. Increases of visitation had contrasting effects on the pollination and reproductive success of different species.

[TSB.1-O-15]

Tuesday 3, morning (second): 13:00
Room: Seminario 3

Mutualistic interactions and taxonomic diversity under variable herbivore abundance: A manipulative experiment

Isla Escudero, Jorge[1]; Hernández-Castellano, Carlos[2]; Calleja, Juan Antonio[3]; Consortium, Incremento[4]; Serrano, Emmanuel[5]; Perea, Ramón[6]

(1) Universidad Politécnica de Madrid; (2) CREAF, Univ Autònoma de Barcelona, Spain / Universidad Politécnica de Madrid; (3) Universidad Autónoma de Madrid / CREAF; (4) Incremento Research Consortium; (5) Universitat Autonoma de Barcelona (UAB); (6) Universidad Politécnica de Madrid

Correspondence e-mail: [jorgeislaescudero1992@gmail.com]

Human-induced overabundance of large herbivores is a growing concern in many natural ecosystems, posing a significant risk to biodiversity and to the mutualistic interactions that sustain ecosystem functionality. Empirical data on plant-animal interactions and community composition under varying levels of herbivore pressure are crucial for understanding the short-term vulnerability of these two fundamental ecosystem components. In this study, we assessed pollination, seed dispersal, and herbivory interactions alongside a comprehensive biodiversity survey (including invertebrates, birds, mammals, herbs, and woody species) in plots subjected to an experimental manipulation of red deer (Cervus elaphus) density. We applied a BACI (Before-After Control-Impact) experimental design in two Mediterranean forests, comparing the short-term vulnerability of both functional (plant-animal interactions) and taxonomic ecosystem components under high and hyperabundant deer densities. Preliminary results indicate that ecological interactions exhibit more pronounced short-term vulnerability to herbivore pressure than many aspects of taxonomic diversity. Key mutualisms, such as plant-pollinator interactions, were highly vulnerable under both ungulate densities. For instance, the robustness of the emergent interaction networks declined rapidly, primarily due to the loss or reduction of highly palatable flowering species. This study highlights the short-term vulnerability of ecosystems to ungulate overabundance and underscores the long-term risks of human-driven herbivory pressure on ecosystem stability. Our findings provide valuable insights for the management and conservation of natural ecosystems in the face of this globally pervasive disturbance.

[TSB.1-O-16]

Tuesday 3, morning (second): 13:15
Room: Seminario 3

The circadian phenology of cork oak in ungulate-dominated landscapes: when do acorns drop? and who interacts with them?

Garrote, Pedro J[1]; Teixidó, Abiel[2]; Morera-Chacón, Brayan[3]; Fedriani, Jose M.[4]

(1) ESTACION BIOLOGICA DOÑANA (EBD-CSIC); (2) Estación Biológica de Doñana (EBD)/ Universidad Pablo de Olavide; (3) Centro de Investigaciones sobre Desertificación (CIDE-CSIC-UVEG-GV); (4) Estación Biológica de Doñana (EBD) / Centro de Investigaciones sobre Desertificación (CIDE-CSIC-UVEG

Correspondence e-mail: [PEDRO.GARROTE@CSIC.ES]

Many Mediterranean landscapes often comprise unnaturally high ungulate densities due to global change drivers such as the extirpation of natural predators and human-managed factors related to limiting culling policies. Ungulate overabundance may impact negatively plant reproductive success directly through seed predation and indirectly by limiting food availability for seed dispersers. Surprisingly, despite huge research efforts made in plant-animal interactions, how such impact varies throughout 24-h cycle remains unexplored. Here, we illustrate how the circadian pattern of the interaction between cork oak (Quercus suber) and acorn vertebrate consumers can impact the reproductive success of this ecologically and culturally important tree. We used camera trapping to characterize the circadian phenology of acorn dropping to the ground, the diel activity of acorn predators (ungulates) and dispersers (rodents and corvids) and their temporal overlap in two declining cork oak populations in Doñana National Park during two consecutive fruiting seasons. Acorn dropping during daytime doubled that during night-time, being considerably consistent between seasons, populations and trees. Overabundant ungulates were the most frequent visitors during daytime (cervids; 56.7% of total visits) and night-time (wild boar; 41.8%) whereas acorn dispersers such as diurnal magpie (0.1%) and nocturnal mice (0.3%) were extremely scarce. Therefore, the high diurnal matching between the circadian phenology of acorn dropping and overabundant cervids activity likely has dramatic demographic consequences for the conservation and regeneration of cork oak populations. Given the global trend of ungulate overabundance, further research and well-designed management strategies are mandatory to minimize their impact on plant population dynamics.

[TSB.1-O-17]

Tuesday 3, morning (second): 13:30
Room: Seminario 3

Spatial ecology of acorn dispersal by a diverse frugivores' community in a Californian oak savanna

Muñoz-Gallego, Raquel[1]; Peláez, Marta[2]; Dirzo, Rodolfo[3]; Perea, Ramón[4]

(1) Universidad Politécnica de Madrid; (2) Universidad Politécnica de Madrid; (3) Stanford University; (4) Universidad Politécnica de Madrid

Correspondence e-mail: [raquel19026@gmail.com]

Animal-mediated seed dispersal plays a pivotal role in shaping spatial structure and recruitment success of plant communities. The spatial patterns of seed deposition are governed not only by the frugivores' behavior but also by seed traits and spatio-temporal variability. In oak-dominated systems, where recruitment failures are widespread, understanding these dynamics is critical. This study aims to evaluate how frugivore species, seed weight, masting vs. non-masting year, and microsite conditions influence seed dispersal of two oak species, Quercus agrifolia and Q. lobata, in a Californian oak savanna. During the falls of 2014 and 2015, we offered 600 intact acorns of each oak species under different microsites to a varied frugivores assemblage (four rodent species, mule deer and jays). Seed dispersal distance, direction, and microsite of seed deposition were tracked by using video monitoring and acorn tagging. Seed weight, fate (survival, burial, recovery) and viability were also recorded. Multivariate models and spatially explicit analysis revealed that oak-frugivore interactions were highly complex. Jays and squirrels facilitated longer dispersal distances, while deer mice contributed shorter dispersal. Seeds deposited in open microsites traveled farther, and Q. agrifolia showed greater dispersal distances than Q. lobata . Acorn weight significantly influenced dispersal for Q. lobata but not Q. agrifolia. These results demonstrate that oak-animal interactions draw context-dependent spatial patterns driven by frugivore identity, seed traits, and environmental conditions. Our findings underscore the need to consider whole animal communities and interspecific oak differences to enhance the regeneration of oak savannas.

[TSB.1-O-18]

Tuesday 3, morning (second): 13:45
Room: Seminario 3

The role of Apis mellifera on plant-pollinator networks in the Seychelles Archipelago

Serra Marín, Pau Enric[1]; SERRA MARIN, PAU ENRIC[2]; GOMEZ DEVIA, LAURA[3]; HERVIAS PAREJO, SANDRA[4]; TRAVESET, ANNA[5]

(1) IMEDEA (CSIC-UIB); (2) Mediterranean Institute of Advanced Studies (IMEDEA, CSIC-UIB); (3) Mediterranean Institute of Advanced Studies (IMEDEA, CSIC-UIB); (4) Mediterranean Institute of Advanced Studies; (5) Mediterranean Institute of Advanced Studies

Correspondence e-mail: [pserra@imedea.uib-csic.es]

Islands, with their isolation, high endemism, and lower species diversity, serve as natural laboratories for studying ecosystem dynamics but are particularly vulnerable to invasive species impacts. This study examines the influence of the invasive honeybee Apis mellifera on plant-pollinator networks by comparing islands with (n=2) and without honeybees (n=2). Specifically, we aim to (1) analyze the structural properties of plant-pollinator networks on islands with and without A. mellifera, focusing on both diurnal and nocturnal interactions to assess the honeybee's role in shaping these networks, and (2) evaluate shifts in pollination interactions caused by the presence of A. mellifera, including changes in visitation patterns and potential disruption to native pollinator species. Fieldwork was conducted between October and December 2024 in the Seychelles archipelago, using diverse data acquisition methodologies: (1) direct observations from 7 am to 6 pm, (2) automated cameras recording 5-min video loops with 10-minute intervals (from 6 am to 5:30 am), and (3) interval-shooting cameras capturing one photo every 2 min over a 24-hour cycle. Preliminary findings suggest that A. mellifera reduces visitation rates of native pollinators, including both invertebrates and vertebrates. The presence of honeybees leads to significant differences in the structure of plant-pollinator networks between invaded and uninvaded islands, which could impact the resilience of plant-pollinator communities to further disturbances. By incorporating data on nocturnal pollinators, our study offers a more comprehensive understanding of the full impact of A. mellifera on island ecosystems and provides valuable insights for developing effective conservation strategies.

[TSB.1-O-19]

Tuesday 3, morning (second): 14:00
Room: Seminario 3

Pine afforestation disrupts ground-dwelling arthropod communities in Mediterranean Heathlands

Pérez-Gómez, Álvaro[1]; Ojeda, Fernando[2]; Repeto-Deudero, Irene[3]; Godoy, Oscar[4]

(1) Universidad de Cádiz; (2) Universidad de Cádiz; (3) Universidad de Cádiz; (4) Estación Biológica de Doñana

Correspondence e-mail: [biolvaro@gmail.com]

Treeless habitats have historically been undervalued and included to afforestation programs. While afforestation aims to deliver economic and ecological benefits, it can negatively impact biodiversity and ecosystem functioning, triggering a cascade of biotic and abiotic changes. Ground-dwelling arthropods can be particularly sensitive to these alterations due to changes in microhabitats and food resources. We aim here to understand the effects of afforestation with pine trees, planted during the second half of the 20th century, on the diversity and compositional changes of ground-dwelling arthropods in the Mediterranean heathland or herriza, a unique habitat from the Mediterranean Basin. Additionally, we aimed to document changes in the functional traits of spider species. To achieve this aim, we conducted field observations with pitfall traps in five selected sites, each comprising adjacent plots of open and afforested herriza. We employed a complementary taxonomic methodology, focusing on ground-dwelling arthropods at the family level and spiders at the species level. While afforested plots did not consistently exhibit lower diversity and abundance of ground-dwelling arthropods and spiders, a noticeable shift in composition was observed across taxonomic scales. However, we did not observe changes in the overall functional traits of spiders, even though functional beta diversity values were high. This suggests that while there is significant species turnover, the new species tend to fulfill similar ecological roles. By assessing these changes, this study aims to provide insights to inform future conservation and management efforts for open ecosystems.

TSB.1. Posters

[TSB.1-P-1]

Tuesday 3
Discussion corner: Room 8

Shrubs induce floristic composition changes in post-mining pastures

Manso Arribas, Miguel[1]; Fernández-Santos, Belén[2]; deTorre-Sáez, Ana[3]; Alonso-Zaldívar, Herminia[4]; García-Duro, Juan[5]; Martínez-Ruiz, Carolina[6]

(1) Sustainable Forest Management Research Institute (iuFOR), University of Valladolid; (2) University of Salamanca; (3) Sustainable Forest Management Research Institute (iuFOR), University of Valladolid; (4) Sustainable Forest Management Research Institute (iuFOR), University of Valladolid; (5) Sustainable Forest Management Research Institute (iuFOR), University of Valladolid; (6) Sustainable Forest Management Research Institute (iuFOR), University of Valladolid

Correspondence e-mail: [miguel.manso@uva.es]

The shrub nurse effect on other plant species is usually greater in water deficit and in overgrazed environments, such as mining lands reclaimed to pastures with unstructured, nutrient-poor, and low water-holding-capacity soils which accentuates summer drought impacts on plant establishment in Mediterranean climates. Therefore, we aimed to assess the effect of scattered C.scoparius plants on the family composition of post-mining pastures in northern Spain. For five isolates, and similar sized, C.scoparius shrubs, the cover of each vascular plant species was recorded, in spring, by sets of seven consecutive 20-cm quadrats following the main orientations (from the shrub's center). Subsequently, species cover was grouped by families. Multivariate analyses (DCA+"envfit") identified the individual shrub plants as the main factor inducing differences in families' composition, followed by distance to the plant and orientation. Huisman-Olff-Fresco models showed grass cover increasing with distance, except in the north where remained constant. Legume cover increased towards the shrub-edge, reaching its maximum in the west, and continued to grow in the other orientations. The composite cover showed different trends with distance depending on the orientation, although no trend was found when aggregating them. Plantaginaceae cover increased with distance, except to the south, while the shrub favoured the cover of Geraniaceae, Caryophyllaceae, Polygonaceae, and Rubiaceae. C.scoparius generated microenvironmental heterogeneity contributing to the spatial arrangements in the herbaceous communities below and around. Funding: MICIU/AEI/10.13039/501100011033/FEDER-EU Project; INVESTIGO-SEPE-2023 (CP23/178) and post-doctoral UVa-María-Zambrano (CONVREC-2021–11) contracts (EU–NextGenerationEU program); Predoctoral contracts PREP2022-000580 and CONTPR-2022-400.

[TSB.1-P-2]

Wednesday 4
Discussion corner: Room 8

FRUSEED: a global, open, dynamic, reproducible database of fruit and seed traits and plant dispersal modes

Rodríguez-Sánchez, Francisco[1]; Quintero, Elena[2]; Ramos-Gutiérrez, Ignacio[3]; Benítez-López, Ana[4]; González-Varo, Juan Pedro[5]; Jordano, Pedro[6]; Masero, Mario[7]; Medina-Gavilán, José Luis[8]; Mendoza, Irene[9]; Pérez-Méndez, Néstor[10]; Sánchez-Gracia, María[11]; Valido, Alfredo[12]

(1) Universidad de Sevilla; (2) Universidad de Sevilla; (3) Universidad de Sevilla; (4) Museo Nacional de Ciencias Naturales - CSIC; (5) Universidad de Cádiz; (6) Estación Biológica de Doñana - CSIC; (7) Universidad de Sevilla; (8) Universidad de Sevilla; (9) Universidad de Sevilla; (10) Institut de Recerca i Tecnologia Agroalimentàries; (11) Universidad de Sevilla; (12) Instituto de Productos Naturales y Agrobiología - CSIC

Correspondence e-mail: [f.rodriguez.sanc@gmail.com]

We have assembled a comprehensive database of more than 60 traits related to plant dispersal, fruit, and seed characteristics, for more than 60,000 angiosperm and gymnosperm species worlwide. Collected traits include dispersal mode, vectors and distances, as well as fruit and seed typology, colour, mass, morphometry, and chemical composition. The database covers biological organisation levels from individuals to populations to species and beyond, and has been designed as a dynamic resource to be continuously updated with minimal effort. The entire database is assembled using reproducible computational workflows, including automated, real-time quality control by means of continuous integration (GitHub Actions). Its robust, dynamic, reproducible design permits total traceability from the raw data to the final database, as well as transitive credit attribution to both data collectors and database curators. We expect FRUSEED will become an invaluable resource for ecological and evolutionary analyses involving plant reproductive traits, and hope its computational design and workflows inspire the development of further open, reproducible ecological databases.

[TSB.1-P-3]

Thursday 5
Discussion corner: Room 8

Impact of foraging in landfills on the community of plants dispersed by white storks

Jiménez-Martín, Iciar[1]; Lovas-Kiss, Ádám[2]; Cañuelo-Jurado, Belén[3]; Green, Andy J.[4]

(1) Estación Biológica de Doñana; (2) Centre for Ecological Research (Debrecen, Hungary); (3) Estación Biológica de Doñana; (4) Estación Biológica de Doñana

Correspondence e-mail: [iciarjm@gmail.com]

Introduction. Global change may threaten seed dispersal interactions by altering vector behaviour or distribution. The white stork (Ciconia ciconia), has undergone changes in its migratory behaviour, increasing the number of birds wintering in Spain, where they feed intensively in landfills. We aimed to investigate the consequences for seed dispersal.

Methods. Landfills, ricefields and wetlands make Andalusia a major wintering area and stopover for white storks, hundreds of which have been marked with GPS tags. We collected 258 pellets at nine different sites, six close to landfills and three farther away, including two in Doñana. Seeds were extracted from pellets and identified. All sites were used by GPS-tagged storks, which we used to relate differences between sites in plant taxa composition and in habitat use, to predict spatial patterns of seed dispersal. Tetrazolium tests were used to test seed viability.

Results and discussion. Over 40.000 seeds from 120 different species were identified, 42 of which were not previously reported as dispersed by waterbirds. In sites closer to landfills we found greater numbers of seeds per pellet, but mainly from domesticated species. At sites far from landfills, seeds of native species were found in higher proportions and the prevalences of weed and domesticated seeds were lower. The increased use of landfills has led to a shift in the types and abundance of seeds dispersed. Our results highlight the importance of studying endozoochory of dry-fruited plants to understand the implications of global change on plant-animal interactions.

[TSB.1-P-4]

Tuesday 3
Discussion corner: Room 8

Microplastics modulate the effects of facilitation of nurse species on annual plant communities in semiarid regions

Zeller, Julian Winston[1]; Armas, Cristina[2]; Terrones, Alejandro[3]; Jorquera, M. José[4]; Lozano, Yudi M.[5]

(1) Estación Experimental de Zonas Áridas-CSIC; (2) Estación Experimental de Zonas Áridas-CSIC; (3) Estación Experimental de Zonas Áridas-CSIC; (4) Estación Experimental de Zonas Áridas-CSIC; (5) Freie Universität Berlin

Correspondence e-mail: [julian.zeller.jz@gmail.com]

Introduction: Facilitation by nurse plants is a key process involved in the organization and functioning of plant communities in drylands, promoting the establishment and survival of plants underneath their canopies. Southeast Spain drylands host more than 40,000 ha of intensive horticulture that heavily relies on plastic films for greenhouses and mulching. These plastics can be rapidly degraded into microplastic (MP) films - plastic particles < 5 mm- due to the high temperatures and irradiation typical of drylands, ultimately leading to soil pollution with unknown consequences on key ecosystem processes such as facilitation. To better understand this issue, we conducted a field study to investigate to what extent microplastics in soil disrupt the positive interactions between plants in drylands.

Materials and methods: Six annual species were planted in communities in gaps or under three shrub species of known nurse effects. We added MPs to the soil of half of these communities and measured the effects of MPs on annual species survival and growth at the species and community level.

Results and discussion: Facilitation affected significantly shoot biomass, specific leaf area, dry matter content, and root traits of most species. On a community level we found significant effects of facilitation on plant survival subtly modulated by MPs, overall affecting the structure of the established plant community. This highlights facilitation as a key process in semiarid ecosystems and shows MPs' potential to modulate this effect, which might, in the long run, change species composition and dominance in annual plant communities.

[TSB.1-P-5]

Wednesday 4
Discussion corner: Room 8

Unraveling the influence of climate and competition on forest structure in mixed pinus stands

Núñez Castillo, Sergio[1]; Pajares Pérez, Javier[2]; Sánchez Pescador, David[3]; Illuminati, Angela[4]; Poyatos Fernández, Cristina[5]; García-Cervigón Morales, Ana Isabel[6]; Sánchez Álvarez, Ana María[7]; Escudero Alcántara, Adrián[8]

(1) Universidad Rey Juan Carlos; (2) Universidad Rey Juan Carlos; (3) Universidad Complutense de Madrid; (4) Universidad Rey Juan Carlos; (5) Universidad Rey Juan Carlos; (6) Universidad Rey Juan Carlos; (7) Universidad Rey Juan Carlos; (8) Universidad Rey Juan Carlos

Correspondence e-mail: [sergio.nunez@urjc.es]

Climatic conditions and competitiveness are key factors in forest ecosystem studies, but they are limited to the moment of measurement. This makes dendroecology an indispensable tool to (i) understand how past circumstances have structured the forest, (ii) interpret the existing relationships and (iii) provide guidance on forest management practices.

A forest stand with Pinus nigra and Pinus sylvestris coexisting was selected in the Alto Tajo Natural Park (40° 43' 28.6" N 2° 07' 00.4 " W; Guadalajara, Spain). All individual trees were georenferenced to estimate the competitivity index of each individual. A subsample of 100 individuals per species were randomly selected for core extraction and cross-dating. Core dating was done, processed and validated with the software CooRecorder, CDendro and COFECHA respectively.

We hypothesize that dendroecology could facilitate understanding of current coexistence patterns and their relationship with biotic and abiotic conditions. Results could be limited to the recent past decades due to the potential inaccuracy of working with older data. In this way, this discipline could be positioned within ecology as one of the most reliable and integrative tools for studying forest ecosystems.

[TSB.1-P-6]

Thursday 5
Discussion corner: Room 8

Influence of shrub vegetation patches on the Family's abundance of post-mining pastures

de Torre Sáez, Ana[1]; Alonso Zaldívar, Herminia[2]; Manso Arribas, Miguel[3]; García Duro, Juan[4]; Martínez Ruíz, Carolina[5]

(1) Sustainable Forest Management Research Institute (iuFOR), University of Valladolid, Spain; (2) Sustainable Forest Management Research Institute (iuFOR), University of Valladolid, Spain; (3) Sustainable Forest Management Research Institute (iuFOR), University of Valladolid, Spain; (4) Sustainable Forest Management Research Institute (iuFOR), University of Valladolid, Spain; (5) Sustainable Forest Management Research Institute (iuFOR), University of Valladolid, Spain

Correspondence e-mail: [ana.torre23@uva.es]

Plant-to-plant interactions play a key role in the assembly of plant communities, especially in harsh and disturbed environments. In this context, we aim to assess the effect of Genista florida L. patches in the floristic composition of post-mining pastures. In spring 2024, the cover of vascular plant species was recorded in eight 20-cm-side quadrats, under and outside the canopy of five shrubby patches dominated by G.florida, following eight directions (N, NE, SE, S, SO, O, NO, N). Subsequently, species cover was grouped by families. The detrended correspondence analysis (DCA) together with the "envfit" function allowed us to identify the individual shrubby patches as the main factor inducing differences in families' composition, followed by the position under and outside them; the effect of orientation was not significant. The canopy of G.florida favoured the cover of grasses and several other less abundant families (Valerianaceae, Violaceae, Rubiaceae, Lamiaceae, Boraginaceae, Caprifoliaceae, and Linaceae). Outside the Genista florida patches, the more abundant families were Cariofilaceae, Rosaceae, Plantaginaceae, Genaniaceae, and Polygonaceae. Asteraceae and Fabaceae were equally abundant outside than under. We conclude that patches of Genista florida in a matrix of post-mining pastures generate microenvironmental heterogeneity contributing to the spatial arrangements in the herbaceous communities below and around. Knowledge of these relationships is essential to understand the dynamics of post-mining pastures, and to optimize their management and restoration. Funding: MICIU/AEI/10.13039/501100011033/FEDER-EU Project; Predoctoral contracts CONTPR-2022-400 and PREP2022-000580; INVESTIGO-SEPE-2023 (CP23/178) and post-doctoral UVa-María-Zambrano (CONVREC-2021–11) contracts (EU–NextGenerationEU program).

[TSB.1-P-7]

Tuesday 3
Discussion corner: Room 8

How does warming affect the coexistence mechanisms of recovering communities?

Granjel, Rodrigo[1]; Holmes, Mark[2]; Huang, Mengjiao[3]; Chrétien, Lucille[4]; Christensen García, Claudia[5]; Burón-Ugarte, Ana[6]; Montoya, Daniel[7]

(1) Basque Centre for Climate Change (BC3); (2) Basque Centre for Climate Change; (3) Basque Centre for Climate Change (BC3); (4) Basque Centre for Climate Change (BC3); (5) Basque Centre for Climate Change (BC3); (6) Basque Centre for Climate Change (BC3); (7) Basque Centre for Climate Change (BC3)

Correspondence e-mail: [granjel@gmail.com]

The natural world faces multiple anthropogenic threats that undermine its resilience and integrity—a trend bound to worsen in the coming years. From chemical spills to rapid changes in land use, ecosystems are being perturbed at uncharted rates, yet we know little about their subsequent recovery dynamics. Adding to this challenge, the globe is getting warmer faster than ever, which is predicted to affect how species perform and interact, ultimately impacting biodiversity. For all of this, it is crucial that we begin to understand how the recovery dynamics of perturbed communities will behave in a warmer world.

In the past two decades, we have significantly advanced our understanding of how the mechanisms of biodiversity maintenance—niche differences that promote coexistence and fitness differences that drive competitive exclusion—respond to multiple global change drivers. However, two caveats are still present: (1) most of this knowledge stems from decomposing natural communities into their most simple, pairwise species interactions, ignoring what happens when multiple species interact simultaneously; and (2) we overall ignore how these mechanisms recover after a perturbation in the context of global change.

Here, we address both caveats by integrating structural stability theory with empirical data on post-perturbation plant recovery dynamics under warming conditions. The data, obtained from a mesocosm experiment involving 24 semi-natural grassland communities, are used to parameterise population models and estimate species interactions and growth rates. This approach shows how multispecies niche and fitness differences respond to warming, how they recover post-perturbation, and the impact of warming on the recovery process.

[TSB.1-P-8]

Wednesday 4
Discussion corner: Room 8

Altitudinal decoupling between recruitment optima and plant abundance suggests contrasting responses of woody species in the Mediterranean to the impacts of global warming

Bastida, Jesús M.[1]; Garrido, José L.[2]; Lendínez, Sandra[3]; Pajares-Murgó, Mariona[4]; Perea, Antonio J.[5]; Prieto-Rubio, Jorge[6]; López-García, Álvaro[7]; Tercero Araque, Amanda[8]; Alcántara, Julio M.[9]

(1) Estación Experimental del Zaidín (CSIC); (2) Estación Experimental del Zaidín (EEZ-CSIC); (3) Estación Experimental del Zaidín (EEZ-CSIC); (4) Universidad de Jaén; (5) Universidad de Jaén; (6) Centro de Investigaciones Sobre Desertificación (CIDE, CSIC-UV-GV); (7) Estación Experimental del Zaidín (EEZ-CSIC); (8) Universidad de Jaén; (9) Universidad de Jaén

Correspondence e-mail: [jesus.bastida@eez.csic.es]

Introduction. Understanding the variation in population dynamics within species' ranges is crucial for ecological and evolutionary theory, as well as for conservation science. Traditionally, species abundance is expected to peak near the center of a species' range, where environmental conditions are optimal, and decline towards the edges. However, global warming may be disrupting this pattern, since recruitment optima under current climate, appear to be displaced from the abundance maxima of adult plants, which are the result of past climate.

Material and methods. We conducted vegetation surveys (1 ha/site) across 42 sites in southern Iberian Peninsula, spanning an altitude gradient from 2 m to 2160 m, registering the cover of dominant woody plant species and the number of recruits growing beneath. We compared along this gradient, the abundance of adult plant species with the recruitment efficiency curves in 21 Mediterranean woody species, by analysig their altitudinal displacement

Results and discussion. Our findings indicate that the abundance and recruitment efficiency curves varied among species along the altitudinal gradient. Specifically, 57% of plant species exhibited maximum recruitment efficiency at higher elevations than their maximum abundance. Conversely, 33% of species demonstrated the opposite trend, with their maximum recruitment efficiency at lower elevations. Notably, 9.5% of species showed no differences between their maximum abundance and recruitment efficiency.

In summary, species responses to altitude were highly species-specific, challenging the conventional expectation that, in response to climate change, species uniformly shift to higher altitudes following their optimal conditions.

[TSB.1-P-9]

Thursday 5
Discussion corner: Room 8

Pathogenic interaction between canopy and regeneration in Pinus nigra forests

Jaime, Luciana[1]; Coll, Lluís[2]; Batllori, Enric[3]; Blanco-Rodríguez, Miguel Ángel[4]; Caballol, Maria[5]; Fontova, Anna[6]; de Frutos, Sergio[7]; G. Alday, Josu[8]; Gelabert, Pere[9]; Lloret, Francisco[10]; Méndez, Ana Lucía[11]; Paneghel, Mara[12]; Pineda-Zapata, Sara[13]; Serradó, Francesc[14]; Torné, Gil[15]; Voltas, Jordi[16]; Oliva, Jonàs[17]

(1) Universitat de Lleida; (2) Universitat de Lleida; (3) Universitat de Barcelona; (4) Joint Research Unit CTFC-AGROTECNIO-CERCA; (5) Universitat de Lleida; (6) Universitat de Lleida; (7) Joint Research Unit CTFC-AGROTECNIO-CERCA; (8) Universitat de Lleida; (9) Universitat de Lleida; (10) Centre de Recerca Ecològica i Aplicacions Forestals (CREAF); (11) Joint Research Unit CTFC-AGROTECNIO-CERCA; (12) Universitat de Lleida; (13) University of Eastern Finland; (14) Centre de Ciència i Tecnologia Forestal de Catalunya (CTFC); (15) Universitat de Lleida; (16) Universitat de Lleida; (17) Universita de Lleida

Correspondence e-mail: [lujaimegonzalez@gmail.com]

The impact of pathogen spillover from adult trees to seedlings can limit natural tree regeneration. Seedling survival may vary across provenances of the same species (intraspecific variability), as well as among different tree species (interspecific variability). In this study, we explored the pathogenic interaction between canopy and tree regeneration in the Pinus nigra - Diplodia sapinea and Pinus nigra - Dothistroma pini systems. Specifically, we assessed whether (i) pathogen specificity and (ii) seedling predisposition to drought tolerance (based on provenance) modulate pathogen interactions in terms of seedlings' growth and survival. For this purpose, we established ten experimental plots with seedlings of five species/provenances: P. sylvestris, P. halepensis and three provenances of P. nigra. In each plot, we planted 40 seedlings (8 from each species/provenance) under affected P. nigra trees following a random distribution pattern and including two treatments (1) without fungicide and (2) with fungicide as control. We expect observe differences in baseline mortality among species/provenance (control treatments) as well as differences in seedling growth and survival to pathogen spillover linked to both intra- and inter-specific variability. Seedlings' growth and survival are also expected to relate with different water use strategies among species.

[TSB.1-P-10]

Tuesday 3
Discussion corner: Room 8

Seasonal and spatial variability of the negative effect of Zostera marina exudates on the toxic dinoflagellate Alexandrium minutum

Díaz-Alonso, Alexandra[1]; Rodríguez, Francisco[2]; Pastoriza-Santaclara, Jorge[3]; Álvarez-Salgado, Xose[4]; Teira, Eva[5]; Fernández, Emilio[6]

(1) Centro de Investigación Mariña, Universidade de Vigo (CIM-UVIGO), Vigo, Spain; (2) Instituto Español de Oceanografía-CSIC, Centro Oceanográfico de Vigo, Vigo, Spain; (3) Centro de Investigación Mariña, Universidade de Vigo (CIM-UVIGO), Vigo, Spain; (4) Instituto de Investigacións Mariñas (IIM), Vigo, Spain; (5) Centro de Investigación Mariña, Universidade de Vigo (CIM-UVIGO), Vigo, Spain; (6) Centro de Investigación Mariña, Universidade de Vigo (CIM-UVIGO), Vigo, Spain

Correspondence e-mail: [alexandra.diaz.alonso@uvigo.gal]

A negative effect of exudates of the seagrass Zostera marina on the toxic dinoflagellate Alexandrium minutum has been reported. The metabolism, physiology, and chemical composition of marine angiosperms are known to vary in time and space as a result of the growth phase and the adaptation to emersion stress. This led us to infer that the chemical composition of the exudates released by these plants is likely to be also highly variable and, thereby, their impact on dinoflagellate growth may differ seasonally and spatially. We assessed the effect of exudates released by plants of Z. marina collected from two intertidal levels during five months on non-axenic A. minutum cultures. The abundance of A. minutum and bacteria were measured every 48 h. Our results show that the negative effect of Z. marina on A. minutum is not an episodic event but extends over different seasons and intertidal levels. However, the magnitude of the impact shows a high spatial and seasonal variability. Exudates from plants located in the high intertidal zone have a greater impact on A. minutum than those from the low one. Exudates released by plants collected in autumn showed the highest negative impact on the dinoflagellate growth rate. Our results suggest that the control of harmful dinoflagellates appears to be a widespread ecosystem service provided by Z. marina.

TSB.2. Coping with the Change: Exploring the impacts of global change on marine biodiversity across spatial-temporal scale

Wednesday, 4 (12:45-14:15)

Room: Balconada

Marine biodiversity is undergoing rapid changes due to widespread human impacts on the oceans. These changes pose serious threats to the integrity of marine ecosystems and the benefits they provide. In response, international political frameworks such as the Kunming-Montreal Global Biodiversity Framework and the Horizon Europe Mission “Restore our Ocean and Waters” have emphasized the urgent need to halt and reverse the degradation of marine ecosystems, guided by robust scientific evidence. However, our current capacity to assess biodiversity changes in the oceans and understand their implications remains limited. This session invites contributions that explore the ecological impacts of global change on marine biodiversity. We welcome studies estimating the magnitude and direction of biodiversity shifts—encompassing taxonomic, functional, and genetic diversity—on marine communities, as well as their consequences for ecosystem functioning and the services they provide to human societies. Contributions that employ long-term monitoring, ecological theory, synthesized data, and/or modeling tools to investigate conservation, adaptation, and management strategies across broad spatial and temporal scales are especially welcomed, as are studies that explore the effects of restoration actions (e.g., of habitat-forming species) on marine communities and ecosystems.

Overall, this session aims to foster a cross-taxonomic perspective on one of the most pressing topics in marine conservation, while also offering a platform for discussing future research challenges related to marine biodiversity change in the Anthropocene.

Organizers:

• **Daniel Gómez-Gras,** Departament Evolutionary Biology, Ecology and Environmental Sciences, Universitat de Barcelona

• **Pol Capdevila,** Departament Evolutionary Biology, Ecology and Environmental Sciences, Universitat de Barcelona

• **Cristina Linares,** Departament Evolutionary Biology, Ecology and Environmental Sciences, Universitat de Barcelona.

TSB.2. Orals

[TSB.2-O-1]

Wednesday 4, morning (second): 12:45
Room: Balconada

Functional diversity dynamics of a copepod assemblage in a coastal upwelling system along three decades of continuous monitoring

Otero Villar, Jaime[1]; Louro, María Ángeles[2]; Bodel Riestra, Antonio[3]

(1) Centro Oceanográfico de A Coruña (IEO, CSIC); (2) Centro Oceanográfico de A Coruña (IEO, CSIC); (3) Centro Oceanográfico de A Coruña (IEO, CSIC)

Correspondence e-mail: [jaime.otero@ieo.csic.es]

Marine copepods are crucial organisms sitting near the base of the food web. These organisms serve as prey for invertebrates and vertebrates upwards the chain while they feed upon phytoplankton a step below. Thus these taxa are indispensable for channeling energy flow through trophic levels. A myriad of copepod species coexist in the plankton, each one with their own biological traits that can determine the species-specific responses to the environment and its overall functionality. While it is known that, at large scales, copepod functional composition shows divergent biogeographies linked to environmental niche preferences, the dynamics in seasonal but highly-fluctuating ecosystems, such as upwelling zones, are poorly understood. Using three decades of plankton monitoring at the NW Iberian Peninsula, we evaluated the temporal changes and responses to the environment of the copepod functional composition. Five functional traits (body size, trophic group, feeding mode, spawning mode and myelination) gathered from the literature, and abundance of 47 species uninterruptedly identified, were used to compute functional diversity indices and assess their links to the environment. While functional richness and divergence minimized during spring and summer, functional evenness maximized in spring. On the long-term, functional richness declined monotonically, while evenness did not change, and divergence peaked in mid 2000s. Functional richness and divergence related positively and negatively to nutrient concentration and primary production, respectively, while functional evenness showed the opposite pattern. The upwelling strength was only positively related with functional richness. Overall, these results illustrate the differing dynamics of copepod functional composition in upwelling regions.

[TSB.2-O-2]

Wednesday 4, morning (second): 13:00
Room: Balconada

Temporal prokaryotic ecotypes shift with dissolved organic matter composition in a coastal upwelling system

Orta-Ponce, C. Pamela[1]; Nieto-Cid, Mar[2]; Alba-Salgueiro, Rodrigo[3]; Valencia-Vila, Joaquín[4]; Bode, Antonio[5]; Varela, Marta M.[6]

(1) Universidade da Coruña; (2) Instituto Español de Oceanografía IEO-CSIC, Centro Oceanográfico de A Coruña; (3) Instituto Español de Oceanografía IEO-CSIC, Centro Oceanográfico de A Coruña; (4) Instituto Español de Oceanografía IEO-CSIC, Centro Oceanográfico de A Coruña; (5) Instituto Español de Oceanografía IEO-CSIC, Centro Oceanográfico de A Coruña; (6) Instituto Español de Oceanografía IEO-CSIC, Centro Oceanográfico de A Coruña

Correspondence e-mail: [p.ortaponce@udc.es]

Coastal upwelling systems are one of the most dynamic environments on Earth, providing numerous marine ecosystem services to society. Therefore, big efforts are being accomplished to explore them. In particular, the study of microbial diversity, responsible of most of the respiration in the oceans and part of all biogeochemical cycles, is pivotal in comprehending the anthropogenic impact in these highly productive ecosystems in a global warming scenario. Within this context, we analyzed the prokaryotic abundance and diversity along with the hydrographic and dissolved organic matter (DOM) characterization of the shallower depths, for 1.5 years, at the temperate NW coastal Iberian upwelling time-series station (E2CO, RADIALES, A Coruña). Prokaryotic communities were clustered into four different assemblages linked to distinct phases of the upwelling cycle: upwelling (superficial and sub-superficial), transition and downwelling. Additionally, the analysis of the temporal variability of the DOM composition resulted in significative differences among samples from transition and upwelling. Also, fine tuning of the prokaryotic community by analyzing single amplicon sequence variants (ASVs) of the abundant prokaryotic taxa, revealed ecotypes (closely related taxa) with contrasting ecological niches that significantly relate with particular hydrography and DOM characteristics (e.g.: Formosa, ASV711 and ASV1486; NS2B, ASV1640 and ASV245). Altogether, this study provides one of the first attempts of exploring the link of prokaryotes with DOM in a temporal scale and emphasizes the importance of studying prokaryotic diversity by a single ASV approach as it harbors hidden intravariability within particular prokaryotic taxa, having relevant ecological implications in highly productive upwelling ecosystems.

[TSB.2-O-3]

Wednesday 4, morning (second): 13:15
Room: Balconada

The PERSIST and InterMaRest projects: understanding and restoring declining habitat-forming macroalgal populations at the rear edge of their distribution

Chefaoui, Rosa M.[1]; Arrontes, Julio[2]; Acuña, José L.[3]; Viejo, Rosa M.[4]

(1) Instituto de Investigación en Cambio Global (IICG-URJC), Universidad Rey Juan Carlos; (2) Departamento de Biología de Organismos y Sistemas, Universidad de Oviedo; (3) Departamento de Biología de Organismos y Sistemas, Universidad de Oviedo; (4) Instituto de Investigación en Cambio Global (IICG-URJC), Universidad Rey Juan Carlos

Correspondence e-mail: [rosa.chefaoui@urjc.es]

Under current global change, canopy-forming macroalgae are shifting their distribution globally, resulting in significant impacts on marine ecosystems. These species play a key role in ecosystems, so their local extinction leads to simplified habitat structure and a loss of biodiversity. Despite these shifts often being related to global warming, the increasing impact of fish herbivory may also play a relevant role. Still, marginal populations can persist in favorable sites and microhabitats determined by local conditions which can modify vulnerability to herbivores or environmental parameters, in particular during emersion times for intertidal species. Understanding the processes that determine the persistence or extinction of populations of these species, especially at the depauperate distribution boundary, the rear edge, is essential to refine future predictions. When natural recovery is very difficult, active restoration emerges as one solution to preserve and recover these valuable ecosystems.

In this talk, a presentation will be given on the main goals, methods and preliminary results obtained during the PERSIST and InterMaRest projects. We have used “in situ” experimentation and sampling surveys as the methodological basis for innovative approaches in climate change research and biogeography. We have measured how physical variables and vital rates of species vary on a small scale to build a baseline on the ecological requirements and most suitable locations and microhabitats. Last, we are combining these experiments and surveys with spatial analysis, Lidar, and thermographic images to understand the dynamics of these species under climate change. Finally, we have upscaled from herbivore exclusion cages to exclosure fences to restore macroalgae populations and examine their potential for population regeneration at local scales.

[TSB.2-O-4]

Wednesday 4, morning (second): 13:30
Room: Balconada

Benthic and Ichthyofaunal Diversity in Black Coral Forests in Santo Antão, Cabo Verde: Establishing a Baseline for Monitoring Global Change

da Silva e Ornelas, Tristan[1]; Amaro, Teresa[2]; Afonso Ferreira, Jessica[3]

(1) University of Aveiro; (2) University of Aveiro; (3) University of Aveiro

Correspondence e-mail: [Twunnemann@gmail.com]

Mesophotic black coral forests (BCFs) are vital marine ecosystems that provide complex three-dimensional habitats supporting diverse biological communities. However, these ecosystems remain understudied, particularly in the Tropical Atlantic Realm. The goal of this study is to establish baseline knowledge on BCF ´s biodiversity to monitor global change impact on marine biodiversity. Specifically, this study investigated benthic and ichthyofaunal diversity associated with BCFs along the coast of Santo Antão, across eight locations at depths ranging from 30-68.7 meters. The BCFs were dominated by three species, Antipathella wollastoni, Stichopathes luetkeni and Tanacetipathes spinescens. Within them, we documented benthic and fish communities using photo quadrats (n=240) and video transects (n=38) respectively, to assess biodiversity patterns and community structure. Image analyses revealed 45 benthic species and 53 confirmed fish species across all sites, with considerable spatial variation in community composition. The location Hanging Garden exhibited the highest benthic species richness (n=25 species) and diversity (H’(loge)=2.12), while Ponta do Tubarão showed the greatest ichthyofaunal richness (n=36 species) and Janela the greatest Shannon’s diversity (H’(loge)=2.03). The endemic damselfish Chromis lubbocki dominated fish assemblages across all sites, while benthic communities were characterised by high coverage of rhodoliths, other red algae, and encrusting sponges. Diversity indices and rarefaction analyses indicated varying levels of community complexity among sites, suggesting the influence of local environmental conditions and habitat characteristics. Our findings establish the first comprehensive baseline of BCF-associated biodiversity in Cabo Verde, highlighting these ecosystems as important biodiversity hotspots and emphasizing their significance for marine conservation in the region.

[TSB.2-O-5]

Wednesday 4, morning (second): 13:45
Room: Balconada

Elucidating scale-dependent effects of marine heatwaves on fish abundance

Chaikin, Shahar[1]; González-Trujillo, Juan David[2]; Araújo, Miguel B.[3]

(1) MNCN-CSIC; (2) Universidad Nacional de Colombia; (3) MNCN-CSIC

Correspondence e-mail: [shahar.chaikin@gmail.com]

A notorious phenomenon associated with anthropogenic change is the increasing prevalence of marine heatwaves (MHWs) i.e., when oceans become anomalously warm. MHWs can expose species to temperatures above their upper thermal threshold but open up new habitats by enabling access to hitherto too-cold environments. Thus, MHWs are suggested as agents of mass mortalities, species turnover, and rapid range shifts. However, the impact of MHWs on species abundance remains equivocal and likely scale-dependent. Here, we investigate the relationship between MHWs and marine fish abundance across a vast geographical area, encompassing the Northeastern Pacific Ocean, North Atlantic Ocean, Arctic Ocean, and the Mediterranean Sea. We utilize an unprecedented dataset comprising abundance estimates from 49,181 bottom trawl samples spanning 19,758 population-level time series and 1,370 fish species. To estimate MHWs, we extracted high-resolution climatic data from the Copernicus Marine Global Ocean Physics Reanalysis spanning a reference period of 30 years. We link MHWs with species abundance while distinguishing between warm and cold edge populations. This novel approach allows us to unravel scale-dependent effects and identify populations most vulnerable to MHWs. Our findings will contribute to predicting the fate of marine species under a warming climate and inform conservation strategies.

[TSB.2-O-6]

Wednesday 4, morning (second): 14:00
Room: Balconada

The role of Marine Sponges in Organic Pollutant Cycling

Garrigós Alcalá, Nuria[1]; Díaz Rebollo, Aitziber[2]; Mallenco Fornies, Rebeca[3]; Romera Castillo, Cristina[4]; Berrojalbiz Castrillejo, Naiara[5]; Costa Vila, Maria[6]; Dachs, Jordi[7]; Ribes Llordes, Marta[8]; Morganti, Teresa Maria[9]

(1) Instituto de Ciencias del Mar (ICM-CSIC); (2) University of Barcelona; (3) Instituto de Ciencias del Mar (ICM-CSIC); (4) Instituto de Ciencias del Mar (ICM-CSIC); (5) Instituto de Diagnóstico Ambiental y Estudios del Agua (ICM-IDAEA); (6) Instituto de Diagnóstico Ambiental y Estudios del Agua (ICM-IDAEA); (7) Instituto de Diagnóstico Ambiental y Estudios del Agua (ICM-IDAEA); (8) Instituto de Ciencias del Mar (ICM-CSIC); (9) Instituto de Ciencias del Mar (ICM-CSIC)

Correspondence e-mail: [ngarrigos@icm.csic.es]

Marine sponges are key players in marine biogeochemical cycles, supporting diverse ecosystems. Sponges host complex microbial communities as symbionts that can take, produce and transform organic compounds. Based on bacterial symbiont abundance, density and composition sponges are generally divided into High (HMA) and Low (LMA) microbial abundance species.

This study aims to investigate the ecological role of sponges in marine pollution cycling, focusing on their ability to uptake and possibly bioaccumulate or biodegrade pollutants like polycyclic aromatic hydrocarbons (PAHs), organophosphate esters (OPEs) flame retardants and plasticizers. These compounds, often toxic to aquatic environments, are a persistent presence in marine ecosystems. We investigated whether sponges can ingest the studied pollutants, as one previous study has shown sponge contaminant retention. We hypothesized that based on microbial abundance and composition, HMA and LMA sponges might play a different role in recycling the studied pollutants.

To test our hypothesis, we exposed two Mediterranean sponge species (Dysidea avara-LMA and Aplysina aerophoba-HMA) to known concentration and composition of PAHs and OPEs. Simultaneous sampling of the water inhaled and exhaled by sponges allowed us to estimate ingestion or excretion of specific pollutants. In parallel, sponge symbionts were analyzed to investigate the presence of bacteria known to degrade these pollutants.

Due to their symbionts, we expect that HMA sponges might show a higher rate of pollutant retention and eventually biodegrade them. Given the growing concern over emerging pollutants, understanding the sponge's role in mitigating pollution through uptake or biodegradation could provide valuable insights as model organism for bioremediation.

TSB.2. Posters

[TSB.2-P-1]

Tuesday 3
Discussion corner: Room 4

The impact of microbial diversity loss on the degradation of polymers in marine sediments

Benito Kaesbach, Alba[1]; Casado-Coy, Nuria[2]; Gran, Alicia[3]; Beltrán-Sanahuja, Ana[4]; Delgado-Baquerizo, Manuel[5]; Sanz-Lázaro, Carlos[6]

(1) University of Alicante; (2) University of Alicante, Alicante, Spain; (3) University of Alicante, Alicante, Spain; (4) University of Alicante, Alicante, Spain; (5) Instituto de Recursos Naturales y Agrobiología de Sevilla (IRNAS, CSIC); (6) University of Alicante, Alicante, Spain

Correspondence e-mail: [alba.benito@ua.es]

Introduction: Biodegradable polymers have emerged in recent decades as an alternative to conventional plastics to reduce the perdurability of plastic wastes in the environment, as they can be degraded by microorganisms. Global change generates a large number of environmental stressors which can decrease biodiversity hampering the capacity of biological communities to degrade organic matter or plastics.

Materials and methods: To analyze the influence of microbial diversity in marine sediment on the degradation of five polymers with different degrees of biodegradability, we exposed these polymers to decreasing diversity by applying the dilution-to-extinction approach in a manipulative laboratory experiment. Additionally, we tested the effect of eutrophication on plastic degradation under these conditions.

Results and discussion: The reduction in microbial diversity significantly decreased the capacity of marine sediments to degrade the tested polymers. Nevertheless, this impairment was attenuated under eutrophic conditions, suggesting that eutrophication could compensate to some extent for the loss of diversity, which may be due to the increased availability of nutrients for microorganisms. Phyla such as Chloroflexi, Calditrichota, Gemmatimonadota, Acidobacteriota and Cyanobacteria, which were responsible for much of the dissimilarity in the community between natural and sterile samples, may play a key role in polymer degradation.

Our results suggest that future losses of microbial diversity would imply a reduction in the degradation of biodegradable polymers, limiting their mitigation capacity against plastic pollution when they end up in the marine environment.

[TSB.2-P-2]

Wednesday 4
Discussion corner: Room 12

Statistical tools and machine learning algorithms to uncover the ecological organization of Mediterranean Cold-Water Coral Reefs

Martinez-Dios, Ariadna[1]; Vad, Johanne[2]; De Clippele, Laurence[3]; Lo Iacono, Claudio[4]

(1) Institut de Ciències del Mar (ICM-CSIC); (2) University of Edinburgh; (3) Glasgow University; (4) Institut de Ciències del Mar (ICM-CSIC)

Correspondence e-mail: [amartinez@icm.csic.es]

The Mediterranean Sea is home to several cold-water coral populations, with seven coral regions or provinces identified to date. While most of Mediterranean Cold-Water Coral (hereafter, CWC) populations do not form reefs, the Alboran Sea hosts extensive and exceptionally thriving reefs growing on top of volcanic banks, such as the Cabliers and Catifas reefs. However, the factors explaining their presence, diversity and exceptional state of conservation remain poorly understood. Here we present the analyses of 7 ROV dives in which cutting-edge Machine Learning tool RootPainter was applied for the automatic detection of key ecosystem engineer species from the ROV imagery. In addition to abundance annotations, trained models allowed to extract metrics related to the size and shape of all the individuals observed. Data on the size structure of Scleractinia, Antipatharia, Octocorallia and Hexactinellida species and their spatial distribution were used to compute Cumulative Abundance Profiles (CAPs), combined with dissimilarity matrices and Distance-based Moran's eigenvector maps (dbMEMs) in order to decompose the spatial relationships among study sites. In essence, the presented approach – to date, only applied to terrestrial ecology – allowed us to understand the scale-dependent distribution of individuals of different sizes, and how inter- and intra-specific interactions foster or impede co-existence of species. Overall, this approach allows us to identify spatial patterns driving richness and composition and allowing the creation of massive biogenic habitats such as the deep reefs of Cabliers and Catifas banks - here is where size matters.

TSB.3. Connecting scales through movement ecology

Wednesday, 4 (12:45-14:15)

Room: Restaurante

In nature, resources are never distributed homogeneously within a species' environment and suitable habitat patches are often embedded in heterogeneous landscapes. Thus, individuals must move optimally between these patches to feed, reproduce, and maximize their fitness, which impacts population dynamics, species persistence, and coexistence (including the coexistence between wildlife and human populations). Movement, therefore, plays a fundamental role in ecological and evolutionary processes and is key to understanding the spatial dynamics and structure of populations and communities. Since ecological phenomena follow different spatial and temporal scales, our understanding of patterns and processes at various levels of biological organization depends on how we address these scales. Recent technological advancements have improved the tracking of animal movement across all spatial and temporal scales. This thematic session aims to share and discuss the latest developments in movement ecology, in a diverse and inclusive environment, bringing together the scientific community involved and fostering future collaboration.

Organizers:

• **María del Mar Delgado Sánchez,** Instituto Mixto de Investigación en Biodiversidad (CSIC/UO/PA)

• **Zaida Ortega Diago,** Departamento de Biodiversidad y Gestión Ambiental, Universidad de León.

TSB.3. Orals

[TSB.3-O-1]

Wednesday 4, morning (second): 12:45
Room: Restaurante

Prioritizing dispersal settlements of a flagship raptor in the Iberian Peninsula: from intensity of use to spatial connectivity

Ormazabal Santa Cruz, Unai[1]; Abad-Gomez, Jose María[2]; Parejo, Manolo[3]; Arredondo, María[4]; Palacios, María Jesús[5]; Sánchez, Ángel[6]; Guerrero, Álvaro[7]; López Calderón, Cosme[8]

(1) Universidad de Extremadura; (2) Sociedad de Gestión Pública de Extremadura, S.A.U. (GPEX); (3) Facultad de Ciencias, Universidad de Extremadura, Avda. de Elvas s/n, Badajoz, España.; (4) Sociedad de Gestión Pública de Extremadura, S.A.U. (GPEX); (5) Consejería de Agricultura, Ganadería y Desarrollo Sostenible. Junta de Extremadura.; (6) Consejería de Agricultura, Ganadería y Desarrollo Sostenible. Junta de Extremadura.; (7) Acción por un Mundo Salvaje (AMUS), Apdo. Correos 6, Villafranca de los Barros, Badajoz, España.; (8) Facultad de Ciencias, Universidad de Extremadura, Avda. de Elvas s/n, Badajoz, España.

Correspondence e-mail: [unaios@unex.es]

Introduction. Prioritizing resource allocation is mandatory in conservation programmes. In this context, it is challenging to quantify the importance of different sites used by wandering wildlife. In this study, we first aim to identify dispersal settlements used by the Spanish imperial eagle (Aquila adalberti), and second, we aim to quantify the spatial connectivity between them.

Material and methods. Using GPS tracking data from 15 eagles tagged in Extremadura, we determined the individual core areas used for hunting as given by spatial polygons accumulating 0.5 probability of the Kernel Utilization Distribution (for fixes with high speed and turning angle). We then identified dispersal settlements for the study population as defined by KUD overlap across individuals. We defined such dispersal settlements as nodes of a spatial network, and we defined links as flights from one node to another. Finally, we calculated network metrics (strength and betweenness) to rank the importance of each node within the Iberian Peninsula.

Results and discussion. Dispersal settlements in the provinces of Badajoz, Sevilla, Cádiz and Toledo resulted the most important as given by their number of flights (i.e. strength). On the other hand, two dispersal settlements nearby Azuaga (Badajoz) and Arcos de la Frontera (Cádiz) resulted key bottlenecks in the overall network (i.e. betweenness). Consequently, we highlight the utmost importance of these particular two sites for the conservation of this species in the Iberian Peninsula, which surprisingly are not fully protected but only their streams are included in Natura2000.

[TSB.3-O-2]

Wednesday 4, morning (second): 13:00
Room: Restaurante

Dirty connections: spatiotemporal connectivity between landfills at intra- and inter-population levels in an opportunistic gull

Martín Vélez, Víctor[1]; Sebastián-González, Esther[2]; Ramirez, Francisco[3]; Montalvo, Tomas[4]; Bécares, Juan[5]; Bota, Gerard[6]; Navarro, Joan[7]

(1) Institut de Ciències del Mar; (2) Universidad de Alicante; (3) Institut de Ciències del Mar; (4) Agencia de Salud Pública de Barcelona; (5) CORY'S - Investigación y Conservación de la Biodiversidad; (6) Centre de Ciència i Tecnologia Forestal de Catalunya (CTFC); (7) Institut de Ciències del Mar

Correspondence e-mail: [victormartin_velez@hotmail.com]

Introduction. Open landfills represent a unique environment for wildlife and play a role in supporting some avian populations by providing food resources. The yellow-legged gull (Larus michahellis) is an example of a facultative scavenger that regularly utilizes landfills. Understanding how landfills influence the spatial movements across multiple spatiotemporal scales is essential for assessing the role of these human-related habitats in supporting opportunistic populations. We aim to determine the importance of discrete landfills in the yellow-legged gull behaviour and population dynamics through a combination of GPS tracking data from 57 individuals with network analyses.

Material and methods. This study was conducted during the breeding and non-breeding season during two consecutive years in three different colonies of northeastern Spain (Barcelona city, Ivars Lake and Ebro Delta). We identified the organization (modularity and specialization degree) of a network where landfills were used as nodes and gull-flights among them were links. Analyses were done at different spatiotemporal scales: (1) breeding season, (2) colony level and (3) individual level.

Results and discussion. Overall, 80% of the GPS-tagged individuals used landfills from Spain, south of France and Tunisia as supporting habitat throughout the whole annual cycle. At breeding and colony level, the network did not show a modular or specialized structure. At individual level, birds from all colonies showed similar degree of specialization; however, individuals from Ivars displayed lower modularity than those from other colonies. This study showed the importance of landfills as discrete locations to maintain population connectivity at different spatiotemporal scales.

[TSB.3-O-3]

Wednesday 4, morning (second): 13:15
Room: Restaurante

Keep the water close: Space use of a key frugivorous bird in a high mountain ecosystem

Rumeu, Beatriz[1]; Illera, Juan C.[2]; Nogales, Manuel[3]; Bracho-Estévanez, Claudio A.[4]; Acevedo-Limón, Lucía[5]; Tarifa, Rubén[6]; González-Varo, Juan P.[7]

(1) Universidad de Cádiz; (2) IMIB (CSIC-Universidad de Oviedo-Principado de Asturias); (3) IPNA-CSIC; (4) Universidad de Cádiz; (5) Universidad de Cádiz; (6) Universidad de Jaén / Estación Experimental de Zonas Áridas (CSIC); (7) Universidad de Cádiz

Correspondence e-mail: [beatriz.rumeu@uca.es]

Simplified island communities provide a privilege setting to study the movement ecology of frugivorous animals, which is crucial for understanding the landscape features that shape their activity and the extent of their seed-dispersal services. Historical deforestation is a global phenomenon that has also severely impacted islands, reducing original forests significantly. Restoration of these ecosystems, typically dominated by frugivore-dispersed plant species, requires understanding where and why frugivores move, as their role is key to connect and expand remaining forest patches.

Here, we focused on a highly fragmented juniper woodland located at the high mountain of Tenerife (Canary Islands) that largely depends on a small wintering population of ring ouzels (Turdus torquatus) for seed dispersal. To evaluate how landscape composition and configuration modulate frugivores' movements, we tagged ring ouzels with GPS-Argos transmitters and combined movement data with high-resolution GIS information. We also used camera-traps at three water points for monitoring water use by tagged birds and, thus, their dependence on a non-fruiting resource.

Ring ouzels had relatively small home-ranges in areas with high juniper density and rarely moved long distances. Water points significantly influenced their habitat use, showing that plant-frugivore interactions can be spatially clustered due to resources other than fruit availability. Our findings reveal a limited role of ring ouzels to connect distant remnant patches of junipers and highlight the importance of water availability in shaping their movement patterns in this arid ecosystem. Artificial water points could be a management tool to guide seed dispersal towards targeted areas for forest restoration.

[TSB.3-O-4]

Wednesday 4, morning (second): 13:30
Room: Restaurante

Towards Unraveling the Role of Daily Bird Movements in West Nile Virus Transmission

Bogdanovic, Nina[1]; K. Scharf, Anne[2]; Safi, Kamran[3]; Bartumeus Ferré, Frederic[4]

(1) Center for Advanced Studies (CEAB-CSIC); (2) Max Planck Institute of Animal Behavior; (3) Max Planck Institute of Animal Behavior; (4) Center for Advanced Studies (CEAB-CSIC)

Correspondence e-mail: [nina.bogdanovic@ceab.csic.es]

Introduction. West Nile Virus (WNV), the most widespread flavivirus globally, is maintained in an enzootic bird-mosquito cycle. Its prevalence, distribution, and severity have increased in recent decades, raising public health concern and exposing humans and farm animals to an elevated infection risk. While bird migration is known to facilitate WNV spread to previously unaffected areas, the role of local and regional bird movements in driving transmission and spillover risks remains poorly understood. To this end, we explored how far different bird species could carry the virus in their daily activities.

Material and Methods. To investigate daily movement patterns of WNV host species, we utilized Movebank, an online repository for animal tracking data. We developed a reproducible R-based pipeline for complete data processing including: data download and cleaning, generating ethograms to classify behaviors (e.g., homing vs. nomadic), calculating daily travel distances (mean, median, and maximum), and computing daily dispersal kernels. The pipeline was tested on five species and will be further applied to all WNV hosts with available tracking data.

Results and Discussion. Preliminary results show that insightful movement patterns can be extracted across species from diverse and heterogeneous tracking data. This information will be further implemented to simulate birds' daily movements using random walks with resetting. By linking bird movement to local and regional WNV transmission, this research lays the groundwork for modeling spillover risks, supporting public health efforts to mitigate them.

[TSB.3-O-5]

Wednesday 4, morning (second): 13:45
Room: Restaurante

Foraging Ants as Liquid Brains: Movement Heterogeneity Shapes Collective Efficiency

Fernández-López, Pol[1]; Oro, Daniel[2]; Lloret-Cabot, Roger[3]; Genovart, Meritxell[4]; Garriga, Joan[5]; Bartumeus, Frederic[6]

(1) Centre d'Estudis Avançats de Blanes (CEAB-CSIC); (2) Centre d'Estudis Avançats de Blanes (CEAB-CSIC); (3) Centre de Biologie Intégrative (Université de Toulouse); (4) Centre d'Estudis Avançats de Blanes (CEAB-CSIC); (5) Centre d'Estudis Avançats de Blanes (CEAB-CSIC); (6) Centre d'Estudis Avançats de Blanes (CEAB-CSIC)

Correspondence e-mail: [pfernandez@ceab.csic.es]

Introduction. In foraging, animals balance the effort of sampling their environment (exploration) with the ability to remember or anticipate the location of resource patches (exploitation). In social species, information transfer adds another layer to movement behavior, enabling individuals to locate both resources and conspecifics for exchanging information. Consequently, movement may play a crucial role in shaping connectivity within information networks.

Material and methods. We conducted foraging experiments with ants (Aphaenogaster senilis) in a 2×1 m discrete honeycomb arena over a 3-hour period. Based on the empirical results, we extended a liquid brain framework to replicate the foraging behavior of ants at natural ecological scales. This approach aimed to uncover the mechanisms driving collective foraging efficiency under conditions of sparse connectivity, influenced by large spatial scales and low density of individuals.

Results and discussion. Foraging occurred in two sequential stages: exploration and exploitation. During exploration, we observed heterogeneous movement patterns among ants. Specifically, we identified ants with a high directional persistence (scouts), and ants that preferred to remain near the nest and exhibited diffusive-like movement patterns (recruits). A higher proportion of scouts enhanced search efficiency, while recruits functioned as communication hubs near the nest. During resource exploitation, recruits optimized food collection by establishing temporary nest-to-food fluid connectivity, while scouts facilitated the simultaneous exploitation of multiple resource patches. These findings highlight the value of integrating behavioral ecology with complex systems frameworks to deepen our understanding of emergent properties and self-organization in ecological systems.

[TSB.3-O-6]

Wednesday 4, morning (second): 14:00
Room: Restaurante

Habitat selection during winter season of a partial migrant falcon revealed through GPS and satellite imagery data

Ramón Martínez, David[1]; Marfil-Daza, Carlos[2]; Bustamante, Javier[3]

(1) Estación Biológica de Doñana; (2) Estación Biológica de Doñana; (3) Estación Biológica de Doñana

Correspondence e-mail: [davidr.martinez@ebd.csic.es]

Introduction. The lesser kestrel (Falco naumanni) is a small falcon, typical of non-irrigated crops and semi-natural grasslands. In the Iberian Peninsula it is considered a partial migrant. Whereas most of the population performs a trans-Saharan migration to its wintering grounds in the Sahel, a small fraction remains in the breeding areas throughout the year.

Although its foraging ecology has been extensively studied during the breeding season, few studies have looked at this aspect outside this period.

Methods. In this study, we investigate the habitat selection of the Iberian population of lesser kestrel throughout its wintering distribution. To this aim, we use both GPS data from both resident and migratory individuals and land use/land cover data from satellite imagery. Focusing on sedentary days (the individual returns to the previous day roost), we compare the prevalence of habitats of used relocations with that of locations randomly generated in a buffer around the roost (available habitats). We also studied whether distances to foraging sites and foraging areas are influenced by habitat composition in the roost environment.

Results. According to previous work focused on the breeding season, we expect to find a selection towards non-irrigated crops and natural grasslands, although the intensity of the selection may vary throughout the winter. Likewise, we expect that distances to foraging sites and foraging areas will be greater in those roosts with less availability of preferred habitats in their environment.

TSB.3. Posters

[TSB.3-P-1]

Wednesday 4
Discussion corner: Room 4

Green Infrastructure for Bees: The Role of Spanish Drove Roads

Hevia, Violeta[1]; Solascasas, Paula[2]; González, José A.[3]; Manzano, Pablo[4]; Azcárate, Francisco M.[5]

(1) Universidad Autónoma de Madrid; (2) Universidad Autónoma de Madrid; (3) Universidad Autónoma de Madrid; (4) Basque Centre for Climate Change; (5) Universidad Autónoma de Madrid

Correspondence e-mail: [violeta.hevia@uam.es]

Agricultural intensification and the loss of proximity to natural habitats negatively impact wild bee diversity. Green infrastructure, such as the Spanish network of drove roads, offers semi-natural grasslands that can serve as refuges for pollinators in intensively farmed landscapes.

To investigate the role of the Conquense drove road—one of the most active transhumance routes in Castilla-La Mancha (central Spain)—on wild bee communities, we sampled three ecoregions with distinct biogeographic traits. Using pan traps, we collected wild bees across three land use types: drove road grasslands, semi-natural vegetation, and crop fields.

Our results revealed that wild bee community composition varied significantly among the three ecoregions. In the most homogeneous and intensively farmed ecoregion, species richness and Shannon's diversity were highest in drove road grasslands, while functional richness was up to 2.5 times greater in these grasslands compared to other land use types. However, in the more heterogeneous ecoregions, no significant differences in taxonomic diversity were found between land use types.

These findings emphasize the importance of drove road grasslands as reservoirs of both taxonomic and functional diversity, particularly in landscapes dominated by intensive agriculture and lacking semi-natural habitats. As highlighted by the EU Pollinators Initiative, maintaining and restoring ecological corridors is crucial for pollinator conservation. Drove roads, sustained by traditional transhumant grazing, provide essential feeding and nesting resources for wild bees, underscoring their role as critical green infrastructure within agricultural landscapes.

[TSB.3-P-2]

Thursday 5
Discussion corner: Room 11

Which perspective is taken when studying the matrix effects on landscapes functional connectivity for plant species?

Yoshizawa Takeda, Cinthia Sayuri[1]; F. L. Pereira-Silva, Erico[2]; T. L ´opez De Pablo, Carlos[3]; Vallejo, V. Ramón[4]; Hardt, Elisa[5]

(1) Universidade Federal de São Paulo (UNIFESP); (2) Universidade de São Paulo (USP); (3) Universidad Complutense de Madrid; (4) Universitat de Barcelona; (5) Universidade Federal de São Paulo (UNIFESP)

Correspondence e-mail: [cinthia.takeda@unifesp.br]

The importance of matrix characteristics for maintaining ecological flow between habitats is often discussed. However the way it is accessed can interfire on studies outcomes, particularly when focusing on plants, considering their different forms of dispersion. This study aimed to review the ways matrix influence on landscapes functional connectivity for flora species is addressed. A systematic search in the Web of Science and Scopus databases was conducted, resulting in 214 papers included in our review.

In an analysis regarding key-words, the "seed dispersal" was one of the more frequent terms related to flora, and the one that co-occurred the most with "connectivity". This indicates it as one of the main used measures of functional connectivity. Looking at the papers that searched for thresholds of dispersion throughout the matrix (30), two other methods were often used: pollen dispersal and genetic structure among populations. Comparing the outputs from papers that used these 3 methods, seed dispersal showed the thresholds closer to the habitat. Most of them were up to 150m. Papers that investigated pollen dispersal showed more distant thresholds, most of them with values higher than 150m. The genetic structure approach was the one that identified less thresholds. Results suggest that it is interesting to include a diversity of perspectives to investigate matrix effects on landscapes functional connectivity. For plant communities, it's important to consider different species and ways to move throughout the matrix.

Study financied by FAPESP (São Paulo Research Foundation). Process Numbers 24/16023-4; 24/00797-0; PI 22/02570-8

TSB.4. Plant-soil interactions: biodiversity, functioning and sustainable practices under global change

Wednesday, 4 (11:00-12:30); (12:45-14:15)

Room: Seminario 1

The increasing global demand for natural resources is driving transformations in ecosystem functioning, with unknown ultimate consequences, ranging from biodiversity loss to disruptions in biogeochemical processes. In this context, plant-soil systems emerge as fundamental pillars for the maintenance of terrestrial ecosystems, underpinning human well-being. However, studying these systems from the perspective of sustainable degrowth and ecological regeneration is becoming increasingly relevant, especially in ecosystems under anthropogenic pressure.

This session aims to bring together contributions that explore the biodiversity and functioning of plant-soil interactions in anthropized systems (such as agricultural, livestock, or forestry systems), as well as ecosystems undergoing degradation processes caused by human action or natural hazards. We welcome submissions investigating the effects of various drivers of change on plant-soil relationships and studies focusing on land management practices aimed at sustainability, conservation, and restoration. We encourage observational, experimental, modeling, and/or meta-analytical studies that promote a transition towards more equitable and regenerative forms of ecological research.

Organizers:

• **Jorge Prieto Rubio,** Centro de Investigaciones sobre Desertificación (CIDE, CSIC-UV-GVA)

• **Álvaro López García,** Estación Experimental del Zaidín (EEZ, CSIC).

TSB.4. Orals

[TSB.4-O-1]

Wednesday 4, morning (first): 11:00
Room: Seminario 1

Contrasting response of plant and soil microbial diversity to lithology and climate in Mediterranean maritime pine forests

Rey Simo, Ana[1]; MERINO MARTIN, LUIS[2]; SALAZAR, CARLOS[3]; VIÑEGLA, BENJAMIN[4]; CARREIRA, JOSE A.[5]

(1) MNCN (CSIC); (2) UNIVERSIDAD REY JUAN CARLOS; (3) UNIVERSIDAD DE JAEN; (4) UNIVERSIDAD DE JAEN; (5) UNIVERSIDAD DE JAEN

Correspondence e-mail: [anareysimo@gmail.com]

Climate change is the main driver of biodiversity loss in terrestrial ecosystems. Plant and soil microbial diversity losses will reduce multiple ecosystem functions. Mediterranean forests are one of the hotspots of biodiversity in the world as well as one of the most threatened ecosystems by climate change. However, how decreased precipitation will affect plant and soil microbial diversity and if and how lithology mediates the response in Mediterranean forests remains unexplored. We selected maritime pine (Pinus pinaster) forests growing on contrasting substrates (calcareous, metapelite and peridotite) in three Sierras along a precipitation gradient (from 1300 to 600 mm). Soil samples and plant diversity transects from 45 forest plots were collected and characterised. Soil microbial diversity was assessed using high throughput sequencing of 16S rRNA genes (bacteria) and ITS region (fungi). Both, precipitation and lithology significantly influenced microbial community structure, showing increased diversity in sites laying on peridotite soils and with the lowest precipitation. While soil microbial diversity was similar among lithologies at the wettest site, diversity increased with increasing aridity in all lithological substrates. The response of plant diversity differed from that belowground, as the strongest effect of lithology occurred at the wettest site and the impact of precipitation reduction differed among communities on different lithologies. Our results highlight the importance of lithology for the response of plant and soil microbial communities to climate change. Moreover, the study clearly suggests that stressful edaphoclimatic conditions, imposed by aridity and lithology, induce higher bacterial and fungal diversity while reduce plant diversity.

[TSB.4-O-2]

Wednesday 4, morning (first): 11:15
Room: Seminario 1

How mycorrhizal symbiosis influence plant strategies?

Bueno, Guillermo[1]; Beccari, Eleonora[2]; Tordoni, Enrico[3]; Meng, Yiming[4]; Caleño, Blanca[5]; Carmona, Carlos[6]

(1) Instituto Pirenaico de Ecología - CSIC; (2) University of Tartu; (3) University of Tartu; (4) University of Tartu; (5) University of Tartu; (6) University of Tartu

Correspondence e-mail: [cgbuenog@gmail.com]

Mycorrhizal symbiosis plays a critical role in shaping plant strategies by enhancing nutrient acquisition, defence, and adaptation to environmental challenges, and it is expected to associate with most plants on Earth. Despite its putative importance for plant survival strategies, the relationship between mycorrhizal symbiosis and plant form and function has primarily been examined indirectly through root trait gradients. In this study, we investigate whether mycorrhizal symbiosis, with its critical roles in defence, detoxification, and nutrition, directly influences plant form and function.

We conducted pairwise and gradient-wise analyses, focusing on plant size, leaf economics, root collaboration, and conservation gradients. Our approach utilized the most comprehensive set of plant mycorrhizal traits to date, including mycorrhizal types (arbuscular, ectomycorrhizal, ericoid, and non-mycorrhizal) and statuses (obligate and facultative mycorrhizal), paired with matching above- and below-ground plant traits.

Our results reveal significant correlations between mycorrhizal symbiosis and examined gradients. Notably, we observed contrasting patterns among mycorrhizal types in relation to above-ground traits, such as plant size and leaf economic gradients, while their effects on below-ground traits were homogeneous. These findings demonstrate that mycorrhizal associations differentially influence plant morphology, physiology, and development. Their presence across different gradients highlights their multifunctional role in plants, encompassing both nutritional and non-nutritional contributions, and aligns with their ancient and diverse coevolution.

Integrating plant mycorrhizal traits into the broader framework of plant form and function deepens our understanding of plant strategies and underscores the pivotal role of mycorrhizal symbiosis in driving plant adaptation to environmental challenges across diverse contexts.

[TSB.4-O-3]

Wednesday 4, morning (first): 11:30
Room: Seminario 1

Disentangling the role of the shrub community in the decline of Mediterranean oaks through indirect mechanisms of microbial sharing

Gómez-Aparicio, Lorena[1]; Serrano, Maria S.[2]; Capote, Nieves[3]; Gallego-Tévar, Blanca[4]; Gil-Martínez, Marta[5]; Melchiore, Gabriela[6]; Alba, Manuela[7]; Herrador, Mª Belén[8]; Pérez-Ramos, Ignacio M.[9]

(1) Institute of Natural Resources and Agrobiology of Seville (IRNAS-CSIC); (2) University of Córdoba; (3) IFAPA Centro Las Torres; (4) Institute of Natural Resources and Agrobiology of Seville (IRNAS-CSIC); (5) University of Seville; (6) Institute of Natural Resources and Agrobiology of Seville (IRNAS-CSIC); (7) Institute of Natural Resources and Agrobiology of Seville (IRNAS-CSIC); (8) University of Seville; (9) Institute of Natural Resources and Agrobiology of Seville (IRNAS-CSIC)

Correspondence e-mail: [lorenag@irnase.csic.es]

Exotic pathogens threat forests worldwide, causing major mortality of susceptible tree species such as Mediterranean evergreen oaks. Disease epidemiology is largely determined by the composition of the woody plant community, since species can act as either “amplifiers” or “diluters” of disease, depending on their host quality for pathogens. Coexisting species can share not only pathogens, but also mutualistic microbes that promote tree health. Therefore, a thorough understanding of microbial sharing among coexisting species in invaded forests might strongly contribute to predict and mitigate oak decline.

We combined greenhouse and field studies to analyse the role of the shrub community as a driver of Quercus rotundifolia health through indirect mechanisms of microbial sharing. In the greenhouse, we conducted an inoculation experiment with the exotic pathogen Phytophthora cinnamomi and 18 Mediterranean shrub species to explore phylogenetic patterns of pathogen sharing. In the field, we sampled 500 adults of Q. rotundifolia in 30 dehesas of southern Spain to explore relationships among tree defoliation, shrub community composition, and mycorrhizal colonization of oak roots.

The shrub community showed a strong phylogenetic signal in host quality and susceptibility to P. cinnamomi. In the field, oak root colonization by beneficial ectomycorrhizal (ECM) fungi was positively related with Cistaceae cover, likely because Cistaceae is the only shrub genus in dehesa systems that predominantly hosts ECM (vs. arbuscular mycorrhizal) fungi. Overall, our results suggest that oak health might be favored by promoting an understory dominated by phylogenetic distant plant species to minimize pathogen sharing, while keeping the few shrub species that can act as sources of ECM fungi.

[TSB.4-O-4]

Wednesday 4, morning (first): 11:45
Room: Seminario 1

Indirect interactions, plant-soil feedback and the coexistence of competitors

Antorán Pilar, Ezequiel[1]; Madrigal-González, Jaime[2]; Bernardo-Madrid, Rubén[3]; Fernández-Martínez, Miguel A[4]; Calatayud, Joaquín[5]

(1) Universidad Rey Juan Carlos; (2) University of Valladolid; (3) Umeå universitet; (4) Universidad de Autónoma Madrid; (5) Universidad Rey Juan Carlos

Correspondence e-mail: [ezequiel.antoran@urjc.es]

Introduction. Plant-soil feedback have been widely proposed as mechanisms to promote coexistence among plant species by limiting conspecific growth. However, recent theoretical work has questioned their role in stabilizing coexistence within multispecies communities. In these systems, indirect interactions —where soil alterations by one species influence the performance of others— may play a pivotal but often overlooked role. This study examines how plant-soil feedback influences these indirect interactions to sustain species coexistence.

Materials and Methods. We used an experimental system involving two competing shrub species grown in soil conditioned by a third tree species. Our study integrates experimental manipulations of soil microbiota and allelochemicals, field observations of plant, microbial, and allelochemical distributions, and stochastic simulations. Stochastic simulations were employed to analyze the demographic and spatial patterns within these multi-species communities.

Results and Discussion. Tree-induced shifts in soil microbial communities, metabolites, and abiotic conditions boost early growth of the non-dominant competitor while reducing germination in the dominant competitor. Simulations suggest that these shifts in demographic parameters are sufficient to stabilize coexistence, predicting closely the spatial distribution of the studied species observed in real-world communities. Our findings highlight the role of plant-soil feedback in driving indirect interactions that sustain coexistence in diverse plant communities.

[TSB.4-O-5]

Wednesday 4, morning (first): 12:00
Room: Seminario 1

Post-fire fungal diversity in maritime pine woodlands in Serra da Estrela (Portugal)

Costa, José[1]; Greene, Lauren[2]; Pedrosa, Maria João[3]; Matti, Arthur[4]; Correia, Marta[5]; Rodríguez-Echeverría, Susana[6]

(1) Centre for Functional Ecology, Associate Laboratory TERRA; (2) Centre for Functional Ecology, Associate Laboratory TERRA; (3) Centre for Functional Ecology, Associate Laboratory TERRA; (4) Centre for Functional Ecology, Associate Laboratory TERRA; (5) Mediterranean Institute for Advanced Studies (IMEDEA, CSIC-UIB); (6) Centre for Functional Ecology, Associate Laboratory TERRA

Correspondence e-mail: [jmgncosta@gmail.com]

Pine woodlands harbour a diverse fungal community that play critical ecological roles in nutrient cycling and plant health. However, these woodlands are very prone to wildfires that usually kill the pines. This change in habitat structure and composition modifies the available resources and might lead to species declines. Fire regimes are changing, being expected to negatively impact these woodlands. As many fungal species are dependent of pines to thrive, it is important to understand how fires affect fungal community composition as this turnover may have important implications for ecosystem functioning. We recorded and identified fungal carpophores along transects in unburned and in burned (fire event in 2022) maritime pine patches in Serra da Estrela (Portugal). Each transect was sampled twice in October and November 2024. Overall, fungal species richness in the unburned area was nearly five times larger than that of the burned area. Few fungal species were common to both habitats. Most of the species in the burned patch were saprophytes, especially those typically found in recently burned areas or on decaying wood. Three taxa (Hebeloma sp., Laccaria sp., and Telephora terrestris) were found in association with Cistus lasianthum, a post-fire seeder that dominated the burned area. The latter two fungal species are also known to establish ectomycorrhizal associations with pines. While the fungal community was impoverished in the burned area, there is a potential role of early successional stage shrubs in sustaining fungal species that might foster the growth of pine saplings and ecosystem recovery.

[TSB.4-O-6]

Wednesday 4, morning (first): 12:15
Room: Seminario 1

Impact of soil degradation due to overgrazing on soil microbial communities and soil carbon storage of seasonal dry tropical forests in Ecuador

Merino Martín, Luis[1]; Guerrero-Jara, Andrea[2]; González-Benítez, Natalia[3]; Espinosa, Carlos Iván[4]; Rey, Ana[5]

(1) Instituto de Investigación en Cambio Global; (2) Universidad Técnica Particular de Loja (UTPL); (3) Instituto de Investigación en Cambio Global; (4) Universidad Técnica Particular de Loja (UTPL); (5) Museo Nacional de Ciencias Naturales (MNCN)

Correspondence e-mail: [luis.merino.martin@urjc.es]

Introduction. Seasonal dry tropical forests (SDTF) are rich in plant diversity and endemism, representing approximately half of the world's tropical forests. Despite their ecological importance, many SDTFs are being degraded by human activities, affecting soil integrity and its microorganisms. However, knowledge about the effect of this anthropogenic degradation on soil microbial communities and their roles in nitrogen fixation, carbon storage, and nutrient cycling is still limited. One of the main factors in the degradation of SDTFs is livestock grazing.

Material and methods. To investigate the effects of overgrazing on soil microbial functionality, we conducted a study in the province of Zapotillo, in southern Ecuador. We analysed a gradient of chronic disturbance caused by goat grazing, categorizing the forest into five stages of degradation, from natural to degraded conditions. In each stage, we collected composite soil samples from five replicated plots. We measured soil bacterial and fungal composition and structure, total organic carbon, nitrogen, major nutrient concentrations, microbial respiration, and its response to temperature.

Results and discussion. Our results showed that disturbance had a significant effect on microbial community composition and structure with the two most degraded stages of the forest presenting lower concentrations of carbon and nitrogen in the soil, as well as lower carbon mineralization and temperature sensitivity. Our results suggests that microbial functionality can withstand moderate levels of grazing degradation, but beyond a certain threshold, degradation becomes chronic, altering soil functionality and decreasing its fertility and carbon retention capacity. These alterations in essential ecosystem services can affect the forest's regeneration capacity. Our results can help develop more effective forest management strategies to conserve these unique ecosystems for future generations.

[TSB.4-O-7]

Wednesday 4, morning (second): 12:45
Room: Seminario 1

The abandonment of non-native radiata pine plantations from the Basque Country - a key process to stimulate soil C sequestration and native forests' ecological restoration

Heres, Ana-Maria[1]; Martínez Santamaría, Andrea[2]; Artetxe, Unai[3]; Esteban, Raquel[4]; Herrero, Asier[5]; Moreaux, Céline[6]; Ortega Barrueta, Unai[7]; SanMiguel Oti, Francisco[8]; Curiel Yuste, Jorge[9]

(1) Faculty of Silviculture and Forest Engineering, Transilvania University of Brasov, Romania; (2) Agrarian Technological Institute of Castilla y León (ITACyL), Spain; (3) University of Basque Country (UPV/EHU), Spain; (4) University of Basque Country (UPV/EHU), Spain; (5) Faculty of Pharmacy, University of Basque Country (UPV/EHU), Spain; (6) BC3 - Basque Centre for Climate Change, Spain; (7) University of Basque Country (UPV/EHU), Spain; (8) BC3 - Basque Centre for Climate Change, Spain; (9) BC3 - Basque Centre for Climate Change, IKERBASQUE - Basque Foundation for Science, Spain

Correspondence e-mail: [annamariaheres@gmail.com]

In Basque Country (north of Spain), radiata pine (Pinus radiata D. Don) has been firstly mentioned in the XIX century in a botanical garden, being currently the tree species that occupies the largest area. This non-native species has been intensively planted for timber production, being highly appreciated for its fast-growth characteristics, reduced rotation periods and wood versatility. However, nowadays its profitability has been affected as timber prices have decreased. A second thought should be thus given to the recovery of the mixed-broadleaf native forests that have once occupied the areas now planted with radiata pine. This study focused on soil, secondary growth and vegetation cover data to evaluate how radiata pine plantations perform under current climate change conditions. Three rotations were considered: abandoned (no clear-cuttings undertaken anymore as > 35 years' trees are considered overaged); medium (clear-cuttings between 30 and 35 years); short (clear-cuttings starting from 22 years). Results showed that, regardless the rotation, analysed radiata pines did not reach the expected 6.5 mm / year average tree-ring width and registered negative growth trends. Additionally, they were all decoupled from climate effects. From a production perspective, these plantations seem thus to not be profitable anymore. Still, from an ecosystem services' perspective, these plantations' abandonment increased the soils' C sequestration capacity and the regeneration of native plant species. Therefore, although these radiata pine plantations have no commercial interest in the current climate context, their abandonment may favour ecological restoration process towards native forests and improve their climate change mitigation capacity.

[TSB.4-O-8]

Wednesday 4, morning (second): 13:00
Room: Seminario 1

Conserved Patterns of Microbial Recruitment and Rhizosphere Assembly in Crop Wild Progenitors

de Celis, Miguel[1]; Fernández-Alonso, María José[2]; Leo, María[3]; Belda, Ignacio[4]; Delgado-Baquerizo, Manuel[5]; Milla, Rubén[6]; García-Palacios, Pablo[7]

(1) Instituto de Ciencias Agrarias (ICA-CSIC); (2) Universidad Autónoma de Madrid; (3) Instituto de Ciencias Agrarias (ICA-CSIC); (4) Facultad de Ciencias Biológicas (UCM); (5) Instituto de Recursos Naturales y Agrobiología de Sevilla (IRNAS-CSIC); (6) Instituto de Investigación en Cambio Global, Universidad Rey Juan Carlos; (7) Instituto de Ciencias Agrarias (ICA-CSIC)

Correspondence e-mail: [migueldc@ucm.es]

Restoring ancestral plant-microbiome relationships, known as microbiome rewilding, offers a promising strategy to enhance crop resilience and productivity in the face of accelerating global environmental change. Examining the intra-specific variation of rhizosphere communities within and across native populations of different Crop Wild Progenitors (CWPs) can reveal conserved patterns of microbial recruitment and adaptation. These insights are key to identifying consistent rules of assembly that underpin microbiome rewilding strategies for sustainable and resilient agriculture.

To identify common trends in rhizosphere assembly among the wild progenitors of 10 major crops, we sampled the rhizosphere microbiomes of three individual plants in 10-15 natural populations per CWP. Using abundance-based and phylogenetic null models, we quantified the intra-specific community variation at the population scale, allowing us to disentangle the ecological processes shaping rhizosphere assembly. Additionally, we conducted local network analysis to evaluate community structure across environmental gradients, identifying specific communities associated with each CWP.

We found that selective processes consistently homogenized communities at higher taxonomic resolution, whereas at finer resolutions these processes involved the assembly of heterogeneous communities. Dispersal processes acted homogenizing rhizosphere communities at each sampled population, but its effect may be limited by local ecological factors. Rhizosphere communities were divided into consistent sub-communities across populations, underlining their stability under varying conditions. These findings provide knowledge on the assembly and structure of rhizosphere microbiomes of CWPs, critical for designing microbiome rewilding strategies to enhance crop production and resilience in changing climates.

[TSB.4-O-9]

Wednesday 4, morning (second): 13:15
Room: Seminario 1

Microbial Strategies for Soil Restoration: Insights from Cover Crop Seed Inoculation

Homet Gutierrez, Pablo[1]; Liberal, Isabel M.[2]; Aguiar, Juan F.[3]; Ochoa Hueso, Raúl[4]

(1) Universidad de Cádiz; (2) Universidad de Cádiz; (3) Universidad de Cádiz; (4) Universidad de Cádiz

Correspondence e-mail: [pablo.homet@gmail.com]

Introduction. The intensification of agricultural land use, combined with the impacts of climate change, has led to a concerning degradation of soil health and quality. The use of cover crops, along with the development and application of inoculants, represents a promising strategy to improve soil health. Particularly, recent studies, suggests that inoculants derived from whole-soil microbial communities could provide an effective solution for restoring soil functionality.

Materials and Methods. In this study, we utilized solid-phase fermentations to produce 25 distinct microbial inoculants derived from complex communities obtained from the rhizosphere of European vineyards. To determine their composition, the inoculants were sequenced. These inoculants were then applied to the seeds of two herbaceous plants commonly used in cover crops (Lolium perenne and Trifolium repens). We monitored the germination and survival of the plants in a greenhouse experiment. After one month, we collected the plants and analysed soil functionality, water-use efficiency, and plant nutrition.

Results and Discussion. Most of the inoculants did not produce significant effects on the germination or survival of L. perenne. However, some had negative impacts on the germination and survival of T. repens. Notably, we observed positive effects of certain inoculants on plant water-use efficiency and alterations in the plants' elemental composition. Additionally, the inoculated seeds successfully transferred the functionality of some complex microbial communities from the inoculants to the soil. These findings demonstrate that inoculating seeds of cover crops could be a powerful strategy for restoring soil health in degraded agricultural systems.

[TSB.4-O-10]

Wednesday 4, morning (second): 13:30
Room: Seminario 1

Regenerative agriculture as a tool for carbon farming: a Mediterranean metanalysis

Andrés, Pilar[1]; Berk, Burcu[2]; Doblas-Miranda, Enrique[3]

(1) CREAF; (2) CREAF; (3) CREAF

Correspondence e-mail: [p.andres@creaf.cat]

Introduction. Regenerative agriculture is gaining ground as a powerful option for sustainability, food security, climate resilience, climate change mitigation and holistic land restoration. Although the definition of regenerative agriculture still merits further discussion, the practices associated to such agricultural management could be searched among the specialized literature to extract potential patterns of its associated benefits.

Methods. Based on the most frequent combination of management practices adopted by farmers who define themselves as regenerative, we performed a literature review in Mediterranean environments, and analysed the few common parameters measured, including sequestered soil organic carbon. The condition for including a study in the meta-analysis was that the farmer had applied at least one practice that supported each of the following principles: minimize soil disturbance, maximize crop diversity, keep soil covered all year round, maintaining living roots all year round and increase soil organic matter.

Results. We found 85 papers 51 of which included the required combination of practices. Our results show that regenerative agriculture clearly increases soil organic carbon (28% increase in average) in comparison to conventional agriculture. Effect of regenerative management of production also cause positive although no significative effect on production (4,7%). Among the most promising practices are catch crops and none or minimum tillage. The review also alerts about the need of more studies, and especially those relating regenerative practices to crop production.

[TSB.4-O-11]

Wednesday 4, morning (second): 13:45
Room: Seminario 1

Towards sustainable plant-disease management: understanding the influence of global change and local environment on nematode communities in Mediterranean olive groves

Salazar García, Rosana[1]

(1) IAS-CSIC

Correspondence e-mail: [rasalazar@ias.csic.es]

Dominating all habitats and trophic levels, nematodes are the most abundant animals on the planet and essential to ecosystem functions. While beneficial in many environments, plant-parasitic nematodes (PPNs) pose a significant threat to agricultural ecosystems, complicating efforts to manage them. Understanding the spatial distribution of PPNs communities in relation to environmental factors is crucial for developing effective disease management strategies. Olive groves, core of Mediterranean agroecosystems, are hosts for many PPNs. The Mediterranean basin, a transitional ecosystem between arid and temperate climates, is a recognised biodiversity hotspot. Nevertheless, its agricultural stability is increasingly at risk due to desertification, worsened by intensive soil management like tilling and phytochemical applications. In this global change scenario, adapting practices is fundamental to maintaining agricultural land viability and soil quality. This study sheds light on the matter, showing how management practices affect nematode communities and that sustainable practices can offer a solution for preserving soil health and managing plant diseases in desertifying regions. To achieve this, a total of 44 olive groves (6 replicates per site) were surveyed during the olive flowering stage (spring 2023), resulting in 264 samples widely distributed across the most important olive-growing regions of the Mediterranean basin (Greece, Morocco, Italy, Portugal and Spain). Data from PPNs communities, local environment and management practices (71 variables total) were compiled to construct a structural equation model that defines how these factors influence soil communities and the relationship between the variables studied. The study concludes that the common practices implemented on organic management help preserve soil health in aridifying croplands.

[TSB.4-O-12]

Wednesday 4, morning (second): 14:00
Room: Seminario 1

Impact of post-disturbance forest management in soil fertility six year after an extreme wind event in an Iberian beech forest

Herrero, Asier[1]; Laskurain, Nere Amaia[2]

(1) University of the Basque Country (UPV-EHU); (2) University of the Basque Country (UPV-EHU)

Correspondence e-mail: [asier.herrero@ehu.eus]

Introduction. Soil fertility is essential for plant performance and plays a key role enhancing forest resilience following extreme disturbances. We assess various physical and chemical soil properties in an Iberian beech forest (Fagus sylvatica) affected by a tornado in 2018, comparing two contrasting post-disturbance management approaches: salvage logging (harvesting of damaged trees; extraction) and retention forestry (dead wood preservation; retention).

Material and Methods. The tornado-impacted area was divided into east and west sections, each containing two plots: one extraction plot and one retention plot. Chemical variables measured included pH, organic matter, nitrogen and phosphorous content and cation exchange capacity. These were assessed across five sapling regeneration microhabitats: litter, branches and logs (representing an increase content in dead organic matter), and herbaceous and blackberry (Rubus spp.) cover. In the extraction plots, machinery tracks resulted from wood harvesting were sampled instead of blackberry cover. Each microhabitat was replicated five times, with soil collected from the top 15 cm. Regarding physical variables, soil texture, bulk density, porosity, water retention curves and hydraulic conductivity were measured in machinery trucks and blackberry cover in extraction plots and in blackberry cover in retention plots.

Results and Discussion. Significant differences were observed between management types and microhabitats, among which stands out the higher organic matter content in extraction plots, likely due to wood harvesting activities that fragmented the wood into smaller particles. Besides, reduced water retention was detected in machinery trucks, highlighting the negative potential impact of heavy machinery in the soil.

TSB.4. Posters

[TSB.4-P-1]

Wednesday 4
Discussion corner: Room 7

Mitigating salinity stress in mediterranean wetland plants: the role of native cyanobacteria and bacteria as bioinoculants

Macis, Silvia[1]; SAVAGLIA, Valentina[2]; VARGAS ORDÓÑEZ, Antonio[3]; BORGES DE ALMEIDA ROCHA, Francisco[4]; PAJUELO, Eloisa[5]; MARIGNANI, Michela[6]; MUÑOZ ROJAS, Miriam[7]

(1) University of Cagliari; (2) University of Sevilla; (3) University of Sevilla; (4) University of Sevilla; (5) University of Sevilla; (6) University of Cagliari; (7) Instituto de Recursos Naturales y Agrobiología de Sevilla (IRNAS)

Correspondence e-mail: [silvia.macis2@unica.it]

Introduction. Climate change, together with increased salinity, poses a threat to Mediterranean coastal wetlands. Some halophytes tolerate salinity during adulthood but can be highly sensitive to salinity stress during germination. Native soil microorganisms, e.g. rhizosphere or endophytic bacteria, have shown promising in mitigating salinity effects. However, the potential of biocrust bacteria and cyanobacteria for promoting restoration of salt-stressed ecosystems has been barely explored.

Material and methods. We isolated biocrust bacteria and cyanobacteria with plant growth-promoting traits and salinity tolerance from native wetlands (North-East Sardinia). Then, we bioprimed seeds from three Mediterranean wetland plants, i.e., Arthrocaulon meridionale, Mentha aquatica, and Juncus acutus with these inoculants, and tested germination under different salinity levels, i.e. 0.3 M, 0.5 M, 0.7 M (including controls). Germination rates and root development were recorded.

Results and discussion. Both inoculants enhanced germination across all the species, with cyanobacteria showing a more pronounced effect under salinity stress. With highest salinity conditions, A. meridionale and J. acutus germinated only when bioprimed with cyanobacteria. For A. meridionale we recorded 7% higher germination compared to the control at 0,5 M. No germination was recorded for M. aquatica, under saline conditions, but both inoculants improved germination by 15% and 2% respectively under non-saline conditions. Cyanobacteria also promoted longer root systems across all species.

These findings highlight the potential of cyanobacteria-based bioinoculants for salinity mitigation in wetland restoration. The next steps will involve field trials to assess these bioinoculants during mature plant stages and develop effective restoration strategies under global change scenarios.

[TSB.4-P-2]

Thursday 5
Discussion corner: Room 7

The role of halophytes in sustainable land management: effects of abiotic stress on yield and bioactive profiles

Martins Noguerol, Raquel[1]; Pérez-Ramos, Ignacio M.[2]; Matías, Luis[3]; Moreira, Xoaquín[4]; Francisco, Marta[5]; Salas, Joaquín J.[6]; Villoslada-Balbuena, Mónica[7]; Pedroche, Justo[8]; Cambrollé, Jesús[9]; Moreno-Pérez, Antonio J.[10]

(1) Facultad de Biología (Universidad de Sevilla); (2) Instituto de Recursos Naturales y Agrobiología de Sevilla (IRNAS-CSIC); (3) Facultad de Biología, Universidad de Sevilla; (4) Misión Biológica de Galicia (MBG-CSIC); (5) Misión Biológica de Galicia (MBG-CSIC); (6) Instituto de la Grasa (IG-CSIC); (7) Instituto de la Grasa (IG-CSIC); (8) Instituto de la Grasa (IG-CSIC); (9) Facultad de Biología, Universidad de Sevilla; (10) Facultad de Biología, Universidad de Sevilla

Correspondence e-mail: [rmartins18@us.es]

Global agriculture is currently facing significant challenges, including the reduction of arable land, water availability and soil degradation, which threaten food security and ecosystem functioning. Consequently, the identification and exploitation of alternative, stress-tolerant crops are becoming increasingly relevant for maintaining productivity in marginal lands while preserving biodiversity and soil health. Crithmum maritimum and Halimione portulacoides are halophytic perennial herbs widely distributed across contrasting coastal habitats. These species have demonstrated the ability to thrive in saline, nutrient-poor soils, where conventional crops cannot survive. Their high nutritional value and elevated antioxidant content make them promising candidates for the food and nutraceutical industries, while also representing sustainable alternatives for degraded and underutilized soils.

In this study, we evaluated the effects of salinity, nutrient deprivation, and their combination on the yield and phytochemical composition (protein, lipid, and antioxidant metabolite content) in the leaves of both species. The results showed that high salinity and nutrient-deficient conditions moderately impacted plant growth, but both species generally maintained good nutritional profiles. Interestingly, only the most extreme treatments, such as severe nutrient deprivation or high salinity, reduced antioxidant content. This demonstrates that C. maritimum and H. portulacoides can tolerate moderate stress levels without compromising quality, highlighting their potential as potential resilient crops to address global agricultural challenges, contributing to sustainable food systems and the rehabilitation of marginal soils.

[TSB.4-P-3]

Tuesday 3
Discussion corner: Room 7

Effects of forest thinning practices on fine root traits in non-natural stands of Pinus pinaster

Palacios Mc Cubbin, Elva[1]; Benavides, Raquel[2]; Roig Gómez, Sonia[3]; Rubio Sánchez, Agustín[4]; Piñeiro, Juan[5]

(1) Universidad Politécnica de Madrid; (2) Universidad Politécnica de Madrid; (3) Universidad Politécnica de Madrid; (4) Universidad Politécnica de Madrid; (5) Universidad Politécnica de Madrid

Correspondence e-mail: [elva.palacios@upm.es]

The morphological characteristics of fine roots are essential functional traits that mediate carbon and nutrient cycling in terrestrial ecosystems. Forest thinning is generally used to enhance forest productivity and functionality by optimizing stand structure, understory environment, and soil conditions. Here, we evaluate the effect of different thinning treatments on fine root traits in an afforestation of Pinus pinaster from the late 60s, in Jócar (Guadalajara, Spain), to learn how management practices influence belowground functioning of these non-natural stands. The treatments were conducted in 2018 and included moderate low thinning (20% basal area extraction of dominated trees), heavy low thinning (35% basal area extraction of dominated trees), heavy selective thinning (35 % basal area extraction, removing most competitive neighbors of 100 previously selected/ha) and no thinning. Specifically, we estimated average root diameter (RD), the specific root length (SRL) and fine root biomass (FRB) at 0-10 cm and 10-20 cm depths. We found that thinning intensity did affect those traits, decreasing RD and increasing SRL. On the other hand, FRB decreased with higher treatment intensity at 0-10cm depth, and increased at higher treatment intensity at 10-20 cm depth. We are also monitoring the availability of multiple soil nutrients, and soil respiration to get a holistic view of the soil biogeochemical cycles under contrasting thinning practices. Our study aims to understand whether belowground ecological processes are mediated by shifts in fine root functioning under common forest management activities.

[TSB.4-P-4]

Wednesday 4
Discussion corner: Room 7

Fungi and Fires: Fungal diversity of post wildfire high mountain beech forests at the southern distribution limit (Serra da Estrela, Portugal)

Greene, Lauren[1]; Miguel Costa, José[2]; Pedrosa, Maria João[3]; Marti-Leão, Arthur[4]; Correia, Marta[5]; Rodríguez-Echeverría, Susana[6]

(1) Center for Functional Ecology, University of Coimbra; (2) Centre for Functional Ecology; (3) Centre for Functional Ecology; (4) Centre for Functional Ecology; (5) Mediterranean Institute for Advanced Studies (IMEDEA); (6) Centre for Functional Ecology

Correspondence e-mail: [lauren.oliviagreene@gmail.com]

Beech forests (fagus sylvatica) host a rich variety of fungi that perform essential ecological functions, including breaking down organic material, recycling nutrients, and forming mutualistic associations with trees. Wildfires, which are common in terrestrial ecosystems, influence fungal communities by altering their traits, composition, and diversity. Fungal responses to fire lead to significant impacts on ecosystem processes such as nutrient cycling and overall functioning. As fire frequency and intensity rise due to climate change and the growing wildland-urban interface, understanding fire's effects on biodiversity and ecosystem properties has become an increasingly critical area of research.

A big wildfire affected a significant part of the Natural Park of Serra da Estrela (Portugal) in 2022, including the forests at the Upper Zezere Valley. Our study takes place two years post-fire, investigating fungal diversity in burnt and unburnt patches of beech forest in the area. Sampling of fungal sporocarps was done weekly from mid-September to the end of November, in both burnt and unburnt areas. Sampling was done along three transects (200m) in burnt and unburnt patches of beech forests.

Our results show a higher fungal diversity found in the unaffected beech forest, which also hosted a higher number of exclusive species. Notably, many of these species are symbionts, forming mycorrhizal relationships with the beech trees, such as species from the genus amanita. Community composition was different in both areas; the fungal community composition in the burnt area was dominated by wood-decaying saprotrophs (ex: Stereum hirsutum), as well as fungal parasites (ex: Tremella mesenterica).

[TSB.4-P-5]

Thursday 5
Discussion corner: Room 7

Effects of sustainable agricultural practices upon extensive environmental variability on nematode communities across diverse production systems in Spain

García Velázquez, Ana[1]

(1) IAS-CSIC

Correspondence e-mail: [agarciavelazquez@ias.csic.es]

Land use changes and agriculture intensification threaten soil biodiversity and health. Soil is one of the most biologically diverse ecosystems on Earth, with soil nematodes playing a critical role in ecosystem functioning. Nematodes are the most diverse and abundant soil invertebrates, occupying multiple trophic levels within the soil food web, and exhibiting various feeding behaviours (bacterial, fungal, and plant-parasitic) and lifestyles. Sustainable solutions, such as organic and regenerative agriculture, are increasingly recognized for their potential to mitigate soil health and biodiversity loss. Regenerative agriculture, in particular, focuses on improving soil health and increasing biodiversity through practices like no-tillage management, crop rotation, cover cropping, and reduced chemical inputs. However, the full extent of nematode diversity and its ecological impact under these agricultural systems remains underexplored. Therefore, we studied the effects of a large variability of cropping practices ranging from agricultural sustainability to intensive production practices on nematode communities across different production systems (conventional, organic, and regenerative), soil management practices (fertilization, tillage, no-tillage, irrigation, and cover crops), and soil and climatic variability. A total of 300 samples were collected from several cultivation plots, including both perennial, annual and horticulture crops such as pumpkin, wheat, olive, almond trees, and vineyards. Six soil samples were collected from each plot at a depth of 0–15 cm. Additionally, we included samples from nearby natural or minimally disturbed environments to deal with the complex and dynamic nature of ecosystems and the absence of complete in the absence of agricultural practices. To ensure broad geographic representation linked to high variability of climate and soil conditions, the selected sites were widely distributed across Spain, from South to North, including Córdoba, Granada, Murcia, Lleida, and Barcelona provinces.

[TSB.4-P-6]

Tuesday 3
Discussion corner: Room 7

Woody litterfall of mixed beech forests overyield pure stands in a temperature gradient

Hernández Alonso, Héctor[1]; Laforgue, Bastian[2]; Marande, Camille[3]; Marcet, Lùla[4]; Ourcival, Jean-Marc[5]; Morin, Xavier[6]

(1) Centre d'Ecologie Fonctionnelle et Evolutive; (2) Centre d'Ecologie Fonctionnelle et Evolutive; (3) Centre d'Ecologie Fonctionnelle et Evolutive; (4) Centre d'Ecologie Fonctionnelle et Evolutive; (5) Centre d'Ecologie Fonctionnelle et Evolutive; (6) Centre d'Ecologie Fonctionnelle et Evolutive

Correspondence e-mail: [hector.hernandez@cefe.cnrs.fr]

Many of the complex ecological functions in the forest-soil interface depend on deadwood, including soil health and carbon storage, being the latter an actively pursued goal to achieve "climate-neutrality" by 2050 in Europe. However, the challenge of implementing successful solutions needs to address the effects of abiotic and biotic factors driving carbon sink, including a possible overyielding effect of mixed forests contingent on species diversity.

The objective of this work was to test whether mixed forest stands show more very fine deadwood debris than pure stands, along a climatic Mediterranean-Alpine gradient (France) including six sites. In each site, forest plots were selected in monospecific beech (Fagus sylvatica) stands and to mixed stands of beech with either oak (Quercus pubescens) or fir (Abies alba). Deadwood was quantified in 49 plots and classified in three diametric classes: woody litterfall (<1 cm), fine woody debris (FWD: 1-5 cm) and coarse woody debris (CWD: 5-15 cm). Additionally, tree size was recorded to derive forest stand characteristics (plot basal area) and diversity indices (Shannon species diversity and Gini tree-size heterogeneity).

Preliminary results showed a contrasting effect of temperature on deadwood volume of pure stands that varied from negative in litterfall to positive in FWD and CWD. Litterfall volume increased according to Shannon index with a lesser effect on FWD and none on CWD. These results were also supported by the direct comparison between pure/mixed nested plots and highlight the relevance of mixed forest overyielding to drive carbon sink in the smallest fraction of deadwood.

[TSB.4-P-7]

Wednesday 4
Discussion corner: Room 7

Distinctive fungal communities in neighbor plantations of beech and pine forests in Serra da Estrela, Portugal

Pedrosa, Maria João[1]; Greene, Lauren[2]; Costa, José Miguel[3]; Marti, Arthur[4]; Correia, Marta[5]; Rodríguez-Echeverría, Susana[6]

(1) University of Coimbra, Centre for Functional Ecology, Associate Laboratory TERRA; (2) University of Coimbra, Centre for Functional Ecology, Associate Laboratory TERRA; (3) University of Coimbra, Centre for Functional Ecology, Associate Laboratory TERRA; (4) University of Coimbra, Centre for Functional Ecology, Associate Laboratory TERRA; (5) Mediterranean Institute for Advanced Studies (IMEDEA, CSIC-UIB), Esporles, Mallorca, Spain; (6) University of Coimbra, Centre for Functional Ecology, Associate Laboratory TERRA

Correspondence e-mail: [mjcpedrosa@hotmail.com]

Fungi are one of the largest, most diverse and under protected kingdoms of eukaryotes. They are also essential to forest ecosystems, playing key roles in nutrient cycling, soil formation, and plant health. Many forest fungi also produce mushrooms that can have economic value. Thus, understanding fungal diversity and community assembly is important for the sustainable conservation of forests.

A huge reforestation effort took place in the second half of the 20th century in the mountains of the Iberian Peninsula, creating new forests and expanding the distribution of some tree species. As part of this reforestation plan, Fagus sylvatica and Pinus pinaster were planted in the Upper Zezere Valley in Serra da Estrela, Portugal, creating a mosaic of deciduous and coniferous forests.

Little is known on the effect of these plantations of mountain biodiversity, and more specifically on the fungal diversity in this area. Thus, we did a survey of fungal sporocarps from September to November in contiguous, undisturbed, and unmanaged patches of beech and pine forests in this region.

Beech and pine forest fungal species richness was quite similar, despite showing differences in their species composition. However, fungal abundance in the beech forest was almost three times bigger than in pine forest. We also found a larger number of species exclusive to each forest type than those shared between forests. Most species found in this study are saprotroph, however, a higher percentage of ectomycorrhizal species was found in the pine forest.

[TSB.4-P-8]

Thursday 5
Discussion corner: Room 7

Reduced rainfall increases the impact of grazing pressure on plant production and soil carbon storage in Doñana seasonal grasslands

Sánchez, Inés M[a1]; Belenguer-Manzanedo, María[2]; Monje, Jorge[3]; Pessano, Tatiana[4]; Crespo Valles, Julia[5]; Santamaría, Luis[6]

(1) University College Dublin (UCD) / Doñana Biological Station (EBD-CSIC); (2) Doñana Biological Station (EBD-CSIC); (3) Doñana Biological Station (EBD-CSIC); (4) Doñana Biological Station (EBD-CSIC); (5) Doñana Biological Station (EBD-CSIC); (6) Doñana Biological Station (EBD-CSIC)

Correspondence e-mail: [ines.sanchezgarcia@ucdconnect.ie]

Grasslands play a critical role in carbon storage, influenced by precipitation patterns and herbivory. Understanding how these factors interact is essential to predict ecosystem responses to climate warming and foster the adaptation of pastoral systems and wildlife reserves to such changes. We investigated how long-term changes in rainfall modulate the impact of grazing pressure on soil organic carbon of Mediterranean grasslands. A total of 15 fenced plots were established at the annual grassland ('vera') of the Doñana Biological Reserve and randomly assigned to three rainfall treatments (+30%, -30% and unmodified control; N=5 per treatment). Within each plot, six treatments simulated different grazing pressures by manually clipping at different time frequencies (every 2, 4, 6, 8 and 12 weeks, starting in October, plus a control that was only harvested following senescence and seed shedding at the end of the growth season, by mid May). Biomass obtained after clipping, including the final harvest, was used to estimate annual aboveground biomass yield. Soil organic carbon was sampled once after four years. Plant production (annual aboveground yield), as well as soil porosity and organic carbon content, decreased monotonically with increasing grazing pressure. Reduced rainfall amplified the effect of herbivory on biomass yield, particularly at the highest grazing pressure; but it reduced its effect on soil parameters, such as bulk density. Herbivory and reduced rainfall, as expected under climate warming, have complex and self-reinforcing effects on plant production and soil carbon storage, which should be incorporated into the management of pastoral system and conservation areas.

[TSB.4-P-9]

Tuesday 3
Discussion corner: Room 7

Size-dissected rhizospheric soil microbial communities show functional and compositional shifts through pore-size filtration

López García, Álvaro[1]; Gómez-Muñoz, Beatriz[2]; Bastida, Jesús[3]; Lendínez, Sandra[4]; Cáceres, Nerea[5]; Tercero, Amanda[6]; Azcón-Aguilar, Concepción[7]; Alcántara, Julio M.[8]; Garrido, José L.[9]

(1) Estación Experimental del Zaidín, EEZ-CSIC; (2) Estación Experimental del Zaidín, EEZ-CSIC; (3) Estación Experimental del Zaidín, EEZ-CSIC; (4) Estación Experimental del Zaidín, EEZ-CSIC; (5) Estación Experimental del Zaidín, EEZ-CSIC; (6) Universidad de Jaén; (7) Estación Experimental del Zaidín, EEZ-CSIC; (8) Universidad de Jaén; (9) Estación Experimental del Zaidín, EEZ-CSIC

Correspondence e-mail: [alvaro.lopez@eez.csic.es]

Introduction. Soil microbial communities play critical roles in ecosystem functioning, but disentangling the contributions of specific microbial groups remains a challenge. We tested a filtration-based method to selectively partition soil microbial communities into functional groups based on pore size. Rhizosphere soils from five Mediterranean tree and shrub species were processed at four filtration levels: unfiltered soil, 2000 µm (bulk community), 20 µm (excluding arbuscular mycorrhizal fungi), and 5 µm (excluding fungi, retaining primarily bacteria).

Material and methods. The effectiveness of these filters in excluding targeted groups was validated using quantitative PCR (qPCR). To explore the functional implications of these partitions, we assessed microbial metabolic activity using MicroResp and community composition via metabarcoding.

Results and discussion. Results demonstrated that filtration effectively reduced the abundance of specific microbial groups, confirming its utility as a methodological tool. Functional profiles revealed increasing stochasticity across replicates as pore size decreased, suggesting a loss of functional redundancy in smaller microbial subsets. Compositionally, microbial community structure explained a significant portion of the observed functional variability, underscoring the tight linkage between community assembly and functional outcomes.

This study highlights the utility of pore-size filtration for dissecting soil microbial community functions and provides insights into the roles of distinct microbial groups in Mediterranean ecosystems. Our findings also underscore the importance of maintaining diverse microbial communities to ensure ecosystem functions are preserved, particularly in the face of environmental changes.

[TSB.4-P-10]

Wednesday 4
Discussion corner: Room 7

N:P stoichiometric shifts induced by N deposition in forests: coupled or uncoupled across organization levels?

Carreira de la Fuente, José Antonio[1]; Alonso, Rocío[2]; Calatayud Lorente, Vicent[3]; Viñegla Pérez, Benjamín[4]

(1) University of Jaén; (2) Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas (CIEMAT); (3) Center for Environmental Studies of the Mediterranean (CEAM); (4) University of Jaén

Correspondence e-mail: [jafuente@ujaen.es]

Chronic atmospheric deposition of pollutant reactive nitrogen (Nr) and subsequent increase in N availability can lead to resource:consumer stoichiometric tensions. Changes in N/P ratios has been extensively described along Nr deposition gradients, especially in forests on P-poor soils. But we lack a mechanistic explanation of why soil and plants N/P stoichiometric shifts are sometimes coupled, while in other cases they are uncoupled.

We monitored pollutant gases, rain and stream waters, soils and plant tissues in locations at increasing distances from the Bay of Algeciras (S. Spain). Two types of forests were sampled; Abies pinsapo forests on serpentines and Quercus suber forests on Miocene sandstones.

We found consistent variations between both forest types in N/P stoichiometry of streams and plants (as indicated by water Cl-/NO3- and PO43-/NO3- ratios, and foliar N/P ratios, respectively). The nearer from the pollution source, the lower these ratio values, indicating increasing N/P tensions at elevated Nr deposition rates both at the catchment and at the plant levels. In Pinsapo forests, we also found that the higher the soil available N/P ratio, the higher the plant-tissue N/P ratio. However, in cork-oak forests, while plant-tissue N/P ratios decreased with distance from the pollution source, soil available N/P ratios increased. To explain why resource and consumer N/P stoichiometry can be either coupled or uncoupled along N deposition gradients, we propose a conceptual model that considers, depending on bedrock type, which nutrient (either N or P) was initially limiting forest production before the onset of a N saturation state.

[TSB.4-P-11]

Thursday 5
Discussion corner: Room 7

Effect of chickpea (Cicer arietinum L.) cultivar diversity on soil microbiota in rainfed cereal-legume rotation

Romero Caballero, Efrén[1]; Merino Marín, Luis[2]; Sánchez Álvarez, Ana[3]; Alarcón Víllora, Remedios[4]; Hernández Plaza, Eva[5]

(1) Universidad Alcalá de Henares; (2) Universidad Rey Juan Carlos (URJC); (3) Universidad Rey Juan Carlos (URJC); (4) Instituto Madrileño de Investigación y Desarrollo Rural, Agrario y Alimentario (IMIDRA); (5) Instituto Nacional de Investigación y Tecnología Agraria y Alimentaria, Madrid (INIA-CSIC)

Correspondence e-mail: [efren.romero@edu.uah.es]

Introduction. Agroecological practices that eliminate the use of synthetic chemical inputs for weed control and recognize soil as a living organism with important ecological processes generate resilient soils essential for adapting to climate change. The CEREDIV project investigates whether increasing chickpea functional diversity through cultivar mixtures can maintain yield stability, reduce external inputs for weed management, and enhance soil microbial functional diversity.

Material and methods. In 2021, a wheat-chickpea rotation experiment was established with four blocks, comparing mixtures of 2, 4, and 8 chickpea cultivars with monocultures. Each diversification treatment was replicated three times per block, totaling 48 plots (80m² each). Soil samples from 20 plots were analyzed for microbial functional diversity using MSIR technique with MicroResp, while samples from all plots underwent NGS sequencing for microbial composition and structure analysis.

Results. The results indicate that increasing chickpea functional diversity does not affect basal soil respiration, measured by water metabolization, or potential respiration, measured by substrate-induced respiration using glucose. Soil microbial functional diversity shows minimal variation with the complexity of chickpea cultivar mixtures. The relationship between these changes in functional diversity and the composition of the soil microbial community is currently being analyzed through 16S and ITS sequencing results. These findings, although unexpected, might suggest the need for strategic planning in combining chickpea cultivars to maximize production without compromising the benefits of a diversified herbaceous community. Further research is needed to understand the mechanisms underlying these observations and to optimize cultivar combinations to enhance soil health and crop productivity.

[TSB.4-P-12]

Tuesday 3
Discussion corner: Room 7

Regenerative agriculture impact on soil carbon and microbial function

Gallardo, Antonio[1]; Rodríguez León, Francisco[2]; Delgado-Baquerizo, Manuel[3]; Flores, Amando[4]; Canosa, Inés[5]

(1) Universidad Pablo de Olavide; (2) ECUÓRUM Servicios Ecosistémicos; (3) Instituto de Recursos Naturales y Agrobiología de Sevilla (IRNAS), CSIC, Sevilla, Spain; (4) Centro Andaluz de Biología del Desarrollo, CSIC, Universidad Pablo de Olavide, Junta de Andalucía; (5) Centro Andaluz de Biología del Desarrollo, CSIC, Universidad Pablo de Olavide, Junta de Andalucía

Correspondence e-mail: [agallardo@upo.es]

Introduction. Regenerative agriculture goes beyond the usual practices in organic farming, with special emphasis on soil restoration, biodiversity maintenance, and climate change mitigation. One of the distinctive elements of regenerative agriculture is the lack of tillage, the maintenance of green cover, and the rational use of livestock. Prior evidence indicated that regenerative practices could increase soil carbon, but there is little information on the effect on organic matter properties and microbial function and diversity.

Material and methods. We selected 20 paired plots located in agricultural and livestock farms in three provinces (Badajoz, Seville and Córdoba). Each pair of plots consisted of an area under regenerative management and an adjacent area under traditional or ecological management, separated by a wire fence. The main difference between the two management systems was the lack of tillage and the livestock management. Both plots were under the same management until 3, 4 and 10 years ago, depending on the farm. Soil samples were taken in July and November 2024 to analyse variables related to soil organic matter and carbon, soil nutrients, microbial diversity and function, and soil physical properties.

Results and discussion. The results depended largely on the context of each farm and the time elapsed since the implementation of regenerative management. The clearest differences occurred in the plots with 10 years of management, where an increase in soil organic matter and carbon, a greater degree of recalcitrance and decomposition of the organic matter, and a large incorporation of plant aliphatic compounds were observed.

[TSB.4-P-13]

Wednesday 4
Discussion corner: Room 7

Soil Conservation for Climate Change Mitigation: Effects of Mulch and Biochar on Erosion Control and Organic Matter Losses

Canedo, João[1]; Coelho, Luísa[2]; Lameira, Bernardo[3]; Munõz-Rojas, José[4]; Bash, Gotlieb[5]; Pinto Cruz, Carla[6]; Marques, João Tiago[7]; Prats, Sergio[8]

(1) Évora University; (2) MED Mediterranean Institute for Agriculture Environment and Development; (3) MED Mediterranean Institute for Agriculture Environment and Development - Évora University; (4) MED Mediterranean Institute for Agriculture Environment and Development - Évora University; (5) MED Mediterranean Institute for Agriculture Environment and Development - Évora University; (6) MED Mediterranean Institute for Agriculture Environment and Development - Évora University; (7) MED Mediterranean Institute for Agriculture Environment and Development - Évora University; (8) MED Mediterranean Institute for Agriculture Environment and Development - Évora University

Correspondence e-mail: [joao.canedo@uevora.pt]

Soil plays a pivotal role in climate change mitigation. However, human activities have accelerated soil degradation, contributing to erosion and desertification. This study, in the framework of SOLVO, SOLVIT and BIOMONTADO projects, investigated the effects of measures to conserve and restore soils, such as soil cover treatments using mulch and mulch+biochar on erosion reduction across eight agro-ecosystems sites in Portugal: four vineyards, two olive groves, and two cork oak woodlands (montado). Each site included three treatments with 3 replicated plots each: control, mulch layer (2 Mg per ha); and mulch + biochar (2 + 10 Mg of Acacia wood-derived biochar per ha). Mulch materials were straw in vineyards and montado, and olive leaves in olive groves. Sediment fences were installed at the base of 150-300 m2 plots with slopes ranging from 6º to 17º. Monthly sediment collections were conducted during a year, and dry matter fractions (<2 mm and >2 mm stones, biochar, litter) and organic matter were quantified, to determine carbon losses by soil erosion.

Our results show a significant reduction in soil erosion, especially in the steepest olive groves, with 89.3% reduction in the mulch and 62.2% reduction in the mulch+biochar treatment as compared to the untreated plots. Organic matter contents were higher in the mulch+biochar treatment, but the mitigation in erosion resulted in low net organic matter losses. These findings highlight the potential of mulch and biochar applications as effective strategies for mitigating soil erosion and reducing carbon losses, particularly in sloped agricultural systems.

TSB.5. Advancing the understanding of plant ecophysiology to inform global vegetation models

Monday, 2 (18:00-19:30)

Room: Restaurante

Natural ecosystems are increasingly threatened by global environmental changes. Rising temperatures driven by climate change are causing higher atmospheric vapour pressure deficits, while drought episodes are expected to become more frequent and severe in many regions of the globe. These novel conditions are likely to affect the productivity and survival of terrestrial woody plants, disrupting water, carbon and biogeochemical cycles, and altering ecosystem dynamics. To better predict these changes, and thus inform adaptive ecosystem management, it is essential to gain a deeper understanding of how plants respond to environmental cues. This session aims to bring together recent research on plant and ecosystem functioning, using both empirical and modelling approaches, with a particular emphasis on studies bridging plant ecophysiology and vegetation models.

Organizers:

• **Laura Fernández de Uña,** Universidade de Vigo

• **Víctor Flo Sierra,** Universitat Autònoma de Barcelona; Raquel Lobo-do-Vale, Universidade de Lisboa.

TSB.5. Orals

[TSB.5-O-1]

Monday 2, evening: 18:00
Room: Restaurante

Contrasting drought adaptive strategies in Mediterranean perennial grasses

Hidalgo-Galvez, Maria Dolores[1]; Akhoun-Piernicka, Chaïa[2]; Cardozo, Gerónimo A.[3]; Morvan-Bertrand, Annette[4]; Prud'homme, Marie-Pascale[5]; Barkaoui, Karim[6]; Morcillo, Luna[7]; Vilagrosa, Alberto[8]; Volaire, Florence[9]

(1) CEFE, France / Univ Seville, Spain / CEAM Foundation, Spain; (2) CEFE, Univ Montpellier, CNRS, INRAE, EPHE, IRD, Montpellier, France; (3) CEFE, France / INIA, Uruguay; (4) Normandy Univ, UNICAEN, INRAE, EVA, France; (5) Normandy Univ, UNICAEN, INRAE, EVA, France; (6) CIRAD, UMR AMAP, France / AMAP, Univ Montpellier, CIRAD, CNRS, INRAE, IRD, France; (7) Mediterranean Center for Environmental Studies (CEAM Foundation), Spain; (8) Mediterranean Center for Environmental Studies (CEAM Foundation), Spain; (9) CEFE, Univ Montpellier, CNRS, INRAE, EPHE, IRD, Montpellier, France

Correspondence e-mail: [mdhidalgogalvez@gmail.com]

Mediterranean grasslands are exposed to intensifying droughts, jeopardizing their survival. Understanding drought-induced plant mortality is key to predict grassland resilience to climate change. We conducted a glasshouse experiment on drought survival, focusing on dehydration tolerance and embolism resistance, considering that dehydration tolerance of leaf bases (including meristems) correlates with soil dehydration tolerance, allowing standardised comparisons via the critical soil water potential. We studied four Mediterranean perennial grasses (Dactylis glomerata, Stipa tenacissima, Dactylis glomerata subsp. hispanica and Stipa pennata) along an aridity gradient from Morocco, Spain, and France. Plants were grown in 4L pots during 113 days, and after plant establishment, were submitted to a gradual drought increase during 61 days. During that period, we regularly monitored tissue water content, water and osmotic potentials, membrane damage, and carbohydrate accumulation. Ten days after rehydration we assessed plant survival. We also measured leaf embolism thresholds (P50). Species from more arid environments (S. tenacissima and both Dactylis) showed higher dehydration tolerance (50% survival rate at a lower soil water potential and lower tissue water content), than species from less arid environments (S. pennata). The high dehydration tolerance of both Dactylis was correlated to a greater fructan accumulation in leaf bases (surviving organs in grasses). Conversely, Stipa species showed higher embolism resistance (lower P50) than both Dactylis, correlated to its higher sucrose content. This unexpected decoupling between dehydration tolerance and embolism resistance highlights diverse drought-adaptive strategies in Mediterranean perennial grasses. Our results provide valuable insights for selecting species in ecological restoration under future climate scenarios.

[TSB.5-O-2]

Monday 2, evening: 18:15
Room: Restaurante

Climate and plant traits drive variation in ecosystem productivity in southern Rocky Mountains

Chacon Labella, Julia[1]; Hinojo-Hinojo, Cesar[2]; Vandvik, Vigdis[3]; Enquist, Brian J.[4]

(1) Universidad Autónoma de Madrid; (2) Universidad de Sonora; (3) University of Bergen; (4) University of Arizona

Correspondence e-mail: [julia.chacon@uam.es]

Photosynthetic and plant respiration rates are key components of the carbon cycle, influenced by plant functional traits and climatic constraints on metabolism. While temperature and water availability are known drivers of the carbon fluxes, it remains unclear whether variations in these rates result from direct climatic effects or indirect effects mediated by plant functional traits or biomass. This distinction is critical for predicting carbon fluxes responses to climate change.We propose a framework where variation in three carbon flux components—net ecosystem exchange (NEE), gross primary productivity (GPP), and ecosystem respiration (ER)—is influenced by both direct climatic effects and indirect effects mediated through plant community dynamics and functional traits. We hypothesize that indirect effects are primarily driven by traits along the fast-slow economic spectrum, with fast-traits linked to higher productivity and respiration. To test this, we used carbon flux data from alpine meadows in the southern Rocky Mountains collected between 2007 and 2024 paired with community composition, leaf trait, and climatic data collected during the same period. Our results show that variation in NEE, GPP, and ER arises from both direct climatic impacts and indirect effects through community-level functional composition. Indirect effects via leaf traits were nearly as significant as direct climate influences, with fast-slow traits dominating over NP ratios in explaining flux variation. These findings underscore the need to integrate climate projections with community functional dynamics to improve predictions of ecosystem responses to global change.

[TSB.5-O-3]

Monday 2, evening: 18:30
Room: Restaurante

Simulation of the effects of climate change by rainfall exclusion in Quercus faginea and Pinus pinea

San Miguel Oti, Francisco[1]; Ruiz de Larrinaga, Lorena[2]; Artetxe, Unai[3]; Esteban, Raquel[4]; Curiel Yuste, Jorge[5]

(1) BC3-Basque Centre for Climate Change; (2) University of Basque Country (UPV/EHU); (3) University of Basque Country (UPV/EHU); (4) University of Basque Country (UPV/EHU); (5) BC3-Basque Centre for Climate Change

Correspondence e-mail: [fransanoti@gmail.com]

Plant species have traditionally been classified as “isohydric” or “anisohydric” based on their ability to regulate stomatal closure under water stress. However, this classification has limitations, as a continuous range exists between these strategies. This variability is linked to the hydraulic capacity of the plant’s water transport system and its tolerance to lower water potentials. The physiological mechanisms enabling a range of water potentials remain poorly understood. To investigate this, a simulation of climate change effects was conducted by installing rain exclusion structures on individual trees in Vitoria-Gasteiz, Spain. Eight exclusion umbrellas were deployed: four in a Quercus faginea Lam. forest and four in a Pinus pinea L. plantation. Eight control trees (four Q. faginea and four pines) were also selected, totalling 16 individuals. The umbrellas, covering approximately 16 m² each, were installed seasonally in 2022 and 2023. Several responses to induced drought conditions were monitored, including radial growth using digital point-dendrometers (TOMST), microclimate variables with sensors, leaf non-structural carbohydrate (NSC) concentrations and photosynthetic variables. Results showed significant differences between species. Pinus pinea (isohydric) experienced reduced radial growth and NSC reserves in drought treatment, while Quercus faginea (anisohydric) exhibited increased growth and accumulated reserves in drought treatment. Photosynthetic measurements indicated enhanced light uptake in Q. faginea under drought and stress in P. pinea. These findings highlight how surface drought can influence species’ physiological responses based on their isohydric and anisohydric strategies, offering insights into adaptive mechanisms under climate change.

[TSB.5-O-4]

Monday 2, evening: 18:45
Room: Restaurante

Inter-annual water fluxes in Mediterranean pine forests: linkages among precipitation, pine transpiration, and aquifer recharge

Vilagrosa Carmona, Alberto[1]; Sabater, Ana M[2]; Morcillo, Luna[3]; Moutahir, Hassane[4]; Valiente, José Antonio[5]; Larsen, Elisabeth K[6]; Bellot, Juan[7]

(1) Fundación CEAM; (2) Fundación CEAM; (3) Fundación CEAM; (4) 6Institue of Meteorology and Climate Research (IMK-IFE); (5) Fundación CEAM; (6) The Royal Horticultural Society (RHS); (7) Univ. Alicante

Correspondence e-mail: [a.vilagrosa@ua.es]

In terrestrial ecosystems, evapotranspiration, particularly tree transpiration, recycles a significant portion of precipitation back into the atmosphere, influencing aquifer recharge and the global water cycle. Mediterranean areas are characterized by high inter-annual variability in precipitation, a trait expected to intensify with climate change, impacting forest water fluxes and functioning. Aleppo pine (Pinus halepensis) forests, which dominate vast areas of the Mediterranean Basin, exhibit transpiration patterns primarily driven by abiotic factors, particularly precipitation regimes.

This study investigated the interannual variability of key water flux components in Aleppo pine forests under varying precipitation conditions. Data were collected over four years from two forests in the Western Mediterranean Basin (eastern Spain) using sap flow techniques, soil moisture probes, and the HYDROBAL ecohydrological model. Key parameters analyzed include annual precipitation (P), pine transpiration (T), total ecosystem evapotranspiration, and aquifer recharge.

Despite the precipitation ranging from 337 to 543 mm per year, annual transpiration remained relatively stable (102–158 mm/year), leading to considerable variation in the T/P ratio (20–44%). Pine transpiration accounted for approximately 56% of total ecosystem evapotranspiration, which varied proportionally with annual precipitation. Importantly, aquifer recharge was influenced by the water unused by pines, highlighting its dependence on precipitation patterns and pine water use strategy.

These findings underscore the critical role of Aleppo pine in shaping the water dynamics in Mediterranean ecosystems. Future research should explore adaptive management strategies and incorporate advanced hydrological models to better predict vegetation-water interactions under changing climatic conditions, thereby enhancing sustainable forest and water resource management.

[TSB.5-O-5]

Monday 2, evening: 19:00
Room: Restaurante

A modular framework for process-based simulations of forest function and dynamics at stand to regional scales

De Cáceres Ainsa, Miquel[1]; Granda, Víctor[2]; Tovar, Adriana[3]; Molowny-Horas, Roberto[4]; Martínez-Vilalta, Jordi[5]; Mencuccini, Maurizio[6]; González-Sanchis, María[7]; D'Adamo, Francesco[8]; Espelta, Josep Maria[9]; Balaguer-Romano, Rodrigo[10]; Beltrán, Mario[11]; Aquilué, Núria[12]; Morales-Hernández, Mario[13]; Caviedes-Voullième, Daniel[14]; Descals, Adrià[15]; Cabon, Antoine[16]; Gea-Izquierdo, Guillermo[17]; Lloret, Francisco[18]; Cochard, Hervé[19]; Ruffault, Julien[20]; Pimont, François[21]; Veuillen, Léa[22]; Poyatos, Rafa[23]; Llorens, Pilar[24]; García-Valdés, Raúl[25]; Nadal-Sala, Daniel[26]; Sabaté, Santiago[27]; Morin, Xavier[28]; Batllori, Enric[29]; Ameztegui, Aitor[30]; Martin-StPaul, Nicolas[31].

(1) CREAF; (2) CREAF; (3) CREAF; (4) CREAF; (5) Universitat Autònoma de Barcelona; (6) CREAF; (7) Universitat Politécnica de Valencia; (8) CREAF; (9) CREAF; (10) CREAF; (11) Forest Science and Technology Centre of Catalonia (CTFC); (12) Forest Science and Technology Centre of Catalonia (CTFC); (13) Universidad de Zaragoza; (14) Forschungszentrum Jülich; (15) CREAF; (16) Swiss Federal Institute for Forest, Snow and Landscape Research WSL; (17) Instituto de Ciencias Forestales ICIFOR (INIA-CSIC); (18) Universitat Autònoma de Barcelona; (19) Université Clermont-Auvergne, INRAE; (20) Écologie des Forêts Méditerranéennes (URFM), INRAE; (21) Écologie des Forêts Méditerranéennes (URFM), INRAE; (22) Écologie des Forêts Méditerranéennes (URFM), INRAE; (23) Universitat Autònoma de Barcelona; (24) Institute of Environmental Assessment and Water Research (IDAEA-CSIC); (25) Rey Juan Carlos University; (26) Facultat de Biologia, University of Barcelona (UB); (27) Facultat de Biologia, University of Barcelona (UB); (28) CEFE, Univ Montpellier, CNRS; (29) Facultat de Biologia, University of Barcelona (UB); (30) Universitat de Lleida; (31) Écologie des Forêts Méditerranéennes (URFM), INRAE.

Correspondence e-mail: [miquelcaceres@gmail.com]

Ongoing global change – which includes extreme climatic events, changes in disturbance regimes or land use changes – is impacting functioning and dynamics of forest ecosystems in multiple ways. Anticipating potential impacts of global change-drivers on forests, and on the ecosystem services they provide, is dependent on accurate estimation of functional, structural and compositional changes on the basis of known mechanisms. While dynamic global vegetation models are commonly used as components in earth system models for global-scale simulations, there is a need for analogous process-based frameworks facilitating the evaluation of global change impacts on forest ecosystems at finer scales, ranging from stand to landscapes or small regions. Here we present a set of R packages conforming an interoperable and modular simulation framework that aims to fulfill this need. In its core packages, the framework includes a set of nested functions for the simulation of local processes in individual stands as well as functions including spatial processes for landscape- and regional-level simulations. A second set of packages are designed to assist the creation of inputs, including weather interpolation, initialization from forest inventory data and estimation of species parameters from functional plant trait databases. The simulation framework is continuously developed as a collaborative effort between several institutions and includes benchmark datasets for evaluation of predictions against observations at tree, stand, watershed and regional levels. While additional efforts are still required to expand its capabilities, we illustrate usefulness of the framework by briefly listing a set of applications spanning different purposes.

[TSB.5-O-6]

Monday 2, evening: 19:15
Room: Restaurante

Plant strategies of two oak species (Quercus petraea and Quercus pyrenaica) in response to stress conditions in post-mining lands

Alonso-Zaldivar, Herminia[1]; Manso-Arribas, Miguel[2]; deTorre-Sáez, Ana[3]; Martínez-Ruiz, Carolina[4]; García-Duro, Juan[5]

(1) Sustainable Forest Management Research Institute (iuFOR), University of Valladolid; (2) Sustainable Forest Management Research Institute (iuFOR), University of Valladolid; (3) Sustainable Forest Management Research Institute (iuFOR), University of Valladolid; (4) Sustainable Forest Management Research Institute (iuFOR), University of Valladolid; (5) Sustainable Forest Management Research Institute (iuFOR), University of Valladolid

Correspondence e-mail: [herminia.alonso22@uva.es]

Ecological restoration in perturbed environments addresses multiple challenges. The establishment of quercine trees in open-cast coal mines of northern Palencia faces the summer drought of the sub-humid Mediterranean climate accentuated by the lack of mine-soil structure. These limiting factors cause water stress that shrubs can ameliorate through microenvironmental improvement.

We aim to assess the leaves' response to stress under different shrub covers in two oak species (Quercus petraea and Q. pyrenaica) and their relationship with plant strategies. Leaf area, dry and fresh leaf weight, and photosynthetic efficiency (Fv/Fm) were measured in 150 leaves from 14-year-old planted trees, at three summer moments (early-, mid-, and late-summer), under three shade levels provided by shrubs and/or the oak themselves (light, medium shade and total shade). We categorised the species' strategies based on their leaf traits following Grime's CSR classification via StrateFy.

Our results indicated that both species were mainly stress-tolerant and slightly competitive (S-CS). However, Q. pyrenaica leaves showed higher stress tolerance than Q. petraea leaves, as late-summer vs early-summer leaves, and light leaves vs total shaded leaves. Moreover, Fv/Fm was below 0.79 for the light leaves indicating the greater stress they endure.

Shrubs can therefore mitigate the exposure of oak leaves to environmental stress, although this effect depends on the Quercus species and the season. Thus, the role of nurse shrubs should be considered as a potential tool for disturbed ecosystem reforestation.

Funding: MICIU/AEI/10.13039/501100011033/FEDER-EU Project; Predoctoral contracts PREP2022-000580 and CONTPR-2022-400; INVESTIGO-SEPE-2023 (CP23/178) and post-doctoral UVa-María-Zambrano (CONVREC-2021–11) contracts (EU–NextGenerationEU program).

TSB.5. Posters

[TSB.5-P-1]

Wednesday 4
Discussion corner: Room 12

Spatiotemporal dynamics of water uptake sources in a Scots pine forest at the southerneastern Pyrenees

Cara Abad, Paula[1]; Barbeta, Adrià[2]; Llorens, Pilar[3]; Latron, Jérôme[4]; Castro-López, Ariel[5]; Alharfouch, Loujain[6]; Gutiérrez, Emilia[7]; Martínez-Sancho, Elisabet[8]

(1) University of Barcelona; (2) Institute of Agrifood Research and Technology (IRTA); (3) Institute of Environmental Assessment and Water Research (IDAEA-CSIC); (4) Institute of Environmental Assessment and Water Research (IDAEA-CSIC); (5) Institute of Environmental Assessment and Water Research (IDAEA-CSIC); (6) Institute of Environmental Assessment and Water; (7) University of Barcelona; (8) University of Barcelona

Correspondence e-mail: [paulacaraabad@gmail.com]

Forests are crucial for regulating the climate, as the water that evaporates through transpiration is a vital component of the water cycle. Our understanding of forest water uptake is still limited, although it is crucial to make reliable predictions of local and global hydrologycal processes in the context of climate change. The isotopic composition of water molecules is a powerful tracer of the Earth's water cycle, as isotopic differences between water reservoirs, mixing, and fractionation processes associated with phase changes can be used to trace water movements through the soil-plant-atmosphere continuum.

Our study aims to analyse the isotopic composition of water in several ecohydrological compartments to identify the source water of trees. To do so, samples of water from precipitation, different soil depths, and the xylem of four Scots pine (Pinus sylvestris L.) individuals were collected every two weeks during the growing season 2024 in a forest plot located in the Vallcebre Research Catchments (SE Pyrenees). Bulk soil was extracted using cryogenic vacuum distillation whereas sap water was collected using a flow-rotor centrifuge (cavitron). All extracted water samples were analyzed to obtain the stable isotope ratios (d2H and d18O). Isotope mixing models were applied to quantify the contribution of different sources to the xylem water and to evaluate how these sources vary spatially and temporally. Our results provide insights into the spatiotemporal variation crucial to determine how vegetation regulates the fluxes of water returning to the atmosphere and how it influences the water that flows downstream into other hydrological compartments.

[TSB.5-P-2]

Thursday 5
Discussion corner: Room 12

Reconciling water-use efficiency estimates across scales under future climate change scenarios using phloem carbon isotopic composition

Gimeno, Teresa[1]; López Castro, Guillermo[2]; Miranda Apodaca, Jon[3]; Pérez López, Usue[4]

(1) CREAF; (2) Basque Centre for Climate Change; (3) Universidad del País Vasco; (4) Universidad del País Vasco

Correspondence e-mail: [t.gimeno@creaf.uab.cat]

Water Use Efficiency (WUE) is key to predict vegetation functioning. In a scenario with rising mean temperature and drought stress, WUE emerges as a pivotal trait to predict the ability of the vegetation to serve as an effective carbon sink and contribute to mitigate climate change. Traditionally, WUE is estimated from destructive measurements, gas-exchange or remote-sensing products, among others. Some of these approaches are laborious, technically demanding and require repeated measurements (e.g. leaf-level gas-exchange or eddy covariance). Others only offer coarse estimates (e.g. remote sensing). The carbon isotopic composition of plant materials (d13C) is a good proxy of WUE that reflects WUE along the ontogeny of the organ sampled (leaves or wood). Phloem d13C is a good intermediate proxy that should reflect WUE at the whole-plant level and over a discrete time window. In this project, we sampled phloem d13C of Fagus sylvatica grown under controlled conditions and in native forests. Our goal was to assess the reliability of phloem d13C as a proxy of whole-tree WUE under contrasting climatic conditions. We found that phloem d13C reflected the impact of elevated CO2, temperature and water-availability. The caveat was that to model WUE from measurements of phloem d13C we needed to incorporate either an estimate of the internal resistance of CO2 inside the leaf and/or specific parameters for each type of tissue (leaf, wood or phloem). Combining such estimates from the literature, together with measurements of phloem d13C could serve as a smart strategy to expand WUE estimates for remote forests.

[TSB.5-P-3]

Tuesday 3
Discussion corner: Room 12

Functional strategies and water use in plant communities in sub-Mediterranean zones

Maluenda Garín, Clara[1]; García de la Riva, Enrique[2]; Marcos Porras, Elena[3]; Muñoz Gálvez, Francisco[4]; Querejeta, José Ignacio[5]; González Barberá, Gonzalo[6]; Lehmann, Marco M[7]; Calvo Galván, Leonor[8]; Prieto Aguilar, Iván[9]

(1) Universidad de León; (2) Universidad de León; (3) Universidad de León; (4) CEBAS-CSIC; (5) CEBAS-CSIC; (6) CEBAS-CSIC; (7) 3Swiss Federal Institute for Forest, Snow and Landscape Research WSL; (8) Universidad de León; (9) Universidad de León

Correspondence e-mail: [cmalg@unileon.es]

The Iberian Peninsula represents one of the broadest boundaries between Mediterranean and Eurosiberian vegetation, including highly diverse Sub-Mediterranean zones. Within these transitional areas, small environmental changes allow the coexistence of rear-edge plant communities dominated by Eurosiberian species (e.g. Betula sp.), Mediterranean species (e.g Quercus pyrenaica), and transitional communities where both types of species co-dominate. However, these ecotonal communities are highly vulnerable to climate change-driven warming and drying. We examined whether the Mediterranization of plant communities entails a shift in their functional resource-use strategies, including water uptake patterns. We measured key leaf traits linked to the LES (leaf economics spectrum: Leaf Mass Area (LMA), Leaf Dry Matter Content (LDMC) and nutrients), leaf isotopic composition (?13C and ?18O as proxies of time-integrated water use efficiency (WUEi) and stomatal conductance (gs)) and leaf gas exchange (photosynthesis (A), gs, WUEi and instantaneous (WUEt)), and stem and soil water isotopes (?18O and ?2H) for species representing 95% cover of the total community composition.A Principal Component Analysis (PCA) revealed a continuum between conservative species (high LMA and LDMC, low nutrients, negative scores) to acquisitive species (opposite trait values, positive scores) along LES. Communities segregated along this axis with Mediterranean communities exhibiting significantly lower scores than Eurosiberian communities, and mixed communities in between. This first axis was positively correlated to carbon uptake (A) and to water use traits (WUEi and WUEt) and was negatively correlated with plant uptake depth (xylem ?18O). This suggests that, as communities become increasingly Mediterranean in response to warmer and drier conditions, plant strategies will shift from acquisitive to conservative along the LES in C and nutrient uptake but also in their water use patterns.

[TSB.5-P-4]

Wednesday 4
Discussion corner: Room 12

How do hydrological conditions influence plant water source partitioning in coastal dunes?

Antunes, Cristina[1]; Chozas, Sergio[2]; Pelle, Jeroen[3]

(1) CE3C - Centre for Ecology, Evolution and Environmental Changes; (2) CE3C - Centre for Ecology, Evolution and Environmental Changes; (3) Wageningen University & Research

Correspondence e-mail: [cmaantunes@fc.ul.pt]

Groundwater changes can affect water balance and plant health in ecosystems dependent on it. Water-table depletion is a concern in regions with dry seasons and high water use, like the coastal dunes of the Iberian Peninsula. Plants in these ecosystems rely on drought strategies and the ability to use the available water. This study aims to understand water-resources use, GW dependency, community water partition, and vulnerability of dune plant communities in SW Portugal. To preserve them, it's essential to understand how plants react to changes in water availability and how co-existing species depend on different water sources under varying hydrological conditions.

We sampled six woody species in contrasting hydrological conditions (shallow and deep water-table; and before and after a rain event) in a dry period in the Troia Peninsula, Portugal, and assess soil moisture, and vegetation cover in each sampling site. Through and isotopic approach (water d18O), we determine the contribution of each water source to plant water.

Findings reveal that woody plants rely on deeper soil water when water levels are low, while xerophytic shrubs use more shallow layers than pines and juniper trees. Hydrological factors, particularly water-table depth, play a crucial role in plant water sourcing, outweighing the effects of short rain pulses during dry periods. These insights are vital for understanding how changing water availability impacts dune plant communities.

TSB.6. Emerging environmental pollutants: from molecular to ecosystemic impacts

Monday, 2 (18:00-19:30)

Room: Salón de actos

Emerging pollutants, including endocrine-disrupting chemicals, persistent organic pollutants, antibiotics, or plastics, present significant environmental challenges associated to their biotoxicity, persistence, and bioaccumulation. Effects on different levels of biological organization (molecular, organism and population) have been recently described after the detection of pollutants in most of the environmental matrices and ecosystems. This session aims to present and elucidate the impact of man-made chemicals on micro and macroorganisms, from individual to ecosystemic level, in aquatic or terrestrial environments. We expect to discuss a range of topics that encompasses from ecotoxicology to bioremediation to allow a holistic understanding of the footprint of pollutants at all levels. We will aim to create a dynamic and stimulant session with early-career researchers along with renowned environmental scientists.

Organizers:

• **Juan Manuel González Olalla,** Instituto del Agua, Universidad de Granada

• **Isabel Forner Piquer,** Institut de Ciències del Mar - CSIC.

TSB.6. Orals

[TSB.6-O-1]

Monday 2, evening: 18:00
Room: Salón de actos

Environmental pollution and bird conservation: white storks as indicators of ecosystem health

Bouso, María[1]; Llompart, María[2]; Castiñeira-Landeira, Ana[3]; Varela, Zulema[4]

(1) CRETUS, Ecology Unit, Facultade de Bioloxía, Universidade de Santiago; (2) CRETUS, Faculty of Chemistry, Universidade de Santiago de Compostela; (3) CRETUS, Faculty of Chemistry, Universidade de Santiago de Compostela; (4) CRETUS, Facultade de Bioloxía, Universidade de Santiago

Correspondence e-mail: [maria.bouso@rai.usc.es]

The global increase in pesticide use, associated with agricultural intensification, represents a significant source of environmental impact, particularly for birds. These chemical compounds, highly persistent in the environment, bioaccumulate in tissues through the food chain, disrupting the biological cycles of birds and negatively affecting their reproduction, behaviour, and survival. Furthermore, habitat contamination reduces the availability of food resources and decreases the diversity of insects and plants essential for their subsistence. In this study, mercury and pesticide concentrations were analyzed in feathers and pellets of white storks (Ciconia ciconia) from different regions of Galicia (NW Spain), categorized by land use type. For feather analysis, the barbs were separated from the rachis, with higher concentrations observed in the barbs, which may be explained by their endogenous capacity to accumulate environmental contaminants over time. The results, though preliminary, showed significant differences in mercury and pesticide accumulation between agricultural rural areas and urban areas, with the highest concentrations recorded in areas with more intensive agriculture. This finding is particularly relevant as many pesticides contained significant amounts of mercury prior to the implementation of usage restrictions in recent years, which may contribute to cumulative exposure to this toxic metal in birds, exacerbating its environmental effects. Understanding these dynamics in ecosystems is crucial for implementing effective conservation strategies and mitigating the impacts of pollution on biodiversity.

[TSB.6-O-2]

Monday 2, evening: 18:15
Room: Salón de actos

Looking at the protective role of Eisenia andrei in the activity of soils contaminated with plastic

Mendes, Luís André[1]; Figueroa Rodriguez, Alejandro[2]; Gómez Brandón, Maria[3]; Beiras, Ricardo[4]; Domínguez, Jorge[5]

(1) Universidad Politécnica de Madrid; (2) Universidade de Vigo; (3) Universidade de Vigo; (4) Universidade de Vigo; (5) Universidade de Vigo

Correspondence e-mail: [luis.a.gama.mendes@gmail.com]

Introduction. The presence of plastics across soil ecosystems is now a given and its accumulation has become a key issue. Several studies have pointed out that plastic accumulation can affect soil physical-chemical properties and fauna, altering microbial communities, and consequently resulting in changes in species abundance in the upper levels of food-webs.

Whilst most of the focus has been on the response of individual species to plastic polymers, there are knowledge gaps regarding interactions between species and trophic levels in response to contamination. Hence the question, whether the presence of earthworms can have a protective effect on soil basal respiration (SBR), as proxy for microbial activity.

Material and methods. Soil samples were retrieved at 28 and 56 days from earthworm (Eisenia andrei) chronic toxicity tests (OECD 222), exposed to different concentrations of individual and mixed polymers. These samples and respective controls (same conditions sans earthworms) where used to assess SBR through CO2 production (ISO 16072). Comparisons were done between non-spiked and spiked conditions and with/without earthworms.

Results and discussion. While results would vary between the tested polymer and in mixture, we observed that the general decrease in SBR in soils spiked with higher concentrations of plastic after 56 days was lessen by the presence of earthworms, with fewer number of significant differences and lower variability of SBR at 28 and 56 days, suggesting that the presence of E. andrei has a buffering effect on SBR, likely due to soil ingestion and microbial selection.

[TSB.6-O-3]

Monday 2, evening: 18:30
Room: Salón de actos

Evaluation of environmentally relevant mixtures of plant protection products on Dario rerio embryos

Muñiz Gonzalez, Ana Belén[1]; Leertouwer, Erica[2]; Domingues, Inês[3]; Campos, Isabel[4]; Ré, Ana[5]; Pereira, Joana[6]; Abrantes, Nelson[7]

(1) Universidad Politécnica de Madrid (UPM); (2) Radboud University; (3) University of Aveiro; (4) University of Aveiro; (5) University of Aveiro; (6) University of Aveiro; (7) University of Aveiro

Correspondence e-mail: [anabmglez@gmail.com]

Introduction: The excessive use of Plant Protection Products (PPPs) in farming systems and their less-than-optimal application have resulted in substantial quantities reaching surface water, in the form of complex mixtures that pose a significant risk to non-target organisms. Despite this, the current PPP risk assessment overlooks these real-case scenarios of mixtures' presence in the environment. This work (EU-H2020 SPRINT project), aimed to assess the impacts of realistic mixtures of PPPs on the model zebrafish organism Danio rerio. Material & methods: 11 mixtures were employed containing 3 to 5 PPPs selected according to the most concerning PPP found in each case study across Europe. Embryos (<24h) of Dario rerio (OECD test guideline 236), were exposed to each mixture at 4 concentrations: measured environmental concentration (MEC), predicted environmental concentration (PEC), 3*PEC and 5*PEC, plus a control. Endpoints: % of mortality, % of hatching, cholinesterase activity (ChE) and behavioural response after 96h of exposure. Results and discussion: D. rerio demonstrated low susceptibility (mortality and hatching), which could be explained by the protective mechanisms present in vertebrates. However, the tested mixtures modulated the zebrafish behaviour on locomotor and swimming patterns, which was corroborated by the strong inhibition observed in the ChE activity, suggesting a neurotoxic effect. These effects were observed at both MEC and PEC after 96 hours of exposure, highlighting the urgent need for mitigation strategies to tackle current and future contamination of aquatic systems by PPPs.

[TSB.6-O-4]

Monday 2, evening: 18:45
Room: Salón de actos

Evaluation of the Effects of Contaminants of Emerging Concern with Androgen Endocrine Disrupting Effect on Cyprinodon variegatus Larvae

Abad Pérez, Raquel[1]; Beiras, Ricardo[2]; Schönemann, Alexandre[3]

(1) University of Vigo; (2) University of Vigo; (3) University of Vigo

Correspondence e-mail: [raquel021x@gmail.com]

An experiment was carried out with the aim of evaluating the reliability of molecular biomarkers to detect endocrine disruption in marine vertebrates. Cyprinodon variegatus was used as a model species, due to its sensitivity and applicability in ecotoxicological studies. C. variegatus larvae were exposed to synthetic testosterone in different dilutions, simulating scenarios of acute exposure to endocrine disruptors. The genes 17ß-hydroxysteroid dehydrogenase (17HSD), 11ß-hydroxysteroid dehydrogenase (11HSD) and the reference gene HPRT were selected as biomarkers. Using the quantitative PCR (qPCR) technique, the expression of 17HSD and 11HSD was evaluated to determine if there was induction or inhibition of these genes after exposure to testosterone.

[TSB.6-O-5]

Monday 2, evening: 19:00
Room: Salón de actos

Hazard assessment of carbon and wood fibers for its incorporation in greener composites

Costa, Sara[1]; Venâncio, Cátia[2]; Barreto, Márcio[3]; Reis, Rafaela[4]; Marqués Paola, Alejandro[5]; Lopes, Isabel[6]

(1) CESAM-Center for Environmental and Marine Studies; (2) CESAM-Center for Environmental and Marine Studies, University of Aveiro; (3) CESAM-Center for Environmental and Marine Studies, University of Aveiro / AITIIP Centro Tecnológico; (4) CESAM-Center for Environmental and Marine Studies, University of Aveiro; (5) AITIIP Centro Tecnológico; (6) CESAM-Center for Environmental and Marine Studies, University of Aveiro

Correspondence e-mail: [sdcosta@ua.pt]

The European Union's global transition towards a more sustainable, bio-based, and circular economy is settled by investment and innovation in recycling materials to generate new products. This study aimed to evaluate the ecotoxicity of eluates prepared from carbon fibers (CF) and wood fibers (WF) and leachates of intermediate products containing a 5% proportion of these fibers (PA5% wood – PA5%W, and PA5% carbon – PA5%C). Eluates were prepared in a proportion of 1:10 (m:v), while intermediate formats leachates were prepared following standard CEN/TS15863 in a proportion of 8 cm3cm?². Dilutions were tested in the range of 100% to 0.19% in six key trophic level species: Raphidocelis subcapitata, Lemna minor, Brachionus calyciflorus, Daphnia magna, Danio rerio, and Xenopus laevis. Whenever possible, lethal or sublethal dilutions causing 50% of the effect [L(E)D50] were estimated and included in a Species Sensitivity Distribution (SSD) curve to estimate the Hazard Concentration at 5%, which is commonly used to derive water quality standards. Carbon fibers did not induce lethal toxicity in D. magna or D. rerio and did not induce a dose-response effect on R. subcapitata. Although, when integrating all data into the SSD curves, it was possible to estimate the HC5 values (with corresponding 95% confidence limits) of 9.44 (6.67 – 13.4)% and 13.9 (6.33 – 29.5)%, which indicate that both CF and WF induced similar toxicity. Regarding the leachates produced from the intermediate products PA5%W and PA5%C, no HC5 values were estimated because these intermediate products have been shown to induce no significant toxicity to all tested species, except for X. laevis. The integration of this ecotoxicological assessment during the development of new products that incorporate recycled materials supports their environmental friendliness and sustainability and is thus a key step in accelerating innovation in the recycling industry and market introduction of more sustainable products.

[TSB.6-O-6]

Monday 2, evening: 19:15
Room: Salón de actos

Could temperature alter the toxicity of an emerging contaminant on phytoplankton?

González Olalla, Juan Manuel[1]

(1) University of Granada

Correspondence e-mail: [jmolalla@ugr.es]

Bisphenol A is an endocrine disruptor released as plastic degrades. The increasing production and release of plastics worldwide have led to extensive research on the effects of bisphenol A on aquatic ecosystems. Additionally, this effect can be modulated by global change stressors such as temperature, which plays a crucial role in the metabolism of organisms, including the degradation and accumulation of toxic compounds. Therefore, the aim of our experiment was, first, to determine how environmental concentrations could affect the physiological activity (photosynthetic performance), metabolism (primary production and respiration), and growth rate of two phytoplankton species representative of aquatic ecosystems (Cryptomonas ovata and Phaeodactylum tricornutum). Subsequently, we analyzed how temperature (+5°C) could modulate the toxic effect of BPA on a phytoplankton species (Cryptomonas ovata). Our results showed significant resilience of phytoplankton to the environmental BPA concentrations detected in European rivers and lakes. However, high BPA concentrations associated with specific discharges or landfill leachates could impact phytoplankton functioning, especially under a future scenario of higher temperatures. We will focus our discussion on how the combined action of both stressors and the increased metabolic activity of phytoplankton at higher temperatures can exacerbate the effects of emerging contaminants.

TSB.6. Posters

[TSB.6-P-1]

Thursday 5
Discussion corner: Room 4

Searching for new candidate biomarkers of environmental pollution: the potential of carboxylesterases

Forner-Piquer, Isabel[1]; Solé, Montserrat[2]

(1) Institut de Ciències del Mar (ICM-CSIC); (2) Institut de Ciències del Mar (ICM-CSIC)

Correspondence e-mail: [iforner@icm.csic.es]

Carboxylesterases (CEs), with a broad substrate specificity, are hydrolases involved in the biotransformation and metabolism of xenobiotics as well as endogenous compounds such as hormones and fatty acids. Although mostly hepatic, they are also measurable in multiple tissues, including blood. In addition, interaction with different chemicals from pesticides to plastic additives may inhibit their activity. To this end, we propose the use of tissue homogenates of various marine species to assess the inhibition of CE activities as a new generalist target for marine pollution. Tissue homogenates of several marine species were initially exposed in vitro to a wide array of man-made chemicals, such as, bisphenols, phthalates or flame retardants, to screen their potential as CE inhibitors. Additionally, CE activities were characterized in several fish tissues such as liver, kidney, gonads, mucus, plasma and brain. By exposing different fish models and tissues to varying concentrations of chemicals, we observed species- and tissues-specific sensitivity of the CE activities to further pursue in vivo studies. Our proposal provides a novel generalist and cost-effective biomarker to test a wide range of chemicals of environmental concern. These outcomes support the premise that the CEs are direct targets of emerging pollutants but also reflect inflammatory processes along with other physiological alterations, such as xenobiotic and endogenous metabolism malfunctioning. Thus, the opportunity to validate and incorporate CE measurements among the classical biomarkers to assess environmental pollution is discussed.

The project received funding from the European Union to MS and IFP under the grant agreement No. 101153110 (HORIZON-MSCA-2023-PF-01) and the Spanish Ministry of Science with the project Ref. PID2021–122592NB-I00 to MS

[TSB.6-P-2]

Tuesday 3
Discussion corner: Room 4

Emerging contaminats on freshwater: A systematic review

Martos Maestre, Alba Lucía[1]; Soliveres Codina, Santiago[2]; Sanz Lázaro, Carlos[3]; Yáñez Amorós, Maria Adela[4]

(1) University of Alicante; (2) University of Alicante; (3) University of Alicante; (4) Labaqua

Correspondence e-mail: [alba.martos@ua.es]

Environmental pollution is amongst the main global change drivers with important effects on natural ecosystems. Amongst those pollutants, contaminants of emergent concern (CEC) are a rising problem due to their multiple sources and lack of knowledge about their effects on ecosystems or how to mitigate them.

We performed a systematic review and quantitative analysis on the effect of different emerging contaminants on freshwater ecosystems, as well as on the available remediation techniques. We included in our analysis the effects and degradation routes of microplastics (MPs), nanoparticles (NPs), pharmaceutical and personal care products (PPCPs), per- & polyfluoroalkyl substances (PFAS) and other persistent organic pollutants (POPs) on freshwater ecosystems.

Our preliminary results show drastic impacts of CEC on freshwater biota. For example, PFAS produce multiple metabolic alterations in freshwater species, even at very low concentrations (10 µg/L). Microplastics, work as vectors to other pollutants increasing their environmental concentration, in addition to their intrinsic effects (e.g., changes of gut microbiota on aquatic animals). The latter suggests potential interacting effects of different CECs and the need to study their co-occurrence in natural ecosystems. Current mitigation techniques focus on bioremediation , extraction of pollutants before they arrive at natural habitats, or research for market alternatives to these damaging compounds.

This review summarizes existing empirical evidence on CEC´s impacts on freshwater ecosystems and (potentially) effective techniques no mitigate such impacts, while highlighting important knowledge gaps to guide future research.

[TSB.6-P-3]

Wednesday 4
Discussion corner: Room 4

Evaluating the potential toxicity of weathered agricultural plastics to earthworms and plants

Figueroa-Rodríguez, Alejandro[1]; Alonso-Crespo, Inés M.[2]; Martínez Cordeiro, Hugo[3]; da Silva Sieiro, Alberto[4]; Aira Vieira, Manuel[5]; Domínguez, Jorge[6]

(1) Universidad de Vigo; (2) Universidad de Vigo; (3) Universidad de Vigo; (4) Universidad de Vigo; (5) Universidad de Vigo; (6) Universidad de Vigo

Correspondence e-mail: [alejandro.figueroa@uvigo.gal]

The widespread occurrence of microplastics in various environments has garnered significant attention due to the emerging role of these particles as pollutants with potentially negative effects on ecosystems. Microplastics (or plastics that eventually break down into micro- or nanoplastics) reach the soil via agricultural practices such as mulching and sludge application, thus altering the balance and integrity of ecosystem functions and affecting soil organisms and plants.

We studied the potential toxicity of weathered agricultural plastics to model soil organisms (i.e. earthworms and garden cress) following an adapted version of OECD 222 and ISO 18763 guidelines. To this end, we tested the effects of three types of microplastics (<250 um) - two derived from weathered agricultural field plastics and micronized in a ultracentrifugal mill, and a low density polyethylene (LDPE) obtained from a commercial source. Each microplastic was applied at three concentrations (low, medium and high) to test the impact on the survival and reproduction of the earthworm Eisenia andrei Bouché and on the germination and development of radicles and sprouts in Lepidium sativum L. (garden cress).

Preliminary findings indicate that none of the microplastics significantly affected earthworm survival or the germination and sprouting rates of L. sativum. However, both microplastics derived from agricultural plastics promoted radicle and sprout growth in a concentration-dependent manner. Additional information regarding the potential toxicity of these microplastics to earthworm reproduction is expected to be obtained in the coming months.

[TSB.6-P-4]

Thursday 5
Discussion corner: Room 4

Plastic Degradation in the Ocean: A Previously Overlooked Source of Volatile Organic Compounds

Briones Rizo, Marina[1]; Sala, Berta[2]; Reche, Isabel[3]; Simó, Rafel[4]; Romera Castillo, Cristina[5]

(1) Institute of Marine Sciences (ICM CSIC); (2) Institute of Marine Sciences (ICM CSIC); (3) Universidad de Granada; (4) Institute of Marine Sciences (ICM CSIC); (5) Institute of Marine Sciences (ICM CSIC)

Correspondence e-mail: [briones@icm.csic.es]

Plastic pollution is a growing environmental concern, with the marine environment acting as a significant final sink for plastic debris. In the ocean, sunlight radiation accelerates the degradation of plastic, likely increasing the release of a wide range of chemical substances, including Volatile Organic Compounds (VOCs). Many VOCs are known to be toxic to marine organisms and pose risks to human health, with potential effects such as endocrine disruption, bioaccumulation, and physiological stress. These harmful consequences underscore the significant ecological risks associated with the release of these chemicals into marine ecosystems. While some studies have measured the emission of plastic-derived VOCs into the air, there is a lack of information regarding their release into seawater.

This study examines the emissions of VOCs into seawater through gas chromatography coupled with mass spectrometry from widely used polymers, including biodegradable plastics and recycled materials, under simulated marine conditions. Degradation experiments were conducted under both light and dark conditions to evaluate the role of photodegradation.

The VOCs found were classified as aromatics, halogenated aromatics, alkenes, and halogenated compounds. In general, UV-enhanced light significantly increased the release of VOCs compared to dark conditions. These results underscore the importance of understanding plastic-derived emissions as a critical factor influencing marine ecosystems.

[TSB.6-P-5]

Tuesday 3
Discussion corner: Room 4

Exposure of zebrafish embryos to amphetamine and its enantiomers resulted in developmental alterations and neurotoxicity

Ribeiro, Ondina[1]; Félix, Luís[2]; Ribeiro, Cláudia[3]; Langa, Ivan[4]; Carvalho, Ana Rita[5]; Tiritan, Maria Elizabeth[6]; M.F. Gonçalves, Vírginia[7]; Ribeiro, Ana Rita[8]; Soares Carrola, João[9]

(1) CITAB, Inov4Agro, 1H-TOXRUN, IUCS-CESPU; (2) CITAB, Inov4Agro; (3) UCIBIO, Associate Laboratory i4HB; (4) UCIBIO, Associate Laboratory i4HB; (5) UCIBIO, Associate Laboratory i4HB; (6) UCIBIO, Associate Laboratory i4HB, CIIMAR, Laboratory of Organic and Pharmaceutical Chemistry; (7) UCIBIO, Associate Laboratory i4HB; (8) LSRE-LCM, ALiCE; (9) CITAB, Inov4Agro

Correspondence e-mail: [ondinaimribeiro@hotmail.com]

The global production and consumption of drugs of abuse, including psychoactive substances (PASs), has resulted in an emergent class of pollutants. Most of the PASs are chiral, presenting (R)- and (S)-enantiomers, that can exhibit different toxicokinetic and toxicodynamic properties. Amphetamine (AMP) has been detected in aquatic environments in its racemic form ((R,S)-AMP) or different proportions of its enantiomers, raising concerns about their potential impact on non-target organisms, like ichthyofauna. Therefore, we used zebrafish embryos with approximately 3 hours post-fertilization to evaluate the AMP effects on developmental, biochemical, behavioural, and bioaccumulation endpoints.

Embryos were exposed to different concentrations (0.02, 0.2, 2.0, 20, and 200 µg/L) of (R,S)-, (R)- and (S)-AMP for 96 hours post-fertilization. (R,S)-AMP exposure increased morphometric abnormalities, reduced heart rate , and diminished activity. Both enantiomers induced heightened spontaneous movement, morphometric changes, and reduced heart rate, although (R)-AMP exhibited stronger neurotoxic effects. Enantioselective differences were evident in toxicity parameters, with (R)-AMP exerting greater developmental and neurotoxic effects than (S)-AMP. The racemate, however, displayed the highest overall toxicity during early development.

These findings underscore the necessity of enantiomer-specific assessments in ecological risk evaluations, particularly emphasizing the racemate and (R)-AMP due to their pronounced toxicological impact. This study enhances our understanding of the environmental risks posed by chiral PASs and their potential effects on fish's early life.

Acknowledgements: The study was co-financed by FCT, under the project PTDC/CTA-AMB/6686/2020 (ENANTIOTOX) and UIDB/04033/2020 (CITAB). Ondina Ribeiro acknowledges her PhD grant provided by FCT (2022.12242.BD).

[TSB.6-P-6]

Wednesday 4
Discussion corner: Room 4

Bioplastics ingestion and effects on Sericostoma vittatum Rambur, 1842 (Trichoptera: Seticostomatidae)

Lagoa, Aarón[1]; Gutiérrez-Rial, David[2]; Villar, Iria[3]; Garrido, Josefina[4]; Mato, Salustiano[5]

(1) University of Vigo; (2) University of Vigo; (3) University of Vigo; (4) University of Vigo; (5) University of Vigo

Correspondence e-mail: [aaron.lagoa@uvigo.gal]

Introduction. Plastic pollution is one of the major environmental challenges facing humanity nowadays. In this context, bioplastics has emerged as a sustainable alternative to conventional petroleum-based polymers, however, their biodegradability in natural ecosystems and, consequently, their impact on the different biotic communities is still unclear. For this reason, the aim of this work is to evaluate the ecotoxicological effects on insect larvae when exposed to bioplastics as well as their ability to ingest and degrade these compounds.

Materials and methods. Sericostoma vittatum larvae individuals were exposed to films of conventional plastic (PP), and bioplastics (PLA, PHB, BGreen (multipolymeric bag) and MaterBi®) for 10 days under laboratory conditions. Plastic degradation and ingestion were assessed by comparing the initial and final areas and dry weight of plastics. Larvae dissections were made to confirm plastic intake too.

Results and discussion . As preliminary results, caddisfly larvae only ingested significantly ($p<0.05$) PHB, BGreen and MaterBi® plastics. Plastic intake was significantly higher ($p<0.05$) than degradation for dry weight and area lost except for the weight of PHB. No mortality associated to plastic exposure was detected even though PHB, BGreen and MaterBi® bioplastics were confirmed inside the digestive tract of S. vittatum larvae. Although no lethal ecotoxicological effects were found, bioplastic ingestion could cause sublethal effects (enzymatic, growth, mobility etc.) not analysed in this experiment. Moreover, microplastics were ejected by the larvae through faeces facilitating the income and bioaccumulation of these materials into de trophic chain too.

[TSB.6-P-7]

Thursday 5
Discussion corner: Room 4

Are biobased thermoplastic organosheets an eco-friendly option for manufacturing industries?

Venâncio, Cátia[1]; Costa, Sara[2]; Reis, Rafaela[3]; Lang, Susanne Kate[4]; Knudsen, Hans[5]; Oliveira, Ana M.[6]; Patrício Silva, Ana L.[7]; Rocha-Santos, Teresa[8]; Lopes, Isabel[9]

(1) Center for Marine and Environmental Studies (CESAM); (2) Centre for Environmental and Marine Studies (CESAM), University of Aveiro, 3810-193 Aveiro, Portugal; (3) Centre for Environmental and Marine Studies (CESAM), University of Aveiro, 3810-193 Aveiro, Portugal; (4) Comfil ApS, Karolinelundsvej 2, 8883 Gjern, Denmark; (5) Comfil ApS, Karolinelundsvej 2, 8883 Gjern, Denmark; (6) Centre for Environmental and Marine Studies (CESAM), University of Aveiro, 3810-193 Aveiro, Portugal; (7) Centre for Environmental and Marine Studies (CESAM), University of Aveiro, 3810-193 Aveiro, Portugal; (8) Centre for Environmental and Marine Studies (CESAM), University of Aveiro, 3810-193 Aveiro, Portugal; (9) Centre for Environmental and Marine Studies (CESAM), University of Aveiro, 3810-193 Aveiro, Portugal

Correspondence e-mail: [catiavenancio@gmail.com]

In order to decrease the use of fossil-based materials in manufacturing industries, the European Union's recommends the transition to biobased materials. Bio-based polymers, like polylactic acid (PLA) have been suggested as more eco-friendly alternatives to be incorporated in composites formats. In this study, PLA-based thermoplastic sheets (HTPLA-PLA-50216; HTPLA-PLA-PLA1-PLA2 with sizes of 1 and 5 mm; HTPLA-PLA-PLA3-PLA4 of 3 mm; and HTPLA-PLA-PLA1-PLA4 of 5 mm) were characterized for their polymeric composition (FTIR-ATR) and surface morphology and elemental distribution (SEM-EDS). Furthermore, the ecotoxicity of their leachates was assessed using five freshwater model species: Raphidocelis subcapitata, Lemna minor, Brachionus calyciflorus, Daphnia magna, and Danio rerio. Leachates were prepared following standard CEN/TS15863 in a proportion of 8 cm3 cm?². No significant mortality was found for the consumer species D. magna, B. calyciflorus, and D. rerio. Though, some adverse effects were observed in D. rerio embryos exposed to HTPLA-PLA-L130-6060D (3 mm). Regarding R. subcapitata and L. minor, there are two patterns of response to highlight: i) a dose-response effect for HTPLA-PLA-50216 and HTPLA-PLA-PLA1-PLA2 (1 mm; only for R. subcapitata), with the former being more toxic than the later; and ii) a non-monotonic response for the remaining intermediates (HTPLA-PLA-PLA1-PLA2 of 5 mm, HTPLA-PLA-PLA3-PLA4 of 3 mm, and HTPLA-PLA-PLA1-PLA4 of 5 mm), where the highest percentages of effect were found to be, in general, between the eluate dilutions of 1.56% to 6.25%. Though a low toxicity was observed for the tested bio-sheets, considering the diversity of responses displayed between producers and consumers, and the results obtained for producers at the lowest tested dilutions, conclusions drawn must be further complemented with a chemical analysis of the leachates to ensure the long-term sustainability of these intermediate products.

[TSB.6-P-8]

Tuesday 3
Discussion corner: Room 4

Microplastics entering the food web – a preliminary, more realistic test with zooplankton from Patagonia Argentina

Gonçalves, Rodrigo J.[1]; De Cian, Antonella[2]; Hernández Moresino, Rodrigo[3]; Martelli, Antonela[4]; Spinelli, Mariela[5]; Guan, Wanchun[6]

(1) CESIMAR-CONICET (Argentina) y Dto. Ecología, Universidad de Granada-Modeling Nature (Spain); (2) CESIMAR-CONICET (Argentina); (3) CESIMAR-CONICET (Argentina); (4) CESIMAR-CONICET (Argentina); (5) IBBEA, CONICET-UBA; (6) Wenzhou Medical University, Zhejiang (China)

Correspondence e-mail: [rogo@ugr.es]

Introduction. Microplastic particles (MP) are mostly incorporated into marine food webs when they are ingested by lower trophic levels (eg. zooplankton) and then propagated up via trophic transfer. Previous research shows mixed results when zooplankton is exposed to untreated plastic particles in laboratory incubations. These cases do not necessarily represent the available microplastic particles in marine ecosystems (i.e., subjected to physical, chemical, and biological changes).

Material and methods. In this study, particles of different plastic materials were incubated outdoors in seawater during summer for 1 month to create more realistic particles ('treated MP'). These, as well as 'untreated MP' were offered to a natural population of copepods (Paracalanus parvus) from a coastal site in mid-latitudes (Atlantic Patagonia, Argentina) and their feeding responses were filmed using a high-speed camera for a detailed study of the trajectory, detection, capture, handling, and ingestion/rejection of each particle per individual predator.

Results and discussion. Copepods detect and capture MP just as efficiently as they do with regular prey (e.g. microalgae). However, they are overall reluctant to ingest both treated and untreated MP. The preliminary data show that realistic MP treatment resulted in increased handling time (e.g. for high-density polyethylene), but this did not ultimately translate into a higher ingestion probability. This study adds to previous ones that the ingestion of microplastic particles is not as widespread as commonly assumed in natural populations, and that laboratory incubations should put efforts into considering realistic conditions both for predators and microparticles.

[TSB.6-P-9]

Wednesday 4
Discussion corner: Room 4

Ecotoxicity assessment of bio-based polymers targeting its use as greener alternatives in composites

Reis, Rafaela[1]; Costa, Sara[2]; Venâncio, Cátia[3]; De Bisschop, Robbe[4]; Geerinck, Ruben[5]; Oliveira, Ana M.[6]; Patrício Silva, Ana L.[7]; Rocha-Santos, Teresa[8]; Lopes, Isabel[9]

(1) Center for Environmental and Marine Studies (CESAM), University of Aveiro, Aveiro; (2) Center for Environmental and Marine Studies (CESAM), University of Aveiro, Aveiro; (3) Center for Environmental and Marine Studies (CESAM), University of Aveiro, Aveiro; (4) Centexbel, Technologiepark 70, 9052 Ghent, Belgium; (5) Centexbel, Technologiepark 70, 9052 Ghent, Belgium; (6) Center for Environmental and Marine Studies (CESAM), University of Aveiro, Aveiro; (7) Center for Environmental and Marine Studies (CESAM), University of Aveiro, Aveiro; (8) Center for Environmental and Marine Studies (CESAM), University of Aveiro, Aveiro; (9) Center for Environmental and Marine Studies (CESAM), University of Aveiro, Aveiro

Correspondence e-mail: [rafaela.reis@ua.pt]

The BIOUPTAKE project aims to develop sustainable bio-based materials to serve as alternatives to current fuel-based ones. For this purpose, several bio-based polymers have been studied. Accordingly, the ecotoxicity of six bio-based homopolymers (in granule forms) was assessed (PA10-10, PLA-L130, PLA-LX930, PLA6060D, PLA-L175, and PCL6800) in four freshwater model organisms: Raphidocelis subcapitata (72-hour growth rate inhibition assay), Brachionus calyciflorus (24-hour mortality assay), Daphnia magna (48-hour immobilization assay) and Danio rerio (96-hour fish embryo acute assay). Additionally, they were characterized for their polymeric composition through Fourier Transform Infrared Spectroscopy with Attenuated Total Reflectance; and for their surface morphology and elemental distribution through Scanning Electron Microscopy coupled with Energy-Dispersive Spectroscopy. The eluates of each polymer were prepared according to DIN 38414-4 in a 10:1 ratio (V:W) using distilled water, stirred for a 24-h period, and then filtered (0.22 µm pore membrane). Overall, the eluates did not induce significant toxicity, except for PCL6800 and PLA-L175. For PCL6800 it was possible to estimate an LC50 for B. calyciflorus (22.59%) and for D. rerio (56.14%), and an LC20 for PLA-L175 for B. calyciflorus (11.23%). All eluates were found to induce a non-monotonic response in R. subcapitata yield and growth rate.

The industrial applicability of these granular polymers seems to be a good alternative; however, decisions should be taken cautiously as some have shown significant toxicity to freshwater biota. These results should be reinforced collecting data for other species. Furthermore, bio-based granular polymers environmental safety should be confirmed by comparison with data with fossil-based polymers.

[TSB.6-P-10]

Thursday 5
Discussion corner: Room 4

Comparative Toxicity Assessment of Bisphenol A and Its Analogues (BPAF and BPZ) Using Zebrafish (Danio rerio) Embryos and Larvae as Model Organisms

Costa, Maria[1]; Vilarinho, Inês[2]; S. Monteiro, Marta[3]; Lopes, Isabel[4]; Domingues, Inês[5]

(1) Centre for Environmental and Marine Studies (CESAM); (2) University of Aveiro; (3) Centre for Environmental and Marine Studies (CESAM); (4) Centre for Environmental and Marine Studies (CESAM); (5) Centre for Environmental and Marine Studies (CESAM)

Correspondence e-mail: [mssousacosta@ua.pt]

Plastic pollution is a major environmental challenge, driven by improper disposal and landfill runoff, leading to plastics' widespread presence in aquatic ecosystems. Bisphenol A (BPA), widely used in the production of polycarbonate plastics and epoxy resins, is a known endocrine disruptor linked to reproductive harm and chronic health issues. Restrictions on BPA and the demand for "BPA-free" products have driven the development of alternatives such as bisphenol AF (BPAF) and bisphenol Z (BPZ). However, emerging evidence suggests these substitutes may pose comparable or greater risks to human health and ecosystems. To address this concern, a comparative toxicity assessment of BPA, BPAF, and BPZ was conducted using zebrafish (Danio rerio) embryos and larvae as model organisms.

Embryos were exposed to three sublethal concentrations (below the EC10 – concentration at which 10% of organisms showed malformations, determined in preliminary studies) over a 120-hour period, with mortality, hatching, and malformation rates monitored at 24-hour intervals. Following exposure, behavioural tests were conducted, and samples were collected for neurotoxicity analysis. For larvae, a 48-hour exposure was conducted using seven concentrations below the no observed effect concentration (NOEC), with the same endpoints assessed as in the embryo tests. The results provide valuable insights into the organismal and molecular toxicity of selected BPA analogues, underscoring the urgent need to develop and evaluate genuinely safer alternatives to BPA.

TSB.7. Drivers of temporal changes in biodiversity: from species demography to communities

Thursday, 5 (12:45-14:15)

Room: Seminario 7

Thursday, 5 (15:30-17:00)

Room: Seminario 1

Species are subject to continuous variation in environmental conditions that determine their population responses as well as their interactions with other species. Multiple studies have documented environmental effects on species´demography or biotic interactions. However, little is known about the feedbacks between demographic and ecological processes that structure the temporal dynamics of communities. Likewise little is known about how these feedbacks are related to the characteristics of environmental conditions such as the type of ambient noise and the physiological, morphological and evolutionary features of species. Understanding these processes is fundamental to integrate different fields of ecology as well as to predict the future of communities under global change. In this thematic session, we propose to gather an ample group of researchers working at the intersection between population and community ecology. This group, who is not taxonomically biased, uses a wide range of techniques from detailed studies to intense statistical modelling to understand temporal changes in the abundance, composition and richness of ecological systems..

Organizers:

• **Oscar Godoy,** Doñana Biological Station (EBD-CSIC)

• **Violeta Calleja Solanas,** Doñana Biological Station (EBD-CSIC)

• **Sergio Picó Jordá,** Doñana Biological Station (EBD-CSIC).

TSB.7. Orals

[TSB.7-O-1]

Thursday 5, morning (second): 12:45
Room: Seminario 7

Plant-pollinator interaction rewiring boosts year to year community survival

Dominguez Garcia, Virginia[1]; Fabra, David[2]; Molina, Francisco P.[3]; Allen-Perkins, Alfonso[4]; Godoy, Oscar[5]; Bartomeus, Ignasi[6]

(1) Estación Biológica de Doñana; (2) Universidad Pablo de Olavide; (3) Estación Biológica de Doñana; (4) Universidad Politécnica de Madrid; (5) Estación Biológica de Doñana; (6) Estación Biológica de Doñana

Correspondence e-mail: [domgarvir@gmail.com]

In an idealized world, species forming an ecological community would interact predictably. Theory suggests that the observed structures of these interaction networks can maximize the probability of survival. Unfortunately, the real world is more messy. Whether an interaction is realized within a set of plants and pollinators depends on multiple processes. Some obvious ones are the affinity of species to interact, but the probability of species encounter over space and time is also determinant. Such probability depends on the demographic responses of species to the environment, their environmental constraints (e.g. phenological overlap), and animals' ability to choose with whom to interact to maximize their fitness. Indeed, although these factors produce considerable year-to-year changes in species interactions within plant-pollinator communities, their consequences for the community persistence are unknown, making unclear if this interaction turnover is a driver or a passenger of inter-annual changes in species populations. Here, we characterize year-to-year variation in plant-pollinator interactions using a unique dataset of 8 years on 12 sites and assess for each community their structural stability, a robust theoretical measure describing species persistence. We show that interaction rewiring within the species core consistently boosts community survival compared to random rewiring scenarios. Shifts in population abundances and phenological activities of the core species emerge as critical drivers of this process. While observed networks are not fully optimized, the observed adaptive rewiring enhances species persistence, buffering plant-pollinator networks against environmental challenges.

[TSB.7-O-2]

Thursday 5, morning (second): 13:00
Room: Seminario 7

Decoding 10,000 years of ecological persistence: non-linear behaviors in community assembly

Cardillo, Alessio[1]; Valgañón, Pablo[2]; Ramos Capón, Cristina[3]; Sáiz, Hugo[4]; González Sampériz, Penélope[5]; Gil-Romera, Graciela[6]

(1) Pyrenean Institute of Ecology - CSIC; (2) Pyrenean Institute of Ecology - CSIC; (3) Pyrenean Institute of Ecology - CSIC; (4) Universidad de Zaragoza; (5) Pyrenean Institute of Ecology - CSIC; (6) Pyrenean Institute of Ecology - CSIC

Correspondence e-mail: [acardillo@ipe.csic.es]

Introduction. The persistence of ecological communities over time and the role of environmental filtering in it are long-lasting questions in ecology. This study investigates the persistence of ecological plant communities, but in principle applicable to any organism, over millennial time periods. We address the use of causal inference to disentangle the relative contributions of species interactions and environmental factors in shaping community assembly through complementary methodological approaches.

Materials and Methods. We employ a novel numerical framework to examine causality networks using fossil pollen abundance data to assess community stability. This approach integrates two established methods: cross-convergent mapping (CCM), widely applied in ecology, and transfer entropy (TE), borrowed from information theory. Both methods address non-linear dynamic systems; however CCM infers causality through state-space reconstructions and attractor manifolds, and TE captures the directional flow of information between stochastic processes (i.e., time-series) by quantifying how past values of one variable improve the predictability of another's future behavior. Using a 10,000-year pollen dataset alongside climate and disturbance proxies, we compare the abilities of these methods in addressing community persistence.

Results and Discussion. Preliminary results reveal causal links within community elements and between these elements and environmental factors. We assess the relative efficacy of CCM and TE in measuring community persistence. This work underscores the value of long-term coexistence networks in understanding ecological persistence, and highlights the intricate interplay between community dynamics and environmental change over millennia. Our findings contribute to advancing analytical tools for exploring the drivers of ecological stability and resilience.

[TSB.7-O-3]

Thursday 5, morning (second): 13:15
Room: Seminario 7

Are our study systems already extinct? Revealing the impacts of climate change on Mediterranean octocorals' slow regime shifts

Capdevila Lanzaco, Pol[1]; Zentner, Yanis[2]; Ruiz, Natalia[3]; Rovira, Graciel·la[4]; Aspillaga, Eneko[5]; Figuerola-Ferrando, Laura[6]; Garrabou, Joaquim[7]; Gómez-Gras, Daniel[8]; Hereu, Bernat[9]; Linares, Cristina[10]

(1) Universitat de Barcelona; (2) Universitat de Barcelona; (3) Universitat de Barcelona; (4) Universitat de Barcelona; (5) Instituto Mediterráneo de Estudios Avanzados; (6) Universitat de Barcelona; (7) Institut de Ciències del Mar-CSIC; (8) Universitat de Barcelona; (9) Universitat de Barcelona; (10) Universitat de Barcelona

Correspondence e-mail: [pcapdevila@ub.edu]

Avoiding ecological system collapse is one of the greatest challenges of the 21st century. A collapse occurs when a system undergoes a substantial transformation in structure and function, often resulting in a regime shift to a new state with distinct properties. Although regime shifts are often perceived as abrupt, some systems may take decades or centuries to decline. Detecting these "slow" regime shifts is critical, as their gradual nature can delay timely management responses. Here, we will present our work studying the impacts of climate change, and in particular marine heatwaves (MHWs), on the resilience of the highly diverse and endemic Mediterranean coralligenous communities. Using long-term population monitoring datasets of the key octocoral species Paramuricea clavata, we show how MHWs induces slow, transient periods of declines that can last for decades. During these prolonged declines P. clavata display less resistance and recovery capacity to further disturbances. Then, combining functional community analyses with network simulations, we show that extinction of P. clavata will have dramatic consequences for the functioning of coralligenous communities. Overall, these findings suggest that these key communities might already be experiencing an extinction debt but also point that we might have a window of opportunity to recover them.

[TSB.7-O-4]

Thursday 5, morning (second): 13:30
Room: Seminario 7

Constraints on the variability of species interactions

Picó Jordá, Sergio[1]; Song, Chuliang[2]; Godoy, Oscar[3]

(1) Universidad de Cádiz / Estación Biológica de Doñana (EBD-CSIC); (2) University of California, Los Angeles (UCLA); (3) Estación Biológica de Doñana (EBD-CSIC)

Correspondence e-mail: [s.pico.jorda@gmail.com]

Introduction. Changes in species' vital rates and species interactions in response to environmental variability can modify the structure and dynamics of ecological communities. But, while the limits to variability in species performance have been widely explored, yet little is known about the constraints on the variability of species interactions.

Material and methods. We used nine years of data from natural annual grasslands in Doñana National Park (Spain) to estimate interaction matrices including seven plant species. Then, we computed the feasibility domains for each triplet of species —a metric summarizing the opportunities for species to coexist based on their interactions—, and the degree of overlap between feasibility domains of successive years in three different scenarios: as observed, disordered (randomizing years) and random (randomizing species interactions). In addition, we examined the effect of precipitation on these feasibility domains.

Results and discussion. We found that the feasibility domains do not sample the parameter space at random, Rather, we observed a core-periphery structure, indicating strong constraints on species interactions in our community. The random treatment reduced the overlap between feasibility domains way more than the disordered one, highlighting the importance of the structure of species interactions. We also found that higher precipitation reduced opportunities to coexist by reducing the mean size of feasibility domains and making interaction matrices more similar between them. These results stress the importance of using (constrained) variability in species interactions in our predictions of species coexistence.

[TSB.7-O-5]

Thursday 5, morning (second): 13:45
Room: Seminario 7

Contrasting tree species basal area gains and losses patterns under recent climate change across their climatic distribution

Bravo-Hernández, Miriam[1]; Astigarraga, Julen[2]; Grajera-Antolín, Cristina[3]; Suvanto, Susanne[4]; Vilà-Cabrera, Albert[5]; Pugh, Thomas A.M.[6]; Zavala, Miguel A.[7]; Rodríguez-Rey, Marta[8]; Esquivel-Muelbert, Adriane[9]; Barrere, Julien[10]; Cienciala, Emil[11]; Cruz-Alonso, Verónica[12]; Fridman, Jonas[13]; Kunstler, Georges[14]; Talarczyk, Andrzej[15]; Thibaut, André[16]; Schelhaas, Mart-Jan[17]; Villén-Pérez, Sara[18]; Ruiz-Benito, Paloma[19]

(1) Universidad de Alcalá, Madrid, Spain; (2) Universidad de Alcalá, Madrid, Spain; (3) Universidad de Alcalá, Madrid, Spain; (4) Natural Resources Institute Finland (Luke), Helsinki, Finland; (5) Universidad de Alcalá, Madrid, Spain; (6) University of Birmingham, Birmingham, UK; Lund University, Lund, Sweden; (7) Universidad de Alcalá, Madrid, Spain; (8) Universidad de Alcalá, Madrid, Spain; (9) University of Birmingham, Birmingham, UK; (10) Université Grenoble Alpes (INRAE), UR LESSEM, Saint-Martin-d`Hères, France; (11) IFER - Institute of Forest Ecosystem Research, Jilove u Prahy, Czech Republic; (12) Universidad Complutense de Madrid, Madrid, Spain; (13) Swedish University of Agricultural Sciences, Umeå, Sweden; (14) Université Grenoble Alpes (INRAE), UR LESSEM, Saint-Martin_d`Héres, France; (15) Forest and Natural Resources Research Centre Foundation, Warsaw, Poland; (16) Service Public de Wallonie, Jambes, Belgium; (17) Wageningen Environmental Research (WENR), Wageningen, Netherlands; (18) Universidad de Alcalá, Madrid, Spain; (19) Universidad de Alcalá, Madrid, Spain

Correspondence e-mail: [miriam.bravo@uah.es]

Introduction. Forests play a crucial role in mitigating climate change as they serve as the primary terrestrial carbon sink. In Europe, forest cover has expanded over recent decades due to shifts in human activities, potentially enhancing this carbon sink. Numerous studies have documented changes in productivity driven by climate change. However, the underlying processes driving species basal area gains and losses have received less attention. By modeling basal area gains and losses, we obtain insights into not only the overall productivity shifts, but also the trade-offs and synergies shaping them in response to climate change.

Material and methods. We analysed data for 18 tree species obtained from over c. 50,000 National Forest Inventory plots across seven European countries. All plots had not been harvested during the study period. Using Generalized Additive Models, we predicted tree species basal area gains (i.e. growth and ingrowth) and losses (i.e. natural mortality) in response to temperature anomalies (i.e. degree difference between study period and reference period) along their climatic distribution (i.e. wet, mild and arid regions of their distribution).

Results and discussion. We observed increased basal area gains and losses in wet regions with increased temperature anomaly. In mild and arid regions, however, we observed increasing losses alongside declining gains with higher temperature anomaly. The observed patterns were pronounced in early rather than late stand developmental stages, especially for arid regions. These findings are crucial for informing conservation strategies, adaptive forest management, and policy decisions aimed at mitigating climate change impacts on European forests.

[TSB.7-O-6]

Thursday 5, morning (second): 14:00
Room: Seminario 7

Frugivore-mediated seed dispersal and diversity dynamics in Mediterranean forest communities: from fruits to saplings

Acevedo Limón, Lucía[1]; Rumeu, Beatriz[2]; Albrecht, Jörg[3]; González-Varo, Juan P.[4]

(1) Universidad de Cádiz; (2) Universidad de Cádiz; (3) Senckenberg Biodiversity and Climate Research Centre; (4) Universidad de Cádiz

Correspondence e-mail: [lucia.acevedo@uca.es]

Seed dispersal shapes plant communities by creating the initial spatial template on which subsequent demographic processes act during recruitment, influencing the survival of early life stages. For fleshy-fruited plants, frugivores determine seed deposition patterns through their foraging preferences and habitat use, with cascading effects on community composition and dynamics. In Mediterranean forests, where more than half of woody species produce fleshy fruits, the role of frugivore-mediated seed dispersal in maintaining diversity by favouring rare species remains poorly understood. Empirical studies linking frugivore-mediated seed dispersal and early recruitment across multiple communities are particularly scarce.

Across ten Mediterranean lowland forests and over two fruiting seasons, we censused frugivorous birds and fruit crops, quantified seed rain patterns and monitored early plant recruitment at the community level. We then assessed diversity shifts across life stages (fruits, dispersed seeds, seedlings, and saplings) to explore how dispersal and demographic processes interact to maintain diversity in these ecosystems.

Preliminary results suggest that frugivore preferences and fruit production jointly shape seed rain composition, with rare species overrepresented in the seed rain. Moreover, subsequent demographic processes further enhanced diversity, increasing compositional differences across life stages and reducing the dominance of prevalent species in later stages. We also unravel the role of frugivore and plant traits on these diversity shifts during early plant recruitment. By providing empirical support on the critical role of frugivore-mediated seed dispersal in sustaining plant diversity, our ongoing research seeks to elucidate processes underpinning plant community assembly in Mediterranean forests.

[TSB.7-O-7]

Thursday 5, after lunch (third): 15:30
Room: Seminario 1

Population structure plays a key role in community stability

Giménez Romero, Alex[1]; Hernández, Christina[2]; Genovart, Meritxell[3]; Salguero Gómez, Rob[4]

(1) Centre d'Estudis Avançats de Blanes (CEAB); (2) University of Oxford; (3) Centre d'Estudis Avançats de Blanes; (4) University of Oxford

Correspondence e-mail: [gimenez.romero.alex@gmail.com]

The relationship between ecosystem complexity and stability remains unresolved. Classical theories often predict instability in large and diverse systems, but empirical observations provide contrary evidence. Recent work has shown that differences in the foraging capacity and predation risk of juveniles versus adults within populations result in larger, more complex communities than predicted by unstructured models. Here, we develop a general framework to integrate population structure into community stability analyses and show that stage-asymmetric interactions are key to stability. Specifically, while cross-stage predator-prey interactions enhance stability, competition across different stages destabilizes the community. Our results offer new insights into the stability-diversity paradox, emphasizing the critical role of population structure in ecological resilience, an often neglected feature of natural systems.

[TSB.7-O-8]

Thursday 5, after lunch (third): 15:45
Room: Seminario 1

Extreme changes in precipitation drive biodiversity loss

Calleja Solanas, Violeta[1]; Bartomeus, Ignasi[2]; Godoy, Oscar[3]

(1) Estación Biológica de Doñana; (2) Estación Biológica de Doñana; (3) Estación Biológica de Doñana

Correspondence e-mail: [violeta.vics@gmail.com]

Species interactions are key to maintaining biodiversity. However, how these interactions change in diverse communities across a broad gradient of precipitation conditions has been seldom explored. This fact limits our understanding of the consequences of extremely dry or wet years on reducing biodiversity.

Here, we explore two independent long-term (> 8 yr) datasets subjected to the same precipitation regime -annual plant grasslands and wild bee assemblages in shrublands- describing changes in species abundance across multiple locations. Then, we used inverse modeling techniques to parameterize the dynamics of the populations as a function of their realized intrinsic population growth rates and the strength of their positive and negative interactions. We also explored the role of environmental anomalies in producing contrasting effects on opportunities to coexist and their overall performance thought the structural approach.

We found that both systems respond similarly to changes in precipitation despite their disparate evolutionary backgrounds. While average years promote more diverse communities, extreme years magnifies the spatial context dependency of biodiversity loss. Our models predict that where we observe a reduction in structural stability there is a reduction of species richness and an increase of single species dominance. The main mechanisms driving that decrease in stability are a combination of species-specific changes in reproduction rates, an increase in variability of interspecific interactions, and a reduction in strength of self-limiting effects. Accounting for the spatiotemporal-varying structure of species interactions is pivotal to our understanding of the impact of extreme climatic conditions on biodiversity loss.

[TSB.7-O-9]

Thursday 5, after lunch (third): 16:00
Room: Seminario 1

From 0 to 100 in 30 years, expansion of Retama monosperma in Doñana National Park

Gallego Fernández, Juan B.[1]; Muñoz Reinoso, José Carlos[2]; Borreguero Vázquez, Ismael[3]; Fernández Martínez, Mario[4]; Zunzunegui, María[5]; Matías, Luis[6]; Delgado Fernández, Irene[7]; Costas, Susana[8]

(1) Universidad de Sevilla; (2) Universidad de Sevilla; (3) Universidad de Sevilla; (4) Universidad de Sevilla; (5) Universidad de Sevilla; (6) Universidad de Sevilla; (7) Universidad de Cádiz; (8) Universidade do Algarve

Correspondence e-mail: [galfer@us.es]

Retama monosperma, a shrub native to coastal dunes in the southwest of the Iberian Peninsula, was historically absent from the Doñana National Park until the 1970s when the presence of some isolated individuals was recorded near the mouth of the Guadalquivir River. Currently, R. monosperma is widespread over approximately 700 ha in this area, occupying the understory of pine plantations and newly formed dune areas over the past 30 years. Understanding the colonization patterns of Retama is crucial for conservation efforts in Doñana, offering valuable insights into the ecological changes shaping habitat dynamics and biodiversity.

The study aimed to establish how the colonization of Retama has taken place, spatially and temporally, in a territory occupied by an open woodland of Juniperus macrocarpa and J. phoenicea. The expansion process of Retama was investigated by locating and dating all the existing individuals within a 70 hectares-dune formed since the 1960s, with RTK-DGPS and dendrochronology techniques. Age structure and cover of Retama were analysed in 10 plots of 1 ha each distributed in a 2000 m-transect along the main observed expansion axis. Results reveal a chronological sequence of the colonization process indicating an exponential increase in both, the number of individuals and plant cover. Plant cover is greater than 100% in the area where colonization originated, with the largest Junipers plants closely surrounded by Retama and the small ones surviving under the canopy. These findings suggest the serious threat posed by the encroachment of Retama into the protected Juniperus open woodland native habitat.

[TSB.7-O-10]

Thursday 5, after lunch (third): 16:15
Room: Seminario 1

Fine-scale spatial connectivity interacts with seasonality to shape macroinvertebrate assemblages in a restored pondscape

Tomás-Martín, Marina[1]; Alcorlo, Paloma[2]; Florencio, Margarita[3]

(1) Universidad Autónoma de Madrid; (2) Universidad Autónoma de Madrid; (3) Estación Biológica de Doñana, Centro Superior de Investigaciones Científicas (CSIC)

Correspondence e-mail: [marina.tomas@uam.es]

Introduction. Temporary freshwater ponds are key stepping-stone habitats within landscapes: they facilitate species dispersal and sustain biodiversity. Species colonisation dynamics in pondscapes are highly dependent on species dispersal and seasonal shifts across the hydrological cycle. Understanding these dynamics provide insights into how environmental variability shapes temporal changes in biodiversity and is crucial for predicting community responses under global change.

Material and methods. We assessed environmental factors influencing aquatic macroinvertebrate patterns at a fine spatial scale in the restored quarry ponds of Charcas de los Camorchos (Madrid, Spain). Across three seasons, we sampled one permanent pond and six Mediterranean temporary ponds, which represented nearly the entire pondscape. We estimated the relative abundances of macroinvertebrates and characterised pond abiotic factors (physical and chemical parameters), biotic factors (chlorophyll-a concentrations, aquatic plant species richness), and spatial connectivity.

Results and discussion. Our results indicated that seasonality and pond water permanence were the main drivers of macroinvertebrate assemblages. In particular, we detected that passive dispersers responded to fine-scale spatial connectivity, while active dispersers appeared unaffected by environmental constraints. Indeed, we observed that pond spatial connectivity was essential in maintaining seasonal patterns in macroinvertebrate assemblages across this pondscape, with the permanent pond playing a crucial “reset” role within the dynamic source-sink system. The study area is a site of significant ecological importance: we identified 79 macroinvertebrate taxa and 12 aquatic plant species, including some rare and endemic taxa. These insights can guide conservation strategies, highlighting the need to preserve entire pondscapes to protect biodiversity from anthropogenic pressures.

[TSB.7-O-11]

Thursday 5, after lunch (third): 16:30
Room: Seminario 1

Urbanization impacts on population trends and phenology of European butterflies

Colom, Pau[1]

(1) Universitat de Barcelona

Correspondence e-mail: [pcolom@ub.edu]

Species population dynamics are often disrupted by rapid environmental changes. Although much is known about population responses to climate change, the increasingly global impact of urbanization remains understudied. Here, we studied species population dynamics (population trends and phenological responses) in relation to climate change and urbanization using long-term monitoring data of 143 butterflies across Europe. We found that population trends were mostly affected by the climatic conditions in urban areas, rather than responding solely to urbanization. Yet, these trends to climate and urbanization varied in relation to their traits. Further, urban populations showed altered phenology, generally advancing the peak of abundance and the offset but delaying the onset, ultimately shortening the flight period in univoltine species. In contrast, urbanization is expected to extend the flight period in multivoltine species by increasing the number of generations driven by a prolonged favorable season.

[TSB.7-O-12]

Thursday 5, after lunch (third): 16:45
Room: Seminario 1

Factors shaping the distribution of old-growthness attributes in the forests of Spain

Cos del Cacho, Adrià[1]

(1) Centro de Investigación Ecológica y Aplicaciones Forestales (CREAF)

Correspondence e-mail: [a.cos@creaf.cat]

Introduction. Conservation and enhancement of old-growth forests is key in forest planning and policies, but more knowledge is needed on what natural or anthropic conditions are affecting the distribution in space of the attributes traditionally associated with old-growth forests.

Material and methods. Using data from the Third Spanish National Forest Inventory (1997-2007), we calculated six indicators associated with forest old-growthness for the plots in the territory of Peninsular Spain and Balearic Islands, and then combined them into an aggregated index. We assessed their spatial distribution and the differences across five forest functional types, as well as the effects of ten climate, topographic, landscape, and anthropic variables in their distribution.

Results and discussion. Clear geographical patterns were apparent, with climate factors playing a crucial role in the distribution of these attributes. This distribution also varied across different forest types, while the effects of recent anthropic impacts were weaker but still relevant. Aridity seemed to be one of the main impediments for the development of old-growthness attributes, coupled with a negative impact of recent human pressure. However, these effects seemed to be mediated by other factors, specially the legacies imposed by the complex history of forest management practices, land use changes and natural disturbances that have shaped the forests of Spain. The results of this exploratory analysis highlight on one hand the importance of climate in the dynamic of forests towards old-growthness and the need for more insights on the history of our forests in order to understand their present and future.

TSB.7. Posters

[TSB.7-P-1]

Tuesday 3
Discussion corner: Room 6

Temporal changes in grasshopper community along altitudinal gradient in the central Pyrenees

Herrera Russert, José[1]; Martínez Viejo, David[2]; Guillera Arroita, Gurutzeta[3]; Lahoz Monfort, José Joaquín[4]

(1) Instituto Pirenaico de Ecología; (2) Instituto Pirenaico de Ecología; (3) Instituto Pirenaico de Ecología; (4) Instituto Pirenaico de Ecología

Correspondence e-mail: [jherrera@ipe.csic.es]

Orthopterans are a key element of the herbivore community in subalpine grasslands and pastures. They are also a good indicator of environmental change and habitat shift. A multi-year study conducted forty years ago in the valley of Aísa is now being replicated and expanded in order to establish how the grasshopper community has changed, and how these changes may relate to underlying shifts in habitat structure, vegetation and climate. A multipronged methodological approach is used to further improve future survey efforts.

During the summer of 2024, we intensively surveyed ten plots from the original study together with several additional ones. We used three survey methods: biocenometer counts (as in the original study), counts from sweep netting along linear transects, and passive acoustic recording via AudioMoth devices. Each plot was sampled an average of six times from July to October, and acoustic monitoring was conducted throughout the season.

We recorded an overall increase in the number of species compared to the original 1987 study. Our preliminary results suggest that abundance and presence patterns of orthopterans have changed. Observed trends seem to fall into one of the following three categories: Mediterranean shrubland or high-growing grassland species that have experienced a positive shift in both abundance and altitude; low-growing, open pasture species with a restricted ecological valence that have experienced a decrease in abundance and a shift towards higher altitudes; and a variety of species that seem to remain stable.

[TSB.7-P-2]

Wednesday 4
Discussion corner: Room 6

Functional structure affects community stability: insights from a removal experiment

Rodríguez Pascual, Arturo[1]; Andivia Muñoz, Enrique[2]; Callieni, Gabriel[3]; Valencia Gómez, Enrique[4]

(1) Universidad Complutense de Madrid, Facultad de Ciencias Biológicas; (2) Universidad Complutense de Madrid, Facultad de Ciencias Biológicas; (3) Universidad Complutense de Madrid, Facultad de Ciencias Biológicas; (4) Universidad Complutense de Madrid, Facultad de Ciencias Biológicas

Correspondence e-mail: [arturrod@ucm.es]

The stability of biological communities is crucial for maintaining ecosystem functions and services in a changing environment. In this context, the implementation of an integrative approach based on functional traits, as indicators of community response to changes in species composition can help elucidating the relationships between community structure, stability and ecosystem services. However, studies focusing on stability components from a functional trait-based perspective are scarce, despite the diversity of species' functional traits affects the community's ability to resist and recover from disturbances. Here, we selected five contrasting plant communities under semi-arid conditions, each characterized by different dominant species and implemented removal treatments to modify the community structure, resulting in 40 plots per community (7 removals of the dominant species, 7 of the 4 most acquisitives, 7 of the 4 most conservatives, 7 of a mix of 2 acquisitives and 2 conservatives and 5 controls). After one growing season, preliminary results showed that the removal treatment of conservative species lead to higher recovery due to their replacement by acquisitive species, while the removal of acquisitives lead to lower recovery due to the consequent predominance of conservatives. However, in mixed removal treatments, replacement occurred with species adopting similar strategies to those that were removed. Lastly, the dominant species removal treatment showed a decrease in plant cover, or that the subdominant acquisitive species occupied the available niche .

These findings highlight the relevance of functional traits as modulators of community recovery and underscore their importance in conservative labor.

[TSB.7-P-3]

Thursday 5
Discussion corner: Room 6

The journey of ants: Temporal and spatial dynamics of grassland ant communities along a Mediterranean elevational gradient

López Pérez, Sebastian Enrique[1]; Sánchez Pozo, Andrea[2]; Silvestre Granda, Mariola[3]; Martín Azcarate, Francisco[4]; Seoane Pinilla, Javier[5]

(1) Universidad Autónoma de Madrid; (2) Universidad Autónoma de Madrid; (3) Centro de investigaciones biológicas Margarita Salas; (4) Universidad Autónoma de Madrid; (5) Universidad Autónoma de Madrid

Correspondence e-mail: [sebas293k@gmail.com]

The study of elevational gradients offers a unique opportunity to explore the impact of environmental factors on community composition and assembly. While numerous studies examine altitudinal changes in ant communities, little is known about the temporal stability of these communities and their response to current trends, including climate change. This study compares the elevational patterns of ant communities in the grasslands of the Sierra de Guadarrama (Madrid) between 2016 and 2023, a period of rising temperatures, using taxonomic, phylogenetic, and functional compositions as community descriptors.

In both years, ants were collected at six sites along a 1712 m elevational gradient using pitfall traps. Ants were identified and functionally characterized using four traits: head width, eye width, scape length, and tibia length of the hind leg. A complete phylogeny was also constructed for the ant species detected in the gradient. Relationships of community composition and alpha and beta diversity with elevation and time were analyzed using generalized additive mixed models.

Findings reveal notable temporal stability in the assembly and patterns of ant communities over the 7-year period. This suggests that ant communities exhibit greater resilience to rising temperatures compared to other insect groups. Consequently, any changes, when they occur, are likely to be gradual and might be reflective of deeper, more.

[TSB.7-P-4]

Tuesday 3
Discussion corner: Room 6

The Use of Remote Sensing in Predicting Mushroom Production in Forests of the Iberian Peninsula

Vegas Lázaro, Elena[1]; Aponte Perales, Cristina[2]; Tanase, Mihai[3]; Miguel, Sofia[4]; de Miguel, Sergio[5]; Martinez-peña, Fernando[6]; Rincón, Ana[7]; Bonet, José Antonio[8]; Goberna, Marta[9]; Martínez de Aragón, Juan[10]; Martín Pinto, Pablo[11]; Juan Andrés, Oria de Rueda[12]

(1) ICIFOR; (2) ICIFOR; (3) ICIFOR; (4) UAH; (5) Centre de Ciència i Tecnologia Forestal de Catalunya (CTFC); (6) Centro de Investigación y Tecnología Agroalimentaria (CITA); (7) ICA-CSIC; (8) Centre de Ciència i Tecnologia Forestal de Catalunya (CTFC); (9) INIA-CSIC; (10) Centre de Ciència i Tecnologia Forestal de Catalunya (CTFC); (11) Universidad de Valladolid; (12) Universidad de Valladolid

Correspondence e-mail: [elenavegas5566@gmail.com]

Wild mushrooms, as non-timber forest products, represent an important resource in forest ecosystems, both from an ecological and socio-economic perspective.

The production of wild mushrooms is influenced by a wide range of factors, including meteorology, microclimatic conditions, forest structure, and edaphic and orographic properties. The high spatio-temporal variability of these factors makes precise prediction of mushroom production challenging. This study evaluates the potential of satellite and airborne remote sensing to improve the predictive capacity of mushroom production. For this purpose, long-term time series of mushroom production in coniferous forests across different geographic areas of the Iberian Peninsula were analyzed. Machine learning models (random forest) were employed to assess the importance and predictive power of a set of variables obtained from freely accessible satellite data sources, such as the Normalized Difference Vegetation Index (NDVI) derived from Landsat imagery, soil moisture derived from synthetic aperture radar data, and forest structure descriptors obtained from airborne LiDAR. These variables were complemented with meteorological and orographic data.

Preliminary results suggest that combining soil moisture and NDVI variables yields higher R^2 values compared to models based solely on climatic data, although this improvement is not consistent across all analyzed inventories. This finding highlights the relevance of using remote sensing to capture specific forest environment dynamics and its potential for developing spatially explicit predictive models for mushroom production.

[TSB.7-P-5]

Wednesday 4
Discussion corner: Room 6

Phylogenetic turnover across community assembly of soil bacterial communities in mining areas

Goberna Estelles, Marta[1]; Colin, Yannick[2]; Verdú, Miguel[3]; Navarro-Cano, Jose A.[4]
(1) INIA, CSIC; (2) Univ Rouen Normandie; (3) CIDE, CSIC-UVEG-GV; (4) INIA, CSIC
Correspondence e-mail: [marta.goberna@inia.csic.es]

Introduction. The drivers of temporal change in soil bacterial communities are relatively unknown. Stochastic processes are thought to dominate the early stages of community assembly, generating phylogenetically random patterns. In degraded drylands, however, stringent environmental filters may override stochasticity from early stages, inducing phylogenetic relatedness due to the overrepresentation of stress-resistant lineages. Evolutionary relatedness may be magnified towards carbon-rich mature stages due to intensified biotic interactions.

Materials and methods. To test our hypotheses, we performed a space-for-time substitution study in seven mining areas. We collected 106 topsoil samples, including bare soils and soils across ontogenetic gradients of 13 plant species that naturally colonize the area and belong to four life forms.

Results and discussion. We detected large levels of phylogenetic relatedness, indicating a negligible role of stochasticity across all stages of community assembly, either considering the tips (terminal clustering) or whole branch lengths of phylogenetic trees (whole-level clustering). Terminal clustering intensified along with plant growth following the enrichment in soil organics, whereas whole-level clustering varied across plant life forms based on their differential effect on soil moisture. Clustering intensified along with the increased phylogenetic turnover during community assembly, due to the progressive dominance of large lineages composed of closely related organisms that were phylogenetically more and more distant to the initial communities. Our data help fine-tune current models of bacterial community assembly indicating that 1. environmental filters can override stochasticity from early stages, and 2. large levels of phylogenetic turnover can magnify evolutionary relatedness across gradients of community assembly.

[TSB.7-P-6]

Thursday 5
Discussion corner: Room 6

Temporal succession of vegetation after clearing actions in the Gorbeia SAC

Gómez Peral, Emma[1]; Martinez, Andrea[2]
(1) NEIKER; (2) NEIKER
Correspondence e-mail: [egomez@neiker.eus]

Mountain pastures are diverse ecosystems that offer provisioning services like grass production and regulation services such as carbon sequestration and water regulation, among others. The abandonment of grazing increases shrubland and reduces grazing value. This study evaluates how clearing influences plant composition and ecological succession under extensive grazing, comparing cleared and non-cleared plots (control), studying changes in species frequency and functional groups.

The study was carried out in the Gorbeia Special Conservation Area (Basque Country, Spain) between 2018 and 2024, with annual vegetation sampling in 8 plots (4 cleared and 4 control). The analysis included a PERMANOVA test to compare communities between years and treatment, SIMPER analysis to identify the species that contributed to their differentiation, and a GLMM model to evaluate the effect of treatment and time on functional groups.

43 plant species were identified, with graminoids and dicotyledons being more frequent in the cleared plots and shrub species in the controls, as expected. The difference in plant structure between treatments was significant ($p<0.001$) and decreased over time. Thus, the gorse (Ulex gallii) and the ericaceous, despite being more frequent in the controls from the beginning, increased in frequency over time in the cleared areas. Although both groups of shrubs showed the same trend, the gorse showed a greater colonization capacity, since by 2024 the frequencies in the two treatments were equal. Necromass was also significantly higher in the areas cleared at the beginning, decreasing progressively.

[TSB.7-P-7]

Tuesday 3
Discussion corner: Room 6

Evaluation of the area and special and temporal variability of edapho-endemism Centaurea ultreiae Silva-Pando (Compositae) and its communities

Silva-Pando, Francisco Javier[1]; Jiménez Tobio, Sara[2]; Bustos Vázquez, Marina[3]

(1) Centro de Investigación Forestal de Lourizán-XERA-AGIF; (2) Consellería do Medio Rural; (3) Centrode Investigación Forestal de Lourizán-XERA-AGIF

Correspondence e-mail: [francisco.javier.silva.pando@xunta.es]

Centaurea ultreiae is an edafp-endemism from northwest Spain that grows on gabros and related rocks. It´s included in the IUCN Category: CR B1+2a,b(i,ii,iii,v) and in the Galician Catalog of Threatened Plants as “in danger of extinction”. In 2003, a total population of 6,821 ramets and a relatively good state of conservation were estimated. Between 2021 to 2024, field work has been carried out to know the occupied area and an annual monitoring in 22 plots of 10x10 m2. Vegetative and floral development and floristic inventories were monitored according to the Braun-Blanquet method.

The area of presence covers 22 km2, with a real occupied surface -minimum area of 1 m2-, of 10,2 hectares. C. ultreiae grows exclusively on gabros or similar rocks, in non-waterlogged soils - some moisture content even in summer -, with an estimated population of 130,000 ramets and an annual variability between 10-20%. The basal rosette is visible all year round, with flowering from May to July. The floristic composition depends on the type of soil and tree cover. A new community Ulici europaie-Ericetum cinereae subassoc centauretosum ultreiae is described., characterized by the presence of Centaurea ultreiae, Thymelaea coridifolia, Euphorbia flavicoma ssp. occidentalis and E. polygalifolia ssp. hirta, in addition to elements of the Cl. Calluno-Ulicetea; two variants have been detected, one in uncovered areas and another under Eucalyptus spp. Temporally, a high constancy of characteristic elements has been observed, with a slight increase in accompanying species, depending on the silvicultural treatment applied.

[TSB.7-P-8]

Wednesday 4
Discussion corner: Room 6

Density dependence and mycorrhizal strategies: Implications for tropical and subtropical forest dynamics

Tyyskä, Henna[1]; Vilà Cabrera, Albert[2]; Gimeno, Teresa[3]; Jump, Alistair[4]; Chen, Jan-Chang[5]

(1) Centre de Recerca Ecològica i Aplicacions Forestals (CREAF-UAB); (2) University of Vic / CREAF; (3) Centre de Recerca Ecològica i Aplicacions Forestals (CREAF-UAB); (4) University of Stirling; (5) National Pingtung University of Science and Technology

Correspondence e-mail: [h.tyyska@creaf.uab.cat]

Recent studies suggest that mycorrhizal strategies can have an important role in shaping forest community structure by influencing the outcomes of density-dependent processes. This occurs due to mechanisms such as mycorrhizae-mediated plant-soil feedback, the suppression of soil-borne pathogens, and the mediation of competitive interactions. Negative conspecific density dependence (CDD) occurs when high adult densities of a species reduce the establishment of conspecific juveniles due to competition or accumulation of species-specific pathogens. This process is thought to favour tree species coexistence and diversity. However, mutualistic symbionts can modulate these effects: Ectomycorrhizal (EcM) trees are expected to experience less negative CDD due to their enhanced protection against pathogens. Moreover, shared mycorrhizal strategy on a community level is expected to benefit both arbuscular- and ectomycorrhizal tree recruitment through positive plant-soil feedback. Despite recent research advances, the role of mycorrhizae in density-dependent processes remains poorly understood in subtropical and tropical ecosystems, particularly across diverse forest types and environmental gradients. This study aims to fill this gap by analysing large-scale (sub)tropical forest inventory data and testing hypotheses on mycorrhizal-mediated density dependence in tree recruitment.

We modelled the impact of mycorrhizal type on recruitment for 144 tree species across 1539 forest inventory plots in the subtropical island of Taiwan, to explore the relationships between mycorrhizal types, density dependence, and community structure along environmental and climatic gradients. Our findings suggest that mycorrhizal-mediated processes shape density-dependent effects on a wide range of tree species and provide novel insights into the subtropical and tropical forest community assembly and structure.

TSB.8. Transitional aquatic-terrestrial ecosystems: the ecological relevance of the dry phase of non-perennial inland waters

Monday, 2 (18:00-19:30)

Room: Cova dos libros

Non-perennial (temporary) inland waters, such as non-perennial rivers and temporary ponds, are coupled aquatic-terrestrial ecosystems that only sometimes present surface water. Despite being found worldwide and increasing in extent due to global change, these ecosystems are still overlooked in conceptual models, legislation, policy, and monitoring efforts. In these ecosystems, drying creates a shifting mosaic of aquatic (lotic and lentic) and terrestrial habitats (dry beds) across wet and dry phases, supporting aquatic, semi-aquatic, and terrestrial communities, as well as processes that occur during these contrasting phases. While knowledge of these ecosystems has grown exponentially in recent decades, most research has focused on the wet phase through the lens of limnologists. The aim of this special session is to bring together aquatic and terrestrial ecologists, as well as managers, to advance the assessment, conservation, and restoration of coupled aquatic-terrestrial ecosystems. We particularly welcome studies focused on: the ecological aspects of the dry phase (e.g., biogeochemical processes, terrestrial biological communities); comparative ecological studies of the wet and dry phases; the influence of the dry phase on the structure and functioning of the ecosystem during the wet phase; and on the human dimensions and socio-ecological perspectives on these coupled ecosystems.

Organizers:

• **María Mar Sánchez-Montoya,** Universidad Complutense de Madrid

• **Pablo Rodríguez-Lozano,** Universitat de les Illes Balears; Núria Catalán, CEAB-CSIC.

TSB.8. Orals

[TSB.8-O-1]

Monday 2, evening: 18:00
Room: Cova dos libros

Expanding towards contraction: the alternation of floods and droughts as a fundamental component in river ecology

Bernal, Susana[1]; Ledesma, José L.J.[2]; Peñarroya, Xavier[3]; Jativa, Carolina[4]; Catalán, Núria[5]; Casamayor, Emilio[6]; Lupon, Anna[7]; Marcé, Rafael[8]; Martí, Eugènia[9]; Triadó-Margarit, Xavier[10]; Rocher-Ros, Gerard[11]

(1) Centre d'Estudis Avançats de Blanes, CEAB-CSIC; (2) Museo Nacional Ciencias Naturales, MNCN-CSIC; (3) Centre d'Estudis Avançats de Blanes, CEAB-CSIC; (4) Centre d'Estudis Avançats de Blanes, CEAB-CSIC; (5) Centre d'Estudis Avançats de Blanes, CEAB-CSIC; (6) Centre d'Estudis Avançats de Blanes, CEAB-CSIC; (7) Centre d'Estudis Avançats de Blanes, CEAB-CSIC; (8) Centre d'Estudis Avançats de Blanes, CEAB-CSIC; (9) Centre d'Estudis Avançats de Blanes, CEAB-CSIC; (10) Centre d'Estudis Avançats de Blanes, CEAB-CSIC; (11) Swedish University of Agricultural Sciences

Correspondence e-mail: [sbernal@ceab.csic.es]

Climate warming is causing more extreme weather conditions, with both larger and more intense precipitation events as well as extended periods of drought in many regions of the world. The consequence is an alteration of the hydrological regime of streams and rivers, with an increase in the probability of extreme hydrological conditions. Mediterranean-climate regions usually experience extreme hydrological events on a seasonal basis and thus, freshwater Mediterranean ecosystems can be used as natural laboratories for better understanding how climate warming will impact ecosystem structure and functioning elsewhere.

Here, we revisited and contextualized historical and new datasets collected at Fuirosos, a well-studied Mediterranean intermittent stream naturally experiencing extreme hydrological events, to illustrate how the seasonal alternation of floods and droughts influence hydrology, microbial assemblages, water chemistry, and the potential for biogeochemical processing. Moreover, we revised some of the most influential conceptual and quantitative frameworks in river ecology to assess to what extent they incorporate the occurrence of extreme hydrological events.

Based on this exercise, we identified knowledge gaps and challenges to guide future research on freshwater ecosystems under intensification of the hydrological cycle. Ultimately, we aimed to share the lessons learned from ecosystems naturally experiencing extreme hydrological events, which can help to better understand warming-induced impacts on hydrological transport and cycling of matter in fluvial ecosystems.

[TSB.8-O-2]

Monday 2, evening: 18:15
Room: Cova dos libros

(Dis)connecting the Globe Through Water-Driven Ecological and Biogeochemical Corridors in the Polar-Alpine Biome

Arias del Real, Rebeca[1]; de los Ríos, Asunción[2]; Hurtado, Pilar[3]

(1) National Museum of Natural Sciences-Spanish National Research Council; (2) National Museum of Natural Sciences-Spanish National Research Council; (3) Rey Juan Carlos University

Correspondence e-mail: [rebeca.arias@mncn.csic.es]

Polar-Alpine regions are warming at an accelerated rate, with projected climate changes such as warmer winters, earlier snowmelt, and intensified precipitation reshaping hydrological and biogeochemical cycles, biodiversity distribution, and ecosystem connectivity. Glacier-fed streams, critical transitional ecosystems in these regions, are undergoing shifts in freeze–thaw cycles, characterized by longer thaw phases and the emergence of a dry phase. These changes create new habitats and alter water-driven ecological and biogeochemical corridors that facilitate the transfer of matter, energy, and biodiversity. While enhanced connectivity can initially boost local biodiversity and facilitate dispersal, prolonged dry phases threaten specialist taxa, leading to biotic homogenization across landscapes. This connectivity is increasingly vulnerable to disruptions from the dry phase, particularly in regions where glaciers have disappeared, resulting in reduced water availability and altered ecosystem dynamics.

The shift in freeze–thaw–dry cycles introduces novel challenges for biodiversity and ecosystem functioning. While expanding glacier-fed streams enhance habitat heterogeneity and connectivity, they also risk biotic homogenization and the loss of specialist taxa as thaw phases dominate. The dry phase allows the colonization of pioneer species, contributing to landscape "greening" but potentially reducing spatial ß-diversity and genetic resilience. This perspective underscores the importance of studying these emerging water-driven connectivity patterns and their cascading impacts on terrestrial and aquatic ecosystems. We highlight the urgent need for research on biodiversity conservation, metacommunity dynamics, and ecosystem resilience, as these changes present critical challenges to the functioning of Polar-Alpine biomes in the context of global change.

[TSB.8-O-3]

Monday 2, evening: 18:30
Room: Cova dos libros

Unfolding the dynamics of ecosystems undergoing alternating wet-dry transitional states

Hurtado, Pilar[1]; Delgado-Baquerizo, Manuel[2]; Sabater, Sergi[3]; Gutiérrez-Cánovas, Cayetano[4]; Valencia, Enrique[5]; Aragón, Gregorio[6]; Cantón, Yolanda[7]; Datry, Thibault[8]; Giordani, Paolo[9]; G. Medina, Nagore[10]; de los Ríos, Asunción[11]; Romaní, Anna[12]; Weber, Bettina[13]; Arias-Real, Rebeca[14]

(1) Rey Juan Carlos University; (2) IRNAS-CSIC; (3) ICRA; (4) Rey Juan Carlos University; (5) Universidad Complutense de Madrid; (6) Rey Juan Carlos University; (7) Universidad de Almería; (8) INRAE; (9) University of Genoa; (10) Universidad Autónoma de Madrid; (11) MNCN-CSIC; (12) University of Girona; (13) University of Graz; (14) MNCN-CSIC

Correspondence e-mail: [phurtadoarague s@gmail.com]

A substantial portion of Earth's ecosystems experiences periodic wet-dry cycles, creating water-driven transitional ecosystems like intermittent rivers and coastal shorelines. These systems, distributed globally, have often been studied as separate entities despite forming a single interconnected meta-ecosystem. This fragmented perspective has hindered a comprehensive conceptual and empirical understanding of these ecosystems. In this work, we propose a conceptual framework that places the temporal dynamics of water availability at the center of biodiversity and functional patterns in transitional ecosystems on a global scale. Biological covers, such as aquatic biofilms and biocrusts, provide an ideal model system as they thrive across both aquatic and terrestrial states. Their successional dynamics illustrate the complex interactions between these states. The characteristics of wet-dry cycles - including their duration, frequency, and rate of change - create distinct scenarios that shape the occurrence of different biological covers based on their desiccation and hydration resistance traits. These trait profiles define the eco-evolutionary potential of biological covers, allowing them to support diverse functions while maintaining comparable levels of multifunctionality. By recognizing alternating transitional states as interconnected components of a larger system, our approach offers new insights into managing the impacts of global change on biodiversity and ecosystem multifunctionality. This perspective also opens pathways for interdisciplinary research aimed at advancing our understanding of water-driven transitional ecosystems.

[TSB.8-O-4]

Monday 2, evening: 18:45
Room: Cova dos libros

Physico-chemical indicators of disconnected pools and dry riverbeds for the assessment of the ecological status of non-perennial rivers

Sánchez Nogueras, Judit[1]; Arce Sánchez, Maria Isabel[2]; Piñero Fernandez, Martí[3]; Quevedo Ortiz, Guillermo[4]; zfreixinos@gmail.com, Zeus[5]; DE LAS HERAS PUNAL, PALOMA[6]; Bonada, Nuria[7]; Cid Puey, Nuria[8]; Sánchez Campaña, Carlota[9]; López-Rodríguez, Nieves[10]; Soria Extremera, Maria[11]; Rodríguez Lozano, Pablo[12]; Ersoy, Zeynep[13]; Roblas Moreno, Neftali[14]; Verdugo, Mari[15]; Miñano Martínez, Jesús[16]; López Pintor, Antonio[17]; Morcillo Alonso, Felipe[18]; Díaz Redondo, María[19]; Suárez Alonso, María Luisa[20]; Vidal-Abarca Gutiérrez, María Rosario[21]; López-Rodríguez, Jose Manuel[22]; Tierno de Figueroa, Jose Manuel[23]; Rovira, Jose Vicente[24]; Fortuño-Estrada,, Pau[25]; Pérez Lajarín, Eva[26]; Sánchez Montoya, María Mar[27].

(1) Complutense University of Madrid; (2) University of Murcia; (3) University of Barcelona; (4) University of Barcelona; (5) University of Murcia, Murcia; (6) Complutense University of Madrid; (7) University of Barcelona; (8) IRTA Marine and Continental Waters Programme, La Rapita, Spain; (9) University of Barcelona; (10) University of Barcelona; (11) University of Barcelona; (12) Autónoma University of Madrid; (13) University of Barcelona; (14) Centre for Hydrographic Studies – CEDEX, Madrid, Spain; (15) Centre for Hydrographic Studies – CEDEX, Madrid, Spain; (16) University of Murcia; (17) Complutense University of Madrid; (18) Complutense University of Madrid; (19) Centre for Hydrographic Studies – CEDEX, Madrid, Spain; (20) University of Murcia; (21) University of Murcia; (22) Department of Ecology; (23) Department of Zoology; (24) Department of Biodiversity, Ecology, and Evolution; (25) University of Barcelona; (26) Complutense University of Madrid; (27) Complutense University of Madrid.

Correspondence e-mail: [judits03@ucm.es]

Non-perennial rivers are highly dynamic ecosystems characterized by alternating flowing (lotic habitats), disconnected pools (lentic habitats) and dry riverbeds (terrestrial habitats) habitats. Research on these ecosystems have revealed their ecological importance for biodiversity, ecosystem processes, and ecosystem services.

Despite their ecological significance, non-perennial rivers are often overlooked in scientific research and policy frameworks. In fact, the European Water Framework Directive (WFD) primarily addresses the flowing phase of rivers, leading to an incomplete assessment and management of non-perennial river systems.In this study, we focused on the physico-chemical component of the assessment of the ecological status of the WFD in disconnected pools and dry riverbed sediments. In order to assess the potential of physico-chemical parameters to assess the physico-chemical quality of non-perennial rivers during the dry phase, we related several parameters to anthropogenic pressures (pH, conductivity, oxygen, nutrients, and carbon for disconnected pools, and pH, conductivity and nutrients, for dry riverbed sediments). To this end, we monitored 65 disconnected pools and 61 dry riverbed sediments across different basins in Spain (Segura, Guadalquivir, Guadiana, Tajo, Jucar, Ebro, Menorca , and Catalan internal basins) along a multiple-stressor gradient. Additionally, we analyzed the geology of each study basin to determine its influence on the responses of physico-chemical parameters to the pressure gradient. These findings will allow advancing the proper assessment of non-perennial rivers, and will support the incorporation of the dry phase of rivers in ecosystem monitoring and assessment works through government policy and legislation.

[TSB.8-O-5]

Monday 2, evening: 19:00
Room: Cova dos libros

Taxonomic distribution and genomic underpinnings of drought tolerance in bacteria

Ramoneda, Josep[1]; Jordá Fernández, Celia[2]; Francesch Vázquez, Andrés[3]; Cáliz, Joan[4]; Ochoa Hueso, Raúl[5]; O. Casamayor, Emilio[6]

(1) Centro de Estudios Avanzados de Blanes (CEAB-CSIC); (2) Centro de Estudios Avanzados de Blanes (CEAB-CSIC); (3) Centro de Estudios Avanzados de Blanes (CEAB-CSIC); (4) Centro de Estudios Avanzados de Blanes (CEAB-CSIC); (5) Universidad de Cádiz; (6) Centro de Estudios Avanzados de Blanes (CEAB-CSIC)

Correspondence e-mail: [josep.ramoneda@ceab.csic.es]

Introduction: Drought has strong impacts on the composition and functionality of microbial communities. However, the range of microbial taxa that are tolerant to drought and the traits that allow them to withstand such conditions remain unclear. By compiling information on the taxonomic composition of 357 drought-impacted bacterial communities across 24 independent experiments, we determined the taxonomic distribution of drought tolerance in bacteria and associated genomic attributes.

Materials and Methods: We compiled 16S rRNA gene sequencing data from 24 independent experiments manipulating water inputs to microbial communities across all continents. We processed all sequences through a common pipeline to infer amplicon sequencing variants (ASVs), performed taxonomic annotation using the Silva v138.1 database, and determined whether taxa were drought-tolerant or -sensitive using differential abundance analysis between drought-impacted and control samples. We mapped the 16S rRNA gene fragments to the Genome Taxonomy Database (GTDB) to obtain representative genomes.

Results and Discussion: We identified a total of 5520 drought-tolerant ASVs from 40 unique phyla. Drought tolerance was most prevalent within the phyla Actinobacteria and Chloroflexi, while sensitive taxa belonged predominantly to the Acidobacteria and Bacteroidetes. However, drought tolerance was widespread across the bacterial tree of life, and the trait was phylogenetically conserved at the family level. Genomes of drought-tolerant taxa had a higher GC content and a higher prevalence of functional genes for carbohydrate metabolism, transcription, and signal transduction. Our results reveal the taxonomic groups most likely to withstand persistent drought in terrestrial environments, and identify functional traits relevant to drought adaptation in bacteria.

[TSB.8-O-6]

Monday 2, evening: 19:15
Room: Cova dos libros

Climate change mitigation strategies in rice farming entail cascading effects across ecosystem boundaries

Pérez-Méndez, Néstor[1]; Pompozzi, Gabriel[2]; Catala-Forner, Mar[3]; Martinez-Eixarch, Maite[4]; Marrero, Hugo[5]

(1) IRTA-Amposta; (2) Instituto Argentino de Investigaciones de Zonas Áridas; (3) IRTA-Amposta; (4) IRTA-La Rapita; (5) Centro de Recursos Naturales Renovables de las Zonas Semiáridas

Correspondence e-mail: [nestor.perez@irta.cat]

Water-saving irrigation strategies have been globally promoted to mitigate the contribution of rice farming to climate change. While the positive effect of those strategies in reducing greenhouse gas emissions is undeniable, potential cascading effects on agroecosystem functioning remain completely unexplored. For instance, multiple drainages throughout the rice cycle associated to alternative irrigation practices may disrupt the emergence of semiaquatic insects from rice fields, reducing prey availability for terrestrial predator (e.g., jumping spiders, Salticidae), and ultimately affecting their reproductive success. Here, by using a two-year field-scale experiment, we addressed these issues by comparing three irrigation strategies that represent a gradient of water use intensity: Conventional permanent flooding (No drying periods) > Mid-season drainage (1 drying period) > Alternate Wetting and Drying (multiple drying periods). Specifically, on each experimental plot (n = 15; 5 replicates per strategy), we quantified i) the emergence of semiaquatic insects, ii) prey availability in rice plants, and iii) abundance and reproductive success (i.e., eggs/sac) of jumping spiders (Salticidae). Our results show that both the emergence of semiaquatic insects and the abundance of available preys were markedly reduced as water use decreased. In addition, while the abundance of jumping spiders did not differ among irrigation strategies, their reproductive success was severely compromised in the Alternate Wetting and Drying strategy. Our results show that water shortening in rice farming indirectly hamper terrestrial spider reproduction through limiting the emergence of potential prey from the aquatic to terrestrial boundaries. This highlights the need to account for potential trophic cascading effects when designing climate change mitigation strategies in agriculture to avoid undesirable side-effects on agroecosystem functioning.

TSB.8. Posters

[TSB.8-P-1]

Tuesday 3
Discussion corner: Room 11

The terrestrial invertebrates of non-perennial rivers and their key role as dry-phase indicators of ecological quality

Sánchez Montoya, María Mar[1]; Sánchez-Nogueras, Judit[2]; Piñero-Fernández, Martí[3]; Freixinos, Zeus[4]; Quevedo-Ortiz, Guillermo[5]; Rodríguez-Lozano, Pablo[6]; Arce, Maria Isabel[7]; Bonada, Nuria[8]; Cid, Nuria[9]; López-Pintor, Antonio[10]; de las Heras, Paloma[11]; Morcillo, Felipe[12]; Díaz-Redondo, Maria[13]; Rovira, Jose Vicente[14]; Suárez, Maria Lusia[15]; Vidal-Abarca, Maria Rosario[16]; Sánchez-Campaña, Carlota[17]; López-Rodríguez, Nieves[18]; Soria, Maria[19]; Ersoy, Zeynet[20]; Roblas, Neftalí[21]; Verdugo, María[22]; López-Rodríguez, Manuel[23]; Tierno de Figueroa, Jose Manuel[24]; Miñano-Martínez, Jesus[25]

(1) Complutense University of Madrid; (2) Complutense University of Madrid; (3) Universitat de Barcelona; (4) Universiy of Murcia; (5) Universitat de Barcelona; (6) Universitat de les Illes Balears; (7) Universiy of Murcia; (8) Universitat de Barcelona; (9) IRTA; (10) Complutense University of Madrid; (11) Complutense University of Madrid; (12) Complutense University of Madrid; (13) CEDEX; (14) Complutense University of Madrid; (15) University of Murcia; (16) University of Murcia; (17) Universitat de Barcelona; (18) Universitat de Barcelona; (19) Universitat de Barcelona; (20) Universitat de Barcelona; (21) CEDEX; (22) CEDEX; (23) University of Granada; (24) University of Granada; (25) Complutense University of Madrid.

Correspondence e-mail: [msanch70@ucm.es]

Rivers are considered critical habitats for freshwater biodiversity. However, this perspective often overlooks the fact that many rivers are non-perennial, and besides freshwater biodiversity they also hold a significant proportion of terrestrial biodiversity during the dry phase that are supported by terrestrial habitats (dry riverbeds). Similar to aquatic invertebrates, terrestrial invertebrates are key elements of the riverine landscape during the dry phase, playing relevant ecological functions such as the decomposition of organic matter. In addition, this community has been proposed as bioindicators of ecological quality in rivers during the dry phase. However, they are largely overlooked in conceptual models, legislation, policy, and ecological monitoring. In this study, developed in the framework of the DRY-Guadalmed Project, first we characterized, from a taxonomic and functional perspective, the terrestrial invertebrate community of non-perennial rivers found along 61 dry riverbeds and adjacent riparian habitats across different basins in Spain (Segura, Guadalquivir, Guadiana, Tajo, Menorca and Catalan internal basins) along a multiple-stressor gradient. Second, we evaluated the potential of different terrestrial invertebrate taxa to act as bioindicators of river health during the dry phase by analyzing their responses to anthropogenic disturbances. These results will guide the development of biotic indices suitable for the assessment of the ecological status of non-perennial rivers during the dry phase.

TSB.9. The flow of elements and the functioning of the biosphere

Wednesday, 4 (11:00-12:30); (12:45-14:15)

Room: Seminario 3

The biogeochemical cycles of several key elements have been significantly altered in the past decades, to the extent that two of them (nitrogen and phosphorus) have crossed the disturbance threshold that we consider safe for the functioning of the Earth. Understanding biogeochemical processes, including their cycles, the relative abundances of elements and the interactions with organisms and the environment, is essential to deciphering the structure and function of ecosystems. By understanding the flow of essential elements such as carbon, nitrogen or phosphorus, we can trace, quantify and predict processes such as photosynthesis, nitrogen fixation and water pollution, which can directly influence Earthâ€™s system responses to global change.

The session aims to present cutting-edge studies in biogeochemistry and ecological stoichiometry to gain insights into the functioning of organisms, ecosystems, and our biosphere. We encourage research across different spatial scales, from local experimental studies to global data syntheses, to improve our understanding and prediction of global change impacts, as well as the biotic and abiotic interactions between terrestrial and aquatic ecosystem compartments. Studies that integrate spatial and temporal scales, combine different methods or provide novel conceptual and theoretical frameworks are particularly welcome.

Organizers:

• **Estela Romero,** CREAF, UAB

• **Marcos Fernández-Martínez,** CREAF, UAB

• **Albert Rivas-Ubach,** Institute of Forest Sciences (ICIFOR-INIA, CSIC)

TSB.9. Orals

[TSB.9-O-1]

Wednesday 4, morning (first): 11:00
Room: Seminario 3

The burden of big genome sizes in plant distribution

Vallicrosa, Helena[1]; Fernández, Pol[2]; Halloy, Anna[3]

(1) EPFL-WSL; (2) Institut Botànic de Barcelona; (3) EPFL

Correspondence e-mail: [helena.vallicrosa@epfl.ch]

The huge variability of genome size across species, with a variation of 61,000-fold among eucaryotes, has intrigued plant researchers and ecologists for several decades. Still, little is known about how genome size variability shapes plant distribution across the globe. In this study, we compile a dataset of more than 28,000 points across the land plant kingdom (comprising Bryophyta and vascular plants (tracheophytes)) encompassing foliar elemental composition (N, P, K, Ca, Mg %), genome size, and environmental variables. Our main objective is to explore the ecological implications of genome size variability based on the biogeochemical niche theory, specially, checking for potential drawbacks in distribution range patterns across the globe. Our results suggest that plants with bigger genome sizes are limited to exist in nutrient-rich environments and tend to have smaller distribution ranges due to the costs of building and maintaining such big genomes. These findings shed light on species distribution patterns and diversity drivers.

[TSB.9-O-2]

Wednesday 4, morning (first): 11:15
Room: Seminario 3

Leaf nutrients, but not genome size, modulate plant photosynthesis

Song, Xin[1]; Vallicrosa, Helena[2]; Fernándezd, Pol[3]; Garcia-Porta, Joan[4]; Anadon-Rosell, Alba[5]; Liu, Daijun[6]; Peguero, Guille[7]; Fernández Martínez, Marcos[8]

(1) Centro de Investigación Ecológica y Aplicaciones Forestales(CREAF); (2) Swiss Federal Institute for Forest, Snow and Landscape Research WSL; (3) Institut Botànic de Barcelona (IBB), CSIC-CMCNB; (4) Faculty of Biological Sciences, Complutense University of Madrid; (5) Centro de Investigación Ecológica y Aplicaciones Forestales(CREAF); (6) University of Vienna; (7) Ecology and Environmental Sciences, Universitat de Barcelona; (8) Centro de Investigación Ecológica y Aplicaciones Forestales(CREAF)

Correspondence e-mail: [x.song@creaf.uab.cat]

Genome size (GS) is extremely variable across plant species, but we do not know whether such differences result in morphological and physiological constraints leading to ecological and evolutionary consequences. Previous studies pointed out that plants with larger GS have lower photosynthetic rates. Plants with larger GS, however, also have higher foliar concentrations of nitrogen (N) and phosphorus (P), which positively correlate with photosynthetic rates following the assumptions of the leaf economics spectrum. Nonetheless, the interplay between GS, leaf photosynthetic rates, N and P concentrations across a relevant phylogenetic scale remains elusive. For the first time, we address this question by compiling a global dataset of GS, photosynthesis rates, leaf concentrations of N and P and environmental information for 376 plant species, thus covering all major families and phylogenetic lineages within the plant kingdom, to test whether the variation across species in plant leaf photosynthetic capacity (Amax) depend on species' GS, and how the environment and functional traits influence the relationship between GS and Amax. Our results indicate that the evolutionary history is a direct factor affecting GS, Amax, foliar N and P. Larger GS were found in plants with high foliar P and living over acidic soils. Amax was higher in P and N-rich plants, but we did not find evidence suggesting that photosynthetic capacity is constrained by their GS. Our results suggest that GS-driven evolutionary limitation does not pivot around a constraint imposed on the photosynthetic capacity of plant species.

[TSB.9-O-3]

Wednesday 4, morning (first): 11:30
Room: Seminario 3

The bioelemental blueprint of bryophytes: Linking composition with function

Rodriguez Penedo, Eladio[1]; Grau Andrés, Roger[2]; Yáñez Serrano, Ana María[3]; Preece, Catherine[4]; Corbera, Jordi[5]; Sabater Comas, Francesc[6]; Fernández Martínez, Marcos[7]

(1) Centre de Recerca Ecològica i Aplicacions Forestals (CREAF); (2) CREAF; (3) CREAF-CSIC-UAB; (4) IRTA; (5) Delegació de la Serralada Litoral Central, ICHN, Mataró; (6) University of Barcelona; (7) CREAF

Correspondence e-mail: [e.rodriguez@creaf.uab.cat]

The study of the elemental composition of living systems has been proposed as an objective approach to understanding species diversity, ecosystem functioning, and species-specific functional traits. Chemical elements, as the fundamental components of the matter constituting living organisms, play critical roles in physiological processes and metabolic pathways, directly influencing how organisms interact with each other and adapt to their environments. By analysing the elemental composition of bryophytes, we here explore its connection with other functional traits and assess whether bioelemental traits or traditional functional traits better differentiate bryophyte groups. We demonstrate that the elemental composition of bryophytes is a more effective tool for distinguishing between moss and liverwort groups than metabolic or morphological functional traits. This distinction is driven by key elements such as boron (B), copper (Cu), carbon (C), sodium (Na), potassium (K), sulphur (S), and nitrogen isotope 15N, which played pivotal roles in separating these groups. Furthermore, the differentiation of bryophyte growth forms based on elemental composition also surpassed the accuracy achieved using other functional traits, highlighting the robustness of the bioelemental approach. Additionally, we identified significant correlations between specific elements and functional traits: nitrogen (N), phosphorus (P), and potassium (K) were strongly linked to photosynthetic activity, while boron (B), iron (Fe), and manganese (Mn) were associated with the production of biogenic volatile organic compounds (BVOCs). This study supports and expands the framework of ecological stoichiometry, emphasizing the potential of a bioelemental space as a powerful tool to link elemental composition with functional ecology.

[TSB.9-O-4]

Wednesday 4, morning (first): 11:45
Room: Seminario 3

Shifting elementomes: addressing long-term changes in the biogeochemical composition of ecosystems from paleoenviromental records

de la Casa, Javier[1]; Nogué, Sandra[2]; de Càceres, Miquel[3]; Sardans, Jordi[4]; Pla-Rabés, Sergi[5]; Benavente, Mario[6]; Giralt, Santiago[7]; Hernández, Armand[8]; Raposeiro, Pedro[9]; Castilla-Beltrán, Álvaro[10]; de Nascimento, Lea[11]

(1) CREAF; (2) Autonomous University of Barcelona; (3) CREAF; (4) CREAF; (5) CREAF; (6) GEO3BCN; (7) GEO3BCN; (8) University of A Coruña; (9) University of Azores; (10) University of La Laguna; (11) University of La Laguna

Correspondence e-mail: [delacasa.snchz@gmail.com]

The elemental composition of ecosystems and the biosphere responds sensitively to environmental perturbations, defining new ecosystem characteristics. With an evidenced disruption on the global C, N and P cycles, global change has potentially shifted the elemental composition of ecosystem and living organisms. However, evidencing those long-term biogeochemical changes remains a challenge. X-ray fluorescence (XRF) and other advanced analytical techniques provide detailed information on the geochemical composition of chronologically dated sedimentary sequences. These methods yield high-resolution data on elemental concentrations and ratios, enabling the reconstruction of past environmental conditions. In this contribution, we introduce a novel approach that utilizes multivariate analysis of all available biogeochemical and geochemical data (elementome) to characterize the trajectories of elemental composition over time and link them to drivers of environmental change. Our analysis of records from Atlantic islands characterizes the magnitude, graduality and direction of biogeochemical shifts in paleoecological records from several archipelagos. This research sheds light on a potential modern shift towards organic-dominated elementomes and examines the effects of human arrival and climate changes on the stability of ecosystem elementomes. Moving ahead, we discuss the potential and limitations of assessing long-term ecosystem elementome shifts from paleoenvironmental records

[TSB.9-O-5]

Wednesday 4, morning (first): 12:00
Room: Seminario 3

Linking root elemental composition and stoichiometry with tree health in forests invaded by soil-borne pathogens

Gaytan, Alvaro[1]; Gallego-Tévar, Blanca[2]; Guiérrez, Eduardo[3]; Alba, Manuela[4]; Pérez-Ramos, Ignacio M.[5]; Gómez-Aparicio, Lorena[6]

(1) Instituto de Recursos Naturales y Agrobiología de Sevilla (IRNAS-CSIC); (2) Universidad de Sevilla; (3) Instituto de Recursos Naturales y Agrobiología de Sevilla (IRNAS-CSIC); (4) Instituto de Recursos Naturales y Agrobiología de Sevilla (IRNAS-CSIC); (5) Instituto de Recursos Naturales y Agrobiología de Sevilla (IRNAS-CSIC); (6) Instituto de Recursos Naturales y Agrobiología de Sevilla (IRNAS-CSIC)

Correspondence e-mail: [alvarogaytan@live.com]

Exotic pathogens are key drivers of tree decline, profoundly transforming forests worldwide. These pathogens frequently disrupt trees' ability to absorb essential soil nutrients, which might translate into stoichiometric imbalances that impair tree performance. However, little is known about the impact of pathogen-driven decline on tree elemental composition and stoichiometry, and whether these changes can be used as early-warning signals of decline.

This study examines the impact of the exotic soil-borne pathogen Phytophthora cinnamomi on the elemental composition and stoichiometry of Quercus rotundifolia trees in agroforestry systems (dehesas) of southern Spain. We analyzed the root elementome (15 chemical elements) of 500 oaks across 30 sites, covering a large gradient of crown defoliation (0-95%) and soil chemical properties. We compared the root elemental composition and stoichiometry of declining vs. healthy oaks, and explored potential thresholds for chemical changes along gradients of crown defoliation.

Our results reveal clear differences in the root elementome of declining and healthy trees, with declining trees showing much lower concentrations of all elements but calcium (Ca). Notably, the K:Ca ratio emerged as the best predictor of crown status, even at low defoliation levels. Since Ca is known to inhibit P. cinnamomi reproduction and enhance plant tolerance to disease, this result suggests that infected oaks might prioritized Ca uptake for pathogen protection at the expense of elements critical for drought tolerance as K. This nutrient imbalance could lead to a feedback loop that exacerbates decline. Our findings also highlight the potential of the K:Ca ratio as an early-warning signal of pathogen-driven tree decline in Mediterranean forests.

[TSB.9-O-6]

Wednesday 4, morning (first): 12:15
Room: Seminario 3

Effects of Leaf and Whole Aboveground Element Stocks on Forest Biomass Production

Diniz, Ecio[1]; Rodríguez-Penedo, Eladio[2]; Grau-Andrés, Roger[3]; Vayreda, Jordi[4]; Fernández-Martínez, Marcos[5]

(1) CREAF; (2) CREAF; (3) CREAF; (4) CREAF; (5) CREAF

Correspondence e-mail: [eciodiniz@gmail.com]

Introduction: Element stocks in aboveground plant organs play an important role in forest biomass production. However, the effects of foliar element stocks compared to the impact of stocks from other organs on biomass production remain unexplored. Methods: We assessed the individual predictive power of foliar element stocks compared to whole-aboveground organs (i.e., leaves, stems, bark, branches) for explaining biomass production across 2000 forest plots in the northeast of the Iberian Peninsula. For that, we used generalized additive mixed models having as predictors the element stocks data (t ha-1) of C, Ca, K, Mg, N, Na, P, and S per organ (i.e., the biomass of the organ multiplied by the concentration of the element). Forest biomass production was considered in our study as the overall total amount of biomass accumulated over the study plots in a given period. Results and Discussion: We found that leaf element stocks were the best predictors, explaining 58% of the variance in biomass production when considering the set of predictors composed of C, Ca, K, Mg, N, P, C×N, C×P, and N×P. Our results indicate leaf element stocks as critical predictors of forest biomass production while providing useful insights for researchers and managers on which type of elemental data to collect and assess for evaluating biomass production.

[TSB.9-O-7]

Wednesday 4, morning (second): 12:45
Room: Seminario 3

The power of joining: Confluences influence water chemistry and biogeochemical processes along Mediterranean fluvial networks

Lupon, Anna[1]; Jativa, Carolina[2]; Xinyue, Zhao[3]; Martí, Eugènia[4]; Catalán, Núria[5]; Peñarroya, Xavi[6]; Rodellas, Valentí[7]; Bernal, Susana[8]; Rocher-Ros, Gerard[9]; Poblador, Sílvia[10]; Merbt, Stephanie[11]; Olid, Carolina[12]

(1) Centre d'Estudis Avançats de Blanes (CEAB-CSIC); (2) Centre d'Estudis Avançats de Blanes (CEAB-CSIC); (3) Universitat de Barcelona; (4) Centre d'Estudis Avançats de Blanes (CEAB-CSIC); (5) Centre d'Estudis Avançats de Blanes (CEAB-CSIC); (6) Centre d'Estudis Avançats de Blanes (CEAB-CSIC); (7) Universitat Autònoma de Barcelona; (8) Centre d'Estudis Avançats de Blanes (CEAB-CSIC); (9) Integrated Science Lab Umeå University; (10) Universitat de Barcelona; (11) Centre d'Estudis Avançats de Blanes (CEAB-CSIC); (12) Unviersitat de Barcelona

Correspondence e-mail: [anna.lupon@gmail.com]

Headwater streams are critical for global biogeochemical cycles, transporting and retaining large amounts of carbon (C), nitrogen (N) and phosphorus (P). However, global element fluxes within headwater fluvial networks remain poorly constrained, partially due to the extreme spatial variability in water chemistry. This study assessed how confluences shape C, N and P concentrations and ratios along Mediterranean fluvial networks. We hypothesized that confluences act as biogeochemical hotspots because lateral inflows can supply limiting resources to the receiving streams.

We conducted synoptic surveys in November 2024 across three Mediterranean headwater fluvial networks within the Tordera basin (Catalonia). Specifically, we measured organic and inorganic C, N and P concentrations every 50 meters along the mainstem as well as in major lateral inflows, including permanent tributaries, intermittent tributaries and preferential groundwater flowpaths. Further, we performed laboratory incubations to assess changes in heterotrophic activity and net nutrient uptake between sites located upstream and downstream of major confluences.

All streams were highly oligotrophic. Yet, C:N:P ratios varied across streams (from 483:2:1 to 818:58:1), suggesting that stream biota was limited by either N, P or both. Further, confluences shaped element concentrations and C:N:P ratios along the mainstem by either diluting element concentrations (mixing effect) or delivering limiting nutrients that enhanced biogeochemical activity (reactor effect). Overall, these findings underscore the role of confluences as biogeochemical hotspots and highlight their importance for regulating water chemistry and element fluxes within fluvial networks.

[TSB.9-O-8]

Wednesday 4, morning (second): 13:00
Room: Seminario 3

Transport and biogeochemical processing of carbon and nitrogen in terrestrial-aquatic interfaces across European ecoregions

Ledesma, José L. J.[1]; Musolff, Andreas[2]; Sponseller, Ryan[3]; Lupon, Anna[4]; Peñarroya, Xavier[5]; Jativa, Carolina[6]; Bernal, Susana[7]

(1) National Museum of Natural Sciences - Spanish National Research Council (MNCN-CSIC); (2) Helmholtz Centre for Environmental Research – UFZ; (3) Umeå University; (4) Centre for Advanced Studies of Blanes - Spanish National Research Council (CEAB-CSIC); (5) Centre for Advanced Studies of Blanes - Spanish National Research Council (CEAB-CSIC); (6) Centre for Advanced Studies of Blanes - Spanish National Research Council (CEAB-CSIC); (7) Centre for Advanced Studies of Blanes - Spanish National Research Council (CEAB-CSIC)

Correspondence e-mail: [jose.ledesma@mncn.csic.es]

Headwaters make up an immense global network that controls the quantity and quality of water in streams, rivers, and larger water bodies downstream. It is well established that soils next to headwater streams, known as riparian zones, play a major role in determining stream chemistry because water from precipitation generally traverses these areas before entering streams. In this study, we compare the role that riparian zones play in boreal, temperate, and Mediterranean forest headwaters in the transport and biogeochemical processing of dissolved organic carbon (DOC) and nitrate (N-NO3-). Hydroclimate, topography, and soil characteristics explain differences among ecoregions in the dimensions of the dominant source layer (DSL), a soil layer through which most of the water and solutes are supplied from riparian zones to streams. Contrasting hydroclimate and soils led to high DOC concentrations in riparian solution in both boreal and upper riparian layers of Mediterranean sites. By contrast, N-NO3- concentrations were driven by differences in soil saturation, being orders of magnitude higher in dry Mediterranean than in wet temperate and boreal riparian soils. Notably, stream chemistry did not consistently reflect riparian DSL chemistry across flow conditions and ecoregions. We hypothesize that ecoregion-specific water sources bypassing the riparian zone (e.g., deep groundwater), as well as ecoregion-specific in-stream biogeochemical processes (e.g., DOC-iron co-precipitation, nitrification) could explain these discrepancies. Overall, conceptualizing the varied roles of the riparian zone across diverse systems can aid in both scientific assessments and management of land-water connectivity in river networks.

[TSB.9-O-9]

Wednesday 4, morning (second): 13:15
Room: Seminario 3

Bioavailable dissolved organic carbon serves as a key regulator of phosphorus dynamics in stream biofilms

Perujo, Nuria[1]; Graeber, Daniel[2]; Fink, Patrick[3]; Neuert, Lola[4]; Sunjidmaa, Nergui[5]; Weitere, Markus[6]

(1) UFZ - Helmholtz Centre for Environmental Research; (2) UFZ - Helmholtz Centre for Environmental Research; (3) UFZ - Helmholtz Centre for Environmental Research; (4) UFZ - Helmholtz Centre for Environmental Research; (5) UFZ - Helmholtz Centre for Environmental Research; (6) UFZ - Helmholtz Centre for Environmental Research

Correspondence e-mail: [nuria.perujo.buxeda@gmail.com]

Phosphorus (P) dynamics at the sediment-water interface of aquatic ecosystems are receiving increasing attention due to their implications for water quality. P uptake by microbial biofilms can serve as a mechanism to control and mitigate the risk of eutrophication. Microbial biofilms capture P both intracellularly and extracellularly. While the significance of extracellular P entrapment in biofilms in engineered systems has recently been established, little is known about its dynamics in aquatic ecosystems. Current research on eutrophication control predominantly emphasizes nitrogen, phosphorus, or nitrogen-phosphorus ratio-based approaches, often overlooking the potential indirect influence of bioavailable dissolved organic carbon (DOC) on P uptake by heterotrophic microorganisms. In this study, we tested the effect of bioavailable DOC on P entrapment patterns in biofilms and in biofilm P-regulation mechanisms such as polyphosphate accumulation and alkaline phosphatase activity in semi-natural flow-through experimental flumes. Our results show that intracellular P entrapment, is limited by bioavailable DOC, while extracellular P entrapment is independent of bioavailable DOC and potential to offset intracellular P saturation. We further demonstrate that DOC bioavailability influences benthic P cycling and that its implications extend into critical areas of ecosystem functioning such as river self-purification, competitive resource utilization and organic P cycling.

[TSB.9-O-10]

Wednesday 4, morning (second): 13:30
Room: Seminario 3

Nitrogen dynamics and Microbial Adaptations in High-Latitude soils under Decadal Warming

Zevenhuizen Martínez, Ana Leticia[1]; Richter, Andreas[2]; Fuchslueger, Lucia[3]; Prommer, Judith[4]; Verbrigghe, Niel[5]; Peñuelas, Josep[6]; Sigurdsson, Bjarni[7]; Marañón-Jiménez, Sara[8]

(1) Center for Ecological Research and Forestry Application; (2) University of Vienna; (3) University of Vienna; (4) University of Vienna; (5) Flanders Research Institute for Agriculture; (6) Center for Ecological Research and Forestry Application; (7) Agricultural University of Iceland; (8) Center for Ecological Research and Forestry Application

Correspondence e-mail: [a.zevenhuizen@creaf.uab.cat]

Soils at high latitudes are experiencing significant warming due to climate change, raising concerns about potential disruptions in nitrogen (N) and carbon (C) cycling.

This study investigates the decadal effects of soil warming on microbial N transformations in an Icelandic grassland subjected to a geothermal gradient, where soil temperature varied naturally from +0°C to +12.3°C. Seasonal sampling of N pools and rates of gross N transformations—including amino acid, ammonia, and nitrate consumption and production—provided insights into microbial responses to prolonged warming.

Warming accelerated the turnover of amino acids, driven by increased rates of production and consumption, but did not affect net protein depolymerization. Ammonia consumption rates increased with temperature, although production rates remained constant. Additionally, total soil N content remained stable after both 5 and 10 years of warming. These findings suggest that N losses induced by warming occurred primarily within the first five years, stabilizing in a new equilibrium without further N losses. The enhanced C limitation in warmed soils likely compelled microorganisms to rely more on the turnover of organic N pools as a dual source of both C and N to meet their heightened metabolic demands, thus preventing further N losses.

Overall, these findings challenge the assumption of progressive N depletion under warming conditions and highlight the role of microbial physiological adaptations in maintaining soil N availability despite increased metabolic demands.

[TSB.9-O-11]

Wednesday 4, morning (second): 13:45
Room: Seminario 3

Nitrogen deposition risk assessment in spanish ecosystems using empirical critical loads

Carrasco-Molina, Tania[1]; González-Fernández, Ignacio[2]; Rábago, Isaura[3]; García-Vivanco, Marta[4]; Theobald, Mark R.[5]; Gil, Victoria[6]; Hernández, Coralina[7]; Garrido, Juan Luis[8]; Alonso, Rocío[9]; de la Maza, Elena[10]; García-Gómez, Héctor[11]

(1) Ecotoxicology of Air Pollution. Environmental Dept. CIEMAT, Madrid, Spain; (2) Ecotoxicology of Air Pollution. Environmental Dept. CIEMAT, Madrid, Spain; (3) Ecotoxicology of Air Pollution. Environmental Dept. CIEMAT, Madrid, Spain; (4) Atmospheric Modelling Unit. Environmental Dept. CIEMAT, Madrid, Spain; (5) Atmospheric Modelling Unit. Environmental Dept. CIEMAT, Madrid, Spain; (6) Atmospheric Modelling Unit. Environmental Dept. CIEMAT, Madrid, Spain; (7) Atmospheric Modelling Unit. Environmental Dept. CIEMAT, Madrid, Spain; (8) Atmospheric Modelling Unit. Environmental Dept. CIEMAT, Madrid, Spain; (9) Ecotoxicology of Air Pollution. Environmental Dept. CIEMAT, Madrid, Spain; (10) Ecotoxicology of Air Pollution. Environmental Dept. CIEMAT, Madrid, S; (11) Ecotoxicology of Air Pollution. Environmental Dept. CIEMAT, Madrid, S

Correspondence e-mail: [tania.carrasco@ciemat.es]

Human activities have significantly increased atmospheric emissions of reactive nitrogen, leading to its deposition in ecosystems that causes eutrophication, acidification and disruption of nutrient cycling. Empirical critical loads for nitrogen (CL), developed under the Convention on Long-range Transboundary Air Pollution, are thresholds presented as a range (minimum and maximum) above which negative effects on sensitive receptors could be detected based on experimental data.

This study develops a methodology to classify two national vegetation inventories into the EUNIS habitat classification using floristic composition (diagnostic and dominant species). This approach allowed the generation of an empirical CL map for Spain, enabling the calculation of nitrogen exceedances and assessing the risk posed by nitrogen deposition to Spanish ecosystems. The exceedances have been analysed in the present (years 2021 and 2022) as well as in a historical (1996-2005) and projected future period (2046-2055) under two RCP8.5 scenario variants using modelled nitrogen deposition with CHIMERE considering changes in climate and atmospheric emissions.

The highest deposition is estimated for northern Spain, particularly Catalonia, the Mediterranean coast, and the Strait of Gibraltar. For 2021 and 2022, 42.50% of the assessed area was classified as having an unfavourable conservation status (within the CL range) and 5.42% as bad (above maximum CL range). Improvements in the conservation status of habitats are observed under the future scenario with emissions reductions, although some may still be endangered by this pollutant. Results may vary depending on the chosen CL range value. Trends and perspectives for EUNIS habitats will be presented and discussed.

[TSB.9-O-12]

Wednesday 4, morning (second): 14:00
Room: Seminario 3

Differences in nutrient content between heterospecific plant neighbours affect respiration rates of rhizosphere microbiota

Jimeno-Alda, Julia[1]; Goberna, Marta[2]; Navarro-Cano, Jose Antonio[3]; Verdú, Miguel[4]

(1) Centro de Investigaciones sobre Desertificación; (2) Instituto Nacional de Investigación y Tecnología Agraria y Alimentaria; (3) Instituto Nacional de Investigación y Tecnología Agraria y Alimentaria; (4) Centro de Investigaciones sobre Desertificación

Correspondence e-mail: [julia.deberes@gmail.com]

Aims. Plant-soil interactions play a pivotal role in governing ecosystem dynamics. Plants directly interact with rhizosphere microorganisms, providing them with labile carbon in exchange for mineral nutrients that are the product of decomposition. Such processes are modulated by ecological interactions between plant species in ways that are not fully understood. We assessed whether rhizosphere respiration rates, as a proxy for decomposition, are influenced by i) heterospecific versus conspecific plant interactions and whether these effects are positive or negative, and ii) how these effects are linked to the identity and the below and aboveground functional traits of the interacting plant species.

Methods. We conducted a greenhouse experiment with 300 pairwise hetero- and conspecific combinations of ten Mediterranean herbs and shrubs species, covering a range of functional distances calculated based on 33 traits. In addition, we quantified heterotrophic respiration in the rhizosphere as a proxy of decomposition.

Results. Plant neighbour identity was the main factor explaining changes on respiration rates. Respiration increased along with the functional distance between heterospecific pairs of interacting plants when considering aboveground or nutritional traits. Morphological and belowground traits were not significant predictors of changes on respiration rates.

Conclusions. Interspecific plant-plant interactions lead to faster respiration rates in the rhizosphere as functional distance between neighbours increases. This study provides experimental support that functional trait dissimilarities between heterospecific neighbouring plants promote the rates of organic matter decomposition, showing cascading effects of aboveground interactions on belowground ecosystem processes.

TSB.9. Posters

[TSB.9-P-1]

Wednesday 4
Discussion corner: Room 7

Carbon and nitrogen fluxes from litterfall to the soil in forest ecosystems in Tenerife

Cabezas Dueñas, Isabel[1]; Sierra Cornejo, Natalia[2]; González, María[3]; Rodríguez, Felipe[4]; Rocaful, Elena[5]; Suárez, Isabel[6]; Otto, Rüdiger[7]; Fernández-Palacios, José María[8]; de Nascimento, Lea[9]

(1) Universidad de La Laguna; (2) Universidad de La Laguna; (3) Universidad de La Laguna; (4) Universidad de La Laguna; (5) Universidad de La Laguna; (6) Universidad de La Laguna; (7) Universidad de La Laguna; (8) Universidad de La Laguna; (9) Universidad de La Laguna

Correspondence e-mail: [isabelcabezas@usal.es]

Carbon and nitrogen fluxes from plant to the soil through litterfall production connect above and belowground processes through decomposition, playing a key role in soil carbon stocks and nitrogen availability in terrestrial ecosystems. In fact, the 50 % of NPP is estimated to return to the soil through these processes. We study annual litterfall production and its fractions (leaves, reproductive organs, branches) and leaf decomposition rates in the laurel and the thermophilous woodland, two ecosystems with different environmental conditions in Tenerife Island. We also determined the effects of abiotic (e.g. temperature) and biotic factors (e.g. litter quality) on these two processes. For this purpose, we selected three 20 x 20 m plots per ecosystem type and established litterfall traps and litter decomposition bags. Collection of samples was done every three months during one year to capture the effects of dry and rainy seasons. We expect: 1) the thermophilous woodland to hold lower litterfall production rates compared to the laurel forest; 2) the leaves to be the major contributor to litterfall; and 3) the dry season to lead to the highest litterfall production, while in the laurel forest we expect the peak to happen in the rainy season. Knowledge about drivers of these processes contributes to understand alterations in soil C stocks, soils being the major C pool in terrestrial ecosystems, and soil fertility, which directly affects the productivity and ecosystem health.

[TSB.9-P-2]

Tuesday 3
Discussion corner: Room 7

Groundwater and stream discharge of dissolved organic matter to the Mar Menor coastal lagoon

Campillo de la Maza, Alex[1]; Rodríguez-Puig, Julia[2]; Alorda-Montiel, Irene[3]; Diego-Feliu, Marc[4]; Alorda-Kleinglass, Aaron[5]; Romano-Gude, Daniel[6]; Dordal-Soriano, Julia[7]; Gilabert, Javier[8]; Garcia-Orellana, Jordi[9]; Mallenco-Fornies, Rebeca[10]; Bravo, Andrea G.[11]; Ruiz-González, Clara[12]; Rodellas, Valentí[13]; Romera-Castillo, Cristina[14]

(1) Institute of Marine Sciences; (2) ICTA-UAB; (3) ICTA-UAB; (4) Universitat Politécnica de Catalunya; (5) ICTA-UAB; (6) Institute of Marine Sciences; (7) Institute of Marine Sciences; (8) UPCT; (9) ICTA-UAB; (10) Institute of Marine Sciences; (11) Institute of Marine Sciences; (12) Institute of Marine Sciences; (13) ICTA-UAB; (14) Institute of Marine Sciences

Correspondence e-mail: [acampillo@icm.csic.es]

Submarine groundwater discharge (SGD) might be an important pathway delivering dissolved organic matter (DOM) into coastal ecosystems, but very little is known about the magnitude of DOM fluxes associated to SGD and their impact in the biogeochemistry of coastal ecosystems. Coastal lagoons like the Mar Menor, the largest in the Mediterranean, are vulnerable to SGD-related impacts due to their confined nature and the large anthropogenic pressures on the watershed. This study assesses SGD contribution to DOM inputs in the Mar Menor, focusing on the analysis of dissolved organic carbon (DOC) concentration and DOM optical properties during summer (July 2021) and late autumn (November 2021). SGD was the dominant net source of allochthonous DOC with an annual flux of 4.01·108 mol C yr?¹ while the Albujón stream was the main source of surface runoff contributing with 1.43·106 mol C yr?¹. DOC fluxes were similar during the two studied periods (~1.10·106 mol C yr?¹). The annual SGD-derived inputs of fluorescent DOM (FDOM) were higher for humic-like substances (6.55·1011 mol C yr-1; peak M) than for protein-like compounds (2.39·1011 mol C yr-1; peak-T). SGD-driven inputs of humic-like compounds was similar in both seasons, but inputs of protein-like DOM were significantly higher in summer than winter, indicating a higher discharge of labile substances in the warm period. Albujon stream flux of FDOM was lower than the SGD with 1.41·108 RU L yr-1 for humic-like substances and 2.66·109 RU L yr-1 for protein-like. These results emphasize the significant role of SGD as source of DOM in coastal ecosystems.

[TSB.9-P-3]

Thursday 5
Discussion corner: Room 7

Tracing silicon in seagrasses: implications for elemental cycles in the land–ocean continuum

Lopez-Acosta, Maria[1]; Roth, Justine[2]; Gallinari, Morgane[3]; Schoelynck, Jonas[4]; Hernán, Gema[5]; Máñez-Crespo, Julia[6]; M. Ricart, Aurora[7]

(1) Instituto de Investigaciones Marinas (IIM-CSIC); (2) Laboratoire Des Sciences de l'Environnement Marin (LEMAR-IUEM), Plouzané, France; (3) Laboratoire Des Sciences de l'Environnement Marin (LEMAR-IUEM), Plouzané, France; (4) ECOSPHERE Research Group, University of Antwerpen, Belgium; (5) Mediterranean Institute for Advanced Studies (IMEDEA, UIB-CSIC), Esporles, Spain; (6) Mediterranean Institute for Advanced Studies (IMEDEA, UIB-CSIC), Esporles, Spain; (7) Institut de Ciències del Mar (ICM-CSIC), Barcelona, Spain

Correspondence e-mail: [lopezacosta@iim.csic.es]

Introduction. Seagrasses play a key role in carbon and nitrogen fluxes between land and ocean, yet their role in silicon dynamics remains largely unexplored. Silicon is essential in marine and terrestrial ecosystems, fueling ocean primary productivity, CO2 sequestration, and supporting structural and physiological functions of terrestrial plants. Whether these benefits extend to seagrasses requires further investigation.

Material and methods. This study evaluated for the first time in seagrasses the use of two widely used methods for determining biogenic silica in water and sediments ?wet-alkaline digestion and hydrofluoric acid digestion? using Zostera marina as a model species. Additionally, we estimated the seagrass silicon reservoir at the ecosystem level in the Bay of Brest (France) to assess their potential role in silicon biogeochemistry.

Results and discussion. Leaves of Z. marina contained 0.26%Si per dry-weight unit, consistent with the few reports of silicon incorporation in seagrasses. Two distinct forms of silica were identified: a labile form digested by the alkaline method, which will be recycled upon leaf degradation, benefiting siliceous organisms, and a more resistant form digested only by acid digestion, which will contribute to the long-term silica burial in the ecosystem. In the Bay of Brest, the seagrass silicon reservoir was estimated at 0.18?(±0.07) g Si m?2, similar to benthic diatoms, underscoring the potential role of seagrasses in silicon biogeochemistry in the land–ocean continuum, where they might act as a buffer for silicon transport to the ocean. Our study also provides the methodological basis for investigating silicon's ecological role in seagrasses.

[TSB.9-P-4]

Tuesday 3
Discussion corner: Room 7

Does predation risk-induced stress shape winter deer diet in Bialowieza Forest?

Losada, María[1]; Origer, Marie[2]; Tomasulo, Cecilia[3]; Kolodziej-Sobocinska, Marta[4]; Palme, Rupert[5]; Schmidt, Krzysztof[6]

(1) Mammal Research Institute, Polish Academy of Sciences, Poland; (2) Gembloux Agro-Bio Tech, University of Liège, Belgium; (3) Mammal Research Institute, Polish Academy of Sciences, Poland; (4) Mammal Research Institute, Polish Academy of Sciences, Poland; (5) University of Veterinary Medicine, Austria; (6) Mammal Research Institute, Polish Academy of Sciences, Poland

Correspondence e-mail: [m.losada@ibs.bialowieza.pl]

Predation risk from large carnivores can induce stress in wild herbivores, triggering gluconeogenesis and increased nitrogen (N) excretion in prey animals. Chronic stress may also lead herbivores to consume carbohydrate-rich plants to meet energetic demands for anti-predatory responses. This study investigates winter diet variation in wild deer populations in Bialowieza Forest (BF, Poland), analysing macronutrient composition (protein and fibre content) considering predation risk and its induced hormonal stress, along with carbon/nitrogen (C/N) ratios. We hypothesise that deer in high-risk areas with higher stress levels will show higher faecal fibre content relative to protein, which may correspond to C/N ratios. In winter 2023, we collected 299 faecal samples (204 red deer, 95 roe deer) from areas with varying predation risk from wolves and lynx. Crude protein and fibre content were analysed using Near-Infrared Spectroscopy (NIRS). Stress levels were assessed by measuring faecal glucocorticoid metabolites, while C/N ratios were determined by elemental analysis, and predation risk was modelled using long-term camera trap data. While NIRS analyses are still in progress, preliminary results show higher C/N ratios in low- and medium-risk areas compared to high-risk areas, with red deer having higher faecal C/N ratios than roe deer. This may reflect their distinct foraging behaviours. Winter food constraints may shape these patterns. Deer may balance foraging on carbohydrate-rich plants and protein-rich foods, with chronic stress exacerbating lower C/N ratios. These findings will be further explored using NIRS data. This project is funded by the National Science Centre, Poland (grant: 2021/42/A/NZ8/00126).

[TSB.9-P-5]

Thursday 5
Discussion corner: Room 7

Hydraulic strategies modulate forest productivity responses to hotter droughts

Tijerín-Triviño, Julián[1]; Astigarraga Urcelay, Julen[2]; Cruz Alonso, Verónica[3]; García Alonso, Mariano[4]; García Valdés, Raúl[5]; Rebollo Orozco, Pedro[6]; Rodes Blanco, Marina[7]; Serra Malaquer, Xavier[8]; Tanase, Mihai[9]; Zavala de Gironés, Miguel Ángel[10]; Ruiz Benito, Paloma[11]

(1) Univerisdad de Alcalá; (2) Universidad de Alcalá; (3) Universidad Complutense de Madrid; (4) Universidad de Alcalá; (5) Universidad Rey Juan Carlos; (6) Universidad Complutense de Madrid; (7) Universidad de Alcalá; (8) Universidad de Alcalá; (9) Universidad de Alcalá; (10) Universidad de Alcalá; (11) Universidad de Alcalá

Correspondence e-mail: [julian.tijerin@uah.es]

Under the ongoing climate change context, forest ecosystems are increasingly exposed to higher stress levels due to more frequent and intense compound climatic events, such as hotter droughts. These events have not only become more frequent but also more intense and prolonged. Forest functional diversity and identity can modulate the impacts of such events by enhancing community stability. Although conservative species are generally thought to be better adapted to withstand drought than acquisitive species, it remains unclear how the composition and diversity of community traits influence forest responses to these events across broad environmental gradients. In this study, we analyzed the temporal variation of different drought dimensions and examined how hydraulic trait diversity and identity influence forest productivity over 33 years. To achieve this, we applied a generalized linear mixed model to productivity data from 748 permanent plots distributed along an aridity gradient in central Spain. Our findings reveal that the relationship between maximum vapor pressure deficit (VPD) and forest productivity has become increasingly negative over time, indicating a stronger effect of hotter droughts in recent years. Furthermore, we observed that the community-weighted mean of drought tolerance (P50) modulated the impact of hotter drought events on forest productivity, with communities characterized by higher P50 values exhibiting lower productivity during these events. These results underscore the escalating influence of compound climatic events on forest productivity and highlight the critical role of specific hydraulic traits, such as P50, in mediating these effects. These findings have important implications for management strategies aimed at enhancing ecosystem resilience and adaptive capacity in the face of ongoing climate change.

TSB.10. Exploring environmental variability in aquatic and terrestrial ecosystems

Tuesday, 3 (12:45-14:15)

Room: Seminario 2

Aquatic and terrestrial ecosystems are exposed to climatically- or naturally-driven short-term variability (deterministic or stochastic fluctuation) of multiple environmental drivers. Environmental variability can affect the performance of organisms and the interactions between species, ultimately impacting the functioning and structure of ecosystems under a global change context. Studies that include environmental variability may lead to responses that differ from those shown in studies focused on the mean alteration of one or several interacting drivers. However, such studies are still scarce, hence the pressing need for research on how environmental fluctuations can alter our understanding of the effects of global change on ecosystems and species' adaptive capacity. In this session, we encourage field, laboratory, modelling and predictive studies investigating the effects of environmental variability on the physiology, metabolism, composition of species and communities in their interaction with the environment. As a result, this session will provide a holistic understanding of the interaction between environmental variability and global-change drivers in aquatic and terrestrial ecosystems, and will enhance the communication among researchers working in different regions to establish new collaborations. Finally, this session will promote a topic that requires further research under current and future events of higher variability (precipitations, heatwaves, etc.).

Organizers:

• **Marco Jabalera Cabrerizo,** Universidad de Granada

• **Juan Manuel González Olalla,** Universidad de Granada.

TSB.10. Orals

[TSB.10-O-1]

Tuesday 3, morning (second): 12:45
Room: Seminario 2

Marine Phytoplankton and Warming: How Fluctuations and Nutritional States Shape Community Responses

Tascón Peña, Osvaldo[1]; J. Cabrerizo, Marco[2]; Marañón, Emilio[3]

(1) University of Vigo; (2) University of Granada; (3) University of Vigo

Correspondence e-mail: [osvaldo.tascon@uvigo.gal]

The effects of thermal fluctuations on marine phytoplankton remain underexplored, despite evidence suggesting that such fluctuations can shape marine phytoplankton responses to warming. Additionally, it is well-established that identical temperature increases can elicit different responses across phytoplankton communities. Nutrient limitation is another critical factor, as it can suppress phytoplankton responses to temperature changes. However, few studies simultaneously address the combined effects of these three factors (thermal fluctuations, community variability and nutritional state) on phytoplankton responses to warming. We hypothesized that thermal fluctuations alter the effects of warming on phytoplankton, with this influence being further modulated by the community's thermal sensitivity and nutritional state. To investigate this, we conducted an experiment exposing three natural phytoplankton communities, sampled in different seasons, to three temperature treatments (control, constant warming, and warming with fluctuations) under two nutrient regimes (high and low). Our results reveal that nutritional state is a limiting factor for phytoplankton communities in March and September, whereas temperature emerges as the primary limiting factor in December. In most cases, high-nutrient conditions amplify the effects of temperature. Warming tended to stimulate phytoplankton growth, an effect that was further enhanced by thermal fluctuations in March. Conversely, in the September community, fluctuations helped mitigate the negative impacts of warming. These findings highlight the need for a holistic approach to understanding how global warming affects phytoplankton. Such an approach must account for the interactive effects of environmental drivers, including the dynamics of thermal fluctuations, community-specific responses, and nutrient availability.

[TSB.10-O-2]

Tuesday 3, morning (second): 13:00
Room: Seminario 2

Adaptations to Extreme Environments: Desiccation Tolerance mechanisms in Ochthebius Species from Supralittoral Rockpools

Botella Cruz, María[1]; Mirón Gatón, Juana María[2]; Hernández Ariola, Elena[3]; Álvarez López, Mara[4]; Velasco García, Josefa[5]

(1) University of Alicante; (2) University of Murcia; (3) University of Murcia; (4) University of Murcia; (5) University of Murcia

Correspondence e-mail: [maria.botella@ua.es]

Introduction. Supralittoral rockpools, located at the intersection of terrestrial and marine environments, present extreme and variable conditions where aquatic insects face significant hydric stress due to fluctuations in temperature, salinity, and humidity. This study investigates the desiccation resistance mechanisms in Ochthebius quadricollis and Ochthebius lejolisii, two beetle species that coexist in southeastern Spain, with a particular focus on the roles of cuticular hydrocarbons (CHCs) and trehalose in reducing water loss and ensuring survival under extreme environmental conditions increasingly exacerbated by global climate change.

Material and Methods. Laboratory experiments were conducted on adults and larvae of the two species acclimated to different salinity and temperature treatments. Specimens were subjected to desiccation treatments (25% relative humidity for six hours). CHC profiles were analyzed using gas chromatography to assess their role in enhancing cuticular impermeability, while trehalose concentrations were quantified via enzymatic assays to evaluate their contribution to cellular stabilization during dehydration.

Results and Discussion. Preliminary results indicate that both species after desiccation stress exhibits similar responses but mechanisms differed between larvae and adults. Adults increased the abundance of long-chain branched alkanes and decreasing abundance of shorter unsaturated compounds. These modifications enhance cuticular impermeability, reducing water loss under desiccation conditions. Larvae were more resistant to desiccation than adults, showed higher trehalose concentrations. Both, high temperature and salinity condition's increased the trehalose concentration, suggesting a key role for trehalose in stabilizing cellular structures and functions during stress.

Our findings provide new insights into the physiological mechanisms of supralittoral beetles in adapting to extreme environmental challenges with the ongoing climate change.

[TSB.10-O-3]

Tuesday 3, morning (second): 13:15
Room: Seminario 2

Environmental gradients drive diversity patterns across the Marañon Valley: Linking coastal drylands to Amazonian rainforests in Peru

Salazar Zarzosa, Pablo Cesar[1]

(1) Universidad de Cordoba

Correspondence e-mail: [pcsalazarz@gmail.com]

In community ecology, neutral and niche theories represent complementary frameworks for understanding community assembly. Recently, several studies have suggested that both theories can be valid explaining deterministic and stochastic processes based on ecosystem dynamics. The objective of our study is to analyze changes in alpha and beta diversity from Peruvian coastal drylands to Amazonian forests in response to abiotic factors and determine the role of dominant species in explaining these differences. We use data from the Peruvian National Forest Inventory to analyze changes in vegetation structure on both sides of the Marañon Valley, a biogeographic barrier between the Northern and Central Andes that forms an ecological corridor connecting Pacific coastal dry forests with the Amazon basin. This longitudinal axis creates a gradient from highly arid and sandy conditions to rainy and nutrient-rich environments. Our results revealed that geographic factors (elevation and longitude), which are highly correlated with climatic and soil conditions, explain the changes in alpha and beta diversity in the dryland forest (from the Pacific coast to the Andes). However, these factors did not explain diversity patterns in the rainforest (from the Andes to the Amazon basin). Similarly, the abundance of dominant species was high in the dryland forest and decreased progressively towards the rainforest. These findings demonstrate how environmental filtering through abiotic factors determines species composition in harsh environments (dryland forests), while community assembly follows more stochastic processes under benign conditions (rainforests), providing empirical support for the integration of niche and neutral theories.

[TSB.10-O-4]

Tuesday 3, morning (second): 13:30
Room: Seminario 2

Decoding the phenotype flexibility of forest species from a metabolomics perspective

Rivas-Ubach, Albert[1]; Aranda, Ismael[2]; Sardans, Jordi[3]; Oravec, Michal[4]; Urban, Otmar[5]; Peñuelas, Josep[6]

(1) Male; (2) ICIFOR-INIA; (3) CREAF; (4) CzechGlobe; (5) CzechGlobe; (6) CREAF-CSIC

Correspondence e-mail: [albert.rivas@inia.csic.es]

Altitudinal gradients can serve as “natural laboratories” for studying climate change, as they are determined by a set of environmental variables which shift gradually with elevation. Plants respond to these environmental fluctuations by adjusting their phenotypes, enabling them to cope with the distinct conditions across gradients. However, plants’ adjustment capacity is finite and directly depends on the flexibility of their phenotypes. Plants growing at the edges of their distribution often face sub-optimal environmental conditions, probably pushing their phenotypes to the flexibility limits. A metabolome, comprising the complete set of low-weighted compounds present at a given moment in an organism, is considered its chemical phenotype and, therefore, play critical roles in plant acclimation and adaptation processes. To evaluate the chemical phenotypic flexibility of forests, and thus their vulnerability to climate change, we analyzed the foliar metabolomes of a Pinus uncinata population along an altitudinal gradient. Our results revealed significant overall metabolome changes across altitudes, with the most contrasting profiles observed at the lowest and highest altitudes, characterized by the upregulation of sugars, amino acids, and different antioxidants. At the lowest altitudes, warmer and drier conditions are directly associated to the increased antioxidant activity, while at the tree line, oxidative stress indicators suggested responses to chilling, UV, and/or tropospheric ozone exposure. Eco-metabolomics studies along environmental gradients offer critical insights into the chemical phenotypic flexibility of natural plant populations. These studies can additionally provide pivotal clues regarding which metabolic pathways plants prioritize to cope with specific environmental challenges.

[TSB.10-O-5]

Tuesday 3, morning (second): 13:45
Room: Seminario 2

OLIGOTREND, a global database of multi-decadal chlorophyll-a and water quality timeseries for rivers, lakes and estuaries

Minaudo, Camille[1]; Abonyi, Andras[2]; Alcaraz, Carles[3]; Diamond, Jacob[4]; J.K. Howden, Nicholas[5]; Rode, Michael[6]; Romero, Estela[7]; Thieu, Vincent[8]; Worrall, Fred[9]; Zhang, Qian[10]; Benito, Xavier[11]

(1) University of Barcelona; (2) MTA-ÖK Lendület Fluvial Ecology Research Group; (3) Institute of Agrifood Research and Technology (IRTA); (4) Intergovernmental Hydrological Programme, UNESCO; (5) School of Civil, Aerospace and Design Engineering, University of Bristol; (6) Helmholtz Centre for Environmental Research; (7) Centre for Ecological Research and Forestry Applications (CREAF); (8) Sorbonne Université, CNRS, EPHE; (9) University of Durham; (10) University of Maryland; (11) Institute of Agrifood Research and Technology (IRTA)

Correspondence e-mail: [camille.minaudo@ub.edu]

Oligotrophication, the reversal of eutrophication, has been widely observed in rivers, lakes, and estuaries over the past three decades. However, a lack of a unified and comprehensive dataset has made it difficult to fully understand its ecological impacts. To fill this gap, we created the OLIGOTREND database, which includes multi-decadal time series data on chlorophyll-a, nutrients (nitrogen and phosphorus), and other related physicochemical factors, amounting to 4.3 million observations. These data come from 1,894 distinct monitoring sites across estuaries (n = 238), lakes (n = 687), and rivers (n = 969), with each site linked to specific catchment and hydroclimatic attributes. We applied trend and breakpoint analyses to all time series. Chlorophyll-a displayed ecosystem-specific, temporally varying responses to nutrient reductions, with 18% of the series showing an overall declining trend, in contrast to a majority of nutrient concentration series exhibiting declines. The database was harmonized to facilitate reproducibility, ease of use, and to accommodate future updates and contributions. OLIGOTREND fosters collaborative efforts to deepen our understanding of the biogeochemical and biological processes driving oligotrophication and the ecological consequences of long-term global environmental change.

[TSB.10-O-6]

Tuesday 3, morning (second): 14:00
Room: Seminario 2

Defining microbial nitrogen guilds in an coastal upwelling system exposed to different nitrogen sources

Lasa González, Aide[1]; Teira, Eva[2]; Fernandez, Emilio[3]; Delgadillo-Nuño, Erick[4]; González, Jose[5]; Pedrós-Alió, Carlos[6]; Pérez, María[7]; Fuentes-Lema, Antonio[8]; Rivas-Santiesteban, Juan[9]; Tamames, Javier[10]; Martínez-García, Sandra[11]; Peláez, Elvira[12]; Vieitez, Sara[13]

(1) CIM-UVIGO; (2) CIM-UVIGO; (3) CIM-UVIGO; (4) CIM-UVIGO; (5) University of La Laguna; (6) Centro Nacional de Biotecnología (CNB), CSIC; (7) CIM-UVIGO; (8) CIM-UVIGO; (9) Centro Nacional de Biotecnología (CNB), CSIC; (10) Centro Nacional de Biotecnología (CNB), CSIC; (11) CIM-UVIGO; (12) CIM-UVIGO; (13) CIM-UVIGO

Correspondence e-mail: [aide.lasa@uvigo.gal]

Microbial plankton play crucial roles in the marine nitrogen cycle, although the specific functions of different taxa are not completely understood. Here we study the composition and importance of the microbial nitrogen guilds that participate in nitrogen transformations in natural communities throughout different seasons, and their response to nitrogen additions of different nature in the upwelling-driven, productive system of the Ría de Vigo.

Nitrogen guilds in field samples, especially nitrate and ammonium transport functions, seasonally changed in composition associated to different ecological contexts. Ammonium transport was the dominant guild in all samples, confirming reduced inorganic nitrogen as a relevant source of N for microbes in this system.

Composition of guilds responded differently at different times of the year to the addition of labile carbon and different nitrogen sources. In winter, with high nitrogen and chlorophyll concentrations in sea water, Vibrionaceae dominated most guilds. For instance, Vibrionaceae members considerably contributed to nitrate assimilation, aminoacid biosynthesis or urea hydrolysis guilds, among others. This result confirms members of the family Vibrionaceae as opportunistic bacteria, and suggests a high specialization in nitrogen usage within this group. In summer and autumn, when resource availability in the ambient was relatively low, nutrient additions promoted slight or null changes in the microbial nitrogen guilds indicating high short-term stability of the guilds during periods of nutrient shortage. Overall, our results shed light on the functional diversification of microbial nitrogen utilization in a productive upwelling system.

TSB.10. Posters

[TSB.10-P-1]

Thursday 5
Discussion corner: Room 10

The resilience of the Canarian Laurel Forest: 12,000 years of fire history in Garajonay National Park (La Gomera)

Rodrigo Navarro, Judit[1]; Castilla-Beltrán, Alvaro[2]; de Nascimiento, Lea[3]; Fernández-Palacios, Quique[4]; Fernández-Palacios, José María[5]; Pla-Rabés, Sergi[6]; Nogué, Sandra[7]

(1) Centre de Recerca Ecològica i Aplicacions forestals (CREAF), Universitat Autònoma de Barcelona (UAB); (2) Universidad de la Laguna; (3) Universidad de la Laguna; (4) Universidad de la Laguna; (5) Universidad de la Laguna; (6) Centre de Recerca Ecològica i Aplicacions forestals (CREAF), Universitat Autònoma de Barcelona (UAB); (7) Centre de Recerca Ecològica i Aplicacions forestals (CREAF), Universitat Autònoma de Barcelona (UAB)

Correspondence e-mail: [j.rodrigo@creaf.uab.cat]

Garajonay National Park (La Gomera, Canary Islands) protects one of the largest remaining areas of the Macaronesian laurel forest. This study aims to reconstruct 12,000 years of fire history to assess changes in the laurel forest fire regime, attributing them to past climate conditions or human-induced disturbances. We analysed macro-charcoal fossil particles to identify changes in fire frequency from two sedimentary sequences within the park boundaries (Laguna Chica and Grande). Previously published fossil pollen data was employed to better understand fuel availability and fire behaviour. We used Generalized Additive Models to identify periods of significant changes in charcoal influx. Results indicate an increasing trend in fire frequency over time, with two significant peaks in charcoal influx: one associated with a seasonal and warm period at the beginning of the Holocene (11,700-9,000 cal. yr. BP) and the other with the initial human colonisation of La Gomera (2,000 cal. yr. BP). The main vegetation change occurred 5,500 years ago, with dense broadleaf laurel forests with hygrophilous species (e.g. Phoenix canarienses, Salix canariensis) transitioning to a cold-adapted laurel forest (e.g. Morella-faya) due to a climatic change, underscoring the resilience of the ecosystem to early human arrival and increased fire frequency. Nevertheless, agricultural abandonment and global warming are currently impacting vegetation dynamics, which, coupled with an increase in fire risk due to population growth, heightens the potential for wildfire. Without effective management strategies, the park faces a significant risk of damaging its ancient forest to wildfire, an unprecedented event for the past 12,000 years.

[TSB.10-P-2]

Tuesday 3
Discussion corner: Room 10

Fluctuating temperature regime and cell size modulates the phagotrophy-phototrophy trade-off in mixoplanktonic protists

Cabrerizo, Marco J.[1]; González-Olalla, Juan Manuel[2]; Medina-Sánchez, Juan Manuel[3]; Vila-Duplá, María[4]; Carrillo, Presentación[5]

(1) University of Granada; (2) University of Granada; (3) University of Granada; (4) University of Granada; (5) Institute of Water Research

Correspondence e-mail: [marcojabalera@gmail.com]

Mixoplankton, a dominant trophic group in aquatic ecosystems, is being greatly affected by global warming. However, studies so far evaluating the effects of temperature on mixoplankton are based on mean constant conditions, thus overlooking how short-term duration (i.e. hours or days) thermal fluctuations could deviate from climate change projections and impact this key biotic compartment. We experimentally investigated how rising thermal fluctuations (±1, 3 and 5ºC) alter the photochemical performance, photosynthesis, respiration and phagotrophy, cell size, growth and carbon use efficiency of four algal species covering a phago-phototrophic and cell-size gradient. In a thermally fluctuating environment, small-sized mixoplankton was benefited compared to larger ones and the phytoplankton species. Phagotrophy was two orders of magnitude higher (carbon-specific phagotrophy rates ~0.6 vs. 150 h-1) in smaller than larger species; however, they were 30% less efficient using the available carbon for sustaining metabolism, performance and growth. A potential mechanism explaining this result is the fact that clearance and ingestion rates in mixoplankton tend to be higher as the cell size decreases. Additionally, the higher specific rates found could try to compensate the reductions (and low) in growth efficiency that these organisms experience as they become smaller. Thus, our finding contradicts the stated idea from observational, theoretical and modeling results that larger mixoplankton cells are more phagotrophic than smaller ones. Finally, our results stress the need of considering thermal fluctuations and mixoplankton physiology in ecological models to improve predictions about the impacts of global change.

[TSB.10-P-3]

Wednesday 4
Discussion corner: Room 10

Home is not enough: nest boxes do not increase bird density for pine processionary moth control in pine plantations

Hódar, José A.[1]; Senhadji, Karim[2]

(1) Universidad de Granada; (2) Universidad de Granada

Correspondence e-mail: [jhodar@ugr.es]

Pine plantations have been used systematically in Spain over the last 75 years to recover forest mass in deforested areas or former crops. However, many of these plantations have not been properly managed afterwards, being repeatedly attacked by pests such as the pine processionary moth (PPM, Thaumetopoea pityocampa). A common solution to control PPM has been setting nest boxes, assuming bird predation upon PPM.

To test the effectiveness of this measure, we arranged an experiment in a Pinus halepensis plantation about 30 years old, located in Guadix (Granada). We carried out a full factorial design with three levels of nest box density (0, 5 and 25 nest boxes per 9 ha plot, four replicates by level). Over two seasons (2023 and 2024) we estimated bird density using line transects in winter, when processionary moth larvae are available, and in spring, during the breeding season, as well as recorded occupancy and breeding success in nest boxes.

Bird density, in particular insectivorous birds (mainly Paridae) was low in winter and very low in spring, with the bird community clearly dominated by granivorous or mixed-diet species, which do not usually prey on PPM. In the same way, only two nest boxes in 2023 and four in 2024 (out of 120 in total) were occupied, with 50% of total predation. Both lines of evidence suggest that nest boxes alone do not represent a solution to control PPM in pine plantations, unless this measure is not accompanied by thinning and diversification of the forest mass.

[TSB.10-P-4]

Thursday 5
Discussion corner: Room 10

Pursuing a pest uphill: how do pine processionary moth parasitoids behave in a global warming scenario?

Senhadji Navarro, Karim[1]; Hódar, José A.[2]; Pérez-Luque, Antonio J.[3]

(1) Universidad de Granada; (2) Universidad de Granada; (3) Instituto de Ciencias Forestales ICIFOR, INIA-CSIC

Correspondence e-mail: [senhadji@ugr.es]

Elevational gradients modify environmental conditions, affecting species distribution, abundance, and interactions. In the pine processionary moth (Thaumetopoea pityocampa, PPM), these variations can alter clutch size (number of eggs) and parasitism rates, with implications for population dynamics under global warming scenarios.

This 12-year study (2008–2019) was conducted along an altitudinal gradient (120–2000 m a.s.l.) in a mountain range in southeastern Spain. Generalized linear mixed models were applied to assess the effects of altitude, the winter North Atlantic Oscillation index, continentality, and PPM infestation levels on clutch size, parasitism rates, and the occurrence of two parasitoid species (one specialist and one generalist). The study area was divided into three climatic zones: coastal (=600 m), intermediate (600–1200 m), and high-altitude (=1200 m).

Clutch size increased with elevation, while parasitism rates and parasitoid presence decreased. However, in high-altitude areas, higher infestation levels led to increased clutch size, parasitism rates, and parasitoid occurrence, except in the specialist parasitoid species. Continentality and infestation levels also influenced these variables, with differences observed across climatic zones. To mitigate the altitudinal and latitudinal expansion of PPM under global warming, it is critical to enhance tree diversity in expansion areas. This approach can promote parasitoid establishment, synchronize host-parasitoid interactions, and reduce the risk of PPM outbreaks.

[TSB.10-P-5]

Tuesday 3
Discussion corner: Room 10

Desmid Diversity and Community Structure Across Azorean Archipelago Lakes

Souto, Martin[1]; Raposeiro, Pedro[2]; Gonçalves, Vitor[3]

(1) CIBIO; (2) CIBIO; (3) Universidade dos Azores

Correspondence e-mail: [martin.s.souto@uac.pt]

The volcanic lakes of the Azores Archipelago, a remote group of islands in the North Atlantic, provide a unique setting to investigate microbial biodiversity in freshwater ecosystems. Desmids (Chlorophyta), a group of unicellular green algae, are distinguished by their morphological diversity, ecological sensitivity, and value as bioindicators of water quality and ecosystem health. Although desmids are globally distributed, their diversity and ecological roles in the Azores—a remote oceanic archipelago—remain poorly understood.

To address this knowledge gap, we analyzed desmid communities across multiple lakes and islands using multivariate analyses, including Principal Coordinates Analysis (PCO) and Similarity Percentage (SIMPER). Four distinct desmid assemblages (SIMPROF) were identified, each shaped by differences in species composition and relative abundances. Assemblage 1 was dominated by Staurastrum pingue, contributing 94.4% to its homogeneity and indicative of eutrophic, nutrient-enriched conditions associated with high-productivity lakes. Assemblage 2, characterized by Cosmarium bioculatum and C. pseudoconnatum, exhibited greater species richness and lower internal similarity, reflecting mesotrophic conditions with moderate nutrient levels. Assemblage 3, dominated by Cosmarium tinctum and C. regnesi, corresponded to oligo-mesotrophic, transitional conditions indicative of ecological stability. Assemblage 4, co-dominated by Euastrum humerosum and E. oblongum, was linked to acidophilic conditions and restricted to littoral habitats.

These findings reveal the sensitivity of desmid communities to environmental gradients and their potential as indicators of aquatic ecosystem health. By providing critical baseline data on desmid diversity and distribution, this study advances microbial ecological research and informs conservation strategies for subtropical island freshwater systems under increasing natural and anthropogenic pressures.

[TSB.10-P-6]

Wednesday 4
Discussion corner: Room 10

Study of Habitats and Aquatic Macroinvertebrate Communities in the Lagares River: Assessment of Ecological Status and Habitat Survey

Alvarez-Troncoso, Romina[1]; Gutiérrez-Rial, David[2]; Lagoa-Núñez, Aarón[3]; Martínez, Yasmina[4]; Polina, Alejandro[5]; Villar Comesaña, Iria[6]; Mato, Salustiano[7]; Soto, Benedicto[8]; Garrido González, Josefina[9]

(1) Universidade de Vigo; (2) Universidade de Vigo; (3) Universidade de Vigo; (4) Universidade de Vigo; (5) Universidade de Vigo; (6) Universidade de Vigo; (7) Universidade de Vigo; (8) Universidade de Vigo; (9) Universidade de Vigo

Correspondence e-mail: [ralvareztroncoso@gmail.com]

The Lagares River, a coastal watercourse in the Galicia Costa hydrographic district, has been the subject of various studies due to its vulnerability to anthropogenic disturbances and its ecological value.In 2001-2002, we conducted sampling of urban and rural stretches of the Lagares River. The objective of this study was to identify the response of aquatic insects to water quality and habitat variables in urban rivers with varying degrees of contamination. The water insect assemblages of the Lagares River were studied over an annual cycle (May 2001-January 2002).

During 2020 and 2021, another study focused on the invertebrate fauna of the Lagares River and its relationship with microplastics. This study aimed to determine the presence and typology of these elements to enhance understanding of the dynamics of MPs (microplastics) in the river and identify potential sources of pollution. In 2025, further research will be conducted to deepen the understanding of the dynamics of the Lagares River's aquatic ecosystems. This will involve the identification and characterization of riverine habitats and the study of macroinvertebrate communities as indicators of ecological status, continuing the monitoring of water quality in the river.

Under the framework of the Water Framework Directive (WFD), the study will include a habitat inventory, detailed sampling of macroinvertebrates, and analysis of interactions between aquatic and terrestrial biodiversity. This approach will help identify critical areas for conservation and restoration, contributing to the maintenance of the "good ecological status" of this ecosystem.

The study also adopts a holistic perspective, addressing both ecological dynamics and the need to protect the ecosystem services provided by the Lagares River. This ensures the sustainability of its resources in the face of threats such as pollution, climate change, and riverbed alteration.

[TSB.10-P-7]

Thursday 5
Discussion corner: Room 10

Macroinvertebrates of Aysén: Diversity, distribution, and New Species in Unique Aquatic Ecosystems of Southern Chile

Aguilar Valladares, Tania[1]; Gomez Peral, Emma[2]; Aldea, Cristian[3]; Acosta-Gallo, Belén[4]; Sanchez-Jardón, Laura[5]

(1) Escuela Técnica Superior de Ingeniería de Montes, Forestal y Medio Natural; (2) Universidad Complutense de Madrid; (3) Universidad de Magallanes; (4) Universidad Complutense de Madrid; (5) Universidad de Magallanes

Correspondence e-mail: [t.aguilar.valladares@gmail.com]

The region of Aysen (43º 85' S – 48º 90' S), located in southern Chile, is a territory of great ecological value with a high level of endemism due to its isolated geography. It hosts a diverse array of unique aquatic ecosystems where macroinvertebrates play a fundamental role in the trophic dynamics and health of freshwater bodies and marine environments. This study aims to characterize the species composition of macroinvertebrates and their spatial distribution in the lakes, rivers, channels, and fjords of Aysén. For this work, a compilation of records published in the literature concerning the invertebrates of the Aysén region was carried out, with the information analysed and systematized in a georeferenced database. Information was gathered from scientific articles and databases, which were then entered and systematized. The taxa were taxonomically adjusted according to the World Register of Marine Species (WoRMS). A total of 77 bibliographic sources were systematized, with 61 of them providing information on the composition, distribution, and abundance of macroinvertebrates, while the remaining sources did not contain systematic records for the region. Approximately 3,700 records were systematized. Half of these records contain information in Spanish, and the other half in English. Most records come from international scientific journals, as well as national journals, book chapters, management plans and technical reports. The relatively limited information for these hyper-diverse taxonomic groups and the large number of new species for science (such as Podocerus chilensis n.sp., Alcyonium jorgei n.sp., and Alcyonium roseum n.sp.), underscore the importance of such reviews and highlight a significant research opportunity in the study of macroinvertebrates in the Aysén region.

TSB.11. Soil biodiversity: digging into one of the last biotic frontiers in ecological research

Tuesday, 3 (12:45-14:15)

Room: Seminario 1

Soil organisms are one of Earth's major reservoirs of living biomass and biodiversity. Belowground biota is dominated by microorganisms (bacteria, fungi, and protists) and a wide variety of invertebrate fauna, and recent advances have improved our understanding of the critical role of these organisms to multiple ecological processes. However, soil biodiversity is still a black box in many critical areas of ecological and evolutionary research, and this situation is impacting our ability to preserve edaphic biodiversity and the key ecosystem functions it provides in the face of human-driven global change. This symposium welcomes observational and experimental studies on soil organisms addressing pending ecological questions on soil biodiversity from a wide range of fields, including community ecology, biogeography, functional and ecosystem ecology, biotic interactions, global change ecology, restoration ecology, in both natural and anthropogenic ecosystems.

Organizers:

• **Albert Vilà Cabrera,** Universitat Central de Catalunya (UVic – UCC) / CREAF

• **Paula Arribas Blázquez,** IPNA-CSIC

• **Miguel de Celis Rodríguez,** Departamento de Suelo, Planta y Calidad Ambiental, Instituto de Ciencias Agrarias, CSIC

TSB.11. Orals

[TSB.11-O-1]

Tuesday 3, morning (second): 12:45
Room: Seminario 1

Long-term effects of experimental fire and post-fire soil stabilization treatments on soil microarthropod communities in gorse shrublands

Juan-Ovejero, Raquel[1]; Carrera, Noela[2]

(1) University of Vigo; (2) Forest Research Centre of Lourizán, Xunta de Galicia

Correspondence e-mail: [raquel.juan.ovejero@gmail.com]

Wildfires are a major disturbance in gorse shrublands of Galicia (NW Spain), and their severity is expected to increase with climate change. Post-fire soil stabilization techniques, such as straw mulching and grass seeding, are widely used to mitigate fire damage, yet their long-term impacts on soil fauna remain poorly understood. This study assesses the effects of an experimental fire and straw mulching and grass seeding on soil microarthropod communities 12.5 years post-disturbance in gorse (Ulex europaeus L.) shrublands. We evaluated microarthropod abundances, foraging behavior, and the QBS-ar (Soil Biological Quality-arthropods) index. Additionally, we analyzed vegetation cover, soil physico-chemical (soil water repellency, water stability of aggregates, pH, electrical conductivity, soil moisture, C and N content, and dissolved organic carbon), and microbiological (microbial biomass, ß-glucosidase and acid phosphatase activities) properties. Our findings reveal that while neither the fire nor post-fire stabilization methods had notable long-term effects on vegetation or soil physico-chemical and microbiological properties, microarthropod communities were significantly impacted. Grass seeding reduced microarthropod densities by 55% on average compared to burned-only areas, and QBS-ar index values were also lower in straw-mulched and grass-seeded soils than in untreated burned soils. Redundancy analysis indicated a negative association between soil water repellency and microarthropod abundance, suggesting that reduced food availability and increased water repellency may have limited soil fauna recovery. These findings suggest that post-fire stabilization practices may not uniformly benefit ecosystem recovery in the long term and and reveal a unique, delayed recovery pattern for soil microarthropods relative to vegetation and soil properties.

[TSB.11-O-2]

Tuesday 3, morning (second): 13:00
Room: Seminario 1

Optimizing soil biodiversity, multifunctionality and yield when transitioning to organic farming

Soliveres Codina, Santiago[1]; García Velázquez, Laura[2]; Sánchez Cuetos, Pablo[3]; Lladó Fernández, Salvador[4]

(1) Universidad de Alicante; (2) Universidad de Alicante; (3) Leitat Technological Center; (4) Universidad de Barcelona

Correspondence e-mail: [santiagosoliverescodina@gmail.com]

Agricultural intensification increases crop production often causing declines in soil biodiversity and functioning, threatening sustainability. To assess those impacts, we first need to develop feasible and comprehensive soil biodiversity indicators. To buffer them, environmental policies aim to increase the amount of organic farming, potentially compromising food supply and nitrogen availability. We measured the diversity (combination of taxonomic identification of soil fauna and DNA sequencing of microbes) and abundance (both with the microscope and through lipid fatty acids [PLFAs/NLFAs]) of soil biota in 179 croplands differing in their soil degradation levels and environmental contexts. And we did so together with the measurement of 22 soil functioning indicators plus in situ crop yield measurements. We found four soil biodiversity indicators able to capture its variation across a wide range of conditions, reflecting both their environmental responses and functional effects. We also evaluated the overall impacts of shifting agricultural management on soil biodiversity and functioning, to show that landscapes with 50% organic agriculture optimize both crop yields and environmental sustainability (biodiversity and multifunctionality). Our results further suggest that prioritizing the transition to organic farming in moderately to highly degraded soils would maximize its benefits while minimizing yield loss. Finally, we also show that crop yields do not necessarily trade-off against soil biodiversity, ecosystem multifunctionality or nitrogen availability, which often related positively. And delve into the biodiversity vs abundance-based mechanisms behind the soil biota-functioning relationships to identify which soil organisms are more beneficial under different environmental and management conditions.

[TSB.11-O-3]

Tuesday 3, morning (second): 13:15
Room: Seminario 1

Soil Fungal Communities Along Elevation Gradients: Insights for Predicting Responses to Future Climate Scenarios

Aponte, Cristina[1]; Goberna, Marta[2]; de Miguel, Sergio[3]; Martínez-Peña, Fernando[4]; Tanase, Mihai[5]; Vegas, Elena[6]; Rincón, Ana[7]

(1) Instituto de Ciencias Forestales (ICIFOR, INIA-CSIC); (2) Instituto Nacional de Investigación y Tecnología Agraria y Alimentaria (INIA-CSIC); (3) Universidad de Lleida; Centro de Ciencia y Tecnología Forestal de Catalunya; (4) Instituto Nacional de Investigación y Tecnología Agraria y Alimentaria (INIA-CSIC); (5) Instituto de Ciencias Forestales (ICIFOR, INIA-CSIC); (6) Instituto de Ciencias Forestales (ICIFOR, INIA-CSIC); (7) Instituto de Ciencias Agrarias (ICA-CSIC)

Correspondence e-mail: [cristina.aponte@inia.csic.es]

Soil fungi are pivotal for plant health, carbon cycling, and maintaining soil carbon balance. Understanding their responses to climate change is essential for predicting shifts in ecosystem functioning. Elevation gradients serve as natural experiments to explore the effects of climatic and environmental variation on soil fungal communities. This study examines how these communities vary along elevation gradients across three Spanish mountain National Parks (NPs), aiming to uncover biogeographical and edaphic influences on fungal diversity and composition.

We studied soil fungal communities in Pinus sylvestris forests distributed along elevation gradients in Ordesa, Guadarrama, and Sierra Nevada NPs. Sampling was conducted at lower, middle, and upper elevation sites, with three replicate plots per elevation. Soil physicochemical properties, vegetation structure, and fungal communities (via ITS2 metabarcoding) were characterized.

Fungal community composition differed significantly among the three NPs, reflecting their unique biogeographical and environmental conditions. Within each park, diversity and composition of soil fungal communities varied along the elevation gradients, suggesting strong links to climatic and associated environmental changes. Richness patterns differed between parks, with declines at higher elevations in the northern NPs and increases in the southern NP. These findings suggest that future climatic shifts may lead to significant changes in fungal diversity and composition, with potential cascading effects on ecosystem processes. Exploring interactions with local vegetation and soil properties is crucial for understanding these dynamics and developing strategies for biodiversity conservation under global change.

[TSB.11-O-4]

Tuesday 3, morning (second): 13:30
Room: Seminario 1

Impacts of canopy disturbances in an oak forest on soil biodiversity increase with organism size

Curiel Yuste, Jorge[1]; Pérez-Izquierdo, Leticia[2]; Ménival, Claire[3]; Baldrian, Petr[4]; Baldy, Virginie[5]; Biryol, Charlotte[6]; Dupouyet, Sylvie[7]; Heres, Ana-Maria[8]; Le Bagousse-Pinguet, Yoann[9]; Martinovic, Tijana[10]; Petritan, Ion Catalin[11]; Sanchez-Moreno, Sara[12]; Santonja, Mathieu[13]

(1) BC3 Basque Center for Climate Change; (2) Basque Center for Climate Change; (3) Aix Marseille Univ; (4) Institute of Microbiology of the Czech Academy of Sciences; (5) Aix Marseille Univ; (6) Aix Marseille Univ; (7) Aix Marseille Univ; (8) Faculty of Silviculture and Forest Engineering, Transilvania University; (9) Aix Marseille Univ; (10) Institute of Microbiology of the Czech Academy of Sciences; (11) Faculty of Silviculture and Forest Engineering, Transilvania University of Brasov; (12) Institute for Agricultural and Food Research and Technology (INIA-CSIC); (13) Aix Marseille Univ

Correspondence e-mail: [jorge.curiel@bc3research.org]

Soil biodiversity is essential for forest ecosystem functioning as it plays a key role in litter decomposition, nutrient recycling and soil carbon sequestration. Since forest disturbances can have major impacts on soil biodiversity and associated ecosystem services, there is an urgent need to provide evidence on the ecological responses of soil biodiversity to forest disturbances. To this end, we established an experimental site to study the impacts of disturbance on soil biodiversity and properties resulting from tree-felling interventions of different intensity and post-disturbance treatments (adding slash to the soil or not) in a Quercus faginea Lam. forest located in the northern Spain. The experimental design consisted in a randomized block design that included five treatments: control, 50% canopy disturbance with and without slash, 100 % canopy disturbance with and without slash. Comprehensive inventories of soil biodiversity of microbes, microfauna, mesofauna and macrofauna were carried out after one, nine and 21 months following the disturbance. Our results showed how body size determined the response of the soil community to canopy disturbance intensity and time since disturbance. The effects of the disturbance were more severe as the size of the organisms increased and as the disturbance intensity increased. We conclude that while forest show certain capacity to absorb disturbance, assisting soils with slash addition after disturbances help maintaining habitats and the soil microclimatic conditions to conserve abundances and diversity of organisms and functions. Moreover, organism body size emerges as a potential integrative functional trait indicative of responses to disturbance.

[TSB.11-O-5]

Tuesday 3, morning (second): 13:45
Room: Seminario 1

Impact of Long-Term Drought on Soil Microbial Communities and Ecosystem Functionality in a Mediterranean Forest

Mattana, Stefania[1]; Ribas, Angela[2]; Ogaya, Romà[3]; Sardans, Jordi[4]; Peñueals, Josep[5]

(1) CREAF; (2) UAB, CREAF; (3) CREAF; (4) CREAF; (5) CREAF

Correspondence e-mail: [s.mattana@creaf.cat]

Understanding how microbial communities acclimate to environmental changes is essential for predicting soil microbiome responses to increasingly severe water availability conditions anticipated in the coming decades, particularly in Mediterranean regions. Soil microorganisms are pivotal in processes such as decomposition, mineralization, and humification of soil organic matter, which are fundamental for maintaining soil functions.

In this study, we investigated the long-term effects of a 23-year experimental drought on a Mediterranean forest community (located in Prades Mountains in Catalonia 41°21'N, 1°2'E) subjected to partial rainfall exclusion and runoff interception. Our primary goal was to uncover the impacts of prolonged drought on the functionality of soil microorganisms and nutrient availability, as well as to identify potential acclimation mechanisms of these communities to more challenging environmental conditions. To accomplish this, we tracked enzymatic activity, assessed the catabolic capacity of the soil microbiome using MicroResp, and measured nutrient availability in the soil.

Microbial communities under limited water conditions exhibited significant shifts in functional diversity, particularly in their ability to decompose various carbon substrates. Additionally, soil respiration was reduced under these conditions. These changes suggest a potential decline in soil carbon mineralization capacity as a result of water scarcity. Mechanisms of microbial adaptation in drought-affected soils will be discussed.

[TSB.11-O-6]

Tuesday 3, morning (second): 14:00
Room: Seminario 1

Bottom-up effects of plant communities on soil food webs in metal-polluted arid areas

Sánchez-Moreno, Sara[1]; Goberna, Marta[2]; Martínez-Gaviria, Amaia[3]; G. Barberá, Gonzalo[4]; Catarineu, Chema[5]; Navarro, José Antonio[6]

(1) National Museum of Natural Sciences (MNCN-CSIC); (2) National Institute for Agricultural and Food Research and Technology (INIA-CSIC); (3) National Institute for Agricultural and Food Research and Technology (INIA-CSIC); (4) Edaphology and Applied Biology Center (CEBAS-CSIC); (5) Association of South-East Naturalists (ANSE); (6) National Institute for Agricultural and Food Research and Technology (INIA-CSIC)

Correspondence e-mail: [sarasm@inia.csic.es]

Introduction. Plant colonization of extremely degraded soils shapes microsites of ameliorated microclimatic and edaphic stress. Some pioneer species promote plant patches in which nucleation processes and functional diversity trigger soil microbial productivity and key microbial-driven ecosystem functions as organic matter decomposition and nutrient cycling. Other direct and indirect cascading effects of plant communities on upper trophic levels have been seldom studied. Here we assessed the effects of plant colonization gradients on soil microbial and microfaunal communities to assess their effects on soil food webs in polluted arid soils. We hypothesized that the progressive assembly of pioneer plant communities triggers cascade effects on microbial decomposers, which in turn support microbivore assemblages ultimately increasing soil food web complexity.

Materials and methods. We sampled 180 plant patches and the topsoils beneath them along nine colonization gradients of different plant species in three metal-polluted mine tailings in Cartagena (Murcia). We quantified plant diversity, characterized soil microbial communities with metabarcoding techniques and microfaunal communities by morphological methods, and estimated diversity and soil food web metrics.

Results and discussion. Our results showed that the assembly of plant communities drives the taxonomical and functional diversity of microbial and microfaunal communities. Plant colonization gradients promoted the complexity of soil food webs and triggered feedback processes that increased the biological productivity of these extreme ecosystems. Plant growth rose the abundance of soil microbes and nematodes, although the response was plant species specific. Understanding how community assembly proceeds is essential for restoring biodiversity and ecological interactions of extremely degraded ecosystems.

TSB.11. Posters

[TSB.11-P-1]

Tuesday 3
Discussion corner: Room 7

Same or different? A comparison of the fungal communities on Casuarinaceae and broadleaf litter

Quintela Sabarís, Celestino[1]; Brearley, Francis Q.[2]; Lo, Chor Wai[3]; Sumail, Sukaibin[4]; Sadim, Snevvy[5]; Jasnie, Farnidah[6]; Domínguez, Jorge[7]

(1) Universidade de Vigo; (2) Manchester Metropolitan University; (3) Universiti Teknologi MARA - Cawangan Sabah; (4) Sabah Parks; (5) Universiti Teknologi MARA - Cawangan Sabah; (6) Universiti Teknologi MARA - Cawangan Sabah; (7) Universidade de Vigo

Correspondence e-mail: [tino.quintela.sabaris@gmail.com]

Introduction. She-oaks (Casuarinaceae) are a group of tropical pioneer trees with extremely reduced vegetative morphology. Photosynthesis is performed by deciduous branchlets which turn, after abscission, into recalcitrant litter that accumulates in thick layers beneath tree canopies. It is known that the quantity and quality of litter has a strong influence on the composition and activity of soil microorganisms. Therefore, we hypothesise that Casuarinaceae litter is decomposed by a specialist fungal community that differs from broadleaf litter.

Material and methods. To test this hypothesis, we focused on three Casuarinaceae species (genera Gymnostoma and Ceuthostoma) from ultramafic and non-ultramafic soils from Sabah (Malaysia). We collected plant, litter and soil samples in 7 sites where Casuarinaceae were present and neighbouring areas where these trees were absent. We analysed the chemical composition and the organic matter functional groups in soils and litter using CN elemental analyser, ICP-AES and infrared FTIR-ATR spectroscopy. Moreover, we extracted DNA from litter and soil samples and described the fungal communities by metabarcoding of the ITS-2 region.

Results and discussion. Contrary to what was expected, Casuarinaceae litter had a similar chemical composition to broadleaved litter. In spite of this similarity, Casuarinaceae and broadleaf litter host fungal communities with different composition and structure, although both types of litter had comparable levels of fungal diversity. The potential enzymatic differences between fungal communities in broadleaved and Casuarinaceae litter and the role of these differences in the reduced decomposition rates of Casuarinaceae litter is discussed.

[TSB.11-P-2]

Wednesday 4
Discussion corner: Room 7

Plant diversity shapes soil microbial networks under climate change

Valencia, Enrique[1]; Maestre, Fernando T.[2]; Pescador, David S.[3]; Singh, Brajesh K.[4]; Calatayud, Joaquín[5]

(1) Faculty of Biological Sciences. Complutense University of Madrid; (2) King Abdullah University of Science and Technology; (3) Facultad de Farmacia, Universidad Complutense de Madrid; (4) Hawkesbury Institute for the Environment, University of Western Sydney; (5) Escuela Superior de Ciencias Experimentales y Tecnología, Universidad Rey Juan Carlos

Correspondence e-mail: [enrvalen@ucm.es]

Soil microbial communities are key regulators of ecosystem processes such as soil nutrient storage and cycling. Specific plant species or climatic conditions can influence soil microbiomes and their functioning. Yet, how plant assembly shape the soil microbiome under climate change conditions is still largely unknown. To fill this gap, we conducted a two-years manipulative mesocosm experiment to evaluate how different plant assemblages (diversity and composition) influence soil bacterial and fungal networks under simulated climate change. The inclusion of plant-related variables, i.e. plant species' biomasses and plant community attributes, largely explained resulting microbial networks. An outstanding 56% of associations between microorganisms were incidental and based on similar plant preferences, showing the crucial importance of considering plant-related variables to a meaningful interpretation of microbial networks. Plants control microbial communities both by tightly species-specific associations with microorganisms and by emergent effects of plant community attributes. These results were independent of climate change treatments, which produced negligible effects. Overall, we show that plant assemblages have the potential to shape soil microbial networks and therefore the ecosystem processes of the whole community.

[TSB.11-P-3]

Thursday 5
Discussion corner: Room 7

Nematodes under fire: how wildfires reshape soil faunal communities

Lillo, Paula[1]; Santiesteban, Amara[2]; Hornos, Zeus[3]; Sánchez-Moreno, Sara[4]; Rincón, Ana[5]; Aponte, Cristina[6]

(1) National Institute for Agriculture and Food Research and Technology, INIA-CSIC; (2) Institute of Forest Sciences, ICIFOR-INIA, CSIC; (3) Institute of Forest Sciences, ICIFOR-INIA, CSIC; (4) National Museum of Natural Sciences, MNCN-CSIC; (5) Institute of Agricultural Sciences, ICA-CSIC; (6) Institute of Forest Sciences, ICIFOR-INIA, CSIC

Correspondence e-mail: [paula.lillo@inia.csic.es]

High-severity wildfires are increasingly common, challenging forest ecosystems adapted to low-severity fire regimes. Belowground responses to wildfires depend on fire temperature and residence time, which do not always align with aboveground impacts. Soil biota is particularly vulnerable, with elevated soil temperatures affecting their diversity and functionality. These effects are often amplified by post-fire soil erosion. In this study, we investigated how fire severity and post-fire erosion influence edaphic nematode communities in a Mediterranean Pinus sylvestris forest.

The research was conducted at the site of the Navalacruz wildfire (Ávila, 2021). Soil samples, comprising topsoil (0–5 cm) and subsoil (5–10 cm), were collected from Pinus sylvestris forests across a gradient of fire severity and erosion. Soil-extracted nematodes were identified using a morphological approach. We sampled immediately post-fire to assess the resistance of nematode communities and 2 years later, in 2023, to evaluate their recovery.

Fire-induced changes were restricted to the upper soil layers, decreasing total nematode abundance and altering their functional composition. Microbial-feeding nematodes dominated high-severity plots, while unburned sites were associated with higher trophic groups. This study highlights the interplay between fire disturbance, soil biota, abiotic properties, and their post-fire recovery.

[TSB.11-P-4]

Tuesday 3
Discussion corner: Room 7

Changes in the functional composition of microbial communities after long-term N addition in a beech temperate forest

López Sánchez, Carme[1]; Ribas Artola, Àngela[2]; Guerreri, Rossella[3]; Ning, Daliang[4]; Zhou, Jizhong[5]; Mattana, Stefania[6]

(1) CREAF (Centre de Recerca Ecològica i Aplicacions Forestals); (2) CREAF (Centre de Recerca Ecològica i Aplicacions Forestals); (3) UNIBO-University of Bologna; (4) University of Oklahoma; (5) University of Oklahoma; (6) CREAF (Centre de Recerca Ecològica i Aplicacions Forestals)

Correspondence e-mail: [c.lopez@creaf.cat]

Increased atmospheric deposition of Nitrogen (N) caused by Global Change, has been documented to profoundly affect terrestrial ecosystems. However, few studies have addressed the impact of N addition on soil microbial communities, both in terms of their composition and the functions they provide to the ecosystem.

The present work aims to evaluate the N supplementation effects on soil microbial communities in a eutrophic temperate beech tree forest located in Northern Italy (The Cansiglio Forest). Since 2015, control (only ambient deposition, N0) and soil N addition (30 kg ha-1 yr-1, N30) plots have been established in this region. Soil biochemical variables including Nitrogen (N), Carbon (C) and Phosphorus (P) content and soluble ions were characterized for both treatments. In addition, GeoChip 5.0S, a microarray technology, was used to characterize the taxonomic and functional diversity of microbial communities.

Although no changes were detected in soil physicochemical characteristics between treatments, there was a significant increase in the relative abundance of some functional genes related to the Nitrogen, Carbon and Sulphur cycles in the N supplemented plots. These results suggest a probable increase in the partial (N2O) or total (N2) denitrification processes of the N-added soil microbiome.

This study contributes to the description of the microbial communities' dynamics in forests under increased Nitrogen deposition conditions.

TSB.12. Spatial modelling of species niches and distributions

Thursday, 5 (11:00-12:30)

Room: Seminario 7

In a world facing significant biodiversity loss, urgent conservation measures and a transformation in our interactions with natural ecosystems are essential. These efforts are critical for several purposes, including assessing species threats, developing conservation guidelines, and anticipating impacts of global change and biological invasions. Achieving these objectives requires a deeper understanding of how socio-ecological systems respond to global changes. In this context, Species Distribution Models (SDMs) are increasingly recognized as valuable tools for understanding species' ecological niches and geographic distributions, as well as forecasting changes and estimating potential vulnerabilities. SDMs have already demonstrated their utility in supporting conservation strategies for threatened species, facilitating habitat restoration, designing protected areas, and assessing risks from invasive species. However, a key challenge is the need to better quantify uncertainty in spatial predictions. The magnitude, significance, and complexity of this uncertainty are influenced by several factors, including the quality of input data (both species and environmental), modeling techniques, model evaluation, and the predictions themselves. In this Thematic Session, we invite contributions that present frameworks and applications aimed at identifying, quantifying, and reducing uncertainty in spatial models and predictions. We also welcome contributions that enhance the spatial modeling of species niches and distributions more broadly.

Organizers:

• **Alejandra Zarzo Arias,** Universidad Autónoma de Madrid

• **Rubén García Mateo,** Universidad Autónoma de Madrid

TSB.12. Orals

[TSB.12-O-1]

Thursday 5, morning (first): 11:00
Room: Seminario 7

sabinaNSDM, an R package for building nested hierarchical Species Distribution Models (SDMs)

Zarzo-Arias, Alejandra[1]; Morales-Barbero, Jennifer[2]; Goicolea, Teresa[3]; Lima, Herlander[4]; Gómez-Rubio, Virgilio[5]; Mateo, Rubén G.[6]

(1) Universidad Autónoma de Madrid; (2) Universidad Autónoma de Madrid; (3) Universidad Autónoma de Madrid; (4) Universidad de Alcalá de Henares; (5) Universidad de Castilla- La Mancha; (6) Universidad Autónoma de Madrid

Correspondence e-mail: [alejandra.zarzo@gmail.com]

Introduction. Species distribution models (SDMs) are critical for predicting where species occur, especially in the face of climate change and biodiversity loss. However, traditional SDMs face limitations due to their reliance on either regional or global scales, often leading to issues like niche truncation (loss of broader-scale information) and inaccurate extrapolation (misapplication to areas beyond observed ranges). To address these challenges, we developed the sabinaNSDM R package, which implements spatially nested hierarchical SDMs (N-SDMs) to enhance model accuracy by combining information from two different spatial scales.

Material and methods. The sabinaNSDM package integrates global models, which capture a species' broad ecological niche (usually climatic), with regional models, which provide finer-scale details on environmental factors and species data. It offers two nesting strategies: a covariate-based and an averaging method. The package also includes automated tools for generating background data with a novel approach for balanced pseudoabsences sampling in the environmental space, spatial filtering of occurrence/absence records, covariate selection, and model calibration and projection.

Results and discussion. Applied to 76 tree species in the Iberian Peninsula, sabinaNSDM outperformed traditional SDMs providing more accurate predictions. Additionally, the package also supported the development of a geoportal mapping the potetntial distribution of 200 woody plant species in peninsular Spain under different climate change scenarios (https://geosabina.com). These results show sabinaNSDM's potential to produce accurate, high-resolution species distribution predictions to support informed conservation planning and climate change mitigation efforts. The package is open-source and accessible via GitHub (geoSABINA/sabinaNSDM), offering an intuitive solution for researchers and conservationists.

[TSB.12-O-2]

Thursday 5, morning (first): 11:15
Room: Seminario 7

Optimising background points in species distribution models: Effects on present and future projections

Rausell-Moreno, Armand[1]; Galiana, Núria[2]; Naimi, Babak[3]; B. Araújo, Miguel[4]

(1) Museo Nacional de Ciencias Naturales (MNCN-CSIC); (2) Museo Nacional de Ciencias Naturales (MNCN-CSIC); (3) University of Utrech; (4) Museo Nacional de Ciencias Naturales (MNCN-CSIC)

Correspondence e-mail: [armand.rausell@mncn.csic.es]

Species Distribution Models (SDMs) are foundational tools for predicting biodiversity patterns and informing conservation planning. However, most SDMs rely on presence-only data, calibrated using background absences, with no consensus on the optimal number of background points. This knowledge gap limits the consistency and accuracy of SDMs, particularly under climate change scenarios.

We addressed three critical questions: (i) How do different background proportions affect SDM accuracy for current species distributions? (ii) How do they influence projections under future climate scenarios? (iii) Should background absences be sampled proportional to the study region or presence data?

Using simulations of 290 virtual species globally under present and future climate conditions, we assessed predictions against simulated "true" distributions. Our findings reveal that sampling background absences proportional to either presence points or the study region yields comparable accuracy. On average, the optimal ratio was 0.5–1 background to presence points when sampling proportional to presences, and ~5% of the study area when sampling regionally. Also, different prevalences might differ in the optimal proportion needed. While baseline predictions were sensitive to background proportions, future projections remained more robust, driven primarily by niche-related variables.

These results provide novel and relevant guidelines for background sampling in SDMs, offering a practical framework to enhance model reliability. By refining background sampling strategies, researchers can achieve more accurate predictions for present distributions and robust projections for future scenarios. This research aims to advance SDM methodology, crucial for biodiversity conservation in the face of climate change.

[TSB.12-O-3]

Thursday 5, morning (first): 11:30
Room: Seminario 7

JSDMs paleoclimatic projections enhance SDMs, offering improved predictions for rare species

Romera Romera, Daniel[1]

(1) Universidad de Córdoba

Correspondence e-mail: [b62rorod@uco.es]

Understanding how biodiversity responds to new environmental conditions is a key challenge in ecology, especially in the context of global environmental change. Past environmental changes provide valuable insights into how biodiversity has adapted over time. Tools such as paleoclimatic reconstructions (e.g., Paleoclimate Modelling Intercomparison Project) and fossil pollen databases (e.g., Neotoma Paleoecology Database) are essential for studying the biogeographical history of plant species and ecosystems. While Species Distribution Models (SDMs) establish links between species' presence and environmental variables, they often fail to account for species interactions and other ecological complexities. Joint Species Distribution Models (JSDMs), which incorporate biotic interactions, functional traits, and phylogenetic relationships, offer improved projections but are still rarely used in paleoecological studies.

In this research, we used Hierarchical Modelling of Species Communities (HMSC) to develop SDMs and JSDMs for conifer and broadleaf forest species in the Western Mediterranean. These models were projected from the Last Glacial Maximum (LGM, 21ka) to the present in 100-year intervals, validated using fossil data from the Neotoma Paleoecology Database.

Our results show that JSDMs refine SDM predictions, especially for rare species, despite similar evaluation metrics for abundant species (both average AUC around 0.7). However, distribution maps showed clear differences (e.g., SDMs predicted 16,262,926 ha more as suitable habitat for Pinus halepensis at 6 ka BP compared to JSDMs). This highlights uneven fossil record coverage, particularly in North Africa. JSDMs provided more conservative predictions, identifying key refugia and overlooked areas, advancing critical knowledge for biodiversity conservation planning.

[TSB.12-O-4]

Thursday 5, morning (first): 11:45
Room: Seminario 7

Enhancing aquatic Species Distribution Models (aSDMs) by utilizing the Ichthyofauna of the Iberian Peninsula as a proxy

Vagenas, Georgios[1]; G. Matias, Miguel[2]; B. Araújo, Miguel[3]

(1) MNCN-CSIC; (2) MNCN-CSIC; (3) MNCN-CSIC

Correspondence e-mail: [georgios.vagenas@mncn.csic.es]

The standardized framework of Species Distribution Models (SDMs) is primarily developed for open-land systems, and certain enhancements are needed for their implementation in aquatic systems. We present a conceptual framework of aquatic SDMs (aSDMs), using presence-only occurrences of the endemic freshwater Ichthyofauna of the Iberian Peninsula. The dataset represents the most up to date collection of occurrences during the last two decades for both countries (i.e., Spain and Portugal). In this study, we propose the application of two different spatial approaches in ensemble SDMs including unconstrained and constrained models within the watersheds of occurrence for each species, while accounting for the topology of the watershed network (i.e., HydroSHEDS). Additionally, we examine the impact of incorporating different sets of climate and hydrology-based environmental variables as envelope layers in the aSDMs, respectively. The results demonstrate that the inclusion of climate and hydrological covariates in aSDMs leads to progressive improvement in model performance, particularly when considering the scale of the hydrographic organization. Finally, we cross-evaluate the metrics for the produced models by each approach and stack the multi-species layers in order to investigate patterns in species richness. The ultimate goal is to obtain an updated set of probabilistic occurrence/suitability maps for the endemic Ichthyofauna of the Iberian Peninsula.

[TSB.12-O-5]

Thursday 5, morning (first): 12:00
Room: Seminario 7

Niche similarity and spatial co-occurrence in lentic and lotic European dragonflies and

Gómez Vadillo, Mónica[1]; Alves-Martins, Fernanda[2]; Ronquillo, Cristina[3]; Hortal, Joaquín[4]

(1) Museo Nacional de Ciencias Naturales (MNCN-CSIC); (2) CIBIO, Centro de Investigação em Biodiversidade e Recursos Genéticos; (3) Museo Nacional de Ciencias Naturales (MNCN-CSIC); (4) Museo Nacional de Ciencias Naturales (MNCN-CSIC)

Correspondence e-mail: [monica.gomez@mncn.csic.es]

Introduction. We investigate the relationship between pairwise species co-occurrence and macroclimatic niche similarity in Odonata, focusing on species adapted to lentic (standing water) and lotic (flowing water) habitats. Climate plays a key role in shaping species distributions, and understanding niche overlap provides insights into species coexistence and adaptation to environmental conditions. In addition to examining niche similarity, we analyze niche hypervolume occupancy rates to assess variability in climatic niche overlap. By exploring these relationships, we aim to uncover patterns in the macroclimatic niche of Odonata species and their spatial distributions.

Methods. We studied niche hypervolumes using the Support Vector Machine (SVM) method for 119 Odonata species across Europe (excluding Russia and all islands except Great Britain and Ireland). Five bioclimatic variables (BIO1, BIO12, BIO4, BIO15, BIO8) from WorldClim 2.1 were scaled and centered to construct the hypervolumes. Three groups were considered: all species, lentic species, and lotic species. Niche similarity among species pairs was quantified using Jaccard and Sorensen indices, and occupancy rates. Differences were tested using Kruskal-Wallis and Mann-Whitney U tests. Matrix regressions were applied to explore bioclimatic niche breadth and area of occupancy (AOO) for each species.

Results. Preliminary results show higher macroclimatic niche similarity between pairs of lentic and lotic species compared to pairs within the same group. However, spatial co-occurrence analysis reveals greater similarity among lentic species. These differences may be due to insufficient random point density during hypervolume construction. Additionally, lentic species exhibit a higher mean occupancy rate in the climatic hypervolume than lotic species.

[TSB.12-O-6]

Thursday 5, morning (first): 12:15
Room: Seminario 7

Human mobility and habitat suitability drive the invasion dynamics of the arbovirus vector Aedes albopictus in Spain

Pardo-Araujo, Marta[1]; Kotov, Egor[2]; Alonso, David[3]; Bartumeus, Frederic[4]

(1) Centro de Estudios Avanzados de Blanes, CEAB-CSIC; (2) ax Planck Institute for Demographic Research (MPI, Rostock, Germany); (3) Centro de Estudios Avanzados de Blanes, CEAB-CSIC; (4) Centro de Estudios Avanzados de Blanes, CEAB-CSIC

Correspondence e-mail: [mpardo@ceab.csic.es]

Biological invasions are a critical global issue, exacerbated by human-mediated dispersal and climate change. Invasive species, particularly mosquito vectors such as Aedes albopictus, pose significant public health risks. We examine the invasion dynamics of Ae. albopictus in Spain, a species whose spread has been facilitated by human-mediated dispersal and adaptation to human-modified environments. Since its first detection in Spain in 2004, Ae. albopictus has expanded its range, underscoring the need for effective monitoring and predictive tools.

Traditional species distribution models often fail to capture the dynamic processes of invasion, including dispersal and habitat suitability. To address this gap, we employed a mechanistic metapopulation model, adapted from Hanski's framework, to investigate the interplay between propagule pressure driven by human-mediated dispersal and habitat suitability. The model is informed by data from traditional monitoring methods, such as traps, and citizen science platforms like Mosquito Alert. Our approach highlights the role of human mobility in regional-scale dispersal, as well as the influence of environmental factors such as temperature and rainfall on establishment.

This study identifies a threshold for human-mediated mosquito dispersal and evaluates the impact of various control strategies. By incorporating climate change projections (CMIP6), we predict potential range expansions under future scenarios and identify future colonization hotspots in Spain. This research advances the understanding of Aedes albopictus invasion dynamics and provides a valuable tool for informing management and mitigation strategies to limit the spread of invasive disease vectors.

TSB.12. Posters

[TSB.12-P-1]

Wednesday 4
Discussion corner: Room 10

Wildfire effect on climatic disequilibrium of understory community of Pinus halepensis forests

Codina Martínez, Gerard[1]; Batllori Presas, Enric[2]; Lloret Maya, Francisco[3]

(1) CREAF; (2) Universitat de Barcelona; (3) CREAF

Correspondence e-mail: [g.codina93@gmail.com]

Post-fire regeneration dynamics in Mediterranean forests are increasingly shaped by climate change, which may affect climatic disequilibrium in plant communities. This study analyzes post-fire climatic disequilibrium in the understory of Pinus halepensis forests affected by recent wildfires (2000–2015), focusing on the understory communities pre- and post-fire states.

Using data from the National Forest Inventories (NFI) and climatic datasets, we conducted a detailed climatic characterization of the understory plant communities. This included evaluating their position within the climatic niche, weighted by species abundance, and quantifying community climatic disequilibrium. The climatic environmental space was constructed by combining the European distribution of the species with corresponding climatic layers. For each plot, we calculated the distance between its position in this environmental space and the core and edge of the climatic niche space of the community (climatic niche position), estimating the degree of climatic suitability. Additionally, we determined the difference between the climate inferred from the climatic requirements of the community's species and the observed local climate (climatic disequilibrium).

Preliminary results suggest that warmer and drier conditions before and after fire, modulate changes in Pinus halepensis understory community, increasing their climatic disequilibrium after wildfires, and moving communities away from their climatic suitability, which may reduce ecosystem resilience.

[TSB.12-P-2]

Wednesday 4
Discussion corner: Room 11

Revealing spatio-temporal Spawning Patterns of European Hake in Atlantic Iberian waters

García Fernández, Cristina[1]; Otero, Jaime[2]; Gomez-Suarez, Francisco[3]; Sampedro, Paz[4]

(1) Centro Oceanográfico de A Coruña (COAC), IEO-CSIC; (2) Centro Oceanográfico de A Coruña (COAC), IEO-CSIC; (3) Centro Oceanográfico de A Coruña (COAC), IEO-CSIC; (4) Centro Oceanográfico de A Coruña (COAC), IEO-CSIC

Correspondence e-mail: [cristina.garcia.fernandez@ieo.csic.es]

Understanding the spatial distribution of commercial fish species is critical for estimating the stock size and its temporal dynamics, and essential for establishing sustainable catch limits and develop management strategies. Spatial data can also reveal suitable habitats, and preferred spawning grounds and nursery areas. The European hake (Merluccius merluccius) is a top predator in demersal communities with a highly significant ecological role. Moreover, this species has an enormous commercial importance in the north-northwest of Spain, where hake is targeted by both large- and small-scale fisheries. Two fundamental fleets use longlines and gillnets to mainly catch large females individuals. By means of linking Vessel Monitoring System data, which provide accurate geographical position of the vessels with first-sale notes and electronic logbooks, which enable the estimation of commercialized hake roe, we studied the spatio-temporal dynamics of spawner females from 2009 to 2022 to detect potential spawning grounds and their seasonality. Species distribution models (SDMs), fitted with sdmTMB, were developed to estimate the persistence of spawning areas and infer the influence of the environmental conditions. Results showed a clear reproductive pattern, characterized by a higher spawning activity in the first part of the year, a geographical expansion from northwest to north, and the effect of sea bottom temperature on the spawning processes. These results are discussed within the current framework of defining the spatial protection measures for fisheries management and marine conservation.

TSB.13. Host-microbe interactions: understanding ecological processes from individuals to ecosystems

Thursday, 5 (15:30-17:00)

Room: Salón de actos

Advancing our knowledge of macro-microorganism interactions, whether in loose relationships or intimate symbioses, is fundamental to understanding the mechanisms that govern these relationships, the evolutionary processes that shape them and ecological consequences. Since Lynn Margulis introduced the holobiont concept in the early 1990s, viewing hosts and their microbiomes as superorganisms, ecological studies have entered a new dimension. Moreover, recent advances on next-generation sequencing and growing accessibility to molecular tools have greatly expanded our understanding of this emerging and exciting field of research. This session aims to explore ecological processes at any level of biological organization (individual, population, community, and ecosystem) from a holobiont perspective, including symbiotic, parasitic, or opportunistic relationships, as well as their relevance to ecosystem functioning and services Any contribution focusing on macro-microorganism interactions, whether theoretical or empirical, is welcome, regardless of host taxon (plant or animal), ecosystem (aquatic or terrestrial), associated microbes, biome, or biogeographic area. Cross-disciplinary research to address the holobiont concept in applied areas, such as management and exploitation as practical solutions to mitigate the impact of human activities are also welcome.

Organizers:

• **Félix Picazo Mota,** Departmento de Ecología, Universidad de Granada

• **Teresa Maria Morganti,** Departamiento de Biología Marina y Oceanografía, Instituto de Ciencias del Mar de Barcelona (ICM)

TSB.13. Orals

[TSB.13-O-1]

Thursday 5, after lunch (third): 15:30
Room: Salón de actos

Eco-evolutionary impacts of deforestation and habitat fragmentation on host-parasite networks

Siliansky de Andreazzi, Cecilia[1]; Lula Costa, Ana Paula[2]; Gawecka, Klementyna[3]

(1) Universidad Complutense de Madrid; (2) Instituto Oswaldo Cruz; (3) UK Centre for Ecology and Hydrology

Correspondence e-mail: [cecsilia@ucm.es]

Introduction. Biodiversity loss increase the risk of zoonotic diseases, particularly in areas with reduced forest cover. While vegetation cover is linked to disease regulation, the impact of landscape configuration on host-parasite evolutionary dynamics remains unclear.

Material and Methods. Parasite attack and host defense traits coevolve across species' ranges, creating geographic mosaics in interaction strength that landscape changes may modulate. We developed a spatially explicit model to investigate how deforestation and fragmentation influence host-parasite eco-evolutionary dynamics. Using data from the Brazilian Atlantic Forest metanetwork (51 mammal species and 103 infectious agents), we modeled trait and abundance dynamics across 12 landscapes with varying levels of fragmentation and vegetation cover. Host occurrence frequencies informed colonization and extinction probabilities in natural and disturbed patches. The model combined metacommunity spatial dynamics with coevolutionary feedback in ecological networks.

Results and Discussion. Core forest patches supported larger, modular networks, while disturbed patches had smaller, highly connected networks. Land use directly affected interaction frequency and species abundance, with core patches hosting more interactions and species. Larger forest patch clusters indirectly reduced extinction rates, promoting higher regional parasite richness, which decreased parasite abundance and interaction frequency. Core areas favored diverse and stable networks, while disturbed areas promoted nested, connected structures favoring zoonotic parasite spread. Stronger interactions in these networks increased the likelihood of new pathogen variants, highlighting the critical role of large forest cores in stabilizing host-parasite dynamics.

[TSB.13-O-2]

Thursday 5, after lunch (third): 15:45
Room: Salón de actos

Root-associated fungal pathogens influence to plant recruitment in Mediterranean forests

Pajares-Murgó, Mariona[1]; Garrido, José L.[2]; Perea, Antonio J.[3]; Bastida, Jesús M.[4]; López-García, Álvaro[5]; Alcántara, Julio M.[6]

(1) Universidad de Jaén; (2) Estación Experimental del Zaidín, CSIC; (3) Universidad de Jaén; (4) Estación Experimental del Zaidín, CSIC; (5) Estación Experimental del Zaidín, CSIC; (6) Universidad de Jaén

Correspondence e-mail: [mpajares@ujaen.es]

Pathogens can affect the performance of individual plants and those in their vicinity, thus affecting the outcome of plant-plant interactions. However, mycorrhizal associations can modulate those effects by improving plant nutrition, modifying host defences or occupying root space. Since juveniles are especially susceptible to pathogens, the process of recruitment provides information on the demographic impact of natural enemies on population dynamics. Recruitment interactions are defined as those occurring between established plants (canopy) and those plants recruiting in their vicinity (recruits) and can be measured as the frequency of recruitment of a given species in the proximity of individuals of a canopy species.

To test the role of pathogens and the type mycorrhizal association in plant recruitment we combined data of the frequency of canopy-recruit interactions and their pathogenic root-associated fungi (pRAF, hereafter) by high-throughput sequencing for 24 woody species from two Mediterranean mixed forests in southern Spain.

We found that pRAF have a negative effect on the frequency of canopy-recruit interactions at a pairwise-level, although this effect is most evident in the sapling bank of species associated with arbuscular mycorrhiza. Additionally, our analysis showed that pRAF impose a filter for the plant early recruitment by influencing the density of the sapling bank. However, plant species associated with ectomycorrhizal fungi facilitate an abundant sapling recruitment. These results highlight the importance of pRAF in structuring the sapling bank and influencing plant recruitment, and the counteracting effect of the mycorrhizal associations in modulating the pathogenic effect for wild species at a community level.

[TSB.13-O-3]

Thursday 5, after lunch (third): 16:00
Room: Salón de actos

Macroalgal biofilm harbours a wide diversity of parasitic protists with distinct temporal dynamics

Alacid Fernandez, Elisabet[1]; Reñé, Albert[2]; Timoneda, Natalia[3]; Garcés, Esther[4]

(1) Centre d'Estudis Avançats de Blanes (CEAB-CSIC); (2) Institut de Ciències del Mar (ICM-CSIC); (3) Institut de Ciències del Mar (ICM-CSIC); (4) Institut de Ciències del Mar (ICM-CSIC)

Correspondence e-mail: [e.alacid@ceab.csic.es]

Marine macroalgae surfaces create a nutrient-rich environment that promotes the formation of epiphyte biofilms. Biofilms are complex systems that facilitate ecological interactions within the community, yet parasitism remains largely unexplored. This study describes the diversity and temporal dynamics of the microeukaryotic community in the biofilm of Mediterranean macroalgae during summer, focusing on parasitic groups. Protist diversity was assessed using metabarcoding sequencing of the V4 region of the 18S rDNA gene using primers biased against metazoans. The macroalgal biofilm exhibited dynamic shifts in the microeukaryotic community structure associated to three phases of biofilm formation. Each phase was characterized by the dominance of specific eukaryotic and parasitic groups with clear successions between them. Our study revealed a high diversity of parasitic protists from different lineages in the macroalgal biofilm. These parasites can infect a wide variety of hosts, including the basibiont, species within the biofilm (micro- and macrocolonizers), nearby marine hosts, and terrestrial organisms. The highest diversity and abundance of parasites were found in the mature phase of the biofilm, where the complexity and stability of the system seem to favour parasitism. The parasite assemblage was dominated by Apicom-plexa, with many corresponding to unknown diversity, demonstrating that biofilms are a hotspot of unknown parasitic interactions. These parasites could potentially affect the dy-namics of these communities and facilitate ecological interactions between the biofilm and surrounding organisms, suggesting that parasitism play a key, but still unexplored role, in shaping complex marine biofilms network.

[TSB.13-O-4]

Thursday 5, after lunch (third): 16:15
Room: Salón de actos

Biogeography and phylosymbiosis as drivers of echinoderm microbiomes

Martínez-Moreno, Silke[1]; Peralta-Maraver, Ignacio[2]; Pula, Héctor J.[3]; Ferrera, Isabel[4]; Reche, Isabel[5]

(1) Universidad de Granada; (2) Universidad de Granada; (3) CEI·MAR; (4) Instituto Español de Oceanografía (IEO-CSIC); (5) Universidad de Granada

Correspondence e-mail: [silke@ugr.es]

The influence of biogeography and phylogeny on marine invertebrate microbiomes differ across distinct compartments of the holobiont. Understanding the processes driving microbiome assembly, such as environmental or taxa filtering, and its function is crucial to determine the nature of the host-microbiome symbiosis and their ecological implications. Although some studies have provided valuable information on echinoderm microbiomes, an exhaustive analysis including all the classes in different environments is lacking. We analyzed the microbiome of 149 individuals from Crinoidea, Asteroidea, Ophiuroidea, Echinoidea, and Holothuroidea classes, across 18 sites in the Alboran Sea and Tenerife. We collected external biofilm mucus and subcuticular samples from all individuals, along with sediment and water samples in each site. We then sequenced the V4 region of the 16S rRNA gene using Illumina sequencing. Our results reveal a strong biogeographic signal in the microbiome composition of both the biofilm and subcuticular samples, with the signal being more pronounced in biofilms. Phylosymbiosis also played an important role in shaping the microbiome, particularly in subcuticular biofilms, indicating a certain degree of host-driven filtering. Biofilm microbiomes were richer and more diverse than subcuticle ones, supporting the host selection hypothesis. This difference was especially pronounced in the more ancestral echinoderm classes (i.e., Crinoidea, Asteroidea and Ophiuroidea). Future research should go deeper into the functional roles of these microbiomes to understand their contribution to host fitness and ecosystem processes performed by the echinoderm holobionts.

[TSB.13-O-5]

Thursday 5, after lunch (third): 16:30
Room: Salón de actos

Light, wounds, action: The contribution of photosymbionts to the sponge metabolism and tissue regeneration

Pintó, Berta[1]; Nader, Lola[2]; García-Altares, María[3]; Morganti, Teresa Maria[4]; Pita, Lucía[5]

(1) Universitat de Barcelona / Institut de Ciències del Mar-CSIC; (2) Christian-Albrechts-Universität zu Kiel; (3) IRTA La Ràpita; (4) Institut de Ciències del Mar-CSIC; (5) Instituto de Investigacións Mariñas-CSIC

Correspondence e-mail: [bpintolo19@alumnes.ub.edu]

Introduction. Sponge holobionts exemplify how symbiont activity scales up to ecosystem level. Sponge hosts with associated microorganisms play an important functional role in nutrient and organic matter cycling. Additionally, microbes produce secondary metabolites that can enhance sponge chemical defenses. Although genomic data suggests microbes support sponge metabolism, manipulative experiments testing microbial influence on sponge physiology and ecological function are still scarce. Here, we evaluated how cyanobacteria symbionts contribute to primary and secondary metabolism of the sponge Aplysina aerophoba.

Methods. We manipulated photosynthesis by keeping sponges under a 12h light:dark photoperiod vs 24h dark (i.e., no photosynthesis). We introduced a second factor, injury, to simulate predation and increase metabolic demands and monitored recovery over time. We measured sponge oxygen uptake and nitrogen and carbon uptake/excretion using InEx technique, and analyzed chemical compound distribution in the sponge tissue by mass spectrometry imaging (MALDI IMS).

Results and discussion. Photosymbiont activity was reduced in the dark. Although the mean regeneration rate was similar across light treatments, sponges under light recovered faster during first 8 days. This indicates that photosymbionts support the early recovery phase, when transcriptomic and cellular responses to wounding are induced. Mass spectrometry imaging data is being analyzed to identify photosymbiont-derived compounds. Oxygen and carbon fluxes remained similar across treatments. However, nitrogen cycling shifted from net ingestion of dissolved inorganic nitrogen (controls) to net excretion in darkness and wounding. Our results suggest A. aerophoba is less dependent on photosynthesis-derived carbon than previously thought, but photosymbionts significantly influence sponge role in nitrogen cycling.

[TSB.13-O-6]

Thursday 5, after lunch (third): 16:45
Room: Salón de actos

The archaeal class Nitrososphaeria is a key component of the reproductive microbiome in sponges during gametogenesis

Turon Rodrigo, Marta[1]; Koutsouveli, Vasiliki[2]; Conejero, Maria[3]; Taboada, Sergio[4]; Verdes, Aida[5]; Lorente-Sorolla, José María[6]; Díez-Vives, Cristina[7]; Riesgo, Ana[8]

(1) Museo Nacional de Ciencias Naturales (MNCN-CSIC); (2) Geomar Helmholtz Centre for Ocean Research; (3) Museo Nacional de Ciencias Naturales (MNCN-CSIC); (4) Museo Nacional de Ciencias Naturales (MNCN-CSIC); (5) Museo Nacional de Ciencias Naturales (MNCN-CSIC); (6) Museo Nacional de Ciencias Naturales (MNCN-CSIC); (7) Museo Nacional de Ciencias Naturales (MNCN-CSIC); (8) Museo Nacional de Ciencias Naturales (MNCN-CSIC)

Correspondence e-mail: [mturonrodrigo@gmail.com]

Introduction. Sponge-associated microbes play fundamental roles in regulating their hosts' physiology, yet their contribution to sexual reproduction has been largely overlooked. Most studies have concentrated on the proportion of the microbiome transmitted from parents to offspring, providing little evidence of the putative microbial role during gametogenesis in sponges.

Material and Methods. Here, we use 16S rRNA gene analysis to assess whether the microbial composition of five gonochoristic sponge species differs between reproductive and non-reproductive individuals and correlate these changes with their gametogenic stages.

Results and Discussion. In sponges with mature oocytes, reproductive status did not influence either beta or alpha microbial diversity. However, in two of the studied species, Geodia macandrewii and Petrosia ficiformis, which presented oocytes at the previtellogenic stage, significant microbial composition changes were detected between reproductive and non-reproductive individuals. These disparities were primarily driven by differentially abundant taxa affiliated with the Nitrososphaeria archaeal class in both species. We speculate that the previtellogenic stages are more energetically demanding, leading to microbial changes due to the phagocytosis of microbes to meet nutritional demands during this period. Supporting our hypothesis, we observed significant transcriptomic differences in G. macandrewii, mainly associated with the immune system, indicating potential changes in the sponge's recognition system. Overall, we provide new insights into the possible roles of sponge microbiomes during reproductive periods, potentially uncovering critical interactions that support reproductive success.

TSB.13. Posters

[TSB.13-P-1]

Wednesday 4
Discussion corner: Room 8

Predictive modelling of zoonotic microparasites for potential host species and geographical areas through joint species distribution analysis

Lima Tabet Cruz, Gabriella[1]; R. Winck, Gisele[2]; Silianksy de Andreazzi, Cecilia[3]

(1) Instituto Oswaldo Cruz; (2) Instituto Oswaldo Cruz; (3) Universidad Complutense de Madrid

Correspondence e-mail: [gabriellatabett@gmail.com]

Introduction. Host trait profiles are good predictors of parasite occurrence, particularly in the context of species distribution shifts driven by land use and climate change. To forecast opportunities for parasite occurrence among wild mammals, we explore the relationship between the richness of zoonotic microparasites (bacteria, protozoa, and viruses)—which are shared between vertebrate animals and humans—and host traits (body mass, litter size, dietary guild, activity period, and foraging strata).

Material and methods. To assess the potential distribution of zoonotic microparasite among wild mammal species across a continental-sized country, Brazil, we applied the Hierarchical Modelling of Species Communities (HMSC), a joint species distribution model. Our model integrated host traits, host identity, geographical factors, parasite transmission modes, and taxonomic relationships across multiple hierarchical levels.

Results and discussion. Body mass was the most influential host trait affecting zoonotic microparasite richness. Geographical variations in mammal diversity also significantly influenced microparasite distribution. Transmission modes correlated with host traits such as body mass, litter size, and activity period, suggesting that these traits shape encounters with parasites. The model further indicated that closely related bacteria exhibit an evolutionary signal with host trait covariates. However, research on the ecological traits of parasites in relation to host ecological and life-history traits remains in its early stages. Our results also highlighted potential distributions of zoonotic microparasites among wild mammals, especially primates, marsupials, and bats, in regions affected by increased deforestation. These findings offer valuable implications for One Health initiatives and wildlife health surveillance.

[TSB.13-P-2]

Thursday 5
Discussion corner: Room 8

Temporal trends in gut microbiota composition of Bombus pascuorum wild bee at Gorbea Natural Park (Northern Iberian Peninsula)

Chueca, Luis J.[1]; Poza, Jon[2]; Dhami, Manpreet K.[3]; Donald, Marion L.[4]; Rose, Jennifer[5]; Salgado-Irazabal, Xabier[6]; Hermosilla, Brais[7]; Gostout, Christian[8]; Magrach, Ainhoa[9]

(1) Basque Centre for Climate Change (BC3); (2) Basque Centre for Climate Change (BC3); (3) Manaaki Whenua Landcare Research; (4) Manaaki Whenua Landcare Research; (5) Basque Centre for Climate Change (BC3); (6) Basque Centre for Climate Change (BC3); (7) Basque Centre for Climate Change (BC3); (8) Basque Centre for Climate Change (BC3); (9) Basque Centre for Climate Change (BC3)

Correspondence e-mail: [luisjavier.chueca@bc3research.org]

The global decline of wild pollinators is a pressing concern, as it leads to biodiversity loss thereby threatening ecosystem stability. Understanding gut microbiota of pollinators is crucial because it plays an essential role in host health and resilience. Studying the composition and variation of the gut microbiome can provide valuable insights for conservation strategies. Here, we investigate the gut microbiota of Bombus pascuorum in Gorbea Natural Park, aiming to characterize its diversity and assess temporal and spatial variations. Between April and July 2023, 127 B. pascuorum specimens were collected from 16 sites across the park, and their gut contents were analyzed using metabarcoding of the 16S rRNA region to investigate diversity and spatiotemporal variation. A total of 265 amplicon sequence variants (ASVs) were identified, revealing relatively simple gut microbiomes dominated by Bombilactobacillus, Gilliamella, and Snodgrassella. The gut microbiota of B. pascuorum displayed bacteria similar to those found in other Bombus species, indicating genus-wide similarity. However, marked differences were observed between the gut microbiota of B. pascuorum and honeybees (Apis mellifera), with certain generalist species absent in Bombus. No significant variation was detected across sites, which likely represent a metapopulation. However, temporal variation was observed, with a notable increase in bacterial diversity during the last periods, coinciding with a greater floral diversity. These findings suggest that while there is overlap in the core gut microbiota among different pollinator genera within the Apidae family, there are also unique microbial strains that may reflect differences in their biology, diet, and ecological interactions.

[TSB.13-P-3]

Tuesday 3
Discussion corner: Room 8

Contrasting diversity and succession patterns in leaf and root microbiome of two nearby temperate Zostera marina meadows

Teira, Eva[1]

(1) Centro de Investigación Mariña-Universidade de Vigo

Correspondence e-mail: [teira@uvigo.gal]

The Zostera marina microbiome plays a crucial role in meadow functioning and resilience. We aim at testing if the microbial communities of Z. marina leaves and roots exhibit distinct diversity and succession patterns associated to different environmental conditions and anthropogenic pressures. Site-specific and temporal changes of Z. marina leaf and root microbiomes were assessed in the urban beach of Bouzas and the rural beach of Cesantes in NW Spain from March 2021 to March 2022.

The prokaryotic microbiome from leaves significantly differed from that in roots. Similarly, significant differences were also found between locations, yet about half of the taxa were common to both sites, suggesting a host-specific core microbiome. In Z. marina leaves, the dominant order Granulosicoccales was more abundant in Bouzas than in Cesantes, which could be indicative of anthropogenic pressures. Desulfobacterota was the dominant microbial group in roots. Many microbial taxa associated to the roots were positively correlated with plant growth, suggesting a positive effect of root microbiome on the plant. A clear seasonal succession pattern was observed in the leaf microbiomes in Bouzas, with communities from the beginning of the growing season (March) strongly resembling between the two sampling years. A disruption of the succession occurred in Cesantes during the second year, likely associated to extensive macroalgae proliferation. The relative abundance of Crenarchaeota, Desulfobacterota, Campylobacterota, Spirochaetota, and Modulibacteria in Z. marina roots was relatively higher in Cesantes than in Bouzas, suggesting a more active role of N2 fixation, nitrification and S cycling in Cesantes.

TSB.14. Expanding the frontiers of trait-based ecology: novel applications across taxa and scales

Thursday, 5 (15:30-17:00)

Room: Seminario 7

Trait-based approaches have revolutionized our understanding of biodiversity by linking species' traits to their roles within ecosystems. This session will explore cutting-edge applications of trait-based frameworks, extending beyond plants to incorporate a wide range of taxa—such as animals, fungi, and microorganisms—across diverse ecosystems. By integrating above- and below-ground traits, as well as considering novel computational tools, this session will address the challenges of predicting community responses to global environmental changes.

The objective is to highlight innovative methods for measuring, analyzing, and interpreting functional traits and their applications in fields ranging from conservation to climate change mitigation. The session will be of interest to ecologists, modelers, and conservation practitioners who are keen to explore how functional traits can improve biodiversity forecasting and inform management strategies across different spatial and temporal scales.

Organizers:

• **Carlos Perez Carmona,** Department of Botany, University of Tartu

• **Eleonora Beccari,** Department of Botany, University of Tartu

• **Enrico Tordoni,** Department of Botany, University of Tartu.

TSB.14. Orals

[TSB.14-O-1]

Thursday 5, after lunch (third): 15:30
Room: Seminario 7

Maps of species strategies: addressing dimensions in global trait spaces

Beccari, Eleonora[1]; Pérez Carmona, Carlos[2]

(1) University of Tartu; (2) University of Tartu

Correspondence e-mail: [eleonora.beccari@ut.ee]

Understanding the global variation of species strategies is essential for unravelling eco-evolutionary processes under global changes. Despite the diversity of phenotypes, trait combinations can be summarized along a few key dimensions of variation, defining a trait space that allows to measure the strategies species use to grow, reproduce, and survive. The dimensionality of trait spaces quantifies the diversity of strategies available in nature. Here, we focus on plant traits to present a new framework capable of disentangling the diversity and ecological identity of the main dimensions shaping global plant trait variation. We test the effect of including new root size traits into existing frameworks mapping above- and belowground plant investments.

We assembled a global dataset comprising ten traits related to aboveground size, and plant economics, commonly used to define global plant trait spaces, and included two additional traits related to root size. We progressively constructed a series of trait spaces with and without the new traits. Dimensionality was compared using the effective number of dimensions. We further examined changes in trait correlation structures across different trait subsets to assess whether the inclusion of new traits modifies trade-offs shaping the main dimensions of global trait variation.

The inclusion of root size traits minimally impacted dimensionality and preserved trade-offs, demonstrating that size strategies are globally coordinated. This framework refines the identification and interpretation of ecological dimensions in trait spaces, providing a tool to compare the diversity of species strategies across spaces built on different trait subsets.

[TSB.14-O-2]

Thursday 5, after lunch (third): 15:45
Room: Seminario 7

The role of trait variability in mediating the effects of global change on ecosystem stability

Huang, Mengjiao[1]; Holmes, Mark[2]; R. Granjel, Rodrigo[3]; Iglesias-Anciones, Laura[4]; T. S. Chrétien, Lucille[5]; Christensen-García, Claudia[6]; Burón-Ugarte, Ana[7]; Montoya, Daniel[8]

(1) Basque Centre for Climate Change; (2) Basque Centre for Climate Change; (3) Basque Centre for Climate Change; (4) Basque Centre for Climate Change; (5) Basque Centre for Climate Change; (6) Basque Centre for Climate Change; (7) Basque Centre for Climate Change; (8) Basque Centre for Climate Change

Correspondence e-mail: [mengjiao.huang@bc3research.org]

Anthropogenic disturbances reduce biodiversity and alter ecosystem functioning and stability. While it has been shown that higher diversity may stabilize ecosystem properties against environmental fluctuations, many studies focus on only a single dimension of biodiversity or stability. This simplistic view may obscure broader biodiversity-stability relationships, as both are inherently multifaceted concepts. Trade-offs in plant functional traits along the fast–slow economics spectrum have been shown to predict community stability. For example, communities dominated by fast species may be less resistant than those dominated by slow species. However, how stability in response to perturbations is mediated by trait variability remains poorly understood. To address this knowledge gap, we conducted a mesocosm experiment in France, comprised of 24 semi-natural grassland patches. We subjected the mesocosms to three global change factors - habitat fragmentation, temperature change and a perturbation – and monitored the metacommunity diversity and stability. We investigated trait variability related to fast–slow economics spectrum and the stability of ecosystem properties after induced perturbations. We demonstrate (1) the effect of multiple global change factors on multiple dimensions of stability; (2) the relationships between trait variability and multiple dimensions of stability; and (3) whether the effect of global change factors on stability mediated by trait variability.

[TSB.14-O-3]

Thursday 5, after lunch (third): 16:00
Room: Seminario 7

On the role of phosphorus availability in tropical rainforest community assembly: functional traits, demographic trade-offs and phylogenetic patterns

Benet Valls, Àntar[1]; Coello, Fernando[2]; Wright, S. Joseph[3]; Peguero, Guille[4]

(1) Universitat de Barcelona; (2) CREAF; (3) Smithsonian Tropical Research Institute; (4) Universitat de Barcelona

Correspondence e-mail: [abenetvalls@gmail.com]

Introduction. Understanding the interaction between nutrient availability, functional traits, and life-history strategies during community assembly is crucial for uncovering the mechanisms that generate and maintain tree species diversity in tropical forests.

Material and methods. We selected 36 1-ha forest plots within the same rainfall regime but encompassing a uniquely large gradient in soil phosphorus (P) availability present across central Panama, and we combined abundance, functional traits, demographic data and phylogenetic relationships of 381 tree species in Bayesian Joint Species Distribution Models with which we assessed: (1) whether soil P availability shapes community assembly; (2) if species responses to soil P are mediated by their functional traits; (3) if tree species position along two demographic trade-off axes align with soil P; and (4) if P availability can be an evolutionary driver, leaving particular phylogenetic and trait distribution patterns.

Results and discussion. We found that P availability accounted for 62-72% of the compositional variation of the studied communities, strongly influencing the distribution of at least half of the tree species. The affinity of tree species to soil P was mediated by key functional traits such as leaf P content, leaf thickness and seed mass, but it was not coordinated with species' position along the growth-survival or the stature-recruitment demographic trade-offs. Although leaf P content tends to be phylogenetically conserved, many pairs of closely related species display contrasting trait values that mirror their estimated soil P affinity. This suggests that edaphic specialization within tree lineages may arise because of niche-mediated community assembly processes ultimately leading to tree species diversification.

[TSB.14-O-4]

Thursday 5, after lunch (third): 16:15
Room: Seminario 7

Integrating plant metabolome in a functional trait-based ecology at the global scale

Teixidó Bonfill, Abiel[1]; Castells Caballe, Eva[2]; Martínez Vilalta, Jordi[3]

(1) CREAF-UAB; (2) UAB-CREAF; (3) UAB-CREAF

Correspondence e-mail: [a.teixido@creaf.cat]

Plant metabolome underpins the biochemical basis of plant function and physiology. Despite its importance, scaling up metabolic processes remains a significant challenge in plant ecology. Integrating metabolic features into trait-based ecology may improve our ability to understand plant responses to changing environmental conditions. While various metabolome chemical properties have been recently proposed as metabolic traits, their representativeness and coordination with more classical functional traits at a global scale remain largely unexplored.

Our objectives were: 1) To explore the metabolomic trait concept by using the LOTUS database, which includes nearly 400.000 pairs of plant species and annotated metabolite occurrences, considering the entire set of metabolites (mostly specialized metabolites); 2) to determine how metabolic traits are coordinated with more classical functional traits, as obtained from global functional trait databases, including resource-use and life-strategy traits (TRY), radicular traits (GRoot), hydraulic traits (Xylem Functional Traits database), among others.

We characterized metabolic traits for over 17.000 plant species. In coherence with previous literature, we found that five chemical properties summarized the metabolomic composition, revealing two primary axes of variation: one linked to metabolite size and H-bond acceptors, and another associated to polarity, aromaticity, and saturation. For the 10,000 species with available metabolomic and functional traits data, we found some significant correlations between metabolomic and functional traits. Incorporating metabolomic data into functional trait ecology may help advancing our understanding of the link between metabolomic processes and ecophysiology and improve the predictions of plant responses to environmental changes by a more integrative concept of functional traits.

[TSB.14-O-5]

Thursday 5, after lunch (third): 16:30
Room: Seminario 7

Complex trait syndromes allow understanding but not predicting dispersal distance in European birds

Fandos, Guillermo[1]; Robinson, Rob[2]; Zurell, Damaris[3]

(1) Universidad Complutense de Madrid; (2) British Trust for Ornithology; (3) University of Potsdam

Correspondence e-mail: [gfandos@ucm.es]

Dispersal is fundamental to many ecological and evolutionary processes, yet understanding the determinants and predictability of dispersal remains a crucial challenge. Dispersal syndromes, which describe patterns in the covariation of traits associated with dispersal, can help to gain a deeper understanding of the evolutionary dynamics of dispersal and its implications for range dynamics and ecosystem functioning in the face of global change. Based on the most comprehensive empirical dispersal dataset to date, we investigate the formation of dispersal syndromes in European birds and their effectiveness in predicting dispersal across species. We found body mass, feeding guild, and life-history traits shape dispersal syndromes in birds. Yet, multi-trait dispersal syndromes poorly predicted dispersal for phylogenetically distant species and were outperformed by single-trait models based only on body mass, life history, or partially also flight efficiency. Thus, single traits with clear mechanistic meaning predicted the dispersal ability of new species better than dispersal syndromes. These results shed light on the complex nature of bird dispersal and emphasize the need for refined approaches in elucidating the mechanisms and constraints underlying dispersal evolution.

[TSB.14-O-6]

Thursday 5, after lunch (third): 16:45
Room: Seminario 7

Species pool functional redundancy enhances local stability in plant communities

P.F. Trindade, Diego[1]; de Bello, Francesco[2]

(1) University of Tartu; (2) Centro de Investigaciones Sobre Desertificación (CSIC-UV-GV)

Correspondence e-mail: [dpftrindade@gmail.com]

Understanding the drivers of plant community stability is crucial under global change. While the diversity of species observed within communities are often linked to stability, these relationships can be inconsistent. We propose that trait-based ecology and the species pool concept—the set of species capable of colonizing and establishing locally—are a robust framework for assessing plant community stability, since it provides a tool to estimate the potential of communities to buffer environmental changes. By estimating the species pool of local communities, we can evaluate how complete these sites are in terms of species and functions. Functional completeness reflects the functional redundancy within the species pool, where locally absent but suitable species with overlapping traits (dark diversity) may buffer local losses sustaining ecosystem functions. We hypothesize that larger and more functionally complete pools will have higher constancy. Species pools were estimated based on co-occurrence analysis using 64 long-term vegetation studies and 3,560 plots worldwide (LOTVS database) and the stability of those communities was calculated over time. The functional space was estimated using plant height, seed mass, and leaf area, and then used to calculate the functional completeness (functional diversity/functional dark diversity). Our results confirm that functionally complete species pools have a greater stability (R^2 = 0.31), suggesting that species pool functional redundancy promotes insurance and complementarity effects in temporal turnover. The synergistic effects of species pool concept and functional redundancy provide a novel pathway for assessing stability of plant communities, offering practical insights for conserving ecosystems under global change.

TSB.14. Posters

[TSB.14-P-1]

Tuesday 3
Discussion corner: Room 10

Beyond community weighted mean: quantifying trait distributions for detecting community assembly patterns

García-Callejas, David[1]; Stefanescu, Constanti[2]; Melero, Yolanda[3]

(1) University of Graz; (2) Natural Sciences Museum of Granollers, Granollers, Spain; (3) Universitat de Barcelona

Correspondence e-mail: [david.garcia.callejas@gmail.com]

Introduction. Trait distributions are commonly used to infer the processes structuring ecological communities, as these processes (either deterministic or stochastic) select and filter species, leading to distinct trait patterns across communities. Such distributions are frequently characterised by community-weighted means, but increasing evidence exists for non-gaussian trait distributions in empirical communities. In such situations, community-weighted means are insufficient to quantify trait distributions and infer ecological processes.

Methods. We analysed the empirical distributions of 6 functional traits of butterflies from a natural community and a filtered urban community across 8 years. First, to characterise distributions, we computed their averages and standard deviations, as well as their skewness, kurtosis, the range of trait values, and a multimodality index. Then, we compared this set of descriptors between our natural and filtered communities.

Results/Discussion. To adequately describe trait distributions, descriptors beyond community-weighted means were needed, as distributions were in all cases non-gaussian. We found clear differences between communities, detected in particular by combining the relationships between skewness, kurtosis, and range of the distributions. From these analyses, we inferred that the filtered community was mostly shaped by deterministic filtering processes, through a mixture of directional and stabilizing assembly filters. These patterns were furthermore consistent across the 8 years of data, providing further evidence of deterministic processes shaping the assembly of our urban butterfly community. Overall, we provide evidence of the ubiquity of non-gaussian trait distributions across natural and filtered communities, propose key descriptors for understanding and comparing such distributions, and identify filtering process structuring these communities.

[TSB.14-P-2]

Wednesday 4
Discussion corner: Room 10

Filling the gaps: evaluating the accuracy and impacts of trait imputation across taxonomic groups

Tordoni, Enrico[1]; Beccari, Eleonora[2]; Fujinuma, Junichi[3]; Caleño Ruiz, Blanca Luz[4]; Tamme, Riin[5]; Toussaint, Aurèle[6]; Pires Ferraz Trindade, Diego[7]; Pérez Carmona, Carlos[8]

(1) University of Tartu; (2) University of Tartu; (3) University of Tartu; (4) University of Tartu; (5) University of Tartu; (6) Centre de Recherche sur la Biodiversité et l'Environnement; (7) University of Tartu; (8) University of Tartu

Correspondence e-mail: [enrico.tordoni@ut.ee]

Trait missingness hampers the assessment of biodiversity and ecosystem functions across scales. Trait imputation based on trait-covariance and/or phylogenetic information across species emerged as a promising tool to tackle this issue, especially for the construction of synthetic functional spaces. However, scepticism about the accuracy and effectiveness of trait imputation persists. Using empirical sets of complete traits from different organisms (vascular plants, birds, mammals, and reptiles) coupled with trait data from different sources (TRY, AVONET, Amniote) we tested whether: i) imputation accuracy with and without phylogenetic information, ii) the effect of species pool spatial resolution (regional, continental, global scale) on imputation performance, iii) whether trait imputation artificially inflates correlations between functional (FD) and phylogenetic diversity (PD), and iv) relationships between observed and imputed trait dissimilarities. Our results showed that imputation error is halved in the trait space compared to single traits and that, on average, the larger the reference pool for imputing traits, the lower the imputation error. The use of phylogenetic information increases imputation accuracy (except for plants), but it does not inflate the correlation between PD and FD. Finally, we detected a strong correlation between observed and simulated plot-plot functional dissimilarities and species pairwise dissimilarities. Our findings demonstrate the reliability of trait imputation in the case of missing trait data, particularly in the context of synthetic functional spaces that make more efficient use of trait correlation.

[TSB.14-P-3]

Thursday 5
Discussion corner: Room 10

Using seed biodiversity and traits for ecosystem restoration

Saiz, Hugo[1]; Encabo, Marcos[2]; Tormo, Jaume[3]

(1) Escuela Politécnica Superior, Universidad de Zaragoza; (2) Escuela Politécnica Superior, Universidad de Zaragoza; (3) Escuela Politécnica Superior, Universidad de Zaragoza

Correspondence e-mail: [hsaiz@posta.unizar.es]

Introduction. In recent years, experiments on biodiversity-ecosystem functioning (BEF) have shown a positive effect of biodiversity on multiple ecosystem components, including resilience, stability and functioning. This suggests that by promoting biodiversity it is possible to improve the management, conservation and restoration of real ecosystems. In this work we applied a BEF framework to evaluate the effect of seed biodiversity (including taxonomic and functional trait diversity) on plant community establishment in an abandoned mine undergoing restoration.

Material and Methods. We used a mix of 12 native plant belonging to the local species pool, commonly used in restoration practices around the mine, showing contrasted seed traits including size, nutrient content and germination rate. We ran a greenhouse experiment where we grew 300 communities along a gradient of taxonomic (i.e., species richness) and functional (i.e., seed traits) diversity, while keeping seed number constant.

Results and discussion. We found that both traits mean and diversity contributed to higher germination success and seedling biomass. Then, we sowed 60 seed mixtures showing best establishment in the field and compare their success against traditional seed mixtures used in restoration practices in the area. The contribution of traits diversity to vegetation established remained important in the field. Our results contribute to further our knowledge on positive BEF relationships for seeds, and support its application to ecosystem restoration.

[TSB.14-P-4]

Tuesday 3
Discussion corner: Room 10

New perspectives on plant community assembly through the lens of Vis-NIR Spectroscopy: from between- to within-species interactions

Illuninati, Angela[1]; S. Pescador, David[2]; de la Cruz, Marcelino[3]; Matesanz, Silvia[4]; Nuñez, Sergio[5]; Pajares, Javier[6]; Sánchez-Bermejo, Pablo Castro[7]; Poyatos, Cristina[8]; García-Cervigón, Ana I.[9]; Sánchez, Ana M.[10]; Escudero, Adrián[11]

(1) Instituto de Investigación en Cambio Global (IICG-URJC); (2) Universidad Complutense de Madrid, Madrid (Spain).; (3) Instituto de Investigación en Cambio Global (IICG-URJC); (4) Instituto de Investigación en Cambio Global (IICG-URJC); (5) Instituto de Investigación en Cambio Global (IICG-URJC); (6) Instituto de Investigación en Cambio Global (IICG-URJC); (7) Martin Luther University Halle-Wittenberg, Halle (Saale), Germany; (8) Instituto de Investigación en Cambio Global (IICG-URJC); (9) Instituto de Investigación en Cambio Global (IICG-URJC); (10) Instituto de Investigación en Cambio Global (IICG-URJC); (11) Instituto de Investigación en Cambio Global (IICG-URJC)

Correspondence e-mail: [angela.illuminati@urjc.es]

One of the main cornerstones of species coexistence theory is the functional niche partitioning hypothesis, which posits that species differentiate functionally to reduce competition. Yet, whether this mechanism also drives plant community assembly in poor-species environments is not clear. Here, we aim to assess both between- and within-species interactions in a Mediterranean mountain forest dominated by Pinus nigra and Pinus sylvestris. We combined a point pattern analysis with the phenotypic characterization of all individuals with the use of visible and near infrared spectroscopy (Vis-NIRS). We considered key plant traits related to competition in forest ecosystems such as specific leaf area, wood density and plant size, but also both leaf and wood spectra as integrated measures of plant phenotypes. We detected non-random patterns showing that spatially closer individuals (0-30 m range) had higher leaf and wood phenotypic similarity. When we accounted for the effects of both plant size and species identity, we found different results depending on the interaction between these two factors. For example, spatially closer individuals of Pinus nigra and Pinus sylvestris were found to be more similar than expected by a random distribution, but only when considering large- sized individuals. In contrast, smaller individuals exhibited different patterns. Our findings suggest that environmental filtering may represent a stronger driver of plant community assembly in poor-species Mediterranean mountain forests, but also point out that the relative importance of biotic and abiotic factors may crucially depend on the ontogenetic stage.

[TSB.14-P-5]

Wednesday 4
Discussion corner: Room 10

Exploring the functional traits and landscape configuration that promote species colonization in temperate forests

Palma-Valencia, Vanesa[1]; Cruz-Alonso, Verónica[2]; Andivia, Enrique[3]; Valencia, Enrique[4]

(1) Universidad Autónoma de Madrid, Universidad Complutense de Madrid; (2) Universidad de Alcalá; (3) Universidad Complutense de Madrid; (4) Universidad Complutense de Madrid

Correspondence e-mail: [vanesa.palma@estudiante.uam.es]

Introduction. Forest succession involves gradual changes in species composition and structure over time. Early plant colonization after disturbances may depend on species functional traits, alongside landscape connectivity. Despite temperate forests are widely distributed, the effect of landscape degradation on species recolonization based on functional traits remains understudied. We aim to (1) analyze the colonization capacity of forest species across successional stages in temperate forests; (2) quantify the functional traits related to colonization capacity; and (3) evaluate how landscape structure affects species colonization ability.

Material and methods. We used a database, composed of chronosequences of forest species assemblages following various anthropogenic disturbances, encompassing 450 forest communities from 37 studies. To characterize the colonization capacity of each taxon, communities were compared across years. Colonization capacity was estimated by categorizing species dynamics as appearing, persisting, absent, or disappearing, and subsequently grouped as colonizing or non-colonizing species. Functional traits were extracted from the TRY database, to characterize the functional features of colonizing taxa and Community Weighted Means (CWM) representing trait averages from each study and successional stage. Landscape metrics (patch size, connectivity, edge-to-area ratio) were computed and related to CWM.

Results and discussion. Preliminary results showed species colonizing initial successional stages had different functional traits (e.g. lower seed mass and higher specific leaf area) than those species colonizing later stages. Landscape metrics indicated fragmented forest landscapes that might be influencing these successional patterns. This research highlights successional dynamics and informs restoration strategies, emphasizing trait-based approaches and landscape management to support colonization in fragmented habitats.

[TSB.14-P-6]

Thursday 5
Discussion corner: Room 10

Phylogenetic and functional diversities offer complementary information to disentangle species assembly processes in experimental gypsophilous annual plant communities

Luzuriaga, Arantzazu L.[1]; Ortiz, Laura[2]; Rodríguez, Laura[3]; Ferrandis, Pablo[4]

(1) Instituto de Investigación en Cambio Global. Universidad Rey Juan Carlos; (2) Universidad Rey Juan Carlos; (3) Universidad Rey Juan Carlos; (4) Universidad de Castilla la Mancha - Jardín Botánico de Albacete

Correspondence e-mail: [arantzazu.luzuriaga@urjc.es]

Phylogenetic and functional diversities of coexisting species can be used to understand the processes that drive community assembly. Many observational studies demonstrated the effect of environmental variables on the functional and phylogenetic diversity of resulting species assemblages; however, little is known about the likely effect of the phylogenetic and functional structure of assemblages on performance of participant species. Our study system was the extremely species rich annual plant communities growing in the gypsum semiarid systems of Central Spain. We manipulated initial phylogenetic and functional diversities of experimental species assemblages, to create eleven species combinations covering a wide range of phylogenetic and functional diversities and each combination was ten times replicated. Two irrigation treatments (mean vs drought) were established following a full factorial design in a greenhouse. We demonstrated the importance of neighbourhood in performance and reproductive success of participating plants. In mean irrigation treatments, most plants fructified and set more seeds per fruit independently of the phylogenetic or functional diversities of their neighbourhoods; however, in drought treatments, plants growing in more diverse neighborhoods were more prone to fructify and set seeds than those growing in less diverse neighborhoods (both phylogenetically and functionally). Therefore, phylogenetically and functionally more diverse communities seem to be more resilient to water stressful events. Remarkably, multi-trait based functional diversity explained a significant fraction of variability regardless of that explained by phylogenetic diversity. These results confirm that the functional and phylogenetic structure of species assemblages offer complementary information about plant performance and assembly processes.

[TSB.14-P-7]

Tuesday 3
Discussion corner: Room 10

Fine root biomass and functional traits of woody plants at ecosystem level in forest and shrublands in Tenerife, Canary Islands

Sierra Cornejo, Natalia[1]; Rodríguez, Felipe[2]; Rocafull, Elena[3]; Ramos, Lucía N.[4]; Suárez, Isabel[5]; Otto, Rüdiger[6]; de Nascimento, Lea[7]; Fernández-Palacios, José María[8]

(1) Universidad de La Laguna; (2) Universidad de La Laguna; (3) Universidad de La Laguna; (4) Universidad de La Laguna; (5) Universidad de La Laguna; (6) Universidad de La Laguna; (7) Universidad de La Laguna; (8) Universidad de La Laguna

Correspondence e-mail: [nsierrac@ull.edu.es]

Fine roots (Ø < 2mm) are key organs for plant performance, being the responsible of water and nutrient acquisition, association with mycorrhiza and fluxes of carbon (C) and nutrients to the soil. These functions are link to their biomass and functional traits (e.g. specific root length (SRL), root tissue density (RTD)), their combination representing plant strategies under different environmental conditions. Despite the relevance of fine roots, they are far more less studied than aboveground components, particularly in volcanic islands, with any research in Canary Islands. Tenerife, with a great variety of ecosystems and possible adaptations of the roots to alterations due to vulcanism, represents a great opportunity to study plant strategies and the effects of abiotic and biotic factors on the fine root system at ecosystem level. For this purpose, we established three plots of 20 x 20 m in five forest and three shrubland ecosystems in this island. We took soil samples down to 30 cm depth and determined the biomass and morphological (SRL, RTD, mean diameter) and chemical (N content) fine root traits. We expect: 1) the fine root biomass to be higher in laurel forest and lower in the termophile forest, coastal and summit scrub and 2) the laurel and “Myrica-Erica” forest to follow an acquisitive strategy while coastal shrub and termophile hold a conservative one. The results are highly valuable to understand plant strategies and ecosystem functioning and the consequences of ecosystem and species composition change on C and N cycles in a global change context.

TSB.15. Impact of human activities on the health of ecosystems: linking different biological organization levels

Wednesday, 4 (12:45-14:15)

Room: Seminario 7

Human activities have caused major shifts in the biosphere, by altering and/or destroying habitats, leading to changes in species communities and dynamics within and across ecosystems. In recent years, due to anthropogenic activity, there has been an exponential rise in the presence of contaminants of emergent concern (CEC) such as microplastics (MPs), plant protection products (PPP), or personal care products (PCPs), across terrestrial and aquatic ecosystems, from diverse sources such as effluents and sewage sludge (SS) from wastewater treatment plants (WWTPs), agriculture, industry and households.

Given the evidence of the hazardous potential of said CECs and the occurring and incoming extreme climatic events, there is the need to understand and link their effects at different levels of biological organization prior to affecting whole communities. Therefore, this session aims to present and discuss research on the effects of exposure to CECs, linking one or more levels of biological organization. These include sub-organismal (molecular responses), organismal (survival, reproduction, and growth) and population response (phenotype change, adaptation), up to mesocosms systems or across ecosystems (soil and freshwater). The obtained information will be essential for the global understanding of the current and long-term impact of CECs on the health and sustainability of ecosystems.

Organizers:

• **Luís André Lima da Gama Mendes,** Universidad Politécnica de Madrid

• **Ana Belén Muñiz González,** Universidad Politécnica de Madrid.

TSB.15. Orals

[TSB.15-O-1]

Wednesday 4, morning (second): 12:45
Room: Seminario 7

Effects of landscape complexity on biodiversity across the freshwater-terrestrial interface in rice agroecosystem

Cambero Conejero, Gema[1]; Alcaraz Cazorla, Carles[2]; Llevat Pamies, Raul[3]; Pérez Méndez, Néstor[4]

(1) IRTA Amposta; (2) IRTA La Ràpita; (3) IRTA Amposta; (4) IRTA Amposta

Correspondence e-mail: [gema.cambero@irta.cat]

Understanding how the landscape context shapes the diversity of biological communities is essential for designing sustainable agroecosystems, yet the information for rice farming which develops in the freshwater-terrestrial interface is surprisingly scarce. This study examines this issue by assessing the role of landscape complexity on shaping the diversity of freshwater and terrestrial organisms of rice agroecosystems at global and regional scales. We performed a global-scale meta-analysis of biodiversity-landscape relationships, yielding 456 effect sizes from 18 papers across 9 countries. Most of these studies were conducted in Asia (89%), with terrestrial invertebrates comprising 92% of the observed effects. This highlights a significant research gap across other continents and taxonomic groups. For vertebrates, landscape composition was the most influential variable, while landscape configuration and heterogeneity were not significant. For invertebrates, results were heterogeneous across different orders. For Odonata, Lepidoptera and Hymenoptera, landscape configuration and heterogeneity had a positive effect, while for Coleoptera and Araneae the main effect was driven by landscape composition. At the regional scale, we used the Ebro Delta as a case study, selecting 24 rice fields that represent a gradient of landscape complexity. For each field we characterized the landscape context, local management practices and the diversity of terrestrial (i.e., birds and spiders) and freshwater communities (i.e., amphibians, fish and macroinvertebrates). While still preliminary, our results suggest that landscape dimensions affect contrastingly to freshwater and terrestrial animals according to their specific life-history traits such as dispersal capacity. Thus, considering landscape effects is key when assessing agricultural impacts on biodiversity.

[TSB.15-O-2]

Wednesday 4, morning (second): 13:00
Room: Seminario 7

MARTRANSFER: mapping antimicrobial resistance transfer from fresh-to-marine ecosystems

Gionchetta, Giulia[1]

(1) IDAEA CSIC

Correspondence e-mail: [giulia.gionchetta@idaea.csic.es]

Introduction. The environmental dimension of antimicrobial resistance (AMR) poses a major threat to human health. Despite advancements in understanding AMR impacts across human, animal, and environmental health, critical knowledge gaps remain due to its complex interactions within ecosystems. The MARTRANSFER projecta addresses these gaps by evaluating the AMR transfer risks in seawater and filter feeders microbiomes periodically exposed to polluted freshwater inputs carrying anthropogenic and agrochemical residues.

Material and methods. This study focuses on the Ebro Delta, characterized by fluctuating river runoff. We use a comprehensive approach that integrates antibiotic resistance profile (targeting 54 resistance genes) and microbiome analyses (16S rRNA amplicon sequencing) of seawater, the ascidian Styela plicata and the bivalve Mytilus galloprovincialis to uncover the interlinkages that contribute to the spread and persistence of AMR vectors across fresh-to-marine ecosystems.

Results and discussion. Preliminary findings reveal distinct microbiome composition across seawater and both filter feeders, forming three separate clusters. Moreover, bacterial community structures vary significantly with exposure to freshwater runoff. These variations were mirrored in the resistance profiles, suggesting significant impacts of anthropogenic and agrochemical inputs when freshwater and marine systems connect. Further analyses will explore shared taxa and AMR determinants to uncover the mechanisms underlying these patterns.

This research provides critical insights into how periodic freshwater runoff influences AMR prevalence and highlights the potential of filter feeders as microbial indicators for AMR monitoring. The results are highly relevant for environmental health and public awareness, emphasizing the need for sustainable management of aquatic ecosystems.

[TSB.15-O-3]

Wednesday 4, morning (second): 13:15
Room: Seminario 7

Metal transfer factor from soil to plant decays with species growth

Martínez Gaviria, Amaia[1]; Goberna Estellés, Marta[2]; Navarro Cano, Jose Antonio[3]

(1) Instituto Nacional de Investigación y Tecnología Agraria y Alimentaria (INIA-CSIC); (2) Instituto Nacional de Investigación y Tecnología Agraria y Alimentaria (INIA-CSIC); (3) Instituto Nacional de Investigación y Tecnología Agraria y Alimentaria (INIA-CSIC)

Correspondence e-mail: [amaia.martinez@inia.csic.es]

Metalliferous abandoned mining areas pose a significant health and environmental risk due to high heavy metal concentrations in soil and the risk of metal transfer into the food web. This risk depends on metal mobility, bioavailability, and the ability of plants to exclude metal absorption or to bioaccumulate metals in aboveground tissues. The uptake rate of many necessary mineral nutrients typically diminishes with age, thus plant growth might also affect heavy metal uptake and accumulation. We hypothesized that metal transfer from soil to plant decreases with ontogenetic development. We collected 180 plant individuals and the topsoil samples beneath them. Plants belonged to nine species and four functional groups (trees, shrubs, dwarf shrubs, and perennial grasses) naturally growing in three mine tailings in SE Spain. We quantified plant and soil carbon, nitrogen, and metal content and calculated the transfer factor for six potentially toxic metals (As, Cd, Mn, Zn, Cr, Pb). We performed generalized linear mixed models to test the effect of 'plant identity' and 'plant age' on metal transfer factor, using pH as a covariate and the geographic location of plant individuals as a random factor to account for spatial autocorrelation. Metal transfer decreased significantly with plant growth for most species, but the response depended on the metal. Soil pH negatively affected metal transfer, consistent with higher pH reducing bioavailability for most metals. These results highlight that metal transfer changes with plant development, suggesting that plant community structure will determine potential metal transfer to the food web.

[TSB.15-O-4]

Wednesday 4, morning (second): 13:30
Room: Seminario 7

Outdoor recreation in protected areas affects animal-mediated seed dispersal

García-Rodríguez, Alberto[1]; Albrecht, Jörg[2]; Farwig, Nina[3]; Schabo, Dana G.[4]; Parres, Aida[5]; Selva, Nuria[6]

(1) Institute of Nature Conservation - Polish Academy of Sciences; (2) Hessian Agency for Nature Conservation, Environment and Geology; (3) University of Marburg; (4) University of Marburg; (5) Institute of Nature Conservation - Polish Academy of Sciences; (6) Institute of Nature Conservation - Polish Academy of Sciences

Correspondence e-mail: [albertogarciarodriguez1985@gmail.com]

Outdoor recreational activities increase human pressures on natural ecosystems, including protected areas. This may adversely impact not only species abundance, but also their associated ecosystem services. We investigated the effects of outdoor recreation on seed dispersal, a critical service primarily provided by birds and mammals in temperate regions. We examined the effects of outdoor recreation on the diversity and composition of bilberry (Vaccinium myrtillus) dispersers in Tatra National Park (Poland), an alpine protected area visited by millions of tourists yearly. We established transects in public-use and restricted areas to systematically collect all bird and carnivore feces containing bilberry seeds. We estimated the seeds contained in each feces, identifying bird species through DNA barcoding and mammals via visual field assignment. Frugivores dispersed almost 20 times fewer bilberry seeds per m2 in public-use than in restricted areas. Outdoor recreation did not strongly influence the diversity of bilberry dispersers, but affected the community composition, with different species dispersing seeds in public-used and restricted areas. Our results additionally suggest that the quantitatively most important disperser species, primarily brown bears Ursus arctos, avoided public-use areas, which explains the large differences found in the quantity of seeds dispersed. This study indicates that outdoor recreation can negatively affect animal-mediated seed dispersal in protected areas, potentially affecting plant community dynamics and ecosystem functioning. Management strategies such as closing areas to people and controlling the number of visitors may be effective in ensuring that human activities do not disrupt vital ecosystem services in heavily visited protected areas.

[TSB.15-O-5]

Wednesday 4, morning (second): 13:45
Room: Seminario 7

Fire shifts the structure and dynamics of woody plant communities in a mediterranean coastal dune ecosystem

F. Mira, André[1]; G. Medina, Nagore[2]; Chozas, Sergio[3]; Divieso, Raquel[4]; Castro-Rivadeneyra, Juan[5]; Díaz-Barradas, Mari Cruz[6]; Hortal, Joaquín[7]

(1) Museo Nacional de Ciencias Naturales; (2) Universidad Autónoma de Madrid; (3) Faculdade de Ciências da Universidade de Lisboa; (4) Real Jardim Botânico de Madrid; (5) Real Jardim Botânico de Madrid; (6) Universidad de Sevilla; (7) Museo Nacional de Ciencias Naturales

Correspondence e-mail: [andrelfmira94@gmail.com]

Coastal dune ecosystems are dynamic and fragile environments shaped by complex interactions between vegetation and its characteristic abiotic factors. This study investigates the effects of the wildfire that affected the Doñana Nacional Park (SW Spain) in 2017 on the composition and structure of woody plant communities in two adjacent Mediterranean coastal dune areas: one affected by fire (Cuesta Maneli) and one unburned (Laguna del Jaral). Using a combination of several analyses (such as non-metric multidimensional scaling (NMDS); Mantel tests; and co-occurrence analyses), we examined how fire influences species distribution, abundance, and their interactions along a coastal-inland gradient. Our results reveal that fire homogenizes woody plant community composition across the coastal-inland gradient, reducing spatial differentiation and increasing overall species abundance in the burned area. Soil characteristics influenced species' composition significantly only in the unburned site, suggesting that fire disrupted abiotic filtering processes. Co-occurrence patterns indicate more neutral interactions in the burned area, consistent with reduced competition and increased resource availability post-disturbance. In contrast, the unburned site displayed structured communities with stronger negative co-occurrence at the smaller scales and spatial clustering of species. Spatial pattern analyses showed that positive co-occurrence was more prevalent in the burned area, particularly at smaller spatial scales, indicating potential facilitation effects during early post-fire recovery. These findings highlight how fire reshapes community structure and dynamics. Understanding these processes is critical for effective conservation and management of Mediterranean coastal dune ecosystems facing increasing anthropogenic pressures and climate change-related disturbances.

[TSB.15-O-6]

Wednesday 4, morning (second): 14:00
Room: Seminario 7

Ecophysiological and Phenolic Production Responses of Corema album to Drought Stress: A Shrub with Potential for Sustainable Cultivation

Pineda-Balbuena, Pilar[1]; León-González, Antonio[2]; Martín-Cordero, Carmen[3]; Díaz-Antunes Barradas, María Cruz[4]; Zunzunegui, María[5]; Álvarez-Cansino, Leonor[6]

(1) University of Seville; (2) university of Seville; (3) university of Seville; (4) university of Seville; (5) university of Seville; (6) university of Seville

Correspondence e-mail: [ppineda1@us.es]

Corema album, a dioecious shrub endemic to the Iberian Peninsula, has become a species of interest due to its habitat loss and pharmacological potential. Studying its ecophysiological responses to drought holds relevance in the context of predicted Mediterranean climate changes, where intensified drought is a major stressor affecting plant physiology and ecosystem dynamics.

This study examines the effects of abiotic conditions on C. album by analyzing its responses under both greenhouse-controlled and natural field conditions. Physiological responses were assessed under restricted irrigation during the growth and flowering season (March–June). Key variables included photosynthetic efficiency (FPSII and Fv/Fm), net photosynthetic rate (A), transpiration rate (E), stomatal conductance (gs), water-use efficiency (WUE), vegetative growth, total phenolic content, and plant water and osmotic potential. Drought did not induce significant reductions in photosynthetic function or water potential, although day-to-day variations highlighted adaptability in photosynthetic efficiency. Interestingly, vegetative growth increased under moderate drought conditions, suggesting a compensatory response to stress.

In the field, seasonal and spatial variations were observed in photosynthetic efficiency and phenolic content among 30 individuals at El Asperillo (Huelva). Female plants exhibited higher mean FPSII and phenolic content than males, particularly in older leaves. July displayed the highest FPSII values, with significant differences among zones.

These findings reveal the physiological plasticity and resilience of C. album, emphasizing its potential as a sustainable crop in Mediterranean regions. Its adaptability under water stress highlights its role in mitigating climate change impacts and ensuring crop stability in Mediterranean environments.

TSB.15. Posters

[TSB.15-P-1]

Wednesday 4
Discussion corner: Room 3

Landscape and biodiversity drivers of Trypanosoma cruzi infection in wild hosts

Martínez Vaquero, Luis Alberto[1]; Siliansky de Andreazzi, Cecilia[2]

(1) Universidad Politécnica de Madrid; (2) Universidad Complutense de Madrid

Correspondence e-mail: [l.martinez.vaquero@upm.es]

Introduction. Land-use change and biodiversity loss disrupt ecosystems and amplify the risk of zoonotic diseases. In particular, the transmission of Trypanosoma cruzi, the agent of Chagas disease, increases in degraded ecosystems due to the reduction of mammal diversity and a positive selection of generalist species with high transmissibility competence. Our study explores ecological drivers of T. cruzi prevalence at individual, community, and landscape levels in Brazil, focusing on biodiversity regulatory effects.

Material and methods. Data from 2,054 small mammals across 250 transects were analyzed. Landscapes were defined by 3, 5, and 10 km buffers. Land cover and biodiversity metrics included vegetation cover, taxonomic, and functional diversity. Machine learning models using balanced and unbalanced datasets were used to analyze feature importance and predict individual infection probability, whereas structural equation models quantified the direct and indirect effects of biodiversity and land cover on community-level prevalence.

Results and discussion. Individual infection probability increased with body mass and intermediate biodiversity levels but decreased with a higher proportion of rodents and stable vegetation cover. Functional traits, such as foraging stratum, also played a role. At the community level, higher vegetation cover and biodiversity reduced prevalence indirectly by increasing rodent dominance. Conversely, land cover changes amplified infection risk, with effects varying by scale and biome. Control measures that combine mitigating deforestation can be efficient to reduce the prevalence of T. cruzi in wild hosts.

[TSB.15-P-2]

Thursday 5
Discussion corner: Room 3

Importance of the leaf conditioning status on litter decomposition in salinized streams

Oliveira, Ricardo[1]; Canhoto, Cristina[2]

(1) Universidade de Coimbra; (2) Universidade de Coimbra

Correspondence e-mail: [ricpedro.oliveira@gmail.com]

Secondary salinization is a global threat to the biodiversity of freshwater ecosystems. Here we assessed the effects of salt contamination (0, 1, 4, 6g NaCl/L) on the decomposition of oak (Quercus robur) leaves with distinct conditioning histories. Mass loss and associated microbial descriptors were evaluated on leaves previously immersed in the stream for 7 (P) or 21 days (C), and further submitted to a 2-week salinization period in the laboratory. Both leaf types were also offered to the shredder Schizopelex festiva (Trichoptera) maintained in the corresponding salinized media. Globally, mass loss of C was higher, but strongly inhibited by increasing salinization. At 1g/L, C showed greater mass loss, fungal biomass and microbial activity, while P presented higher fungal biomass and sporulation rates at intermediate and lower salt-levels, respectively. At 6 g/L salt, all microbial descriptors between both leaf types (P and C) were low and leveled. Leaf consumption by S. festiva was consistently lower when fed C. Distinct and richer fungal communities associated with the more coherent P leaves may have favored shredders' consumption across salinities, despite a depressive effect mediated by waterborne and/or food-mediated salt-toxicity. Results suggest that deleterious consequences of salinization on fungal degradative role, observed in P (= 4g/L), may be counterbalanced by higher processing by the tested leaf-consumers. We suggest that leaf conditioning status and the timing of salt inputs should be considered when studying the effects of secondary salinization to the process of aquatic litter decomposition, its consequences on streams' functioning, their protection and management.

[TSB.15-P-3]

Tuesday 3
Discussion corner: Room 3

Long term soil organic carbon changes in Mediterranean organic and conventional dryland arable fields

Cortés, Guadalupe[1]; Pérrez-Ferrer, Alejandro[2]; Chamorro-Lorenzo, Lourdes[3]; Romanyà, Joan[4]; Blanco Moreno, José M.[5]; Sans Serra, F. Xavier[6]

(1) Universitat de Barcelona; (2) Universitat de Barcelona; (3) Universitat de Barcelona; (4) Universitat de Barcelona; (5) Universitat de Barcelona; (6) Universitat de Barcelona

Correspondence e-mail: [guadalupecortes@ub.edu]

Soil organic carbon (SOC) is a key indicator of soil quality and fertility. Promoting farming practices that enhance its conservation and accumulation is essential for transitioning to more sustainable agricultural systems. This study evaluated temporal changes in SOC of a network of organic and conventional farms evenly distributed in 12 localities scattered in Central Catalonia.

In each locality, a conventionally managed field and an organically managed field were selected. Soil sampling was conducted at the beginning (2008) and 15 years later (2023), et the four georeferenced points per field. Soil samples were collected down to 30 cm, and SOC concentrations were analysed at corresponding depths of 0-10, 10-20, and 20-30 cm. Differences between management systems were assessed using ANOVA.

Studies indicate that the mean (± SE) percentage of SOC in organic fields was 1.30% ± 0.03 and 1.41% ± 0.04, in 2008 and 2023, respectively. These values were significantly higher than those observed in conventional fields, which recorded averages of 1.13% ± 0.03 (2008) and 1.26% ± 0.04 (2023). Although SOC percentage increased in 2023 in conventional arable fields, it did not reach the SOC levels of organic fields during the first sampling. Results also reveals that in both systems, differences in SOC between samplings occurred at a soil depth of 0–20 cm.

Overall, the comparison of SOC of organic and conventional reflects a similar temporal trend, but the greater accumulation of SOC in organic arable fields with respect to conventional ones is maintained, reflecting that organic systems are more environmentally friendly.

TSB.16. Connecting Portuguese and Spanish Ecological Restoration experiences and future perspectives under the EU Nature Restoration Law

Thursday, 5 (15:30-17:00)

Room: Seminario 3

Restoration challenges to halt and reverse ecosystem degradation and biodiversity loss are often transnational, requiring cooperation across borders to effectively address ecological degradation. The Nature Restoration Law recently adopted in the EU also reinforces the need for coordination between countries which, in the case of Portugal and Spain, can largely benefit from the potential for collaboration between the Portuguese and Spanish ecological restoration networks. This session aims to foster cooperation between Portuguese and Spanish restoration researchers and practitioners, benefiting from the potential of their respective Restoration Networks to address common environmental issues and share restoration experiences and approaches for varied contexts, e.g. terrestrial, inland water, and marine and coastal ecosystems. Contributions are expected on topics such as transnational restoration efforts, shared degraded ecosystems or environmental/social challenges, as well as comparative perspectives. The session also aims to explore the potential for collaborative projects and share and discuss perspectives on the preparation and implementation of the respective National Restoration Plans under the EU law. The political momentum regarding ecosystem restoration offers a unique opportunity to apply ecological knowledge in a transnational context, allowing attendees to learn from each other's experiences and explore future collaborative pathways for ecological restoration in both countries.

Organizers:

• **Alice Nunes,** cE3c - Centre for Ecology, Evolution and Environmental Changes, Universidade de Lisboa

• **Josu Alday, Universitat de Lleida,** ETSEAFIV

• **Patricia Rodríguez-González,** Forest Research Centre, Associate Laboratory TERRA, School of Agriculture, University of Lisbon.

TSB.16. Orals

[TSB.16-O-1]

Thursday 5, after lunch (third): 15:30
Room: Seminario 3

Evaluating Climate Change Impacts on Protected Areas: A Climate Representativeness Approach for the Natura 2000 Network

Mingarro, Mario[1]; del Barrio, Gabriel[2]; Sanjuan Martínez, Marieta[3]; Ruiz Rancaño, Alberto[4]; Numa Valdez, Catherine[5]; Lobo, Jorge M.[6]

(1) EEZA-CSIC; (2) EEZA-CSIC; (3) EEZA-CSIC; (4) EEZA-CSIC; (5) IUCN Centre for Mediterranean Cooperation; (6) MNCN-CSIC

Correspondence e-mail: [mario_mingarro@mncn.csic.es]

New approaches are needed to assess the impacts of climate change on protected areas. Protected areas are crucial for biodiversity conservation; however, climate change threatens their effectiveness. Traditional species distribution models present limitations. This alternative approach estimates the location of areas with similar climatic conditions to a protected area in both present and future projections. This enables the evaluation of climate representativeness under various climate scenarios and the development of more robust conservation strategies.

Here, a novel methodology is presented for assessing the impacts of climate change on protected areas within the Natura 2000 network. Instead of focusing on individual species distributions, this approach is based on analyzing the climate representativeness of each area. Specifically, it identifies geographic regions that, under future scenarios, will exhibit analogous climatic conditions to a given protected area, termed “recipient areas.”

By characterizing how a protected area network represents climatic conditions, an indicator of biodiversity requirements, we can anticipate significant biodiversity shifts within the Natura 2000 network. This information facilitates the development of more effective, climate-adapted conservation strategies. This methodology has been implemented in an R package, ensuring reproducibility and broader applicability.

[TSB.16-O-2]

Thursday 5, after lunch (third): 15:45
Room: Seminario 3

Establishing Live Fences: Evaluating the Benefits of Wood Chip Mulching and Co-Plantation

Chozas, Sergio[1]; Clemente, Adelaide[2]; Ulm, Florian[3]; Anjos, Andreia[4]; de Jesus, Joana[5]; Jacinto, João[6]; Máguas, Cristina[7]

(1) cE3c - Center for Ecology, Evolution and Environmental Changes & CHANGE - Global Change and Sustaina; (2) CE3C - Centre for Ecology, Evolution and Environmental Changes & CHANGE; (3) CE3C - Centre for Ecology, Evolution and Environmental Changes & CHANGE; (4) CE3C - Centre for Ecology, Evolution and Environmental Changes & CHANGE; (5) CE3C - Centre for Ecology, Evolution and Environmental Changes & CHANGE; (6) CE3C - Centre for Ecology, Evolution and Environmental Changes & CHANGE; (7) CE3C - Centre for Ecology, Evolution and Environmental Changes & CHANGE

Correspondence e-mail: [scvinuesa@fc.ul.pt]

The importance of diverse and heterogenous landscapes for maintaining ecosystem services has led European Union to establish measures to support biodiversity-fostering elements in the Common Agricultural Policy (CAP). However, the natural and seminatural habitats within agroecosystems currently hold the worst conservation status within Europe. In this context, applying Small Natural Features (SNF) as Nature-based Solutions emerges as a promising strategy to implement biodiversity-friendly guidelines into CAP application. SNF are sites and small elements of the landscape, such as fences, hedgerows and outcrops, with disproportionate ecological importance compared to their size. They make critical contributions to biodiversity dynamics and ecological functioning. Live fences are linear rows of woody plants that provide important services to agricultural and livestock systems. Their development requires appropriate and sustainable plantation practices; however, we currently lack systematic information on which methods are more effective under varying climate conditions, especially given the consistently low survival rates of seedlings observed in restoration efforts.

Understanding the factors that influence the success of revegetation practices is crucial for ensuring effective plantation performance and improving live fences outcomes. We analysed the impact of two techniques - wood chip mulching and co-plantation - on seedling survival of four Mediterranean shrub species in a life fence restoration pilot project. The assessment used diverse metrics, including ecophysiological indices, to support adapted guidelines for creating live fences, benefiting landscapes, biodiversity, and ecosystem services.

[TSB.16-O-3]

Thursday 5, after lunch (third): 16:00
Room: Seminario 3

Effectiveness of seed bank transfer as a method for herb community restoration in Mediterranean mining areas

Villar Salvador, Pedro[1]; Espigares, Tíscar[2]; Pavón, Javier[3]; Córdova, Leyanira Franccesca[4]; Nicolau, José Manuel[5]; Tormo, Jaume[6]

(1) Universidad de Alcalá; (2) Universidad de Alcalá; (3) Tragsatec; (4) Universidad de Alcalá; (5) Universidad de Zaragoza; (6) Universidad de Zaragoza

Correspondence e-mail: [pedro.villar@uah.es]

Introduction. Establishing herbaceous vegetation is important to prevent erosion and increase soil fertility in the restoration of mining spaces, often traditionally carried out with ineffective or costly methods. The objectives of this study were to evaluate 1) the effectiveness of transplanting seed banks of local herb communities for mining restoration sites and 2) the recovery of donor herb communities. Methods. We conducted an experiment at a mine in Guadalajara, Spain, in which we manually transplanted a seed bank to experimental plots of 2.85 m2 under three treatments: full dose (undiluted seed bank), half dose (50% dilution) and control (no dose). Additionally, at a management scale, a seed bank was transplanted to a plot of 3080 m2. In both study scales the effectiveness of the method was compared with conventional commercial seed sowing used in the rest of the mine. Results & Discussion. Plant cover and species richness were higher in the seed bank transplanted plots (both 100 and 50% doses) than in the commercial sowing plots, consistent across both spatial scales. Floristic composition in transplanted seed bank plots resembled natural reference donor plots, unlike control plots, which formed species-poor, low-cover communities. After the first growing season, the seed bank generated in the studied plots showed higher density in transplanted plots than in commercial seeded ones. The recovery of donor herb communities was high at the experimental scale and moderate at the management scale. Seed bank transfer is an innovative, effective, and cost-effective method for revegetation in mining restoration projects.

[TSB.16-O-4]

Thursday 5, after lunch (third): 16:15
Room: Seminario 3

Red de Restauración Minas y Canteras: An opportunity to share technical and scientific knowledge contributing to the development of effective ecological restoration strategies

Alday, Josu[1]; López-Marcos, Daphne[2]; Olmo Gilabert, Beatriz[3]; Martínez-Ruiz, Carolina[4]

(1) Universitat de LLeida; (2) Universidad de Valladolid; (3) Red de Restauracion de Minas y Canteras; (4) Universidad de Valladolid

Correspondence e-mail: [josu.alday@udl.cat]

Based on the recognition of mining as a strategic sector for Europe and Spain, essential for the supply of raw materials, the European Union has supported initiatives aimed at improving the global competitiveness of the sector. In recent decades, environmental policies and mining regulations have sought to integrate sustainable development requirements into mining operations. However, despite advances in restoration techniques, further progress is needed to ensure the sector's compatibility with current sustainability standards and social demands.

With the aim of establishing standardized restoration protocols, based on scientific evidence and practical experience, the "Red de Restauración de Minas y Canteras" (RedRMC) emerged in 2019, and is constitute as a national non-profit organization in 2023, acting as a key platform to promote restoration practices in the mining sector, facilitating knowledge sharing, technical support, and guidelines for restoration projects to ensuring that projects are ecologically efficient, economically viable, and socially acceptable.

RedRMC aims to play a crucial role in promoting sustainable mining practices in Spain by contributing to the development of effective restoration strategies that mitigate the environmental impact of mining activities. Continued collaboration with industry, academia and administrations will be crucial to achieving long-term ecological and social benefits in regions affected by mining.

While mining carries serious environmental threats, it also presents opportunities to foster valuable habitats, promote desirable biodiversity, guide ecological restoration, and strengthen conservation efforts, aligned with the recently enacted European Union's Nature Restoration Law aiming to restore 20% of land and sea areas by 2030.

[TSB.16-O-5]

Thursday 5, after lunch (third): 16:30
Room: Seminario 3

Harnessing IUCN nature-based solutions framework to mitigate extreme wildfire impacts

Regos, Adrián[1]

(1) Misión Biolóxica de Galicia

Correspondence e-mail: [aregos@mbg.csic.es]

Nature-based solutions (NbS) are emerging as a valuable approach to mitigate the growing threat of extreme wildfire events (EWEs), which present substantial ecological and socioeconomic challenges on a global scale. These extreme fires, often exceeding the capacity of traditional suppression methods, are increasingly driven by climate change. While NbS are widely recognized for addressing climate and biodiversity crises, their potential for managing EWEs has been largely overlooked, resulting in limited political and financial investment.

Tackling the societal challenges linked to EWEs requires a multifaceted approach that incorporates land-use management and fire suppression policies. This presentation proposes a roadmap for integrating NbS into wildfire management, emphasizing ecosystem resilience and sustainable wildfire strategies. Key steps include reconciling policy objectives, involving local stakeholders, and balancing trade-offs across ecosystem services. Enhancing monitoring systems and early-warning tools will also be critical for NbS success, providing valuable insights for post-fire recovery.

Adopting a 'fire-smart' approach within NbS frameworks could transform wildfire management. Achieving this requires interdisciplinary collaboration, capacity building, integrated policy strategies, stakeholder engagement, and diversified funding from public and private sectors. By addressing these needs, NbS can be translated into practical solutions for mitigating the increasing impacts of EWEs.

Acknowledgments: This work is inspired by insights from the FirESmart project, funded by the FCT (PCIF/MOG/0083/2017), and discussions from Firelogue workshops, funded by Horizon 2020 (Grant Agreement No. 101036534).

TSB.16. Posters

[TSB.16-P-1]

Thursday 5
Discussion corner: Room 3

Beyond borders: Riparian restoration as a key to climate resilience in southern iberian agroecosystems

Santos Gomes, Gabriela[1]; Matono, Paula[2]; Sabino-Marques, Helena[3]; Barreto, Raquel[4]; Pinto-Cruz, Carla[5]

(1) MED – Mediterranean Institute for Agriculture, Environment and Development & CHANGE – Global Change; (2) MED – Mediterranean Institute for Agriculture, Environment and Development & CHANGE – Global Change; (3) MED – Mediterranean Institute for Agriculture, Environment and Development & CHANGE – Global Change; (4) Departamento de Biologia, Universidade de Évora, Pólo da Mitra, Ap. 94, 7002-554 Évora, Portugal; (5) MED – Mediterranean Institute for Agriculture, Environment and Development & CHANGE – Global Change

Correspondence e-mail: [gabriela.gomes@uevora.pt]

Introduction. As climate change intensifies and temperatures rise, prioritizing the conservation and ecological restoration of riparian galleries is pivotal for ensuring ecological resilience, agricultural sustainability, and long-term socio-economic stability. Mediterranean regions, particularly vulnerable to prolonged droughts and high agricultural water demand, require integrated restoration strategies that reconcile productive landscapes with biodiversity conservation. The EU Nature Restoration Law emphasizes ecological connectivity and climate resilience, offering a unique opportunity for transnational cooperation in river restoration across the Iberian Peninsula. In this study, we provide insights for restoration planning and propose scalable solutions for riparian restoration actions in Mediterranean temporary rivers.

Material and methods. We explored riparian restoration strategies and concepts in Mediterranean agricultural landscapes. We based our approach on a case study of the Enxoé watershed

GENERAL SESSION

GSC. The Interplay Between Species Coexistence and Abiotic Factors: Community Ecology

Tuesday, 3 (11:00-12:30) • Wednesday, 4 (11:00-12:30) • Thursday, 5 (11:00-12:30)

Room: Restaurante

Coexistence is balance maintained through adaptive strategies and species interdependencies. Species employ various adaptive strategies, such as niche differentiation, resource partitioning, and temporal segregation, to enhance survival. These strategies allow multiple species to coexist, promoting biodiversity and ecosystem complexity. Understanding this balance requires moving beyond reductionist approaches, which often isolate components of the ecosystem for study, and instead embracing the complexity of ecological interactions. This perspective recognizes that abiotic factors and biotic communities are co-constitutive, each shaping the other in continuous mutual influence.

Key Questions:

• How do species interactions shape bottom-up biodiversity patterns?

• How do abiotic factors and biotic communities mutually influence each other?

Coordinators:

• **Adrián Castro-Insua,** Universidade de Vigo (UVigo)

• **Isabel Ferrera,** Instituto Español de Oceanografía (COM-IEO)

• **Graciela Gil Romera,** Instituto Pirenaico de Ecología (IPE-CSIC)

• **Rubén Heleno,** Universidade de Coimbra (UC)

• **Lea del Nascimiento,** Universidad de La Laguna (ULL)

• **Rodrigo R. Granjel,** Basque Center for Climate Change (BC3)

• **Montse Vilá,** Estación Biológica de Doñana (EBD-CSIC).

GSC. Orals

[GSC-O-1]

Tuesday 3, morning (first): 11:00
Room: Restaurante

Scavenger communities and soil enrichment: Insights from carcass sites

Colino Barea, Adrián[1]; Sebastián González, Esther[2]; García Orenes, Fuensanta[3]; Morales Reyes, Zebensui[4]; Moleón Paiz, Marcos[5]; Arcenegui, Victoria[6]; Mataix Solera, Jorge[7]; García Carmona, Minerva[8]; Sánchez Zapata, José Antonio[9]

(1) Universidad Miguel Hernández de Elche; (2) Universidad de Alicante; (3) Universidad Miguel Hernández de Elche; (4) Instituto de Estudios Sociales Avanzados (IESA), CSIC; (5) Universidad de Granada; (6) Universidad Miguel Hernández de Elche; (7) Universidad Miguel Hernández de Elche; (8) Instituto Mixto de Investigación en Biodiversidad (IMIB-CSIC-UniOvi-PA); (9) Universidad Miguel Hernández de Elche

Correspondence e-mail: [acolinob@gmail.com]

The soil is a dynamic matrix that underpins essential ecosystem functions and services worldwide. Its formation involves intricate interactions between abiotic and biotic factors, including the decomposition of organic matter. While plant-derived organic matter has been the focus of extensive research, the contribution of animal remains to soil nutrient cycles remain understudied. Mid-sized mammal carcasses, although sporadically distributed, serve as critical resources for scavenger communities and influence local biogeochemical processes. This study aims to quantify the biomass input from carcasses to soils and examine the scavenger communities mediating this process. Specifically, we explore scavenger diversity, functional roles, the influence of habitat on community composition, and the impacts of carrion decomposition on soil properties. Carcasses of ten red foxes (Vulpes vulpes) and ten aoudad (Ammotragus lervia) were placed in Sierra Espuña Regional Park (Murcia, Spain) to represent mesocarnivores and herbivores. Camera traps documented scavenger activity, providing data on community composition, carcass detection, and consumption patterns. Soil samples collected before carcass placement and five months later were analyzed for physical, chemical, biochemical, and biological properties. Our findings reveal significant changes in several soil properties following carcass decomposition. Facultative scavengers playing a dominant role in carcass consumption, with vegetation cover significantly influencing scavenger activity. Carrion decomposition enriched soils, altering properties relevant to primary production. These results highlight the pivotal role of animal-derived organic matter in nutrient cycling and underscore the keystone ecological function of scavenger communities in modulating these processes.

[GSC-O-2]

Tuesday 3, morning (first): 11:15
Room: Restaurante

Livestock trends in Spain: insights for wildlife conservation

Velado Alonso, Elena[1]; Romero, Marina[2]; Bernues, Alberto[3]; Prat-Benhamou, Alicia[4]; Couto, Mariana[5]; Anadón, José Daniel[6]; Martin-Collado, Daniel[7]

(1) Wageningen University; (2) Agrifood Research and Technology Centre of Aragon; (3) Agrifood Research and Technology Centre of Aragon; (4) Agrifood Research and Technology Centre of Aragon; (5) Agrifood Research and Technology Centre of Aragon; (6) Pyrenean Institute of Ecology-CSIC; (7) Agrifood Research and Technology Centre of Aragon

Correspondence e-mail: [elena.velado@outlook.es]

Agriculture has become a major threat to biodiversity and the provision of many ecosystem services. The livestock sector is playing a key role due to the expansion of more intensified livestock systems that contribute to, among others, landscape simplification, habitat loss and fragmentation, environmental pollution, soil degradation, and greenhouse gas emissions. This expansion of intensive livestock systems also leads to the decline of extensive livestock and the abandonment of traditional semi-natural habitats, which are fundamental for wildlife conservation. For instance, biodiversity-rich ecosystems, like pastures and meadows, are being transformed into other land use types like shrubs and forest areas. Other land-use and socio-economic changes are also associated with the transformation of livestock systems. In this work we study the cattle, sheep and pig sector trends since 2007 in Spain to better understand the relationship between livestock population dynamics and the changes in land use types, and socio-economic factors. We have used different national databases such as REMO (Spanish Register of Livestock Farms), INE (Spanish Statistical Institute), and the CORINE land cover aggregated at the municipality level to analyze livestock trends. Preliminary results show that decreased sheep stocks are linked to diminished grassland covers and population ageing, while increased cattle and pig stocks are related to intensification of agricultural landscapes, higher rents and agrarian productivity and increased population. We will discuss the implications of these transformations for wildlife conservation in different regions considering the network of protected areas.

[GSC-O-3]

Tuesday 3, morning (first): 11:30
Room: Restaurante

Unraveling the diet of a potential biocontrol agent, the whirling mite (Anystidae), in citrus cover crops

Casiraghi, Alice[1]; Moreno-González, Víctor[2]; Garrote-Sánchez, Emilio[3]; Urbaneja, Alberto[4]; Gil, Rosario[5]; Monzó, César[6]

(1) Instituto Valenciano de Investigaciones Agrarias (IVIA); (2) Biodatev (www.biodatev.com); (3) Institute for Integrative Systems Biology (I2SysBio), University of Valencia and CSIC; (4) Instituto Valenciano de Investigaciones Agrarias (IVIA); (5) Institute for Integrative Systems Biology (I2SysBio), University of Valencia and CSIC; (6) Instituto Valenciano de Investigaciones Agrarias (IVIA)

Correspondence e-mail: [casiraghi_alia@gva.es]

Cover crops are green infrastructures implemented in agroecosystems, offering alternative food sources to natural enemies and as a sustainable solution to prevent imbalances in biocontrol services. Knowing the trophic webs they can sustain is important to address pest problems. Identifying potential predators can be achieved through various methods, with gut content DNA metabarcoding of field-sampled predators being one of the most effective for studying their actual prey range. In a three-year survey, we identified Anystidae mites as one of the most abundant predator taxa living in cover crops. Although being globally distributed, this is a poorly studied taxon of generalist predators of invertebrates. Due to their polyphagous nature, much is likely still unknown about the full range of prey species they target, making them potential biocontrol agents that have not yet been sufficiently explored.

Mites were collected using a suction device from three cover crop types (flowering dicotyledonous, grass, and spontaneous) in two young mandarin orchards under a replicated experimental design (Pego, Spain), from autumn 2022 to summer 2023. Individual specimens' gut content was analysed using Illumina-based amplicon sequencing with two different universal arthropod COI primers. Raw reads were processed using standard procedures and identified using an RDP classifier associated with a COI-RDP database. The results show that, although prey vary among seasons and cover crop treatments, mites prefer "soft-bodied" insects, like aphids and thrips, but also target natural enemies like hoverflies and lacewings (probable larval stages) and key citrus pests, including whiteflies and mealybugs.

[GSC-O-4]

Tuesday 3, morning (first): 11:45
Room: Restaurante

Millennial-Scale Community Dynamics and Ecosystem Transitions in Lake Prata, Azores

Raposeiro, Pedro[1]; Matias, Miguel[2]; Pla-Rabes, Sergi[3]; Souto, Martin[4]; Gonçalves, Vítor[5]

(1) CIBIO, Research Centre in Biodiversity and Genetic Resources - Polo Açores; (2) Museo Nacional de Ciencias Naturales, Madrid, Spain; (3) BABVE, UAB; (4) CIBIO, Research Centre in Biodiversity and Genetic Resources - Polo Açores; (5) CIBIO, Research Centre in Biodiversity and Genetic Resources - Polo Açores; (6)

Correspondence e-mail: [pedro.mv.raposeiro@uac.pt]

Understanding temporal dynamics in ecological systems is critical for uncovering how ecosystems and communities respond to long-term environmental change. While spatial processes have traditionally dominated community ecology, the role of temporal dynamics are increasingly recognized as crucial for predicting biodiversity patterns and ecosystem resilience.

We reconstructed millennial-scale changes in community structure in Lake Prata (São Miguel Island, Azores) using a multiproxy approach, incorporating data from green algae, diatoms, testate amoebae, cladocerans, and chironomids. Functional trait-based analyses and advanced statistical methods identified four distinct assemblages zones: ca. 750–1250 (Z1), 1250–1700 (Z2), 1700–1850 (Z3), and 1850–present (Z4). Water depth emerged as the primary driver of biological changes. Z1 was characterized by a deeper lake with clear waters, dominated by planktonic green algae, high-profile diatoms, and herbivorous chironomids. Z2 marked anthropogenic disturbances with forest declines and an increase in euplanktonic diatoms and terrestrial testate amoebae. Z3 reflected declining water levels, with an increase in benthic and semi-terrestrial taxa. Z4 revealed rapid paludification, transitioning from a lake to a peatland dominated by semi-terrestrial and benthic taxa.

These findings provide crucial insights into the mechanisms of community assembly and ecosystem transitions, offering a framework for understanding resilience under accelerating environmental change.

This work was supported Fundação para a Ciência e a Tecnologia through the DISCOVERAZORES project (PTDC/CTA-AMB/28511/2017), the European Union (QREN, FEDER, COMPETE), CIBIO/InBIO (UIDB/50027/2020, UIDP/50027/2020, LA/P/0048/2020), and the Spanish Ministry of Economy and Competitiveness (PID2022-137749NB-I00).

[GSC-O-5]

Tuesday 3, morning (first): 12:00
Room: Restaurante

Diatoms radiation across continental pH-alkalinity gradients

Martínez Artero, Jordi[1]; Batalla Mercadé, Meritxell[2]; Marcer, Arnald[3]; Catalan, Jordi[4]

(1) CREAF; (2) CREAF; (3) CREAF; (4) CREAF

Correspondence e-mail: [j.artero@creaf.uab.cat]

Diatoms are the younger clade among algae life forms. They evolved in the oceans about 200 million years ago and progressively invaded freshwaters in successive episodes, embracing several main evolutionary clades. The diversification rates in freshwaters appear to be higher than in the oceans. One of the primary environmental factors enhancing the continental radiation could be the pH-alkalinity gradients existing in freshwaters compared to the buffered oceans. Indeed, diatoms are widely used as indicators of pH conditions and for reconstructing acidic conditions from the past using lake sediments. In this study, we evaluate if the radiation along the pH-alkalinity gradients mirrored the habitat availability in the continents at a global scale. We compiled pH and alkalinity data for surface inland waters, which were the basis for an extrapolation across continents using HydroBASINS watersheds as units, and provided the surface water availability along the pH-alkalinity gradients. Diatom species distributions were also compiled across continents, and the species distribution optima compared to surface water availability along the chemical gradients. We concluded that diversification of diatoms proportionally occurred according to the habitat availability across the pH-alkalinity gradient in inland waters when considering the entire clade. However, there were peculiarities within the major evolutionary branches and invasions from marine environments, the contingencies of which are discussed.

[GSC-O-6]

Tuesday 3, morning (first): 12:15
Room: Restaurante

Temperature effect on the macroalgae consumption and respiration rate of the invasive crab Percnon gibbesi in the Mediterranean Sea

Pasalodos Barceló, Laura[1]; Garcia, Francisca[2]; Antón Gamazo, Andrea[3]

(1) Global change Research Group, IMEDEA (CSIC-UIB), Mediterranean Institute For Advanced Studies, Espor; (2) King Abdullah University of Science and Technology; (3) Global change Research Group, IMEDEA (CSIC-UIB), Mediterranean Institute For Advanced Studies, Espor

Correspondence e-mail: [pasalodoslaura@gmail.com]

Introduction. The Mediterranean Sea is the most invaded marine region in the world. The rise in sea temperatures occurring in this region in the past decades may be exacerbating the ecological impact of exotic species from warmer regions. The invasion of the crab P. gibbesi presents a unique opportunity to study how temperature influences the ecological impact of marine exotic herbivores.

Materials and Methods. This study examines the relationship between temperature and the physiological performance of Percnon gibbesi, particularly focusing on how it affects the herbivory rate on the macroalgae Haliptilon virgatum and the metabolic respiration rate of the crab.

Results and discussion. The findings highlight that P. gibbesi exhibits an optimal thermal range for algae consumption and respiration between 26.3°C and 31.1°C, with average optimal values per crab of 2.706 g WW macroalgae d-1 crab-1 and 0.915 mg O2 h-1 crab-1, respectively. A theoretical upper thermal limit of P. gibbesi was calculated at 35.39°C. Temperatures within 50% of optimal consumption rates (23.21 – 30.05°C) were considered peak performance, likely occurring during the months of June and November in the shallow rocky subtidal shores in the island of Mallorca. The results underline the potential ecological threat posed by P. gibbesi in the context of global climate change, emphasizing the need for effective management strategies to mitigate its impact on native ecosystems.

[GSC-O-7]

Wednesday 4, morning (first): 11:00
Room: Restaurante

Frozen Archives: Exploring Avian Population Histories and other Environmental Changes Using Arctic Eider Nests

Álvarez-Manzaneda, Inmaculada (Ada)[1]; Rühland, Kathleen M.[2]; Campbell, Marlo[3]; Hargan, Kathryn E.[4]; Duda, Matthew P.[5]; Mallory, Mark L.[6]; Gilchrist, Grant[7]; Smol, John P.[8]

(1) University of Granada; (2) Queen's University; (3) Queen's University; (4) University of Ottawa; (5) Queen's University; (6) Acadia University; (7) Environment and Climate Change Canada; (8) Queen's University

Correspondence e-mail: [miams@ugr.es]

Introduction. Seabird populations have fluctuated due to natural variability and human-induced stressors, but long-term monitoring data remain scarce and inconsistent, particularly in remote areas like Hudson Strait in the Canadian Arctic. However, important information for effective conservation strategies is available through long-term perspectives. We used paleoecological approaches to explore whether eider nests served as reliable geochronological archives containing proxies of past avian activity to determine how long eiders have been occupying the region and to better understand long-term changes in nest environments and populations.

Material and methods. This research introduces, for the first time, a promising approach available for conservation biologists that applies paleoecological techniques to eider nest material. Eider nests from remote islands in Digges Sound, in the Canadian Arctic were sampled and 210Pb-dated. By analyzing biological indicators preserved in the accumulating nest material, such as diatoms and other siliceous proxies together with ornithogenic proxies, we assessed the potential of this method to track environmental changes and long-term eider population dynamics.

Results and discussion. Our findings show that eiders have been nesting on this island for at least the past ~780 years. Warmer post-Little Ice Age conditions after the mid-19th century, together with higher eider occupation rates promoted the growth of diatoms and other siliceous indicators. Changes in metals tracked anthropogenic activities, particularly an increase in lead likely associated with increased shotgun usage in the mid-20th century. Based on our exploratory study, the application of paleoecological approaches to nest archives can provide critical insights for managing seabird populations.

[GSC-O-8]

Wednesday 4, morning (first): 11:15
Room: Restaurante

The extraordinary contribution of social media and media to map rare and endangered species: the Mediterranean Monk Seal in Madeira and Porto Santo Islands

Castro, Andry[1]; Capinha, César[2]

(1) CEG/IGOT- University of Lisbon; (2) CEG/IGOT- University of Lisbon

Correspondence e-mail: [andrycastro@edu.ulisboa.pt]

The Mediterranean monk seal (Monachus monachus) is an endangered species that has garnered significant conservation attention. In the Atlantic, there are two colonies of this seal, one located in the Madeira Autonomous Region, where sightings are rare outside the Desertas Islands—an uninhabited group of islands with a small population of fewer than 30 individuals. On other islands in the archipelago, patterns of occurrence for this species are poorly documented. In this study, we explore how social media and news media can enhance current knowledge about the occurrence of the Mediterranean monk seal on Madeira and Porto Santo Islands, the two main islands of the archipelago. We compared records from these sources with those from reference biodiversity repositories (GBIF) and citizen science platforms (iNaturalist and Observation.org). Data were collected from local news media and social media platforms, including Facebook, Instagram, YouTube, X, and blogs. Our findings revealed that social and news media increased the number of available occurrence records by 2645%. Most records (n=302) were identified along the south coast of Madeira Island, with a temporal distribution showing a concentration of sightings during the summer months. The majority of records were made near beaches and natural pools (n=115), at underwater diving/spearfishing locations (n=74), and around artificial coastal structures, such as ports, harbours, marinas, and the mouths of streams with concrete walls (n=49). These results underscore the remarkable potential of social and news media to track rare and emblematic marine species, serving as valuable tools for supporting species distribution knowledge and conservation efforts.

[GSC-O-9]

Wednesday 4, morning (first): 11:30
Room: Restaurante

Compensatory changes in photosynthetic tissue, wood production and water use in trees defoliated by pine processionary moth

Houdas, Hermine[1]; Olano, José Miguel[2]; Hultine, Kevin[3]; Hernández-Alonso, Héctor[4]; Bush, Susan[5]; Fernández-Marín, Beatriz[6]; García-Plazaola, José Ignacio[7]; Guo, Jessica[8]; García-Hidalgo, Miguel[9]; Coca, María[10]; Sangüesa-Barreda, Gabriel[11]

(1) iuFOR-EiFAB; (2) iuFOR-EiFAB, University of Valladolid; (3) Desert Botanical Garden; (4) CEFE-CNRS, University of Montpellier; (5) University of Utah; (6) University of the Basque Country; (7) University of the Basque Country; (8) Hixon Center, Harvey Mudd College; (9) iuFOR-EiFAB, University of Valladolid; (10) iuFOR-EiFAB, University of Valladolid; (11) iuFOR-EiFAB, University of Valladolid

Correspondence e-mail: [herminejosephine.houdas@uva.es]

Insect-plant interactions are key drivers of ecosystem processes and dynamics. Defoliating insects such as the Pine Processionary Moth (Thaumetopoea pityocampa, PPM), a major defoliator of pines and cedars in the Mediterranean Basin, reduce leaf area and directly impact carbon assimilation. However, it is still unclear how trees adjust their functional traits in response to defoliation. We conducted a two-year monitoring in two Pinus nigra stands affected by PPM in north-central Spain. High-temporal-resolution sap flux rates (Js), radial growth increments, and microclimatic data were collected from trees with contrasting defoliation degrees. We also examined xylogenesis, including cell elongation, lignification, and tracheid traits. In the first year, needle length, stomatal conductance, and photosynthesis were measured on pre- and post-defoliation needles. Segmented regressions identified breakpoints where Js stopped responding to increases in soil moisture, and linear mixed-effects models were used to analyze slopes before and after the breakpoints. Defoliation reduced radial growth, with cumulative effects in response to consecutive events. It also reduced stomatal sensitivity to soil moisture, likely due to higher water availability per leaf unit, resulting in higher Js throughout the year. We hypothesize that defoliation increased tracheid lumen area and reduced wall thickness to support water transport. Defoliated trees produced longer needles with higher stomatal density, improved maximum quantum efficiency of Photosystem II (Fv/Fm), and enhanced net photosynthetic assimilation rates. These findings suggest that defoliated trees actively modify their photosynthetic tissue and water economy in response to canopy loss.

[GSC-O-10]

Wednesday 4, morning (first): 11:45
Room: Restaurante

Coevolution of phenological traits shape plant-pollinator coexistence

Duchenne, François[1]; Dominguez-García, Virginia[2]; Molina, Francisco[3]; Bartomeus, Nacho[4]

(1) EBD - CSIC; (2) EBD - CSIC; (3) EBD - CSIC; (4) EBD - CSIC

Correspondence e-mail: [francois.duchenne.bio@gmail.com]

Previous research has revealed how species traits determine species interactions, and how species interactions influence species coexistence. However, this hierarchical view ignores the coevolutionary feedback from species interactions to species traits and its consequences for species coexistence. Here, we developed a theoretical model to explore how the coevolution of morphological and phenological traits shape the structure and stability of mutualistic interaction networks. We found phenological traits lead to distinctive coevolutionary opportunities for species and to different emergent properties at community level than morphological traits, because they decouple mutualism and competition. Morphological coevolution led to modular and specialized interaction networks with a low structural stability, while phenological coevolution was required to achieve nested interaction networks with a higher structural stability. This suggested that phenological coevolution is key in the emergence of stable communities. Our theoretical prediction was consistent with empirical observations: across 17 empirical pollination networks we found a high proportion of phenological motifs promoting facilitation over competition, suggesting an important role of phenological coevolution in community assembly. In addition, the phenological structure of the empirical communities was a major determinant of their structural stability. Our results highlight the importance of phenological coevolution in the emergence of diverse and stable communities.

[GSC-O-11]

Wednesday 4, morning (first): 12:00
Room: Restaurante

Cooperation maximizes biodiversity

Godoy, Oscar[1]; Soler Toscano, Fernando[2]; Portillo, José R.[3]; Suarez, Antonio[4]; Langa, José Antonio[5]

(1) EBD-CSIC; (2) Universidad de Sevilla; (3) Universidad de Sevilla; (4) Universidad de Sevilla; (5) Universidad de Sevilla

Correspondence e-mail: [oscar.godoy@ebd.csic.es]

Cooperation, the mutual benefit that individuals of different species obtain when interacting, is ubiquitous. Despite their importance, current ecological theories have been formalized focusing on negative interactions such as competition or predation. The role of cooperation, or other types of positive interactions including facilitation and mutualism, has not been fully addressed, or, if so, always in combination with negative interactions. This fact limits our understanding of the unique features by which cooperation as opposed to competition promotes biodiversity. To address this gap, we introduce here cooperation into structural stability, a general framework to understand how species interactions and environmental variability determine the long-term persistence of species within communities. Compared to a pure competitive case, cooperation promotes three distinctive features. First, cooperation increases the opportunities for species to coexist. This feature increases species persistence with contrasted phylogenetic, functional, and demographic strategies that the environment would otherwise filter. Second, cooperation creates intertwined biodiversity where the existence of some species begets the presence of others. Third, cooperation promotes multistability by changing the dynamics of community assembly due to variations in environmental conditions. In conclusion, we present a fully operational framework to understand the unique ecological roles of cooperation in nature. It indicates that cooperation as opposed to competition maximizes the maintenance of biodiversity.

[GSC-O-12]

Wednesday 4, morning (first): 12:15
Room: Restaurante

The critical deficit of herbivores in Mediterranean woody systems turns them into fire dominated ecosystems

Pauné, Ferran[1]; Masó, Guillem[2]; Manzano, Pablo[3]; Fanlo, Rosario[4]; Fillat, Federico[5]

(1) Basque Centre for Climate Change (BC3), Leioa, Spain; (2) Universitat de Vic; (3) Basque Centre for Climate Change (BC3); (4) Universitat de Lleida; (5) Instituto Pirenaico de Ecología (CSIC)

Correspondence e-mail: [ferran.paune@bc3research.org]

Introduction. Mediterranean landscapes are often associated with poor, dry ecosystems linked to forest fires. Under global warming, large fires are spreading to many further forest ecosystems on the planet. What if it turned out that this increase in frequency and intensity of disturbances had an underlying historical cause – prior to climate change? Immersed in the Anthropocene, reference to baselines of some ecological processes could have been lost. Could the global fire crisis result from a biodiversity crisis related to not properly adapted land management and species extinction?

Material and methods. To test the use of extensive livestock as a tool for changing the structure and composition of vegetation, we reintroduced herds in five afforested areas that were forested for the last 80 to 120 years, and compared them with control areas where mega and meso-herbivores are extinct. We analysed floristic composition, biomass, population dynamics and soil nutrients according herbivory density and stocking rate.

Results and discussion. The results revealed the connection between the structures of herbaceous and shrub strata. Afforestation leads to impoverished forest communities. Herbivores increase biodiversity and reduce flammability through structural changes in vegetation, water content and species composition. We conclude that certain habitats have been described in a state of abandonment and, therefore, the dominance of a few species is not characteristic – but due to the change in biocenosis. We postulate that herbivore disappearance during the Holocene and Anthropocene is one of the underlying causes for ecosystems to switch from herbivory to fire dominance.

[GSC-O-13]

Thursday 5, morning (first): 11:00
Room: Restaurante

The ecological benefits of traditionally-managed wild pony populations for heathlands in Galicia

Lagos Abarzuza, Laura[1]; Cortés Vázquez, Jose Antonio[2]; Fagúndez Díaz, Jaime[3]

(1) Universidade da Coruña.; (2) Universidade da Coruña; (3) Universidade da Coruña

Correspondence e-mail: [laura.lagos@udc.es]

The use of large herbivores, such as free-ranging horses, has been highlighted as an effective strategy for preserving natural landscapes and biodiversity. In this context, the traditional systems of wild ponies that persist in Galicia, is a valuable model for understanding the potential benefits of such practices. These grazed areas, once widespread in other European Atlantic regions, are threatened by land-use changes such as afforestation or land abandonment, and semi-natural habitats such as heathlands are especially affected.

We performed a comparative study of heathlands grazed by ponies vis-à-vis alternative land uses such as short-term and long-term afforestation, intensive grazing and abandonment. We measured plant diversity, aerial biomass, and accumulated organic matter and carbon in both soil and vegetation as indicators of biodiversity, carbon storage, and fire risk prevention. Additionally, 20 interviews were conducted with different stakeholders to assess perceptions of the ecological benefits generated by wild ponies.

Grazed heathlands showed higher values for species richness, soil carbon accumulation, and forest fuel reduction compared to compared to alternative land uses. There was also a general agreement among local stakeholders on the positive effect of wild ponies on preventing shrub encroachment and reducing fire risk. We conclude that wild ponies are key to maintaining a socio-ecological system that provides strong benefits in the region, particularly when compared to the impacts of growing phenomenon of land abandonment.

[GSC-O-14]

Thursday 5, morning (first): 11:15
Room: Restaurante

Exploring Ecosystem Services and Disservices of Free-ranging Garrano Ponies

Freitas, Joana[1]; Lagos, Laura[2]; Vaz, Ana Sofia[3]; Álvares, Francisco[4]

(1) Faculdade de Ciências da Universidade do Porto; (2) Facultade de Ciencias e Centro de Investigación Interuniversitario das Paisaxes Atlánticas Culturais; (3) NBI, Natural Business Intelligence; (4) BIOPOLIS-CIBIO

Correspondence e-mail: [joanafreitas@cibio.up.pt]

Understanding ecological, sociocultural and economic contributions of large herbivores is pivotal for biodiversity conservation and sustainable land management. Garranos are an endangered autochthonous breed of mountain ponies from northwest Portugal, which play a crucial role in ecosystem functioning and hold high sociocultural value for rural communities. However, rural abandonment, land use changes, wolf predation and administrative requirements threaten their survival and traditional free-ranging system.

We aim to examine the ecosystem services (ES) and disservices (EDS) associated with Garranos, exploring their roles in biodiversity conservation, wildfire mitigation and sociocultural significance, through a multidisciplinary approach. This includes a systematic literature review, ecological field assessments, stakeholder interviews and questionnaires, and benchmarking analyses.

Regarding biodiversity conservation, the role of Garrano ponies in wolf diet was assessed using a meta-analysis based on data collected from a systematic literature review. Preliminary results showed Garranos are a preferred prey of Iberian wolves, with higher consumption rates than domestic and wild ungulates in areas where these ponies are free-ranging. This highlights Garranos' role as a buffer species, potentially reducing predation on economically valuable livestock.

Regarding habitat conservation and wildfire mitigation assessment, currently we have GPS-tagged 9 Garrano ponies to assess habitat use and collected 240 faecal samples for dietary analysis. The sociocultural and economic roles of Garranos are analysed using online surveys on general public's perception towards this breed and interviews with horse owners. The results will support a cost-benefit analysis, assessing synergies and trade-offs between ES and EDS to develop sustainable management and conservation strategies for Garranos.

[GSC-O-15]

Thursday 5, morning (first): 11:30
Room: Restaurante

From pollen to landscape: quantitative reconstruction of past vegetation dynamics in Iberia through novel relative pollen productivity estimates

Jungkeit-Milla, Kilian[1]; Abraham, Vojtech[2]; Font, Xavier[3]; González-Sampériz, Penélope[4]; Gil-Romera, Graciela[5]

(1) Pyrenean Institute of Ecology - Spanish National Research Council; (2) Charles University; (3) University of Barcelona; (4) Pyrenean Institute of Ecology - Spanish National Research Council; (5) Pyrenean Institute of Ecology - Spanish National Research Council

Correspondence e-mail: [kilian@ipe.csic.es]

A major milestone in global change research is tracing conservation baselines aligned with ecosystem resilience, especially in long-standing ecological debates, such as the natural versus anthropogenic drivers of open ecosystems. The general lack of robust land cover data over centennial to millennial timescales has hindered answers to this debate. Palaeoecological tools like fossil pollen have often produced biased results due to the non-linear relationship between pollen remains and vegetation cover.

Quantitative reconstruction of past vegetation cover from pollen data requires a pollen-vegetation calibration using present-day data. For the first time in the Spanish Territory of Iberia, we calculated relative pollen productivity (RPP) estimates for 50 taxa. We combined modern vegetation data with 1,147 pollen samples from the European Modern Pollen Database (EMPD) across the Iberian Peninsula and used the REVEALS model to derive the RPPEs. These estimates were then applied to a fossil sequence from the central Pyrenees, enabling the reinterpretation of forest evolution on a centennial timescale.

The new RPP estimates for trees and herbs have provided key insights into forest versus open ecosystem dynamics. These estimates refine our understanding of vegetation changes over time, offering a more accurate framework for interpreting past forest cover. This work contributes to palaeoecological knowledge and enhances our understanding of ecosystem resilience to natural and anthropogenic changes.

[GSC-O-16]

Thursday 5, morning (first): 11:45
Room: Restaurante

Long term trends in greening of a mountain grassland: integrating fine scale herbivore foraging with vegetation and climate

Rincon-Madroñero, Marina[1]; Sánchez-Zapata, Jose Antonio[2]; Morant, Jon[3]; M. Barbosa, Jomar[4]

(1) Universidad Miguel Hernández; (2) Universidad Miguel Hernández; (3) Universidad Miguel Hernández; (4) Universidad Miguel Hernández

Correspondence e-mail: [mrincon@umh.es]

A global trend towards greening of terrestrial ecosystems has been detected since the 1980s, with regional variations. These regional differences highlight the importance of considering factors like forest demography and differences pasture management. This study focuses on a Mediterranean grassland in Los Campos de Hernán Perea, part of the Cazorla, Segura, and Las Villas Natural Park (SE Spain). This area, characterized by well-preserved transhumant livestock grazing traditions, offers a unique setting to examine how herbivory influences vegetation trends and climate responses. This study aims to investigate how herbivory modulates both trends and vegetation responses to climate at a fine scale. Using GPS data from 30 sheep herds (2021–2023), we developed an herbivory index map for the study area. We divided the area into 500×500 m grids and added an herbivory index value. We obtained the NDVI vegetation series (1985–2024) and their relation with precipitation and temperature using MARSS models. Vegetation trends were determined with the Theil-Sen estimator, and Bayesian logarithmic models explored the relationships between herbivory and (1) vegetation trends, (2) precipitation, and (3) temperature. The results show a predominantly positive vegetation trend (greening), with no negative trends (browning) for any grid cell. However, a negative relation was observed between herbivory intensity and vegetation trends, indicating that higher herbivory reduces greening. Herbivory was positively correlated with precipitation and negatively with temperature. In conclusion, this region exhibits generalised greening modulated by herbivory, which plays a crucial role in regulating vegetation responses to climate variables and vegetation trends.

[GSC-O-17]

Thursday 5, morning (first): 12:00
Room: Restaurante

When seasons change, so does defense: plant sex-driven herbivory in Pistacia lentiscus

Valdés Correcher, Elena[1]; Calvo, Gemma[2]; Rigueiro, Cristina[3]; Lago-Núñez, Beatriz[4]; Jordano, Pedro[5]; Moreira, Xoaquín[6]

(1) Estación Biológica de Doñana, EBD-CSIC, Sevilla, Spain; (2) Estación Biológica de Doñana, EBD-CSIC, Sevilla, Spain; (3) Estación Biológica de Doñana, EBD-CSIC, Sevilla, Spain; (4) Misión Biológica de Galicia (MBG-CSIC), Pontevedra, Galicia, Spain; (5) Estación Biológica de Doñana, EBD-CSIC, Sevilla, Spain; (6) Misión Biológica de Galicia (MBG-CSIC), Pontevedra, Galicia, Spain

Correspondence e-mail: [elena.valdes.correcher@gmail.com]

Dioecious plants often exhibit sex-specific differences in growth and defense due to contrasting reproductive strategies. Females typically allocate more resources to reproduction, potentially enhancing defenses, while males may invest more in growth, making them more susceptible to herbivory. However, recent research suggests that these patterns can change throughout the growing season due to dynamic shifts in resource allocation. In this study, we investigated the effects of plant sex on herbivory and defense traits in the dioecious shrub Pistacia lentiscus across the growing season at Doñana National Park. We monitored 100 plants (53 females, 47 males) at two sites during early and late growing seasons, measuring insect herbivory and leaf traits associated with herbivore resistance, including phenolic concentrations and specific leaf area (SLA). Herbivory was consistently higher in males, particularly during the late season, while seasonal changes significantly influenced leaf traits but did not fully explain herbivory patterns. A significant interaction between plant sex and season highlighted males' increased susceptibility later in the season. These findings underscore the importance of incorporating temporal dynamics when studying sex-specific plant-herbivore interactions, revealing complex defense strategies shaped by both sex and seasonal resource allocation.

[GSC-O-18]

Thursday 5, morning (first): 12:15
Room: Restaurante

A conceptual model of coastal dune ecology in arid climate zones

Castaño-Rodríguez, Beatriz[1]; Hernández-Cordero, Antonio I.[2]; Gallego-Fernández, Juan B.[3]

(1) Universidad de Las Palmas de Gran Canaria; (2) Universidad de Las Palmas de Gran Canaria; (3) Universidad de Sevilla

Correspondence e-mail: [beatriz.castano@ulpgc.es]

The environmental conditions that control the composition and abundance of vegetation and its spatial distribution pattern in arid-climate dunes are poorly understood, in contrast to dunes in tropical and temperate climates. This study aims to develop a spatially explicit conceptual model that integrates the main environmental factors (sand mobility, salinity, distance from the coast and topography) and the precise location of plant individuals. The study area consisted of a 100 x 400 m plot located on the sea-land gradient in the dune system of Famara, Lanzarote (Canary Island, Spain). A digital elevation model was obtained by drone flight. A digital model of sand mobility was obtained using LiDAR data (2009 and 2015) from the Spanish National Geographic Institute. Electrical conductivity was measured in soil samples and a digital salinity model was generated. All nebkhas (discrete dunes formed by sand deposition around isolated or discrete plants) were geolocated using differential GPS, and species composition and abundance were recorded. Species richness and the Shannon index were also calculated. The results show that species composition and abundance are primarily determined by sand mobility. All species are perennial and salt-tolerant. The most mobile areas show larger nebkhas formed by a single species, Traganum moquinii. As mobility decreases, the number of nebkhas increases and their size decreases, supporting more diverse vegetation. Our model highlights the importance of studying the vegetation pattern of arid-climate dunes along mobility gradients from beach to inland.

GSC. Posters

[GSC-P-1]

Tuesday 3
Discussion corner: Room 10

Regenerative traits dynamics and interplay in post-fire-shrublands of NW Spain

García-Duro, Juan[1]; Pesqueira Cameselle, Xosé Manoel[2]; Muñoz Espasandín, Ana[3]; Álvarez Fernández, Rebeca[4]; López Marcos, Daphne[5]; Martínez-Ruiz, Carolina[6]; Reyes Ferreira, Otilia[7]; Casal Jiménez, Mª Mercedes[8]

(1) ETSIIAA Palencia. UVa; (2) Department of Functional Biology. Faculty of Biology. University of Santiago de Compostela. Spain; (3) Department of Functional Biology. Faculty of Biology. University of Santiago de Compostela. Spain; (4) Department of Functional Biology. Faculty of Biology. University of Santiago de Compostela. Spain; (5) Sustainable Forest Research Institute (iuFOR); (6) Sustainable Forest Management Research Institute (iuFOR). University of Valladolid; (7) Department of Functional Biology. Faculty of Biology. University of Santiago de Compostela. Spain; (8) Department of Functional Biology. Faculty of Biology. University of Santiago de Compostela. Spain

Correspondence e-mail: [juan.garcia.duro@uva.es]

The resilience of the plant communities in burned environments is essential to minimize fire impacts. However, the response of the vegetation is not easily predicted because every plant species and the community respond in many different ways depending on the fire intensity, the status of the vegetation before the fire, and the environment.

The species functional traits have been found to provide valuable information about the species behaviour in many different situations and, among them, the regenerative traits. However, the way how the different traits succeed and integrate in the post-fire communities needs to be understood. Within this context, our objective is to deepen into the relationship among the main regenerative traits and the patterns of the different assemblies in different environments in a transition from Atlantic to Mediterranean areas in NW Spain. We identified shrublands burned from 2005 to 2007 in NW Spain and we measured by linear cover estimates the vegetation change over time in 26 permanent sampling stations covering different environmental gradients. We found different recovery patterns and different ecological preferences consistent with the functional-regenerative types of the dominant species. The species that recovered exclusively or mostly by seeds after fire tend to recover successfully, but slower than the vigorous and intermediate resprouters. Resprouters and seeders showed differences in abundance and changed roles over different environmental gradients investigated. The abundance and dominance of the main regenerative groups revealed strong mutual interactions, determining the recovery of the whole vegetation.
Funding: CONVREC-2021-11 Next Generation UE, MICIU/AEI/10.13039/501100011033/FEDER, UE

[GSC-P-2]

Wednesday 4
Discussion corner: Room 11

A longstanding coexistence between pine and oaks: Phylogenetic congruence or not?

Escudero, Adrián[1]; Poyatos, Cristina[2]; de la Cruz, Marcelino[3]; Illuminati, Angela[4]; Núñez, Sergio[5]; Pescador, Davis S.[6]; Sánchez, Ana[7]

(1) Instituto de Investigación en Cambio Global (IICG URJC); (2) IICG URJC; (3) IICG URJC; (4) IICG URJC; (5) IICG URJC; (6) Facultad de Farmacia, UCM; (7) IICG URJC

Correspondence e-mail: [adrian.escudero@urjc.es]

Introduction. Cooccurrence at fine scales reflects the existence of a common ground for evolution. Pines and oaks coexist along their global distributions although they have different evolutive histories. Our hypothesis is that co-occurring pines and oaks are complementary in functional terms conforming an evolutive complex -co-evolution- that would be able to maximize niche separation in realized assemblages. If true, it would be expected a certain phylogenetic congruence between coexisting pine and oaks.

Material and methods. We collected globally forest inventories with dominance of pine and/or oaks to evaluate how coexistence patterns between both genera may be reflecting their evolutive history. Each inventory comprised environmental but also tree information such as total richness and cover. Each species was characterized with its functional information, its global distribution and, also, with its historical origin from the available phylogenies.

Results and discussion. Preliminary results suggest that pine and oaks are not only functionally coordinate along their vast distribution ranges, but also phylogenetically suggesting a common history of coexistence and evolution.

[GSC-P-3]

Thursday 5
Discussion corner: Room 11

Assessing the contribution of deterministic vs. stochastic processes to local plant species assembly: a field experiment in a gypsum system

Ferrandis Gotor, Pablo[1]; Ortiz, Laura[2]; Luzuriaga, Arantzazu L.[3]

(1) Instituto Botánico de la Universidad de Castilla-La Mancha; (2) Instituto de Investigación en Cambio Global (IICG – URJC); (3) Instituto de Investigación en Cambio Global (IICG – URJC)

Correspondence e-mail: [pablo.ferrandis@uclm.es]

Introduction. The theoretical, long-standing debate around processes involved in species assembly has generated a conceptual gradient from deterministic to stochastic postulates. Nowadays, there is a broad consensus that both process types participate in the conformation of communities. However, the actual weight of each opposing assumptions on species assembly remains underexplored. We experimentally assessed the contribution of deterministic vs. stochastic processes to the assembly of annual-dominated plant communities in a semiarid gypsum system.

Material and methods. We setup a field experiment in a semiarid gypsum steppe in central Spain to test the effects of seed arrival (stochastic event) and the main biotic components in the system (deterministic filtering) on plant assembly. We replicated paired 50 x 50 cm plots, 3-cm deep excavated and then filled with either seed-free soil from a quarry or homogenized natural soil with the complete seed bank, under the influence of two biotic scenarios: biocrust (seed-free intact pieces) and Macrochloa tenacissima tussocks, using open areas as control. We sampled assemblages in plots (composition, species richness and cover) during four consecutive springs.

Results and discussion. Stochastic processes prevailed over deterministic biotic filtering in the assembly of our plant community, largely dominated by ephemeral annuals. Although biotic scenarios decisively affected richness and cover in assemblages, experimental treatments did not clearly select neither functional nor compositional patterns. The study temporal series was rainy, suggesting that the relaxation of the main abiotic factor may attenuate small-scale biotic filtering effects on the assembly process, according to a hierarchical filtering model.

[GSC-P-4]

Tuesday 3
Discussion corner: Room 11

Modelling the patterns of use of space and dominant behaviours of a Geomalacus maculosus population core: influence of habitat and climate

Machado, Mara[1]; Rodrigues, Sylvia[2]; Santos, Mário[3]; Cabral, João Alexandre[4]

(1) Laboratory of Fluvial and Terrestrial Ecology (LEFT); (2) Laboratory of Fluvial and Terrestrial Ecology (LEFT); (3) Laboratory of Fluvial and Terrestrial Ecology (LEFT); (4) CITAB/Inov4

Correspondence e-mail: [maralmachado7@gmail.com]

Introduction. Biodiversity conservation requires structurally complex and functional ecosystems in terms of macrohabitats and microhabitats. In reality, fragmentation, destruction and loss of habitat are also the main causes of biodiversity degradation in biological micro-communities at a global level.

Geomalacus maculosus is a slug that belongs to the Arionidae family and can be found in damp places during most of the year if the conditions of temperature and humidity are the ideal. Since it is associated with extremely specific environmental conditions, namely climate and microhabitats, this species may function as an ecological indicator of the integrity of these systems.

Material and methods. To develop the model, were used data collected between July 2011 and June 2012 in Borbela, parish of the municipality of Vila Real. During this period, field trips were made to record the behaviour of individuals in 2 segments of a granite wall. Additionally, surveys of the micro-habitat characteristics and climatic conditions were carried out.

Results and discussion. In this study, we have developed a reductionist Agent Based Model (ABM) capable of recreating the activity of Geomalacus maculosus in a virtual environment, replicating the observed microhabitats, enabling to mimic the use of space patterns and behavioural characteristics of the species in different environmental conditions. We then compared the predicted variables with the know variables to validate the ABM model, that could be used to forecast the results of conservation actions.

[GSC-P-5]

Wednesday 4
Discussion corner: Room 11

Bird and mammal communities across a gradient of forest integrity: native oak forests, intensive eucalypt plantations, and mixed habitats in between

Velo-Antón, Guillermo[1]

(1) Universidad de Vigo

Correspondence e-mail: [guillermo.velo@uvigo.gal]

The forestry industry often relies on monocultures of exotic species, with Eucalyptus spp. being one of the most important genera. Their recent large-scale expansion, beginning in the mid-20th-century and driven by the growing demand in the paper industry, has led to plantations in over 100 countries outside their native range. Among these, Eucalyptus globulus is dominant in temperate regions, particularly in Spain and Portugal. The establishment of forestry monocultures replaces natural and seminatural habitats, altering local biodiversity. Additionally, E. globulus can spread naturally, especially after fires, and abandoned or poorly managed plantations often develop into mixed habitats with native vegetation. This phenomenon is particularly evident in SW Galicia, NW Spain, where rural abandonment has promoted the expansion of native forests, Eucalyptus plantations, and mixed habitats. Our study investigates the capacity of these habitats to support vertebrate communities, comparing four habitat types representing a gradient of disturbance and ecological integrity: native oak forests (OakFor), mixed oak-eucalypt forests (OakEucFor; oak-dominant), mixed eucalypt plantations (EucOakPla; eucalypt-dominant), and intensive eucalypt plantations (EucPla). In spring 2024, we used camera traps and audio recorders to monitor mammals and birds, across 40 patches (10 per habitat type). Preliminary results suggest reduced diversity and abundance in EucPla. In contrast, mixed habitats (OakEucFor and EucOakPla) showed diverse and abundant communities, unveiling their potential in maintaining biodiversity. Notably, even eucalypt-dominated stands, when mixed with oaks and other trees, supported rich communities. Further analyses will explore species and functional composition to understand patterns of success across habitats.

TECHNICAL SESSIONS

TSC.1. Ecosystem functioning: from individual to food web levels

Thursday, 5 (12:45-14:15)

Room: Restaurante

Thursday, 5 (15:30-17:00)

Room: Seminario 6

Identifying the mechanisms responsible for ecosystem functioning is a keystone in ecology, as it implies unravelling energy fluxes among organisms and with their environment. Understanding ecosystem functioning can be explored using different biological levels, i.e. from organismal energy use – how individuals allocate metabolic energy for production and survival – to the food web level – feeding links and energy trophic transfer. This thematic session aims to consider important aspects of trophic complexity and stability, including connectance, omnivorous role, intraguild predation, and metabolic scaling, which are responsible of ecosystem functioning across freshwater, marine and terrestrial habitats. The session encompasses a wide range of approaches, including stable isotope research, allometric scaling rules, and energy budget models, utilizing diverse experimental, field-based, and theoretical study designs. Ecosystem integrity is being threatened by current human-driven changes, bringing novel research questions to be formulated and tested, such as how ecological systems are shaped in terms of energy fluxes, and feeding links, and how they respond to new environmental conditions. This matter involves the entire scientific community and will be addressed in the proposed session.

Organizers:

• **Ignasi Arranz Urgell,** Instituto de Investigación en Cambio Global (IICG-URJC), Universidad Rey Juan Carlos

• **Javier Sánchez-Hernández,** Instituto de Investigación en Cambio Global (IICG-URJC), Universidad Rey Juan Carlos

• **Guillermo García-Gómez,** Instituto de Investigación en Cambio Global (IICG-URJC), Universidad Rey Juan Carlos.

TSC.1. Orals

[TSC.1-O-1]

Thursday 5, morning (second): 12:45
Room: Restaurante

Anthropogenic and environmental drivers of size spectra across marine and freshwater ecosystems

Evangelista, Charlotte[1]; Arranz, Ignasi[2]; Ersoy, Zeynep[3]

(1) Norwegian Institute for Nature Research (NINA), Trondheim, Norway; (2) Universidad Rey Juan Carlos, Campus de Móstoles, 28933, Madrid, Spain; (3) Universidad Rey Juan Carlos, Campus de Móstoles, 28933, Madrid, Spain

Correspondence e-mail: [charlotte.evangelista@nina.no]

The size spectrum (hereafter SS) represents the relationship between abundance (or biomass) and individual body size. Size spectrum parameters, such as the slope or the intercept, have been widely used as ecological indicators of community and food-web structure. While SS patterns have been studied across various aquatic ecosystems and taxa, we lack a comprehensive synthesis that is key to (i) identifying common responses to environmental drivers among aquatic ecosystems and (ii) assessing key drivers of SS in different taxonomic groups. We compiled a unique global database of 8,459 size spectrum slopes or exponents, 5,237 intercepts and 4,497 linearity coefficients from 127 articles and grey literature. The GLOSSAQUA database includes mainly heterotrophic communities composed of single (e.g., zooplankton, macroinvertebrates or fish) to multi-taxa groups (e.g., from primary consumers to apex predators), across diverse spatial and temporal scales, from surveys in freshwater (43%), marine (52%) and brackish (5%) ecosystems. We then used GLOSSAQUA to assess the SS responses to latitudinal gradients across different trophic levels, biogeographical realms, and aquatic ecosystems. Using external databases, we also investigated the influence of climate (temperature) and anthropogenic (human footprint) factors on global SS patterns. Specifically, we tested whether more negative slopes (i.e., greater relative abundance of small-sized individuals) were associated with warmer climates or lower latitudes and areas with high human impact. Our results may reveal global patterns in size-based communities and food webs, which could help to identify key regions vulnerable to climate change and human footprint.

[TSC.1-O-2]

Thursday 5, morning (second): 13:00
Room: Restaurante

Disentangling complexity in ecosystem services: a multilayer approach for understanding pest control by birds and spiders in apple orchards

García, Daniel[1]; Jiménez-Albarral, José Javier[2]; Morán-López, Teresa[3]; Vitali, Agustín[4]; Illera, Juan Carlos[5]; Miñarro, Marcos[6]; Hambäck, Peter[7]

(1) Universidad de Oviedo; (2) Servicio de Investigación y Desarrollo Agroalimentario de Asturias; (3) Universidad de Oviedo; (4) Ben-Gurion University; (5) Instituto Mixto de Investigación en Biodiversidad IMIB; (6) Servicio de Investigación y Desarrollo Agroalimentario de Asturias; (7) Stockholm University

Correspondence e-mail: [danielgarcia@uniovi.es]

Animal-derived ecosystem services frequently emerge from complex interactions between species at different trophic levels. This is the case of pest control by different natural enemies (e.g. vertebrates and arthropods), whose outcome depends on pest predation by the different animals but also on intraguild predation that may ultimately release pests. Here, we address pest control by birds and spiders on apple orchards in northern Spain by building a multilayer network with interactions detected through DNA-metabarcoding of bird and spider gut contents. We classified interspecific interactions into four types: direct predation (birds or spiders preying exclusively on pests), intraguild predation (birds preying on spiders that consume pests), trade-off interactions (birds preying on both pests and spider predators of the same pest), and bird-spider interactions (birds preying on spiders that do not eat pests). Bird direct pest predation accounted for 33% of interactions. Intraguild predation accounted for 46% of interactions, and trade-off interactions for 11%. Bird-spider interactions represented 10% of interactions. A similar interaction allocation pattern was found for pests, for which spider direct predation represented 5% of interactions. The relative proportions of interactions accounted by the different bird species were positively correlated among interaction types, leading to strong differences in bird centrality in the multilayer network. Conversely, in the case of pest species, those more involved in spider predation, intraguild predation and trade-off interactions were less affected by bird direct predation. This led to significant modularity in the multilayer network, underscoring the complexity of pest control processes in agroecosystems.

[TSC.1-O-3]

Thursday 5, morning (second): 13:15
Room: Restaurante

Warming-driven shifts in size spectra alter predator-prey mass ratios in stream fish communities

Arranz, Ignasi[1]

(1) Universidad Rey Juan Carlos

Correspondence e-mail: [ignasi.arranz@urjc.es]

Introduction. Ecological communities are facing important changes induced by human activities. The size spectrum has emerged as an integrative approach to quantify the responses of ecological systems to global changes and explain key trophic functions, such as the predator-prey mass ratio (PPMR). However, empirical assessments of the association between PPMR and size spectrum are still lacking. In this study, we analyzed the spatial variations in size spectrum and PPMR in stream fish communities, and to tested whether global change factors, including climate warming and human footprint, modulate the relationship between size spectrum and PPMR.

Material and methods. We used a unique dataset containing individual body size data (n = 12,763) and stable isotope values (n = 2,048) of fish from 54 streams across France.

Results and Discussion. The results showed that climate warming and stream temperature interacted with the size spectrum to explain changes in PPMR. Specifically, in streams with significant temperature increases over the last decades, the size spectra were positively linked to PPMR. In streams with low temperature increases, the size spectra negatively affected PPMR. Our findings also revealed that high human footprint values negatively impacted PPMR, reducing predation pressure on prey. These results suggest that warming may further intensify the top-down control exerted by predators on ecological communities, likely due to the increased energetic demands of predatory fish in warmer environments, reducing predation pressure on prey and ultimately disrupting the stability of ecosystem functioning.

[TSC.1-O-4]

Thursday 5, morning (second): 13:30
Room: Restaurante

What drives synergies and trade-offs between ecosystem functions?

Monfort Calatayud, Marta[1]; Sebastián González, Esther[2]; Soliveres Codina, Santiago[3]

(1) University of Alicante; (2) University of Alicante; (3) University of Alicante

Correspondence e-mail: [marta.monfort@ua.es]

Ecosystem functions, defined as ecological processes occurring within ecosystems, are fundamental to ecosystem maintenance and service provision. Multifunctionality, the capacity of ecosystems to simultaneously deliver multiple functions and services, has gained significant attention in recent ecological research. However, different functions are not independent from each other, with clear evidences of synergies and trade-offs amongst them, and the ecosystem service context, often used in management and policy-making, often amalgamates a variety of functions that may or may not respond similarly to the same environmental changes. We investigated the interrelationships between multiple ecosystem functions to identify patterns in their associations, to identify those that often correlate positively (synergies) and does that cannot be reached at high levels simultaneously (trade-offs), and to evaluate the environmental and anthropogenic predictors (climate, biome type, plot size and number, etc) that drive these relationships. We also tested if those functions associated to a given ecosystem service present synergies more often than those belonging to different services. To do so, we conducted a meta-analysis of correlations between ecosystem functions extracted from existing literature. Our preliminary results from a lineal model suggest that the biome could significantly influence the correlation value between the ecosystem functions, so we expect that other climatic variables also have an effect. This research seeks to contribute to the growing body of knowledge on ecosystem multifunctionality and its environmental drivers, providing insights for ecosystem management strategies in the context of global change.

[TSC.1-O-5]

Thursday 5, morning (second): 13:45
Room: Restaurante

Energy mobilisation in food webs of mountain lakes

Sánchez Hernández, Javier[1]; García Gómez, Guillermo[2]; García–Astillero, A, Ariadna[3]; Jiménez Corbacho, Carlos[4]; Arranz Urgell, Ignasi[5]

(1) Universidad Rey Juan Carlos; (2) Universidad Rey Juan Carlos; (3) Universidad Rey Juan Carlos; (4) Universidad Rey Juan Carlos

Correspondence e-mail: [javier.sanchezh@urjc.es]

Introduction. Energy mobilisation within lacustrine food webs can occur through autochthonous (pelagic and littoral) or allochthonous pathways although is not yet resolved the main energy mobilisation routes that regulate food web stability and structure.

Material and methods. We explore energy mobilisation routes in lacustrine food webs through a holistic approach. We conducted three consecutive sampling campaigns in September between 2022 and 2024 in Gredos and Sanabria mountain lakes Specifically, we consistently sampled from basal resources to fish following standardised sampling protocols.

Results and discussion. In lakes affected by anthropogenic eutrophication, we observed elevated d15N levels and constrained d13C values at lower trophic levels. Stomach content analyses revealed that apex predators in these food webs predominantly consumed terrestrial (allochthonous) invertebrates. In contrast, long-term (stable isotope analysis) dietary tracers from bayesian mixing models indicated that apex predators relied more heavily on autochthonous resources. The seasonal importance of aquatic versus terrestrial resources appeared flexible, shifting from aquatic to terrestrial invertebrates. This transition likely corresponds to the phenology of aquatic insects, which typically emerge during spring and early summer, and the increased availability of terrestrial invertebrates later in the summer as they become more accessible to apex predators. Apex predators can facilitate cross-ecosystem fluxes in lacustrine lakes through consumption of terrestrial carbon sources, showing that freshwater and terrestrial ecosystems are functionally connected by trophic resources migrating between them.

[TSC.1-O-6]

Thursday 5, morning (second): 14:00
Room: Restaurante

The role of tadpoles in temporary ponds

Monreal Rodríguez, Adrián[1]; Díaz-Paniagua, Carmen[2]; Gomez-Mestre, Ivan[3]

(1) Estación Biológica de Doñana; (2) Estación Biológica de Doñana; (3) Estación Biológica de Doñana

Correspondence e-mail: [adrian.monreal@ebd.csic.es]

Anuran tadpoles play important ecological roles in freshwater systems, altering algal and zooplankton communities, nutrient cycling, enhancing litter decomposition or being prey to other organisms. In addition, tadpoles may also feed on aquatic macrophytes, which are key in the functioning of these systems, not only as primary producers but also providing structural complexity. However, little is known about tadpole-macrophyte interactions. Focusing on temporary ponds of Southern Spain, we experimentally assessed the effect of larvae of 7 anuran species on the macrophyte composition and physico-chemical characteristics of temporary ponds. We conducted a series of mesocosm experiments to simulate temporary ponds where we tested the effects of each amphibian species on aquatic vegetation, nutrient concentration, water physico-chemistry and zooplankton. We found that Pelobates cultripes and Pelodytes ibericus significantly reduced the total macrophyte biomass, almost depleting all and by 23 %, respectively. They also increased water turbidity, by 58 and 81%, and decreased oxygen concentrations, by 15 and 11%. Five species altered the plant species composition , mostly by reducing the biomass of Callitriche sp. by herbivory. Pelodytes ibericus also increased the biomass of Potamogeton sp., probably indirectly by feeding on attached periphyton or other competing plants. These results show how different tadpole species play different ecological roles and highlight the importance of considering them when trying to understand the functioning of these systems, especially in the case of the species strongly impacting the aquatic vegetation, given the drastic changes they induce to the whole system.

[TSC.1-O-7]

Thursday 5, after lunch (third): 15:30
Room: Seminario 6

Sexual differences in energy use among ectotherms: does resource availability matters?

Garcia Gomez, Guillermo[1]; Arranz Urgell, Ignasi[2]

(1) Universidad Rey Juan Carlos; (2) Universidad Rey Juan Carlos

Correspondence e-mail: [guillegar.gz@gmail.com]

Introduction. Since Darwin's pioneering work on sexual selection, a handful of studies have investigated differences in life-history traits between sexes, i.e. sexual dimorphism. Yet, sex-related variation in energy use has remained largely unexplored, despite this variation may reflect differences in resource allocation among life functions. Theory predicts that resource availability may constrain the extent to which sexes differ in energy-demanding traits. We here aim at quantifying sexual dimorphism in energy use among wild ectotherm populations. We hypothesise that, while sexual differences in energy use are primarily underpinned by sexual selection, the magnitude of such differences may be ultimately imposed by resource availability.

Material and methods. We retrieved data through a systematic search that included peer-reviewed literature as well as public and on-request databases. We assess sexual differences in energy use by estimating three traits: (i) average body mass, (ii) body shape, and (iii) body mass-scaling of metabolic rate estimated by Maximum Entropy Models. We quantify sexual differences using sexual dimorphism indexes (SDI), calculated as the ratio between larger and smaller trait values. We will conduct Bayesian mixed-effects models to test for changes in SDI of the body traits across resource gradients.

Results and Discussion. We found over 200 data sources containing body mass and length records of sexed individuals, which yielded so far ca. 9000 sampling events, comprising mostly fish and aquatic invertebrates. Overall, our work emphasises the need for a comprehensive analysis to better understand how the environmental context influences sexual dimorphism of species adapting to a rapid-changing world.

[TSC.1-O-8]

Thursday 5, after lunch (third): 15:45
Room: Seminario 6

Global patterns in freshwater microcrustacean zooplankton body-size distributions across environmental gradients

Ersoy, Zeynep[1]; Bruel, Rosalie[2]; Calderó-Pascual, Maria[3]; Barth, Lauren E.[4]; Anton-Pardo, Maria[5]; Baludo, Marjohn Y.[6]; Bartrons, Mireia[7]; Bernard, Anaëlle[8]; Beyer, Jessica E.[9]; Bizani, Mfundo[10]; Blackburn-Desbiens, Pénélope[11]; Brucet, Sandra[12]; Carey, Cayelan C.[13]; Chaguaceda, Fernando[14]; Chen, Huihuang[15]; Christoffersen, Kirsten S.[16]; Cortes, Alicia[17]; de Eyto, Elvira[18]; Dimante-Deimantovica, Inta[19]; Doubek, Jonathan P.[20]; Dulic, Zorka[21]; Figary, Stephanie E.[22]; Fischer, Janet M.[23]; Forasaco, Elena[24]; Gal, Gideon[25]; García-Girón, Jorge[26]; Ger, Kemal A.[27]; Gjoni, Vojsava[28]; Gray, Emma[29]; Grosbois, Guillaume[30]; Gutierrez, María F.[31]; Halabowski, Dariusz[32]; Hambright, K. David[33]; Harris, Ted D.[34]; Hovel, Rachel A.[35]; Jakobsson, Ellinor[36]; Jensen, Thomas C.[37]; Korponai, Janos L.[38]; La Fuente, Ruth Sofia R.[39]; Lakka, Hanna-Kaisa[40]; Leoni, Barbara[41]; Lepori, Fabio[42]; Lin, Shuqi[43]; López-Vázquez, Mercedes[44]; Mariani, Matias O.[45]; Mccarthy, Valerie[46]; MCelarney, Yvonne R.[47]; Menezes, Rosemberg F.[48]; Merkli, Stefanie[49]; Michaloudi, Evangelia[50]; Montoya, José V.[51]; Moore, Tadhg[52]; Motitsoe, Samuel N.[53]; Napoleoni, Raphaëlle[54]; Nava, Veronica[55]; Nejstgaard, Jens C.[56]; Nelson, Sarah J.[57]; Obetergger, Ulrike[58]; Overholt, Erin P.[59]; Papa, Rey Donne S.[60]; Pilla, Rachel M.[61]; Pomati, Francesco[62]; Rasconi, Serena[63]; Rutio, Milla[64]; Richardson, David C.[65]; Rippey, Brian[66]; Rose, Kevin C.[67]; Rudstam, Lars G.[68]; Rusak, James A.[69]; Santangelo, Jayme M.[70]; Scofield, Anne E.[71]; Seda, Jaromir[72]; Shin-ichiro, Matsuzaki S.[73]; Stochwell, Jason D[74]; Straile, Dietmar[75]; Strecker, Angela L.[76]; Symons, Celia C.[77]; Tanentzap, Andrew J.[78]; Thackeray, Stephen J.[79]; Ungerer, Luke A.[80]; Wander, Heather L.[81]; Webster, Katherine E.[82]; Weyhenmeyer, Gesa A[83]; Znachor, Petr[84]

(1) Universidad Rey Juan Carlos, Madrid, Spain; (2) OFB, DRAS, Aix-en-Provence, France; (3) BETA Technological Center (UVic-UCC), Barcelona, Spain; (4) University of Toronto, Ontario, Canada; (5) University of Valencia, Valencia, Spain; (6) Limnological Institute, Konstanz, Germany; (7) Universitat de Vic, Barcelona, Spain; (8) Private personal institution, Espirat, France; (9) University of Oklahoma, OK, USA; (10) South Africa Environmental Observatory Network (SAEON), Summerstrand, Gqeberha, Eastern Cape; (11) Université du Québec à Chicoutimi, Québec, Canada; (12) Universitat de Vic & ICREA, Barcelona, Spain; (13) Virginia Tech, VA, USA; (14) IMDEA Water Institute, Madrid, Spain; (15) Institute of Urban Environment, Chinese Academy of Sciences, Xiamen, China; (16) University of Copenhagen, Copenhagen, Denmark; (17) University of Califonia Davis, California, USA; (18) Marine institute, Mayo, Ireland; (19) Latvian Institute of Aquatic Ecology, Riga, Latvia; (20) Lake Superior State University, Michigan, USA; (21) University of Belgrade, Faculty of Agriculture, Belgrade, Serbia; (22) Cornell University, Ithaca, NY, USA; (23) Franklin & Marshall College, PA, USA; (24) Imperial College London, London, UK; (25) Israel Oceanographic and Limnological Research, Migdal, Israel; (26) University of Oulu, Oulu, Finland; (27) Universidade Federal do Rio Grande do Norte, Natal, Brazil; (28) University of South Dakota, SD, USA; (29) Atlantic Technological University, Galway, Ireland; (30) Université du Québec en Abitibi-Témiscamingue, Québec, Canada; (31) Instituto Nacional de Limnología, Santa Fe, Argentina; (32) University of Lodz, Lodz, Poland; (33) University of Oklahoma, OK, USA; (34) Kansas Biological Survey, Kansas, USA; (35) University of Maine-Farmington, Maine, USA; (36) Uppsala University, Uppsala, Sweden; (37) Norwegian Institute for Nature Research, Oslo, Norway; (38) University of Public Service, Baja, Hungary; (39) Vrije Universiteit Brussel, Brussels, Belgium; (40) Univerity of Jyväskylä & Kilpisjärvi Biological Station, Jyväskylä, Finland; (41) University of Milano-Bicocca, Milano, Italy; (42) ; (43) ; (44) (45) Instituto Tecnológico de Chascomús, Buenos Aires, Argentina; (46) Dundalk Institute of Technology, Dundalk, Ireland; (47) Agri-Food and Biosciences Institute, Belfast, N. Ireland; (48) Universidade Federal de Paraíba, Paraíba, Brazil;(49) Eawag, Zürich, Switzerland; (50) Aristotle University of Thesaloniki, Thessaloniki, Greece; (51) Universidad de Las Américas, Quito, Pichincha, Ecuador; (52) Limnotrack, Hamilton, New Zealand; (53) University of the Witwatersrand, Johannesburg, Gauteng, South Africa; (54) Asters Conservatoire d'espaces naturels de Haute-Savoie, Pringy, France; (55) University of Milano-Bicocca, Milano, Italy; (56) Leibniz-Institute of Freshwater Ecology and Inland Fisheries (IGB), Stechlin, Germany; (57) Appalachian Mountain Club, Gorham, USA; (58) Research and Innovation Centre, Fondazione Edmund Mach, San Michele all'Adige, Italy; (59) Miami University, Oxford, OH, USA; (60) University of Santo Tomas, Manila, Philippines; (61) Oak Ridge National Laboratory, Tennessee, USA; (62) Eawag, Dübendorf, Zürich, Switzerland; (63) INRAE, Thonon-les-bains, France; (64) Université du Québec à Chicoutimi, Chicoutimi, Québec, Canada; (65) State University of New York at New Paltz, NY, USA; (66) Ulster University, Coleraine, N. Ireland; (67) Rensselaer Polytechnic Institute, NY, USA; (68) Cornell University, NY, USA; (69) Ontario Ministry of the Environment, Conservation and Parks, ON, Canada; (70) Universidade Federal Rural do Rio de Janeiro, Rio de Janeiro, Brazil; (71) U.S. Environmental Protection Agency, IL, USA; (72) Biology Centre CAS, Institute of Hydrobiology, Ceské Budejovice, Czechia; (73) National Institute for Environmental Studies, Tsukuba, Ibaraki, Japan; (74) University of Vermont, Vermont, USA;(75) University of Konstanz, Konstanz, Germany; (76) Western Washington University, Washington, USA; (77) University of California, Irvine, CA, USA; (78) Trent University, Peterborough, Canada; (79) UK Centre for Ecology & Hydrology, Lancaster, Lancashire, UK; (80) Saint Louis University, WATER Institute, Missouri, USA; (81) Virginia Tech, VA, USA; (82) Michigan State University, East Lansing, Michigan, USA; (83) Uppsala University, Uppsala, Sweden; (84) Biology Centre CAS, Institute of Hydrobiology, Ceské Budejovice, Czechia.

Correspondence e-mail: [zzeynepersoy@gmail.com]

Body size is a key functional trait that affects many physiological and ecological processes. In ectotherms, temperature variation strongly influences body size patterns. Consequently, climate change is likely to alter patterns of body size and thus ecosystem function, particularly in size-structured aquatic communities. However, predicting the impacts of a changing climate on aquatic communities is challenging due to interacting pressures (e.g., predation, nutrient enrichment). Therefore, building a comprehensive database of organism body sizes and their associated environmental characteristics is a crucial step toward unraveling the complex interactions between these factors. GLEON ZooSize project was launched in 2021 to create a unique large-scale global database of individual crustacean zooplankton body size measurements and environmental factors from over 300 freshwater lakes to address the following questions: (1) How do zooplankton body size metrics vary across lake thermal regions? (2) How do local environmental factors influence the body size structure and trophic interactions within and across thermal regions? We expect that the response of the zooplankton size structure to environmental stressors will vary across geographical and ecological gradients. For example, lakes in warmer regions with more intense fish predation and nutrient enrichment will have a greater relative abundance of small-bodied zooplankton and less variation in size structure, altering trophic interactions. Our unique dataset will contribute to a better understanding of how climate impacts global patterns of freshwater zooplankton and how body size can be used as an indicator of ecological status in the conservation and restoration of lakes worldwide.

[TSC.1-O-9]

Thursday 5, after lunch (third): 16:00
Room: Seminario 6

Stoichiometric mismatch of Armadillidium vulgare drives compensatory feeding, stoichiometric shifting, and differential assimilation

Abelho, Manuela[1]; Molles, Manuel C.[2]

(1) Research Centre for Natural Resources, Environmental and Society - CERNAS; (2) University of New Mexico

Correspondence e-mail: [abelho@esac.pt]

Ecological stoichiometry offers important insights into how the elemental composition of food resources affects their consumers. As plant detritus is typically comprised of refractory, carbon-rich and nutrient-limited compounds, detritivorous consumers face a challenge to meet their nutritional demands and developed strategies to decrease the imbalance between the elemental composition of their bodies and that of their food resources. Here we evaluate if Armadillidium vulgare, a common and widespread detritivorous invertebrate, compensates for the elemental imbalance of food resources. We assessed consumption, growth and survival with five food resources varying in C:N:P ratios in a 4-week feeding experiment, and measured C:N:P ratios in the food resources, the consumers, and their faeces. The results indicate that A. vulgare uses three complementary strategies to deal with low-quality food resources: (1) stoichiometric shift in C:N ratio, (2) compensatory feeding to maximize intake of N and P, and (3) differential assimilation of P during digestion. Somatic C:N ratios increased with increasing C:N ratios, but not with C:P or N:P ratios of the food resources. There was increased consumption of food resources with low C:N and C:P ratios to take advantage of an abundant source of nutrients, and there was increased consumption of high C:N and C:P food resources to compensate dietary deficiencies. Finally, A. vulgare selectively assimilated phosphorus, but not nitrogen, from the ingested food, producing faeces with C:P and N:P ratios unrelated to the respective ratios of the food resources and maintaining somatic C:P and N:P ratios relatively constrained. Although there was still a mismatch between the elemental composition of their bodies and that of their food resources, these compensatory mechanisms are probably one of the reasons for the success of these detritivorous invertebrates worldwide.

[TSC.1-O-10]

Thursday 5, after lunch (third): 16:15
Room: Seminario 6

Shifts in species roles and interaction patterns between a nearly pristine and a disturbed island

Parejo, Sandra[1]

(1) IMEDEA (UIB-CSIC)

Correspondence e-mail: [shparejo@gmail.com]

Ecosystems are supported complex and dynamic networks of species interactions, shaped by both biotic and abiotic factors, and understanding their functioning is challenging due to their intricate and ever-evolving nature. Global change exacerbates this complexity by increasing variability and disrupting ecosystem processes. Islands, with their distinct boundaries and simplified ecosystems, provide unique opportunities to study ecological complexity and network dynamics. In this study, we used metabarcoding to reconstruct the food webs a relatively undisturbed, uninhabited island and a nearby, disturbed inhabited island within the Cabrera Archipelago National Park (Balearic Islands, Western Mediterranean) and compare their structure. Using motif analysis and U-statistics, we construct network profiles that reveal species roles and the underlying patterns of ecological interactions. We also employ null models to assess network dissimilarity, allowing us to evaluate the effects of disturbance on interaction patterns and community resilience. The food web of the uninhabited island display lower species redundancy and greater specialization, leading to a less robust and less resilient ecological network. In contrast, on the disturbed island, invasive species and altered species interactions disrupt network connectivity and shift species roles. Our findings provide valuable insights into how disturbance influences ecological networks and ecosystem resilience, which can inform conservation strategies aimed at protecting vulnerable island-like habitats.

[TSC.1-O-11]

Thursday 5, after lunch (third): 16:30
Room: Seminario 6

Soil microbial communities control plant-plant competition

Pugnaire, Francisco I.[1]; Kindler, Christian[2]
(1) EEZA-CSIC; (2) EEZA-CSIC
Correspondence e-mail: [fip@eeza.csic.es]

Microbes influence many ecological processes that affect plant community dynamics, but whether they influence plant competition is unclear. We established an experiment to clarify the role of soil microbial communities (SMC) associated to different plant species on plant competition. We used Lycium intricatum and Maytenus senegalensis growing in inter- and intra-specific competition. Plants, raised from sterilized seeds, were added with soil extracts collected in the field under either species with a factorial design. We found that Lycium was largest growing with Maytenus and added with Lycium extracts. When both extracts were added together, Lycium plants were smallest. Lycium grew overall significantly less when in intra-specific competition, with the same pattern regarding added extracts. Maytenus individuals were overall much smaller than Lycium plants, but their responses to competition and soil extracts paralleled that of Lycium, growing largest in intra-specific competition when added with its own extracts, followed by plants added with Lycium extracts. When both extracts were added together, growth was again smallest. Similar patterns were recorded under inter-specific competition, which was stronger than intra-specific competition. Our data show that SMC had a clear effect on plant-plant competition, plants growing more with extracts from their soil of origin and less when extracts were mixed. These data evidence that SMC assembled by each plant species compete when plants grow in close proximity, and that the outcome of microbial competition greatly influences the outcome of plant-plant competition, suggesting that the holobiont concept must be taken into consideration when addressing plant-plant interactions.

[TSC.1-O-12]

Thursday 5, after lunch (third): 16:45
Room: Seminario 6

Contrasting effects of plant invasion and climate on plant diversity across a large elevation and aridity gradient in Southern Europe

Navarro López, Sara[1]; Onoszko, Katherine[2]; Bernal Borrego, Jessica[3]; Nieto Lugilde, Diego[4]; González Moreno, Pablo[5]
(1) Universidad de Córdoba; (2) Universidad de Córdoba; (3) Universidad de Córdoba; (4) Universidad de Córdoba; (5) Universidad de Córdoba
Correspondence e-mail: [b62nalos@uco.es]

An important consequence of human activities at global scale is species' (un)intentional migration, facilitating access of non-native species to new habitats. The naturalization of non-native species might negatively affect native species, altering the functioning of the ecosystems, and causing biodiversity loss. Ecosystems located at the extremes of environmental gradients are among the few ecosystems in the world that have not yet been heavily invaded by non-native plants. However, studies based on the Mountain Invasion Research Network (MIREN) show that non-native species are increasingly reaching higher altitudes. This study tests for the first time the plant invasion patterns in the Mediterranean mountains, considering both a large elevation and aridity gradient (~2700m). We set 94 sites along three roads in Sierra Nevada (Granada) and three roads in Sierra de Filabres (Almeria). At each site we surveyed three plots (50m each); one parallel to the road and two traversals from the road edge (N=280), recording the abundance and cover of all plant species. Then, we analysed the association of local and landscape environmental variables with alpha diversity metrics using Generalized Linear Mixed Models. We found plant invasion in 18% of the sites, all located at low elevation. While Shannon's diversity and evenness were more influenced by local scale variables (i.e. soil humidity); species richness was influenced by variables at larger scale (i.e. aridity). More interestingly, we observed a significant and positive effect of invasive species occurrence and road edge on species richness but not on Shannon's diversity or evenness.

TSC.2. Marine ecosystems: human impacts, adaptation and mitigation

Thursday, 5 (15:30-17:00)

Room: Restaurante

Local and global anthropogenic impacts are deeply affecting marine ecosystems, from the behavior of individuals to the dynamics of populations and whole assemblages. Gradual warming, marine heat waves, herbivory pressure, marine pollution, and invasive species are some of the drivers of ecosystem changes and biodiversity loss. There is also an emerging interest in assessing the potential for adaptation of marine ecosystems to the environmental changes and in promoting their resilience through protection and restoration actions.

In this thematic session we aim to gather a better understanding of marine ecosystems in the present scenario of change through research focused on: the human impacts at local and global scales on populations and biotic interactions, and how we can promote habitats restoration and conservation to increase resilience of these populations. We, then, welcome submissions on topics including, but not limited to: climate change effects, the impacts of herbivory, loss and resilience of species and marine habitats restoration and conservation.

Organizers:

• **Rosa María Chefaoui Díaz,** Instituto de Investigación en Cambio Global (IICG-URJC), Universidad Rey Juan Carlos

• **Rosa María Viejo García,** Instituto de Investigación en Cambio Global (IICG-URJC), Universidad Rey Juan Carlos

TSC.2. Orals

[TSC.2-O-1]

Thursday 5, after lunch (third): 15:30
Room: Restaurante

Tittle: 20 years of decline in Mediterranean octocoral populations: Do current protection strategies help?

Zentner, Yanis[1]; Garrabou, Joaquim[2]; Capdevila, Pol[3]; Gómez-Gras, Daniel[4]; Aspillaga, Eneko[5]; Bensoussan, Nathaniel[6]; Figuerola-Ferrando, Laura[7]; Kersting, Diego K.[8]; Ledoux, Jean-Baptiste[9]; López-Sendino, Paula[10]; Margarit, Núria[11]; Medrano, Alba[12]; Pagès-Escola, Marta[13]; Rovira, Graciel·la[14]; Linares, Cristina[15]

(1) Universitat de Barcelona (UB), Barcelona, Spain; (2) Institut de Ciències del Mar (ICM-CSIC), Barcelona, Spain; (3) Universitat de Barcelona (UB), Barcelona, Spain; (4) Universitat de Barcelona (UB), Barcelona, Spain; (5) Instituto Mediterráneo de Estudios Avanzados (IMEDEA, CSIC-UIB), Esporles, Spain; (6) Univ Brest, CNRS, Ifremer, IRD,IUEM, Plouzané, France; (7) Universitat de Barcelona (UB), Barcelona, Spain; (8) Instituto de Acuicultura de Torre de la Sal (IATS, CSIC), Castelló, Spain; (9) CIIMAR, University of Porto, Matosinhos, Portugal; (10) Institut de Ciències del Mar(ICM-CSIC), Barcelona, Spain; (11) Universitat de Barcelona (UB), Barcelona, Spain; (12) Universitat de Barcelona (UB), Barcelona, Spain; (13) Universitat de Barcelona (UB), Barcelona, Spain; (14) Universitat de Barcelona (UB), Barcelona, Spain; (15) Universitat de Barcelona (UB), Barcelona, Spain

Correspondence e-mail: [yaniszentner@ub.edu]

Mass mortalities of habitat-forming organisms, driven by ocean warming and marine heatwaves, are transforming benthic ecosystems around the world. Understanding the effectiveness of marine protected areas in maintaining the viability of foundation species is therefore crucial. In this context, enhanced demographic resilience to extreme climate events is often assumed but rarely detected nor quantified in natural systems.

In this study, we delve into the role of protection in mitigating the impacts of marine heatwaves on shallow (15-30 m) Paramuricea clavata populations, a key octocoral to sustain the biodiversity and structural complexity of Mediterranean coralligenous assemblages but highly susceptible to such events. Specifically, we aim to quantify demographic responses across contrasting protection levels and thermal regimes to assess their capacity for resistance and/or recovery. To achieve this, we combined in-situ local temperature time series with long-term demographic data on P. clavata, collected over more than 20 years across 44 sites in the north-western Mediterranean, ranging from 39º to 43ºN latitude and 1º to 9ºE longitude.

Preliminary results indicate that all populations have been impacted, with cumulative biomass losses reaching up to 86% in the most severe cases. Whether the current implementation of protected areas is effective enough to generate a positive response is still being explored. However, the severity of recent marine heatwaves, combined with potential shortcomings in protection measures, appears to outweigh any benefits provided by these areas.

[TSC.2-O-2]

Thursday 5, after lunch (third): 15:45
Room: Restaurante

Unifying thermal stress predictions of coral bleaching

Peralta-Maraver, Ignacio[1]; Verberk, Wilco C. E. P.[2]; Carter, Mauricio J.[3]; Rezende, Enrico L.[4]

(1) Universidad de Granada; (2) Radboud University; (3) Universidad Andrés Bello; (4) Departamento de Ecología

Correspondence e-mail: [peraltamaraver@ugr.es]

Coral bleaching caused by Global Warming is a major threat to marine biodiversity. Over more than 30 years, numerous experiments have been performed to predict coral bleaching in warming oceans. However, a comprehensive mechanistic approach to forecast coral bleaching has not yet been established. The existing frameworks mostly rely on static critical thermal limits, which represent a coarse metric that has been shown to be unrealistic. Here, we develop a dynamic model to predict coral bleaching under variable thermal regimes, integrating laboratory-based heat tolerance with environmental temperature records. Applying our analytical framework, we reanalyze thermal stress-induced bleaching data reported in the literature over the last three decades and encompassing 53 coral species. Our model predictions showed an unprecedented match with empirical measurements across studies and coral species (R2 = 0.91). Furthermore, we validated reliability of our approach by retrospectively predicting coral bleaching events at global scales from an extensive database. Importantly, we demonstrated that general relationships between temperature stress and exposure duration effectively quantify and compare bleaching events both within and across coral species. In this manner, we provide a unified framework for anticipating how coral species will respond to future global warming.

[TSC.2-O-3]

Thursday 5, after lunch (third): 16:00
Room: Restaurante

Fish herbivory reaches the intertidal zone: an increasing threat in the conservation of algal forests

Viejo, Rosa M[1]

(1) Instituto de Investigación en Cambio Global (IICG-URJC), Universidad Rey Juan Carlos

Correspondence e-mail: [rosa.viejo@urjc.es]

Large brown algae are key components of temperate rocky coasts and sustain some of the most productive marine ecosystems. Currently, these habitat-forming algae are under threat due to a combination of local stressors and climate change. Additionally, herbivory by fishes is increasing in temperate regions, although to date, these shifts in grazing intensity have been mostly reported in subtidal algal forests rather than in intertidal canopies.

We tested the effect of fish herbivory on the performance of the fucoid Ascophyllum nodosum, considered an intertidal marine 'tree', at the southern range of its distribution in northern Spain. In recent years, these southern populations have shown signs of heavy grazing and an inability of individuals to form canopies.

We set up exclusion experiments at three sites within the wide and muddy estuary of Villaviciosa, and at one site in the rocky mouth of Tina Menor estuary (northern Spain), where an increase in grazing damage has been observed in the target species. Besides, we quantified the diversity and abundance of fish through underwater recordings. Our results demonstrated that fish impacts greatly reduced the growth, cover, and reproductive potential of Ascophyllum at both estuaries, with grazing being mostly concentrated in autumn. Our study reveals that the increasing and severe impacts of fish species in temperate waters are also reaching the intertidal zone, impairing the resilience capacity of Ascophyllum populations to environmental changes and limiting their potential for habitat generation. Conservation measures for these valuable southern populations should include actions to reduce fish damage.

[TSC.2-O-4]

Thursday 5, after lunch (third): 16:15
Room: Restaurante

Characterising the fish diversity of Santo Antão, Cabo Verde

Afonso Ferreira, Jessica[1]; Ornelas, Tristan[2]; Amaro, Teresa[3]

(1) CESAM - University of Aveiro; (2) CESAM - University of Aveiro; (3) CESAM - University of Aveiro

Correspondence e-mail: [jessica.f@ua.pt]

Cabo Verde, a tropical African archipelago in the Eastern Atlantic Ocean, is renowned for its rich marine biodiversity. Santo Antão is the northwesternmost island of the archipelago, and its population heavily depends on marine resources. Nonetheless, the local marine ecosystems remain notably under-studied. This study presents the first comprehensive assessment of the fish community composition around Santo Antão.

To assess species assemblages, underwater video transects were conducted during SCUBA diving surveys at both shallow (3–30 m depth) and mesophotic (30–70 m depth) sites. Shallow sites were primarily characterised by sandy and/or rocky seafloor with occasional gorgonian fields, whereas mesophotic sites were characterised by black coral forests.

Preliminary results suggest that Pomacentridae is the dominant fish family at both shallow and mesophotic depths. At the mesophotic sites, 53 fish species were identified, with Chromis lubbocki (Pomacentridae) emerging as the most abundant species. Diversity indices and rarefaction curves indicate that the northern region of Santo Antão, particularly Janela, exhibits the highest fish diversity in the mesophotic zone.

By investigating distinct depth levels and marine habitat types, this research establishes a crucial baseline for understanding the fish communities of Santo Antão. Long-term monitoring is essential to gain deeper insights into the spatial and temporal patterns of these assemblages. Such efforts are also vital for supporting marine conservation initiatives and informing management recommendations for relevant stakeholders and local communities.

[TSC.2-O-5]

Thursday 5, after lunch (third): 16:30
Room: Restaurante

Phytoplankton structure and production during two different coastal acidification events in the Ría de Vigo

Clerencia Izquierdo, Mar[1]; Castro Olivares, Adrián[2]; Alcaraz Rocha, Paulo[3]; Fuentes Lema, Antonio[4]; Sobrino, Cristina[5]

(1) Centro de Investigación Mariña, Universidade de Vigo; (2) Centro de Investigación Mariña, Universidade de Vigo; (3) Centro de Investigación Mariña, Universidade de Vigo; (4) Centro de Investigación Mariña, Universidade de Vigo; (5) Centro de Investigación Mariña, Universidade de Vigo

Correspondence e-mail: [mar.clerencia.izquierdo@uvigo.gal]

Anthropogenic CO2 emissions to the atmosphere are driving ocean acidification. In nearshore environments, changes in freshwater discharge and nutrient runoff, among others, also contribute to pH decreases. Coastal acidification affects the structure and metabolism of phytoplankton communities with important consequences for marine food web and ecosystem services. This study focuses on the Ría de Vigo (Rías Baixas, Iberian Upwelling System) one of the main bivalve producer areas of the world. Temperature, salinity, dissolved inorganic carbon (DIC), CO2 partial pressure (pCO2), size-fractionated chlorophyll-a (for picophytoplankton, nanophytoplankton and microphytoplankton assessment), photosynthetic efficiency (Fv/Fm) and net production were compared during two coastal acidification events in 2019-2020 and in 2023-2024. In January 2020, a natural CO2 gradient was observed, with 5429.28 ppmv in the inner part of the Ría and 713.14 ppmv closer to the ocean-estuary boundary. A positive correlation between pCO2, chlorophyll-a and Fv/Fm was found with a predominance of nanophytoplankton (60.83%) and medium-high photosynthetic efficiency (0.601-0.404). In October 2023, the acidification occurred due to extreme precipitation and high river discharge (close to 200 m3s-1). The decrease in salinity was associated with low DIC (max.: 117.92 µmol/Kg) and pCO2 (max.:107.32 ppmv), as well as negative net production, dominance of nano- (43%) and picophytoplankton (36%), and low photosynthetic efficiency (Fv/Fm: 0.563-0.148), which showed a positive correlation with pH and a negative one with pCO2. These results indicate that coastal acidification in Ría de Vigo may be led by different drivers that are linked to contrasting responses on phytoplankton community structure and production.

[TSC.2-O-6]

Thursday 5, after lunch (third): 16:45
Room: Restaurante

Multi-decadal changes in zooplankton trophic dynamics in a highly dynamic upwelling ecosystem: a climate change refugia?

Viana, Inés[1]; Otero, Jaime[2]; García-Seoane, Rita[3]; Louro, M. Ángeles[4]; Bode, Antonio[5]

(1) Instituto Español de Oceanografía (IEO-CSIC); (2) Instituto Español de Oceanografía (IEO-CSIC); (3) Instituto Español de Oceanografía (IEO-CSIC); (4) Instituto Español de Oceanografía (IEO-CSIC); (5) Instituto Español de Oceanografía (IEO-CSIC)

Correspondence e-mail: [ines.viana@ieo.csic.es]

Zooplankton is a critical component in pelagic food webs transferring energy and materials from phytoplankton to the large consumers. However, changing ocean conditions are differentially reshaping the structure and functioning of zooplankton at regional scales worldwide. Here we use data from a long-term monitoring series (1995-2021) at the northern boundary of the Canary Current upwelling system (NW Spain) to investigate whether changes in environmental conditions induced changes in the trophic structure of mesozooplankton through the analysis of the community (biomass, abundance and trophic guilds) and stable isotope (bulk d15N and d13C, and d15N in specific amino acids) composition. We observed that there were no clear long-term patterns in the upwelling intensity; however, principal component analysis of biogeochemical variables revealed periods with differential conditions of nutrient fertilization or consumption. A decreasing trend was observed in d13C and in the community trophic position as estimated with amino acid d15N. Zooplankton biomass related positively to d15N and d13C, while primary production had negative and positive effects respectively. While environmental variables did not fully explain stable isotope composition changes, further analysis showed that community trophic position were lower when primary production and abundance of strict omnivorous copepods increased. By contrast, trophic positions increased with the percentage of carnivore copepods. These results show that zooplankton trophic dynamics in the area capture the changes in environmental conditions but, especially, in the copepod community composition. Overall, this study supports the importance of long-term data to elucidate the effects of hydrographic conditions on planktonic ecosystem functioning.

TSC.2. Posters

[TSC.2-P-1]

Wednesday 4
Discussion corner: Room 3

Harvesting and climate impacts on natural bivalves production in intertidal shellfish grounds: A modelling approach

Cerdeira Arias, José Daniel[1]; Otero Villar, Jaime[2]; Álvarez Salgado, Xosé Antón[3]

(1) Xunta de Galicia; (2) IEO-CSIC; (3) CSIC;

Correspondence e-mail: [jose.daniel.cerdeira.arias@xunta.gal]

Productivity of intertidal bivalve species is affected by an ample variety of environmental and climate factors, including beach geomorphology, water and sediment composition, freshwater flow and wind regime, as well as harvesting activities. Disentangling the environmental effects from those exerted by the exploitation is complex, and little is known about its impact on the population dynamics of commercially important bivalve species. Here we have compiled historical production data for six bivalve species including Venerupis corrugata, Ruditapes decussatus, Ruditapes philippinarum, Donax trunculus, and Solen marginatus exploited in multiple natural shellfish grounds located in five embayments of the NW Iberian Peninsula, collectively known as Rías Altas. Using time-series analyses we studied the changes in production and the environmental influence during two periods. First, from early 1960s until early 1990s, a period when the Spanish government was the main authority and access to the resources was almost open, and, second, from the early 1990s to 2023 when authority resides on the Galician government and resources are regulated through co-managed territorial use rights for fishing (TURFs) by specific exploitation plans designed and implemented after thorough monitoring. We further developed detailed statistical models at the shellfish ground level for a most recent period (2000-2023) when information is rich to jointly study the influence of local hydrographic and geomorphological conditions and the harvesting regime on the production dynamics in the different embayments. Together, all this knowledge will allow designing and implementing better management plans aiming at a more efficient and sustainable exploitation of shellfish resources.

[TSC.2-P-2]

Thursday 5
Discussion corner: Room 3

Decadal upwelling variability and changes in new nitrogen sources for coastal ecosystems in NW Spain

Bode, Antonio[1]; García-Seoane, Rita[2]; Varela, Zulema[3]; Viana, Ines G.[4]

(1) Instituto Español de Oceanografía (IEO-CSIC); (2) Instituto Español de Oceanografía (IEO-CSIC); (3) Universidade de Santiago de Compostela; (4) Instituto Español de Oceanografía (IEO-CSIC)

Correspondence e-mail: [antonio.bode@ieo.csic.es]

Global change is likely to affect coastal upwelling intensity and impact the supply of nutrients for marine food webs. Here we analyze a long series of nitrogen stable isotope composition of coastal macroalgae and mussels at the northern boundary of the Canary Current upwelling system (NW Spain) to examine the effect of quasi-decadal variations in upwelling intensity between 1989 and 2023. We detected three periods with characteristic upwelling and nutrient regimes across the region but no trends in the series of upwelling strength, nitrate, or stable isotopes. The enrichment in heavy nitrogen isotopes, particularly in macroalgae, with decreasing upwelling nitrogen suggests the increasing contribution of anthropogenic sources. The absence of trends, and the inverse relationship between heavy isotopes and upwelling inputs suggest the existence of a compensatory mechanism between natural and anthropogenic nitrogen sources. As a consequence, no net change in productivity would be expected in this region even when upwelling dynamics change at quasi-decadal periods

[TSC.2-P-3]

Tuesday 3
Discussion corner: Room 3

Understanding CO2, DIC and pH gradients in the Galician Rías Baixas: Insights from the ACID Project

Castro-Olivares, Adrián[1]

(1) Universidade de Vigo

Correspondence e-mail: [adrian.castro@uvigo.es]

Deep water upwelling plays a key role in modulating CO2 fluxes, water temperature, nutrient cycling, and primary production in coastal systems. Interaction with freshwater inputs, such as river runoff, can intensify gradients in CO2, DIC and pH that affect plankton and calcifying organisms. The Rías Baixas (NW Spain), located at the North Atlantic Upwelling System, support vital socio-economic activities like small-scale fisheries and aquaculture. However, the effects of main drivers on CO2, DIC and pH remain poorly understood. Monthly sampling was carried out in the Ría de Vigo from April 2023 to December 2024, collecting hydrographic profiles and samples for pH, DIC, and CO2 determination along a longitudinal transect. Data from October 2023 and 2024 were compared with previous data from October 2019. Results showed that CO2, DIC, and pH were regulated by wind-driven circulation and freshwater intrusion. October 2019 exhibited steeper CO2 gradients, with higher CO2 concentrations in inner stations (~1000 ppmv) that decreased towards the outer stations (~600 ppmv). pH followed an opposite pattern to CO2, with the lowest values in October 2023 (6.5 at the inner station). October 2023 also showed the lowest DIC concentrations (<100 µmol kg-1), linked to extreme precipitation events and high freshwater input (~150 m3 s-1), while October 2019 and 2024 exhibited similar DIC levels, attributed to lower freshwater supply. Differences in CO2 were linked to opposing wind-driven circulation regimes: While October 2024 was preceded by an upwelling event which enhanced DIC consumption, primary production and pH, downwelling favoring winds dominated in October 2019.

[TSC.2-P-4]

Wednesday 4
Discussion corner: Room 3

Extreme storms could limit the expansion of the invasive species Caulerpa cylindracea on rocky shores

Sanz-Lazaro, Carlos[1]; Terradas-Fernández, Marc[2]; Casado-Coy, Nuria[3]

(1) University of Alicante; (2) University of Alicante; (3) University of Alicante

Correspondence e-mail: [carsanz@ua.es]

Introduction. Invasive species constitute a major environmental concern worldwide and extreme events, favoured by climate change, are expected to enhance their invasibility. However, more scientific evidence is needed to better understand under which circumstances this assumption holds

Materials and methods. We manipulatively perform mechanical disturbances to simulate storms with varying intensity and frequency to study its effect on the re-colonization of the non-indigenous species Caulerpa cylindracea at a rocky shore in the Mediterranean coast of Alicante.

Results and discussion. Low intensity storms with a high frequency enhanced the invasibility of Caulerpa cylindracea, while extreme storms, limited the invasibility of this alga. These effects occurred on the short-term, and up to 9 months after the disturbance could be observed. Caulerpa cylindracea has a low attachment capacity to the substrate, and its colonization capacity may be favoured by the existence of other canopy-forming algae that create structures to where Caulerpa cylindracea can establish. While in situations after high intensity disturbances that lead to bare rock, Caulerpa cylindracea may be too affected by uproot and dislodgement by shear stress driven by waves on rocky shores, hindering colonization of upper subtidal zone. This study suggests that extreme events do not necessarily enhance the invasibility of exotic species and can have contrasting effects depending on the habitat. Thus, the effects of extreme events on the invasibility of exotic species needs to be studied in different habitats, to optimize management strategies that can be adapted to each habitat.

TSC.3. Plant-herbivore interactions in the face of global change

Monday, 2 (18:00-19:30)

Room: Balconada

Plant-insect herbivore interactions are important drivers of ecosystem functioning and shape the distribution and evolution of organisms. The stability of these interactions is currently being threatened by global change, with consequences for the preservation of ecosystem services and biodiversity. For example, climate change may alter plant-herbivore interactions through several processes, including effects on plant traits that mediate such interactions, and shifts in the distributions and relative abundances of plants, insects and their natural enemies, which decouples current interactions and creates novel ones.

In this context, a key challenge in ecology is to unravel the mechanisms that drive plant-herbivore interactions and how global change drivers may alter these dynamics. Gaining this understanding is essential for mitigating the negative impacts on ecosystem functioning and biodiversity, while also generating the knowledge necessary to inform policy decisions. This organized session will bring together speakers who study the effects of different drivers of global change on plant-herbivore interactions and how the effects cascade up to different trophic levels, including climate change, shifts in species distributions, plant invasions, or habitat disturbance and fragmentation. We aim to include studies conducted in both natural and urban ecosystems and in underrepresented regions, such as those in the global south.

Organizers:

- **Andrea Galmán,** Montana State University
- **Carla Vázquez-González,** Misión Biológica de Galicia (MBG-CSIC).

TSC.3. Orals

[TSC.3-O-1]

Monday 2, evening: 18:00
Room: Balconada

Insularity effects on seed damage by insect herbivores and associated traits across oak species

Martinez Virseda, Irene[1]

(1) Misión Biolóxica de Galicia

Correspondence e-mail: [irene.martinez@mbg.csic.es]

1. Ecological theory predicts reduced herbivory on islands compared to the mainland, due to lower herbivore abundance and diversity. However, most previous research has focused on vegetative tissues, like leaves, often overlooking reproductive structures such as seeds. Since seeds are crucial for plant fitness and evolutionary success, their susceptibility to herbivory warrants further attention.

2. In this study, we compared seed (acorn) damage caused by insect herbivores across seven different oak (Quercus) species at three island-mainland paired sites: Lesbos island vs. mainland Greece, Balearic Islands vs. mainland Spain, and Bornholm island vs. mainland Sweden. At each site, we selected three populations of each species and collected 10 acorns from four trees (n = 150). Additionally, we also measured acorn chemical defences (phenolics) and nutrients (nitrogen, phosphorous) to better understand the factors influencing acorn damage patterns.

3. We found higher acorn damage in the Balearic Islands compared to mainland Spain, but no significant differences at other sites. Insularity had no effect on acorn phenolic compounds or nitrogen content. However, acorn phosphorus content was higher in mainland Sweden than on Bornholm Island and lower in mainland Greece than on Lesbos Island. Notably, differences in acorn phosphorous content did not explain the insularity effects on acorn damage. These findings challenge the ecological theory predicting reduced herbivory on islands, especially regarding reproductive structures, emphasizing the need to reassess theoretical frameworks and explore additional mechanisms underlying insularity effects on seed herbivory.

[TSC.3-O-2]

Monday 2, evening: 18:15
Room: Balconada

Alteration and recovery of trophic interactions after multifactorial disturbance: drivers and processes

Chrétien, Lucille T.S.[1]; Burón-Ugarte, Ana[2]; Christensen García, Claudia[3]; Montoya, Daniel[4]

(1) Basque Center for Climate Change (BC3); (2) Basque Center for Climate Change (BC3); (3) Basque Center for Climate Change (BC3); (4) Basque Center for Climate Change (BC3)

Correspondence e-mail: [lucille.chretien@bc3research.org]

Introduction. The sheer number of arthropod species place them as a key constituent of trophic interactions and therefore, arthropods greatly contribute to ecosystem functions. Changes in land-use pose a large threat to arthropod diversity, and their vulnerability to warming also threatens ecosystem stability and ability to recover after perturbation. The difficulty to predict global change alteration of food webs emerges notably from the distinct responses each network component and property can have when combining different types of disturbances. This work aims at unravelling how such factors affect plant-herbivore-carnivore networks and what are the underlying processes that govern shifts in interactions.

Material and Methods. The factors we study are threefold: tilling, warming, and dispersal limitation, which we apply in twelve connected pairs of enclosures following a semi-factorial design. The enclosures are located in a grassland that we study from 2023 through 2025. Plants are monitored 10 times a year to collect four variables: plant species and corresponding dry biomass, phenology, and feeding damages. Arthropods and molluscs are trapped four times a year to record species, functional groups, abundance, and body length as fitness proxy.

Results and discussion.Occurrence and strength of herbivory decreased within three months following tilling, although warming and fragmentation mitigated this effect. Further analysis of the 2024 data will assess changes in communities of plants, herbivores, and carnivores, identify and quantify shifts in trophic networks, and evaluate their capacity to resist and recover under multifactorial disturbance. Results will provide background information necessary to anticipate global change-driven repercussions on herbivory and better target adaptation measures.

[TSC.3-O-3]

Monday 2, evening: 18:30
Room: Balconada

How do herbivores modulate floral phenotypic plasticity to abiotic conditions?

Quiroga-Álvarez, Violeta[1]; González-Megías, Adela[2]; Armas, Cristina[3]; Gómez, José María[4]; Perfectti, Francisco[5]

(1) Estación Experimental de Zonas Áridas (EEZA-CSIC); (2) Universidad de Granada; (3) Estación Experimental de Zonas Áridas (EEZA-CSIC); (4) Estación Experimental de Zonas Áridas (EEZA-CSIC); (5) Universidad de Granada

Correspondence e-mail: [vquiroga@eeza.csic.es]

Phenotypic plasticity is the ability of a genotype of producing alternative phenotypes when exposing to different environments, so it can be triggered by both biotic and abiotic factors. A typical plastic response in plants occurs in response to herbivore attack with the induction of defenses, but the role of the herbivores as modulators of the plastic response of the plant to abiotic conditions has been seldom studied. In this study, we experimentally explore the effect of damage by florivores and folivores on the occurrence and intensity of floral phenotypic plasticity of Moricandia arvensis (Brassicaceae) under two contrasting abiotic conditions. In nature, this mustard species blooms in two contrasting environments, facing mild and wet conditions during spring, and hot and dry during summer. In response to these environmental changes, the same individual is plastic for floral traits. Our preliminary results show that plants attacked by each type of herbivores retain the capacity to flower during summer conditions, expressing plasticity for floral traits. These herbivores limit the plastic response of the plant to the abiotic conditions. This study highlights the complex interaction between biotic and abiotic stressors and their combined effect for the evolution of plasticity in M. arvensis.

[TSC.3-O-4]

Monday 2, evening: 18:45
Room: Balconada

Analysis of arthropod diversity in subtropical crops of Mediterranean agroecosystems using DNA Metabarcoding

Romero, Helena[1]; Aquilino, Mónica[2]; Díaz Pendón, Juan Antonio[3]; Planelló, Rosario[4]; de la Peña, Eduardo[5]

(1) Instituto de Hortofruticultura Subtropical y Mediterránea “La Mayora”; (2) UNED; (3) Instituto de Hortofruticultura Subtropical y Mediterránea “La Mayora”; (4) UNED; (5) Ghent University

Correspondence e-mail: [hromero@ihsm.uma-csic.es]

The growing global demand for fruit commodities has driven significant changes in agricultural production areas, often resulting in the introduction of new crops. However, this poses substantial challenges, as they can bring new pests that threaten native flora and disrupt existing native community dynamics. A relevant example of this issue can be observed in Malaga, Granada and other areas of the Iberian Peninsula, where subtropical crops introduced have experienced exponential growth in cultivation areas over the past decades.

Despite this rapid expansion, our understanding of the impact these crops have on the composition of arthropod communities remains limited. Gaining insights into how these introductions may affect native and introduced species is critical for developing sustainable agricultural practices and effective conservation strategies.

In this study, we examined the insect macrocommunities associated with subtropical crops in a Mediterranean context, comparing them with the macrocommunities linked to native flora. Malaise traps were deployed in the field from late winter to summer, and collected samples were preserved for DNA extraction. DNA barcoding was then used to identify the species present within these communities. The resulting sequence data were compared against reference databases to assign taxonomic identities and assess community structure.

Our findings revealed significant differences between insect communities in subtropical crops and those in native ecosystems. Notably, potential natural enemies of pests—previously observed visually on the trees—were also detected. These results highlight the importance of understanding native biodiversity to better assess and mitigate the ecological impacts of agricultural expansion and the introduction of non-native species.

[TSC.3-O-5]

Monday 2, evening: 19:00
Room: Balconada

Enhancing crop pest resistance through plant-derived volatile organic compounds: a sustainable alternative to chemical pesticides

Martín-Cacheda, Lucía[1]; Tei, Alessio[2]; Röder, Gregory[3]; Arnaiz, Yolanda[4]; Abdala-Roberts, Luis[5]; Moreira, Xoaquín[6]

(1) Misión Biológica de Galicia (MBG-CSIC), Pontevedra, Galicia, Spain.; (2) Institute of BioEconomy (IBE) - National Research Council of Italy (CNR), Bologna, Italy.; (3) Institute of Biology, University of Neuchâtel, Neuchâtel, Switzerland.; (4) Misión Biológica de Galicia (MBG-CSIC), Pontevedra, Galicia, Spain.; (5) Campus de Ciencias Biológicas y Agropecuarias, Universidad Autónoma de Yucatán, Mérida, México.; (6) Misión Biológica de Galicia (MBG-CSIC), Pontevedra, Galicia, Spain

Correspondence e-mail: [luciamartincacheda.93@gmail.com]

Climate change accelerates pest development, threatening crop yields. The overuse of chemical insecticides and fungicides controls pests but risks human and environmental health, contributing to resistance and worsening crop damage. To address these challenges, sustainable alternatives to chemical pesticides are needed. Research into volatile organic compounds (VOCs) involved in plant-plant communication offers a promising approach to enhance pest resistance in crops, providing an eco-friendly solution for pest management.

We investigated whether exposure to plant-derived VOCs, induced after herbivore damage or control, could further enhance plant resistance to herbivory. Potato (Solanum tuberosum) plants were paired in cages and exposed to two artificial VOC blends, one mimicking undamaged (control) plants and the other mimicking plants damaged by Spodoptera exigua (induced). After three days, one plant from each cage was removed to analyze gene expression and defense responses. The remaining plants underwent a bioassay to assess herbivory resistance by measuring the percentage of leaf damage after 48 hours of feeding by S. exigua. At the same time, we also collected leaves to analyse gene expression and defense responses. The experiment aimed to compare gene expression and defense responses before and after induction of damage, focusing on the effects of VOC exposure.

Plants exposed to induced VOC blends showed significantly higher resistance to S. exigua herbivory compared to those exposed to control blends. This suggests that exposure to plant-VOCs could enhance pest resistance in potato crops, offering an ecologically sustainable approach within Integrated Pest Management strategies.

[TSC.3-O-6]

Monday 2, evening: 19:15
Room: Balconada

No evidence of prescribed burning effects on needle terpene content of Pinus nigra spp. salzmannii and larvae survival of pine processionary moth (Thaumetopoea pityocampa)

Vilà-Vilardell, Lena[1]; Llusià, Joan[2]; Hódar, José[3]; Valor, Teresa[4]; Piqué, Míriam[5]; Peñuelas, Josep[6]; Casals, Pere[7]

(1) Centre de Ciència i Tecnologia Forestal de Catalunya (CTFC); (2) Centre de Recerca Ecològica i Aplicacions Forestals (CREAF); (3) Universidad de Granada; (4) Universitat Politècnica de Catalunya-BarcelonaTECH; (5) Centre de Ciència i Tecnologia Forestal de Catalunya (CTFC); (6) Centre de Recerca Ecològica i Aplicacions Forestals (CREAF); (7) Centre de Ciència i Tecnologia Forestal de Catalunya (CTFC)

Correspondence e-mail: [lena.vila@ctfc.cat]

Prescribed burning often aims to reduce wildfire risk, but its ecological impacts extend beyond the primary goal and may potentially enhance forest resistance to other disturbances. Prescribed burning can alter tree defences both directly, through thermal stress, and indirectly, by changing soil nutrient concentration and forest structure; these effects, in turn, may influence the performance of defoliator species like the pine processionary moth (PPM). Given the increasing intensity of PPM defoliation associated with warmer winters, it is essential to evaluate the effects of prescribed burning on tree defences against PPM.

Here, we examined the needle terpene content of dominant black pines before and one year after prescribed burning treatments across three sub-Mediterranean forests. Additionally, we assessed the influence of terpene content on PPM larvae survival through a bioassay. Needle terpene content, along with nitrogen content, d13C and d18O were measured in both current-year and mature needles from burned and unburned sites. Fire severity parameters of sampled pines were measured during and after burning.

Prescribed burning did not significantly affect needle terpene content one-year post-treatment. Terpene content could not be explained either by fire severity, N content or isotope composition. Despite the lack of burning effect on terpenes, PPM larvae survival was influenced by the interaction between treatment and needle age, as larvae fed current-year needles of unburned units exhibited 79% higher mortality. These findings suggest that prescribed burning has no effect on terpene content that may influence pine susceptibility to PPM, but factors influencing larvae survival warrant further investigation.

TSC.3. Posters

[TSC.3-P-1]

Wednesday 4
Discussion corner: Room 8

The complex dynamics of ant-plant mutualisms: exploring the role of plant resource availability for ants and intraguild predation by birds on plant fitness

Costa-Silva, Vitor Miguel[1]; De-Freitas, Iasmim[2]; Del-Claro, Kleber[3]; Moreira, Xoaquín[4]

(1) Universidade de São Paulo Faculdade de Filosofia, Ciências e Letras de Ribeirão Preto; (2) Universidade de São Paulo Faculdade de Filosofia, Ciências e Letras de Ribeirão Preto; (3) Universidade Federal de Uberlândia; (4) Misión Biológica de Galicia (CSIC)

Correspondence e-mail: [vitormcs146@gmail.com]

Protection mutualisms involve indirect interactions between plants and predators, facilitated by food resources. Ants play a key role in these interactions by foraging on plants that provide extrafloral nectaries (EFNs) or through their relationships with trophobiotic insects like treehoppers and myrmecophilous caterpillars. In these cases, ants act as defenders, protecting plants from herbivores while benefiting from these food resources. In a similar way, insectivorous birds can also provide indirect plant defense by preying on herbivores. While there has been significant research on ant- and bird-mediated plant defense, few studies have explored the combined effects of multiple mutualistic resources like EFNs and trophobiotic insects. Additionally, the impact of intraguild predation by birds on ant protection has rarely been examined. In this study, we investigated how multiple food resources for ants and intraguild predation by insectivorous birds affect the fitness of the tropical shrub Banisteriopsis malifolia. We conducted two field experiments: one manipulating mutualistic resources for ants and the other manipulating the presence of ants and birds. Plant fitness was assessed through herbivory levels, and fruit number, size and weight. The results revealed that plants with all mutualistic resources for ants experienced lower herbivory and higher fruit production compared to those without these resources. In contrast, excluding birds led to increased herbivory and reduced fruit production. The most detrimental effects occurred when both birds and ants were excluded. This research emphasizes the importance of multiple mutualistic resources and the role of birds in shaping plant fitness through indirect interactions with herbivores.

[TSC.3-P-2]

Thursday 5
Discussion corner: Room 8

Diterpene chemotypes in Pinus pinaster: detection and quantification by airborne hyperspectral imagery

Rodríguez Larrinaga, Asier[1]

(1) Misión Biológica de Galicia (MBG-CSIC)

Correspondence e-mail: [arodriguez@mbg.csic.es]

Introduction. The recent advances in detecting tree and stand health are most often focused on detecting signs of herbivore attack or tree illness, but seldom address intrinsic defensive traits of trees, hampering the application of preventive actions in forestry. We analyzed the diterpene profile of Pinus pinaster and describe a workflow to predict it from airborne hyperspectral images.

Material and methods. We combined hyperspectral airborne imagery with laboratory analyses of defensive compounds on needles of field stands, to remotely detect levels of volatile defensive compounds in Pinus pinaster plantations in Zamora, in three public states: a healthy one, one with decay signs and one close to stands recently attacked by Ips sp. Diterpene variance was subjected to a principal components analysis (PCA), a multiresponse partial least square regression model (MPLSR) was fitted to predict diterpene concentration and a discriminant PLSR to detect the two different chemotypes found.

Results and discussion. We identified 15 diterpenes, nine of them common enough to be analyzed. The PCA analysis showed two neatly discriminated diterpene chemotypes, which remained unchanged along the year for each tree. The prediction R2 of the MPLSR for the analysed diterpenes averaged 36,45%, varying between 3,7% and 66,4%, while detection of the two chemotypes reached and accuracy of 89.4%.

The results are promising, specially if further studies confirm the generality and shed light on the implications of the different chemotypes, and could be improved by wider spectral ranges and additional computations on the raw spectra.

TSC.4. The ecosystem role of large herbivores. Impacts, challenges and lessons for conservation in a warming world

Monday, 2 (18:00-19:30)

Room: Seminario 6

Large herbivores are one of the most relevant components of many different ecosystems across the globe. However, the discussion on the factors modulating the balance between their environmental positive and negative impacts on ecosystems functions and services continues within the scientific community. This symposium aims to bring together researchers dealing with all aspects of the biology and ecology of ungulates and other large herbivores, including their role in shaping vegetation composition and productivity, as well as their impact on endangered flora, seed dispersal, interactions with top predators, or the prevention of wildfires. Particularly, we welcome studies on the importance of herbivores in protected areas, on differences between domestic vs wild or native vs invasive species, and on the potential interactions with global warming. We seek to create a discussion forum, eventually producing final conclusions to aid in the development of better management practices linked to the environmental and social particularities of each system.

Organizers:

• **Luis Santamaría,** Estación Biológica de Doñana, EBD-CSIC

• **Jaime Fagúndez,** Universidade da Coruña

• **Laura Lagos Abarzuza,** Universidade da Coruña.

TSC.4. Orals

[TSC.4-O-1]

Monday 2, evening: 18:00
Room: Seminario 6

Ungulate herbivory and plant dynamics: Direct and maternal effects on herbaceous plants in Mediterranean dehesas

Gallego-Tevar, Blanca[1]; Delgado-Galán, Andrés[2]; Martins-Noguerol, Raquel[3]; Herrador, Belén[4]; Gómez-Aparicio, Lorena[5]; Pérez-Ramos, Ignacio M.[6]

(1) Universidad de Sevilla; (2) Instituto de Recursos Naturales y Agrobiología de Sevilla (IRNAS-CSIC); (3) Universidad de Sevilla; (4) Universidad de Sevilla; (5) Instituto de Recursos Naturales y Agrobiología de Sevilla (IRNAS-CSIC); (6) Instituto de Recursos Naturales y Agrobiología de Sevilla (IRNAS-CSIC)

Correspondence e-mail: [bgallego@us.es]

Herbivory by wild and domestic ungulates exert significant direct and indirect effects on plant community dynamics in agrosilvopastoral systems, such as Mediterranean dehesas. These ecosystems are shaped by centuries of grazing, providing an ideal context to explore plant-herbivore interactions. However, the strategies developed by different species in response to herbivory within plant communities, and the extent to which these responses can be transmitted across generations are not fully understood. We conducted a field experiment using grazed and ungrazed plots in a dehesa to evaluate real-time effects of herbivory on herbaceous community composition, and vegetative and reproductive responses of representative species. Additionally, we carried out a greenhouse experiment to assess potential maternal effects influencing offspring performance of some selected species. Results showed that grazing increased plant diversity, likely through competitive release, as dominant species were suppressed, enabling less competitive species to establish. Early-flowering species, associated with acquisitive resource-use strategies, exhibited greater sensitivity to herbivory stress, particularly in reproductive traits such as seed weight and production. In contrast, late-flowering, conservative species demonstrated higher resilience to herbivory. Maternal effects were detected, particularly in Avena barbata, where offspring from grazed mothers displayed reduced seed weight but increased reproductive effort, suggesting transgenerational responses to grazing pressure. Our findings demonstrate that herbivory differentially modulates plant competitive networks and resource-use trade-offs in species with contrasting functional strategies and phenologies, while also inducing transgenerational effects. These insights are crucial for understanding how grazing shapes community assembly and evolutionary dynamics in dehesas, helping to inform sustainable management practices.

[TSC.4-O-2]

Monday 2, evening: 18:15
Room: Seminario 6

Ungulate guilds shaping the functional structure of herbaceous plants: the role of epigenetics in short-term coevolution

Delgado-Galán, Andrés[1]; Gómez-Aparicio, Lorena[2]; Aguilera-Gutiérrez, Lorena[3]; Alba-Gutiérrez, Manuela[4]; Chano, Víctor[5]; Cid-Alarcón, Adaia[6]; Gallego-Tévar, Blanca[7]; Gaytán, Álvaro[8]; Gutiérrez-González, Eduardo[9]; Melchiorre, Gabriela[10]; Solera-Álvarez, Pedro[11]; Werner, Olaf[12]; Pérez-Ramos, Ignacio Manuel[13]

(1) Instituto de Recursos Naturales y Agrobiología de Sevilla (IRNAS-CSIC); (2) Instituto de Recursos Naturales y Agrobiología de Sevilla (IRNAS-CSIC); (3) Instituto de Recursos Naturales y Agrobiología de Sevilla (IRNAS-CSIC); (4) Instituto de Recursos Naturales y Agrobiología de Sevilla (IRNAS-CSIC); (5) University of Göttingen; (6) Instituto de Recursos Naturales y Agrobiología de Sevilla (IRNAS-CSIC); (7) Universidad de Sevilla; (8) Instituto de Recursos Naturales y Agrobiología de Sevilla (IRNAS-CSIC); (9) Instituto de Recursos Naturales y Agrobiología de Sevilla (IRNAS-CSIC); (10) Instituto de Recursos Naturales y Agrobiología de Sevilla (IRNAS-CSIC); (11) Instituto de Recursos Naturales y Agrobiología de Sevilla (IRNAS-CSIC); (12) Universidad de Murcia; (13) Instituto de Recursos Naturales y Agrobiología de Sevilla (IRNAS-CSIC)

Correspondence e-mail: [andresdgalan@gmail.com]

Terrestrial plants have evolved mechanical and chemical defenses against herbivory. Large herds of wild and domestic ungulates have shaped vegetation structure worldwide, through a coevolutionary process whose full complexity is still being uncovered. Mediterranean pastures host diverse plant communities with a broad range of strategies to cope with livestock grazing activity. Here we examined how different ungulate guilds promote both the identity and the diversity of defensive traits within plant communities. Additionally, we analyzed the evolutionary impact of grazing on these defensive traits and explored the role of epigenetic regulation in driving the natural plasticity of these strategies.

We collected functional trait data from herbaceous communities in 24 Iberian savannas (dehesas or montados), covering all possible combinations of cattle, pigs, and sheep. Measurements were taken inside and outside ungulate exclusions, controlling for edaphic and climatic variables. Furthermore, we conducted a greenhouse experiment in which we measured morphological, chemical, physiological, and phenological traits in plants subjected to four treatments of herbivory: proceeding from inside and outside 6-year ungulate exclusions, and with and without real-time herbivory simulation. To analyze the role of epigenetic regulation, we used the epiGBS sequencing method.

Our results demonstrate that the diversity and identity of plant functional strategies to cope with herbivory are largely driven by livestock composition. We further observed that the differences in defensive strategies resulting from ungulate exclusions persist in the offspring of plants grown under controlled conditions. This finding suggests a short-term evolutionary response, potentially driven by epigenetic regulation.

[TSC.4-O-3]

Monday 2, evening: 18:30
Room: Seminario 6

Increasing knowledge on ungulate carrying capacity through European scale empirical abundances`

Serrano Zulueta, Rubén[1]; Gonzalez, Laura[2]; Pardo, Guillermo[3]; Del Prado, Agustín[4]; Manzano, Pablo[5]

(1) Basque Centre for Climate Change (BC3); (2) Basque Centre for Climate Change (BC3); (3) Basque Centre for Climate Change (BC3); (4) Basque Centre for Climate Change (BC3); (5) Basque Centre for Climate Change (BC3)

Correspondence e-mail: [ruben.serrano@bc3research.org]

Knowledge of ungulate population dynamics in Europe has been conditioned by the anthropogenic influence on land use for centuries. This makes estimates of carrying capacity heterogeneous and dependent on the approach, which impacts on decisions about land management. In this context, it is necessary to evaluate the factors that shape ungulate carrying capacity and population dynamics on a large scale.

We compiled a small database of empirical ungulate densities in the Natura 2000 protected areas through 1) direct surveys to management agencies, and 2) literature review. We collected parameters relevant to herbivore populations, such as the size of protected areas, primary productivity, land cover and the presence of livestock or predators.

Data show differences in ungulate abundances between protected areas larger and smaller than 600 km2. In the larger ones, the size of the protected areas appears to be the most explanatory parameter of the abundance of ungulates, while in the smaller ones, these are the diversity of land covers and the absence of predators. We conclude that the density of ungulate herbivore populations can be modelled with a few parameters. However, there are few ecosystems that can be considered as reference in Europe. Monitoring herbivore abundance according to the protection status or state of abandonment of large areas should be crucial to understand ungulate carrying capacities and population dynamics.

[TSC.4-O-4]

Monday 2, evening: 18:45
Room: Seminario 6

Wild Ungulates Shaping Plant Landscapes: Impacts on Vegetation Structure and Composition in the Catalan Pre-Pyrenees

Casals, Pere[1]; Teruel, Miguel[2]; Taüll, Marc[3]; Curià, Joan[4]; Palau, Jordi[5]; Fernandez-Gil, Juan[6]

(1) Joint Research Unit CTFC-AGROTECNIO-CERCA; (2) Joint Research Unit CTFC-AGROTECNIO-CERCA; (3) Joint Research Unit CTFC-AGROTECNIO-CERCA; (4) Boumort National Game Reserve (Generalitat de Catalunya).; (5) Boumort National Game Reserve (Generalitat de Catalunya).; (6) Forestal Catalana SA, Reserva Nacional de Caça de l'Alt Pallars, Generalitat de Catalunya

Correspondence e-mail: [pere.casals@ctfc.cat]

Effective decision-making requires robust information and monitoring programs to assess medium- and long-term changes and identify potential solutions. Herbivory by wild and domestic ungulates fluctuates across time and space, ultimately shaping the plant landscape over the long term. Continuous monitoring is essential to track vegetation changes and detect potential impacts of grazing or browsing. In the National Game Reserve (NGR) of Boumort and adjacent Tornafort area, browsing pressure was assessed in 2017 across 135 plots spanning various habitats. Subsequent monitoring of land cover and floristic composition was conducted in 2018 and 2023 within 20 permanent 100 m² plots, distributed among five main habitats. In five of those, ungulates were excluded. Additionally, browsing pressure was tracked on 232 georeferenced woody plants, including 50 individuals within the exclusion plots, representing 15 species.

Browsing pressure varied by habitat, being lowest in Scots and Black pine forests and highest in holm oak, and scrub habitats. Since 2018, NGR technicians have documented a decline in ungulate populations, which corresponds to a general decrease in browsing pressure. This reduction was particularly evident in shrub species less preferred by ungulates. In the exclusion plots, notable changes were observed compared to the open plots, including increased herbaceous biomass and flower density.

Shrub species such as Arctostaphylos uva-ursi, Lonicera xylosteum, and Cotoneaster integerrimus appeared in the exclusion plots, while the cover of species like Asphodelus cerasifer declined. These findings highlight the ecological shifts driven by variations in browsing pressure and underscore the importance of monitoring in understanding herbivory-plant dynamics.

[TSC.4-O-5]

Monday 2, evening: 19:00
Room: Seminario 6

Arthropod diversity shaped by traditional pastoralism

Pascual Parra, Esteban[1]; Perez Barberia, Javier[2]; Laiolo, Paola[3]

(1) Instituto Mixto de Investigación en Biodiversidad, IMIB; (2) Instituto Mixto de Investigación en Biodiversidad, IMIB; (3) Instituto Mixto de Investigación en Biodiversidad, IMIB

Correspondence e-mail: [estebanfrusciante@gmail.com]

Herbivory impacts biodiversity, ecosystem functions, and landscape heterogeneity, with effects varying by grazing intensity and ecosystem type. Understanding the relationship between biodiversity and herbivory levels offers insights into community assembly processes and helps establish indicators for ecosystem functions and services. Traditional pastoralism uses native plants as livestock's primary source of food, which impact on plant and invertebrate communities.

This study aimed to assess how variations in grazing intensity affect the abundance and diversity of insect populations. It was carried out in 12 sites of Castilla y León, this region is the stronghold of pastoralism in Spain. Grazing intensity within each site was measured by following the spatial movement of sheep herds marked with GPS units for a year. Two habitats were considered, grasslands and woodlands, in which between 3 and 6, 30 m, transects using a sweep net were conducted.

A total of 11,278 arthropod individuals were collected, from 182 families. No significant differences were observed in family richness between low and high grazing intensity levels, but there were differences between grassland and woodland, with lower number of families in woodland. We found a significant interaction between grazing intensity and habitat on arthropod abundance. Numbers decreased by 11% at high levels of grazing in woodland but there was no effect in grasslands. These results suggest that grasslands ecosystems are well-adapted to herbivory, and actual pastoralism practices are within sustainable grazing levels and sustain high invertebrates diversity.

[TSC.4-O-6]

Monday 2, evening: 19:15
Room: Seminario 6

Assessing the potential reproductive collapse of Halimium halimifolium: cervids density drives the outcome of a common but overlooked interaction

Fernández Fuerte, Rocío[1]; Garrote García, Pedro José[2]; Virgós Cantalapiedra, Emilio[3]; Fedriani Laffitte, José María[4]

(1) Estación Biológica de Doñana; (2) Estación Biológica de Doñana; (3) Universidad Rey Juan Carlos; (4) Estación Biológica de Doñana

Correspondence e-mail: [rocio.fernandez@ebd.csic.es]

Seed dispersal by ungulates is one of the most important processes for the dynamics of many plant populations in Mediterranean habitats. However, this interaction can also have substantial costs for the plant (e.g. some seed consumers destroy a large fraction of ingested seeds). We investigate the interaction between overabundant ungulates (mainly cervids) and the Mediterranean shrub Halimium halimifolium in the Doñana National Park. Specifically, we quantified the costs of such interaction through the consumption of plant reproductive structures. To this end, we monitored plant consumption throughout phenological stages (flowers, immature and mature fruits) in two contrasting habitats located in three study sites. Preliminary results showed that flowers and fruits production differ between habitats and study sites depending partly on red deer abundance, being 1.2 times higher in high deer-density areas. We also found a loss of the reproductive structures, finding 2.6 times more flowers than immature and mature fruits. Other initial findings comparing fruit consumption revealed a predominance of herbivory on immature fruits (74%, n=255) over mature fruits (26%, n=213), suggesting a primary predatory role. Despite this predatory impact, overabundant red deer seems to have a strong potential as long-distance seed disperser of H. halimifolium seeds, promoting gene flow and the (re)colonisation of vacant habitats. The interaction between H. halimifolium and red deer is characterized by substantial costs which fluctuate in space and time. Future studies should quantify such changes and identify whether such a widespread interaction shifts along a mutualism-antagonism continuum.

TSC.4. Posters

[TSC.4-P-1]

Tuesday 3
Discussion corner: Room 8

First demographic data on the European bison in Spain

Bartolomé, Jordi[1]

(1) Universitat Autònoma de Barcelona

Correspondence e-mail: [jordi.bartolome@uab.cat]

For several years, small populations of European bison (Bison bonasus) have been introduced to Spain under semi-free conditions, with the goal of supporting the species' conservation and maintaining pastoral ecosystems. Between 2018 and 2023, 60 individuals were imported from Poland, including 22 males and 38 females, of which 18 were adult females (>4 years old). These bison were distributed across four big farms, covering a total area of 3,478 hectares: two farms in Segovia, one in Jaén, and one in Ciudad Real. During this period, 37 calves were born, and 19 individuals died, five of which were under one year old. As of now, the population stands at 78 individuals, representing a 30% increase over the initial number of imported animals. These preliminary data suggest that birth and mortality rates in the Spanish populations are comparable to those observed in Central European populations, indicating that the European bison is adapting well to the environmental conditions of the Iberian Peninsula.

[TSC.4-P-2]

Wednesday 4
Discussion corner: Room 8

Retama monosperma seed dispersal by four natives herbivorous in Doñana National Park

Muñoz-Reinoso, José Carlos[1]; Fernández Martínez, Mario[2]; Gallego Fernández, Juan Bautista[3]

(1) Universidad de Sevilla; (2) Universidad de Sevilla; (3) Universidad de Sevilla

Correspondence e-mail: [reinoso@us.es]

Retama monosperma is a shrub, up to 7 m tall and 14 m of canopy diameter, native to the coastal dunes of the south-western Iberian Peninsula that has undergone a significant spread during the 20th century, threatening habitats of European interest. Since the last decade of the 20th century, one-seed broom has expanded rapidly in the Doñana area, where it was never present before. So far, the spread of Retama has been attributed to the dispersal of its seeds by rabbits and hares. In this paper, we address the identification of disperser species and the quantification of their importance as dispersal agents in Doñana. In the Doñana Retama expansion area, two transects were established from the coast inland, 500 m long and 4 m wide, 500 m apart, crossing different dune habitats. On a monthly basis (June 2023-December 2024), the faeces present in the transects were collected, identified, and their contents analysed for seeds. Seed dispersal was from June to November, with peaks in late summer and early autumn. A total of 1083 samples were collected and 6884 seeds extracted. 91.1 % of the seeds were dispersed by cervids (deer and fallow deer), the rest by wild boar (4.7%) and hares (4.2%), with no seeds found in fox or badger faeces. Although it could be thought that the greater the number of herbivores the greater the dispersal success, in this case, the high number of cervids could be behind the rapid expansion of Retama in the Doñana area.

[TSC.4-P-3]

Thursday 5
Discussion corner: Room 8

Destocking of extensive livestock impacts regional primary production

Cruz-Amo, Lydia[1]; Sala, Osvaldo E.[2]; Barbosa, Jomar M.[3]; Beguería, Santiago[4]; Pueyo, Yolanda[5]; Anadón, José D.[6]

(1) Instituto Pirenaico de Ecología (IPE-CSIC); (2) Arizona State University; (3) Centro de Investigación e Innovación Agroalimentaria y Agroambiental (CIAGRO-UMH),; (4) Estación Experimental de Aula Dei (EEAD-CSIC); (5) Instituto Pirenaico de Ecología (IPE-CSIC); (6) Instituto Pirenaico de Ecología (IPE-CSIC)

Correspondence e-mail: [ldelacruzamo@ipe.csic.es]

Extensive livestock is a key primary consumer globally. Managed grazing occupies 25% of the world's land, making it the most extended form of land use. Local experiments have clarified the impact of livestock on vegetation. However, how these impacts translate to larger-scale effects on the carbon cycle remains unclear. The objectives of this work is to test for the impact of extensive livestock on large-scale net primary productivity (NPP) patterns and quantify the magnitude of this impact. We analyzed the effect of changes in extensive livestock on NPP patterns in rangelands of peninsular Spain over a 15 years period (2007-2021). The study focused on meat-oriented sheep due to its significant extensive component. We employed linear models to evaluate the relationship between livestock trends on NPP trends over the study period on 5x5 km cells, and incorporating the effect of climatic covariates.

Our results indicate a marked decrease in livestock stocking rates in Spain, which significantly increased NPP over the study period. This effect was strongly related to the initial stocking rate. In cells with substantial declines in livestock (> 1000 heads/25km2), livestock declines accounted for 4.2-6.5% of the observed NPP increment trends in rangelands. This study highlights the largescale effects of extensive grazing on NPP, even in the short term, and demonstrates the role of changes in extensive livestock stoking rates as a driver of global change. Our work contributes to designing improved land-use strategies for mitigating global warming and sustainable rangeland management.

[TSC.4-P-4]

Tuesday 3
Discussion corner: Room 8

Livestock behaviour in different Management Units from the Gorbeia Special Area of Conservation

Urkijo Letona, Ainhoa[1]; Martinez, Andrea[2]

(1) NEIKER; (2) NEIKER

Correspondence e-mail: [aurkijo@neiker.eus]

Landscape structure affects livestock behaviour when it is extensively managed. Thus, livestock selects and rejects specific zones in its grazing-area depending on several biotic and abiotic factors. For that reason, the objective of this study is to compare the behaviour of the livestock in areas with a similar grazing-pressure, but with different landscape matrixes.

For that purpose, different Management Units (MU) from the Gorbeia Special Area of Conservation (SAC) that had a similar size and livestock density were selected. Then, the landscape was characterised according to its vegetation and slope. Finally, livestock movement was analysed using GPS data of Digitanimal collars obtained from the livestock-campaign of 2023. For this analysis Jacobs index and GPS register density in different landscape-patches were calculated for each MU.

Livestock behaviour changed depending on vegetation and slope, which makes a more specific and differentiated management model necessary: not only considering pasture extension, but also integrating other characteristics of the landscape.

[TSC.4-P-5]

Wednesday 4
Discussion corner: Room 8

Introduced red deer in the National Park of As Illas Atlánticas and their impact on ecosystem management and conservation

Carro, Francisco[1]; Pardavila, Xosé[2]; Moraña, Álvaro[3]; Santamaría, Luis[4]; Piorno, Vicente[5]; Soriguer, Ramón C.[6]

(1) Estación Biológica de Doñana, CSIC; (2) Sorex Ecoloxia e Medio Ambiente S.L.; (3) Sorex Ecoloxia e Medio Ambiente S.L.; (4) Estación Biológica de Doñana, CSIC; (5) Parque Nacional Marítimo Terrestre de las Illas Atlánticas de Galicia; (6) Estación Biológica de Doñana, CSIC

Correspondence e-mail: [xosepardavila@gmail.com]

The red deer,a species widely distributed in the Iberian Peninsula, was introduced in on the Island of Sálvora (a small islet of 209 hectares now included in the National Park of As Illas Atlánticas de Galicia during the second half of the 20th century, for hunting purposes. An unknown number of individuals was released by the former owners and few specimens (over 10) were reported in the 80s and 90s. From 2019 to 2022, we quantified red deer abundance, age structure, sex ratio, and distribution using a combination of camera traps, drive-based counts, and nocturnal surveys using linear transects and vantage-point counts with thermal cameras. During the study period, deer abundance and density were low (mean=15 and CI90 = 5-28 individuals, equivalent to 7.2 and 2.4-13.4 individuals/km2). The low density is probably related to the low population productivity (0.28, 0.35, 0.12 and 0.31 offspring per adult female in 2019, 2020, 2021 and 2022 respectively), which probably arises from low vegetation productivity modulated by strong competition with other herbivores (most importantly, feral horses and rabbits). Previous experiments using exclosures had shown that large ungulates had strong effect on vegetation structure and productivity (in particular, the balance between woodland and grassland vegetation), with cascading effects on flora and fauna species of conservation interest (e.g., yellow-legged gull Larus michahellis, sand toadflax Linaria arenaria). Future management decisions should therefore consider the interplay among different herbivores and their effects on other ecosystem components.

[TSC.4-P-6]

Thursday 5
Discussion corner: Room 8

Effects of deer on the functioning of Mediterranean oak woodlands: carbon, water and fire

Bugalho, Miguel[1]; Lecomte, Xavier[2]; Caldeira, Maria[3]; Wilcox, Bradford[4]; Leite, Pedro[5]

(1) Center for Applied Ecology “Prof. Baeta Neves” (CEABN-InBIO); (2) CEABN-InBIO; (3) Center for Forest Studies (CEF), Associated Laboratory TERRA; (4) Department of Ecology and Conservation Biology, Texas A&M University, College Station, Texas, USA; (5) Department of Ecology and Conservation Biology, Texas A&M University, College Station, Texas, USA

Correspondence e-mail: [migbugalho@isa.ulisboa.pt]

Wild ungulates, which populations are expanding across their geographical areas of distribution, can affect the plant species

composition, productivity and structure of the plant communities, ultimately altering ecosystem properties and functioning. Here we summarize the effects of deer on the plant community and on the carbon storage, fire hazard and the water cycle of a Mediterranean oak woodland located in Southeast Portugal. We use data from a long-term deer (Red deer, Cervus elaphus and Fallow deer Dama dama) exclusion experiment and compare fenced plots where deer has been excluded for 7, 12 and 20 years, with control plots where deer maintains grazing and browsing activities. We show that deer changes ecosystem properties

with significant effects on the species composition and structure of the plant community. Through reduction of the shrub cover deer significantly reduces the above-ground carbon storage and concomitantly mitigates fire hazard. Additionally, through trampling and reduction of the shrub cover, deer significantly alters water infiltration

rates with effects varying with age of deer exclusion. Our results show how wild ungulates can alter the whole functioning of ecosystems suggesting that management of wild ungulate populations must consider multiple effects on ecosystems that may imply synergies and trade-offs.

TSC.5. The value of time: understanding the fate of ecosystems, communities and metacommunities over time

Tuesday, 3 (12:45-14:15)

Room: Seminario 6

Community ecology has advanced the notion of how biotic and abiotic factors interact to structure ecological communities, yet with a strong focus on spatial scales. Understanding how accelerating environmental change will impact populations, communities and ecosystems requires also to explore temporal dynamics at different time scales. This session calls for recent perspectives in community ecology emphasizing the importance of long-term metacommunity dynamics studies, integrating local and regional processes such as dispersal, and historical contingencies such as priority effects and past disturbances, and considering a long-term view of past environmental variability. Incorporating evidence of repeated community assembly processes and dynamic equilibrium together with environmental filtering would benefit from temporal approaches at scales from years to millennia. This is timely as the increasing availability of long-term datasets has coincided with the development of new analytical tools (e.g., sedimentary ancient DNA) and theoretical advancements (e.g., resilience theory). These tools offer valuable insights into studying temporal dynamics in community ecology from a multidisciplinary perspective within community ecology such as paleoecology, disturbance ecology, conservation ecology, and evolutionary biology. This session welcomes contributions that specifically seek to bridge the local-regional and short-long term divide, using diverse sources of datasets and approaches to better understand the role of spatiotemporal environmental regimes in shaping community assembly factors.

Organizers:

• **Xavier Benito Granell,** Marine and Continental Waters Program, Institute of Agrifood Research and Technology (IRTA)

• **Sergi Pla-Rabés,** CREAF

• **María Cuenca-Cambronero,** Universitat de Vic

TSC.5. Orals

[TSC.5-O-1]

Tuesday 3, morning (second): 12:45
Room: Seminario 6

Drivers affecting the temporal stability of plant-pollinator communities

Tobajas, Estefanía[1]; Artamendi, Maddi[2]; Chueca, Luis J.[3]; Domínguez-Lapido, Paula[4]; Gostout, Christian[5]; Hermosilla, Brais[6]; Poza, Jon[7]; Rose, Jennifer[8]; Salgado-Irazábal, Xabier[9]; de Simón, Martina[10]; Magrach, Ainhoa[11]

(1) BC3 Basque Centre For Climate Change-Klima Aldaketa Ikergai; (2) BC3 Basque Centre For Climate Change-Klima Aldaketa Ikergai; (3) BC3 Basque Centre For Climate Change-Klima Aldaketa Ikergai; (4) eNeBaDa ENTORNO S.L. and BC3 Basque Centre For Climate Change-Klima Aldaketa Ikergai; (5) BC3 Basque Centre For Climate Change-Klima Aldaketa Ikergai; (6) BC3 Basque Centre For Climate Change-Klima Aldaketa Ikergai; (7) BC3 Basque Centre For Climate Change-Klima Aldaketa Ikergai; (8) BC3 Basque Centre For Climate Change-Klima Aldaketa Ikergai; (9) BC3 Basque Centre For Climate Change-Klima Aldaketa Ikergai; (10) BC3 Basque Centre For Climate Change-Klima Aldaketa Ikergai; (11) BC3 Basque Centre For Climate Change-Klima Aldaketa Ikergai

Correspondence e-mail: [estefania.tobajas@bc3research.org]

The ability of an ecosystem to buffer perturbations in the environment over time while preserving ecologically significant functions is known as temporal stability. While factors affecting this temporal stability have been well studied in plant communities, only a few studies have assessed the stability of pollination services. The temporal stability of pollinator visitation rates may be influenced by species richness, species asynchrony or stability across aspects such as flower production, or plant and pollinator abundances, which can ultimately impact the functioning (e.g., plant reproductive success) or stability of those functions. Understanding these different relations is important to improve our understanding of how changes in plant or pollinator communities could affect ecosystem functioning. Here, we use well-resolved data on floral resource availability, plant and pollinator interaction frequencies and plant reproductive success, that includes four years of data collected at 5 sites within Gorbea Natural Park (Bizkaia), by conducting biweekly transects during the flowering season (April-July). We expect that factors like greater asynchrony of plant and pollinator species abundance and higher pollinator diversities will increase the stability of pollinator visitation rates, which will also affect the reproductive success of different plant species. These results will be instrumental in moving beyond patterns to understanding the mechanisms driving the temporal stability plant-pollinator communities in natural systems.

[TSC.5-O-2]

Tuesday 3, morning (second): 13:00
Room: Seminario 6

A millennial increasing trend in diatom diversity in naturally acidic alpine lakes disrupted by enhanced nitrogen availability

Martín Lorenzo, Daniel[1]; Catalan, Jordi[2]; Pla Rabés, Sergi[3]
(1) CREAF; (2) CSIC CREAF; (3) UAB CREAF
Correspondence e-mail: [d.martin@creaf.uab.cat]

In densely populated lowlands, increased nitrogen loadings to lakes are usually related to eutrophication. In contrast, in remote areas, such as high-latitude or high-elevation lakes, nitrogen impacts during the last decades have been mainly related to the acidifying effects on generally low-buffered waters. The potential fertilizing effect has been barely investigated because of the more apparent consequences of acidification. Lakes that have always been acidic due to the rock composition in their catchments provide an opportunity to investigate the nitrogen impact exclusively related to an enhancement as nutrients. This study analyses sediment cores from two naturally acidic Pyrenean lakes above 2500 m.a.s.l. to investigate how lake biodiversity over the last 5000 years, assessed using the diatoms record, have been affected by enhanced nitrogen loadings during historical times, evaluated using sediment elemental and isotopic chemical composition. After a tendency of 3000 years of increasing diversity, a progressive decline started around 2000 years ago. The shift appears related to nitrogen availability as indicated by sediment nitrogen features, particularly the isotopic signature. Although land use changes related to livestock farming cannot be entirely disregarded, atmospheric sources associated with the historical iron mining and foundry are also likely, provided their proliferation down the valley and surrounding areas. The study emphasizes the relevance of atmospheric pollution as a fertilizing agent in poor-nutrient catchments disrupting natural biodiversity tendencies.

[TSC.5-O-3]

Tuesday 3, morning (second): 13:15
Room: Seminario 6

Stable assembly processes despite signs of non-equilibrium species distributions over four decades of environmental change in bird communities across North America

Viana, Duarte[1]; Pichler, Maximilian[2]; Hartig, Florian[3]; Jeliazkov, Alienor[4]; Zurell, Damaris[5]

(1) Estación Biológica de Doñana, CSIC; (2) University of Regensburg, Germany; (3) University of Regensburg, Germany; (4) INRAE, HYCAR, University of Paris Saclay, France; (5) University of Potsdam, Germany

Correspondence e-mail: [dviana@ebd.csic.es]

(1) When environmental conditions change, species adjust their distributions and biological communities reassemble. It has been speculated that during this process, community assembly rules, such as environmental niche responses and species interactions, vary in space and time. However, empirical data and studies on these questions remain scarce.

(2) Here, we use joint species distributions models (jSDMs) and 38 years of monitoring data from 775 bird communities across North America, at a relatively coarse spatial scale (~40km grain), to test the extent to which environmental niche preferences, coarse-scale co-occurrence patterns and the relative importance of community assembly processes change over time.

(3) We observed pervasive compositional changes among bird communities, associated with changing environmental conditions over time. The responses of many individual species to environmental drivers changed through time, and species associations were mostly positive and tended to decrease in magnitude through time. When considering the relative importance of inferred processes for explaining species distributions and community composition, we observed a significant but weak decrease in the relative importance of environmental niche processes at the species and site levels, indicating progressive environment-distribution decoupling, whereas the relative importance of species associations remained stable. Overall, our study reveals environmental decoupling consistent with non-equilibrium species distributions following widespread environmental change, but a fairly stable contribution of fundamental processes to the assembly of bird communities at a relatively coarse spatial scale and at a decadal temporal span.

[TSC.5-O-4]

Tuesday 3, morning (second): 13:30
Room: Seminario 6

Long-term resilience of Pyrenean subalpine ecosystems: a high resolution sedaDNA approach to reconstruct ecological communities using Holocene paleoenvironmental records

Ramos Capon, Cristina[1]; Epp, Laura[2]; Cardillo, Alessio[3]; Saiz Bustamante, Hugo[4]; Julián Posada, Irene[5]; Moreno, Ana[6]; Ara, Angela[7]; Zech, Michel[8]; Zech, Roland[9]; González-Sampériz, Penelope[10]; Gil Romera, Graciela[11]

(1) Instituto Pirenaico de Ecología; (2) University of Konstanz; (3) Pyrenean Institute of Ecology-CSIC; (4) University of Zaragoza; (5) Pyrenean Institute of Ecology-CSIC; (6) Pyrenean Institute of Ecology-CSIC; (7) Pyrenean Institute of Ecology-CSIC; (8) University of Dresden; (9) University of Jena; (10) Pyrenean Institute of Ecology-CSIC; (11) Pyrenean Institute of Ecology-CSIC

Correspondence e-mail: [cramos@ipe.csic.es]

Introduction. There is growing interest in understanding the long-term effects of global change on mountain systems, given their vulnerability to disturbances. Climate warming and human activities are reshaping subalpine biodiversity, possibly altering community assemblies and stability. Understanding how past mountain communities responded to disturbances is crucial for predicting the effects of current and future changes. This research examines ecosystem resilience to natural and anthropogenic disturbances using the Holocene paleoenvironmental record of plant and animal communities from the subalpine Pyrenean Basa de la Mora lake (BSM).

Material and methods. We recovered a new lacustrine sequence from BSM, enabling the reconstruction of physical and biological variables. We employed the rarely used molecular tool of sedimentary ancient plant and animal DNA (sedaDNA) to infer past subalpine community composition. Additionally, we used organic biomarkers and charcoal to reconstruct temperature, precipitation, and fire time series. We inferred community stability and resilience, applying diversity and structural metrics, then comparing the results with preliminary causal ecological network reconstructions based on pollen abundance from a previous record.

Results and discussion. SedaDNA proved to be an innovative tool for reconstructing past local plant community composition as well as providing animal presence data, offering a more comprehensive view of ancient subalpine communities and potential interactions, such as herbivory, pollination, and mutualism. Comparing community resilience to disturbances with preliminary causal networks, we revealed significant structural community resilience changes, synchronized with various environmental factors—fire, human activities, and climate change—throughout the Holocene. These results pave the way for comparing resilience changes with previous sedaDNA reconstructions conducted in the Pyrenees.

[TSC.5-O-5]

Tuesday 3, morning (second): 13:45
Room: Seminario 6

Humans, then Climate, Simplified Lake Trophic Structures Across the Azorean Archipelago

Matias, Miguel[1]; Gonçalves, Vitor[2]; Pla-Rabes, Sergi[3]; Mendoza, Manuel[4]; Raposeiro, Pedro[5]

(1) Museo Nacional de Ciencias Naturales, CSIC; (2) CIBIO - Universidade dos Açores; (3) BABVE, UAB; (4) Museo Nacional de Ciencias Naturales, CSIC; (5) CIBIO - Universidade dos Açores

Correspondence e-mail: [miguel.matias@mncn.csic.es]

Island lake ecosystems are critical sentinels of environmental change, reflecting natural transitions over millennia. However, human activities have increasingly pushed these systems past ecological thresholds, triggering abrupt and often irreversible ecosystem shifts. Recent human-driven climate change has compounded these impacts, accelerating changes in lake trophic structures.

This study adopts a comprehensive ecosystem-level approach, advancing beyond traditional single-proxy analyses to examine trophic structures across the Azores Archipelago. Using an unprecedented multi-trophic analysis of Azorean lakes spanning the past two millennia, we demonstrate how primary producers and consumers group into trophic guilds that form repeated patterns across multiple lakes and islands. Our findings reveal that human activities, followed by climate variability, have driven ecosystem shifts toward simplified trophic structures.

Trophic guilds exhibited asynchronous responses, with distinct timing and speeds of shifts across islands. Regional analyses highlight periods of stability punctuated by abrupt transitions linked to human settlement, volcanic activity, and recent climatic variability. Local lake trajectories align closely with regional environmental pressures, underscoring the coupling of ecological change to human and climatic drivers.

These findings emphasize the vulnerability of small, isolated ecosystems to ongoing changes and highlight the importance of scaling from individual lake studies to archipelago-wide perspectives. By integrating paleoecological records with modern assessments, we provide critical insights into ecological tipping points and opportunities for adaptive management.

This work was supported by Fundação para a Ciência e a Tecnologia through the DISCOVERAZORES project (PTDC/CTA-AMB/28511/2017), the European Union (QREN, FEDER, COMPETE), CIBIO/InBIO (UIDB/50027/2020, UIDP/50027/2020, LA/P/0048/2020), and the Spanish Ministry of Economy and Competitiveness (PID2022-137749NB-I00).

[TSC.5-O-6]

Tuesday 3, morning (second): 14:00
Room: Seminario 6

Five centuries of Human Impacts on Coastal Ecological Communities of Santiago Island, Cabo Verde

Castilla Beltrán, Álvaro[1]; Evans, Christopher[2]; Stig Sørensen, Marie Louise[3]; Navarro, Mario[4]; de la Casa Sánchez, Javier[5]; Picornell Gelabert, Llorenç[6]; Martin Ramos, Maria del Pilar[7]; Nogué, Sandra[8]

(1) University of La Laguna; (2) Cambridge University; (3) University of Cambridge; (4) University of La Laguna; (5) UAB Barcelona; (6) Universitat de les Illes Balears; (7) Universidad de La Laguna; (8) UAB Barcelona

Correspondence e-mail: [acastilb@ull.edu.es]

Coastal ecological communities on islands are often the first to have been exposed to human-induced changes, making them key systems for studying long-term ecological dynamics. This study investigates ecological change and human impacts on coastal ecosystems near Alcatraces, an early Portuguese settlement on Santiago Island, Cabo Verde. We explore c. 500 years of shifts in vegetation, fungal and mollusk communities associated with the rise and

decline of this settlement by analysing a 275 cm stratigraphic test pit (SIR) with 12 distinct

strata rich in shells and charred material. Multi-proxy archaeobotanical and palaeoecological analyses—including pollen, fungal spores, phytoliths, charcoal, and mollusk remains—reveal distinct stages of ecological transformation, including fire events, erosion, vegetation shifts,

and preliminary evidence suggesting the presence of native mangrove communities, now absent in Cabo Verde. By providing a diachronic perspective on land-use changes and their consequences in the coastal ecosystem, this research contributes to a broader discussion on coastal ecosystem vulnerability, and the value of long-term perspectives for management.

TSC.5. Posters

[TSC.5-P-1]

Wednesday 4
Discussion corner: Room 11

Coastal wetlands dynamics in Ría de Vigo during the Holocene transgression: is the onshore and subtidal palaeoevidence

able to capture the main stages of change?

Cazás Fraga, Nerea[1]; Castro Parada, Alberto[2]; Cartelle Álvarez, Victor[3]; García Gil, Soledad[4]; Muñoz Sobrino, Castor[5]

(1) Facultade de Bioloxía, Universidade de Vigo & Centro de Investigación Mariña (CIM); (2) Facultade de Bioloxía, Universidade de Vigo & Centro de Investigación Mariña (CIM); (3) Flanders Marine Institute (VLIZ), InnovOcean Campus; (4) Centro de Investigación Mariña (CIM), Universidade de Vigo; (5) Facultade de Bioloxía, Universidade de Vigo & Centro de Investigación Mariña (CIM)

Correspondence e-mail: [ncazas@alumnado.uvigo.gal]

A sediment core from the outer margin of Ría de Vigo (-30 m bmsl) contains evidence of redeposition of ancient coastal upland sediments, formed above the ancient coastline at different intervals between the end of the Last Glacial Maximum and the Lateglacial. During the Holocene, palaeoevidence of cf. Juncus in subtidal fluviomarine sediments indicates larger extensions of coastal sedges well connected to sea by tidal channels, developed during periods of increasing precipitation/runoff regimes. At the southern intermediate margin of the ria, upland evidence indicates the local development of a floodplain alluvial forest (ca. 8-6 ka BP), which was subsequently replaced by dunes and dune slacks (6-4 ka BP). During the last 3000 years, several cold events affected the coastal lagoon-beach complex at the Cíes Islands, with periods characterized by enhanced upwelling regimes, alternated with warmer stormy periods of prevailing downwelling conditions. These changes altered the balance among the lacustrine, marsh, dune and lagoon systems, opening ephemeral inlets and modifying the trophic stage of the shallow waters surrounding the archipelago. In San Simón Bay, at -3.5 m bmsl, seismic records and pollen stratigraphy reveal a hiatus in the sediment that can be dated to 2000 – 1600 cal a BP. This suggests that an erosive event occurred in the area before the local development of a marsh/alder swamp. This collection of apparently puzzling evidence may serve to reconstruct the main stages of change affecting the coastal wetlands developed at the ria margins during the marine transgression.

[TSC.5-P-2]

Thursday 5
Discussion corner: Room 11

Estimation of the biodiversity changes in Ría de Vigo during the Holocene using terrestrial and marine remains from fluviomarine sediments

Muñoz Sobrino, Castor[1]; Cazás Fraga, Nerea[2]; Castro Parada, Alberto[3]

(1) Universidade de Vigo; (2) Universidade de Vigo; (3) Universidade de Vigo

Correspondence e-mail: [bvcastor@uvigo.es]

Subtidal sediments from Ría de Vigo indicate that pinewoods and heathlands were part of the regional upland ecosystems at the beginning of the Holocene. Even so, changes in Pinus grain sizes and pollen concentrations suggest that some upland ancient pollen evidence might be remobilised during stages of intensified upwelling and resedimented on the seabed. The re-gional summer mean temperature rose about 2° C between 12.5 to 10 kcal a BP, with an esti-mated July air temperature of 21.5 °C along this coast. Then, evidence of deciduous oaks and aquatic freshwater flora rises in the sediments of Ría de Vigo between ca. 8.0-6.0 kcal a BP, a phase that coincided with the Holocene Climatic Optimum described in northern Iberia. There-fore, it is still unclear whether the significant differences in the sizes of Pinus pollen grains dur-ing the Early and Mid-Holocene are due to climatic variations or to a replacement of pine spe-cies in the area. Nonetheless, the total tree pollen in sediment declined during the last 3.5 ka BP, and Pinus pollen evidence almost disappeared with the first signs of anthropization in the area, only recovering after the modern repopulation efforts. We use different (marine and ter-restrial) remains to independently calculate several diversity indexes to compare the presuma-bly remobilized sediment layers with those from historical phases dominated by pinewoods, deciduous forests, agropastoral systems, and reforestation practices. Our goal is to estimate and discuss the impact of climate forcing and human impacts on regional biodiversity.

[TSC.5-P-3]

Tuesday 3
Discussion corner: Room 11

Palaeoecological evidence reveals the 'unexpected' history of the iconic Montejo beechwood

Morales del Molino, César[1]; Morellón, Mario[2]; Villasante Marcos, Víctor[3]; Gobet, Erika[4]; Tinner, Willy[5]; Gil, Luis[6]

(1) Universidad de Alcalá; (2) Universidad Complutense de Madrid; (3) Instituto Geográfico Nacional; (4) University of Bern; (5) University of Bern; (6) Universidad Politécnica de Madrid

Correspondence e-mail: [cesar.morales@uah.es]

Introduction. The Montejo beechwood is one of the most iconic forest stands in central Iberia because: ii) it represents the southwestern limit of the distribution range of Fagus sylvatica i) it is a well-developed and highly diverse cool-temperate deciduous forest located within a predominantly submediterranean setting; and iii) the abundance of ancient trees makes it be considered an 'old-growth' and even 'primary' forest. In this study we aimed to investigate the long-term dynamics of this forest.

Material and methods. In April 2023, we retrieved a sediment core from a forest hollow located within the Montejo beechwood. To establish the chronology, we fitted a Bayesian age-depth model ('rbacon') to ten 14C dates on terrestrial plant macrofossil samples and 14 210Pb dates on bulk sediment. We have carried out palynological and macrofossil analyses.

Results and discussion. The ca. 3000 year-long palaeoecological record shows that pinewoods with deciduous oaks and hollies dominated in the area until ca. 1700 years ago under substantial fire occurrence. The local presence of Pinus is supported by the findings of macrofossils and stomata. Following a hiatus, the record resumes around 1100 years ago showing a landscape dominated locally by birch woodlands with hazels, whereas oaks and pines would dominate outside the mire. Finally, over the past 800 years, forests were opened to promote livestock husbandry. Interestingly, the data show that Fagus sylvatica was present in the area throughout the record but only played a relatively significant role in the local woods for the past few centuries.

[TSC.5-P-4]

Wednesday 4
Discussion corner: Room 11

Sharp decrease of snowbed specialists in the catalan Pyrenees in 20 years

Lluch Oms, Oriol[1]; Illa Bachs, Estela[2]; Ninot Sugrañes, Josep Maria[3]; Carrillo Ortuño, Empar[4]

(1) Universitat de Barcelona; (2) Universitat de Barcelona; (3) Universitat de Barcelona; (4) Universitat de Barcelona

Correspondence e-mail: [olluchom7@alumnes.ub.edu]

Introduction. Snowbed vegetation grows in the snowiest patches of alpine environments where, within few meters, there is a succession from alpine grasslands to strictly snowbed communities. The short growing period in these areas constrains the growth of most alpine species, and only a few can thrive there. Climate change causes an earlier snowmelt and a reduction in snow cover, which enables the colonization of snowbed patches by more competitive grassland species from the neighbouring grasslands.

Material and methods. Between 2003 and 2005 we established eight permanent transects in central Pyrenean snowbed patches, each covering the steep snowmelt gradient, from alpine grasslands to snowbed communities, where we sampled species composition and cover in plots distributed at regular intervals. We characterized the vegetation groups present at each transect by grouping the plots according to their floristic similarity using the fuzzy-cmeans algorithm. Between 2013-2015 and 2023-2024, we resampled all the transects with the same methodology.

Results and discussion. Our results show how all the vegetation groups found in the different transects have slightly shifted towards the snowiest end of the snowbed transect, indicating that grassland communities are colonizing snowbed communities. At species level, snowbed specialists show different responses: some are declining due to a lack of colonizable areas, whereas others are increasing in frequency, colonizing the snowiest end of the transect. In contrast, grassland specialists are becoming more abundant in the snowbed vegetation groups. These results suggest that snowbed vegetation may experience a sharp decrease in the Pyrenees with the ongoing climatic trends.

[TSC.5-P-5]

Thursday 5
Discussion corner: Room 11

The value of time: understanding the long-term fate of island summit ecosystems

de Nascimento, Lea[1]

(1) University of La Laguna

Correspondence e-mail: [leadenas@ull.edu.es]

Volcanic summits are extreme environments home to endemic species. These ecosystems are particularly vulnerable due to their limited space, isolated populations, and ephemeral nature, shaped by geological and climatic forces. In the Canary Islands, the summits of Tenerife also played a significant cultural role for indigenous and colonial populations, offering seasonal pastures and natural resources. With restricted opportunities for altitudinal migration, summit communities face growing threats from invasive herbivores and climate change, which are altering species distributions. For example, the Teide broom (Spartocytisus supranubius) is declining, while other shrub species expand. The historical distribution of Canarian Junipers (Juniperus cedrus) is also debated, with evidence suggesting a past broader range, including isolated populations, long-lived trees and residual interactions with migratory birds. To address these challenges, managers need to differentiate between natural and cultural vegetation communities to guide conservation and restoration efforts. This study uses paleoenvironmental methods, including pollen, phytolith, charcoal and diatom analysis, and sediment composition to reconstruct past vegetation dynamics. Results show that pre-human summit vegetation had moderate tree cover (Juniperus and Pinus), slightly more represented than in the present, under a natural fire regime likely influenced by volcanic activity. The earliest signs of anthropogenic impact, including herbivore grazing, date to around 1500 years ago. Indigenous activities such as grazing and fire influenced vegetation changes driving ecological succession. The introduction of new herbivores like rabbits during the colonial period led to further vegetation shifts, a trend that has continued with the establishment of the Teide National Park.

[TSC.5-P-6]

Tuesday 3
Discussion corner: Room 11

When You Lose in Hake, but Gain in Herring

Pascual, Juan[1]; Oliveira, Daniel[2]; Vidal-Cordero, J. Manuel[3]; Angulo, Elena[4]; Broggi, Juli[5]; Gracia-Quintas, Laura[6]; C. de la Barrera, Carlos[7]; Cerdá, Xim[8]

(1) Estación Biológica de Doñana, Consejo Superior de Investigaciones Científicas (CSIC); (2) RAIZ - Instituto de Investigação da Floresta e Papel; (3) Estación Biológica de Doñana, Consejo Superior de Investigaciones Científicas (CSIC); (4) Estación Biológica de Doñana, Consejo Superior de Investigaciones Científicas (CSIC); (5) Museo Nacional de Ciencias Naturales, Consejo Superior de Investigaciones Científicas (CSIC); (6) Fundació Pau Costa; (7) Centro Oceanográfico de Cádiz, IEO; (8) Estación Biológica de Doñana, Consejo Superior de Investigaciones Científicas (CSIC)

Correspondence e-mail: [juan.pascual@ebd.csic.es]

Introduction. Ants are prevalent in all terrestrial ecosystems and can serve as reliable bioindicators, particularly for assessing the recovery of biotic communities after major disturbances. In this study, we evaluated the response of ant communities in a Mediterranean coniferous forest to a crown wildfire, providing a snapshot of their status in the fourth year following the disturbance.

Materials and Methods. During May, July, and October 2021, we conducted a study on four plots: two burned and two unburned. For each plot, we characterized the ant assemblage by deploying 20 pitfall traps along two 100-meter transects. Pitfall traps were operated for 24 hours. We then analyzed the taxonomic structure and composition of ant communities by calculating species occurrence, taxonomic richness (S), the Shannon diversity index (H), and Pielou's taxonomic evenness index (J). These indices were compared between burned and unburned plots using linear mixed-effects models.

Results and Discussion. Our results showed that most of the taxonomic diversity indices explored did not exhibit significant differences between burned and unburned areas. However, the taxonomic composition of the ant communities differed four years after the fire. The loss of taxonomic richness and diversity immediately following the fire was compensated within a short period (four years) by the colonization of new species and/or the expansion of more resilient species. Our findings indicate that wildfire promoted the short-term replacement of arboreal ant species with species better adapted to open habitats.

[TSC.5-P-7]

Tuesday 3
Discussion corner: Room 3

A Holocene perspective of deltaic pulse events combining paleoecology and Earth System modeling

Benito, Xavier[1]; Giosan, Liviu[2]; Vilà, Miquel[3]

(1) Institute of Agrifood Research and Technology (IRTA); (2) Woods Hole Oceanographic Institution; (3) Catalan Cartographic and Geological Institute

Correspondence e-mail: [xavier.benito@irta.cat]

Understanding the long-term evolution of Mediterranean deltas may provide insights into analog situations of modern accelerated rates of sea-level rise, and situations where natural processes without significant human alteration drive pulse events of water and sediments responsable for their formation and sustainability. Yet there exists limited empirical data on millennial-scale deltaic habitat changes that allow testing the relative effect of hierarchical events of regional (catchment, hydroclimate) and local (sea-level rise, subsidence) forcings on such pulse events.

We use a plethora of empirical datasets including benthic foraminiferal assemblages and sediment geochemistry from a 9800-year sediment record in the deltaic plain, and hydroclimate and pollen records from the Ebro River basin (Spain) to establish the ecological rules that links vegetation changes, climate, humans, and coastal processes over the Holocene. We also compared fossil foraminifera trajectories with a regional data set characterizing the full range of modern communities from marine to deltaic plain habitats, to validate drivers of community change.

Results show that under post-glacial sea level rise, significant peatland-type habitats developed. Thereafter the delta has gone through three habitats with varying degrees of ecological confinement-here defined as external inputs of energy-by crossing two assemblage-wide foraminifera transitions temporally coherent with changes in XRF and sand content at 7850 and 2817 cal yrs BP, respectively. Regional vegetation changes did not show significant effects, whereas rates in sea-level rise accounted for most of the variance in foraminifera assemblage transitions. Interestingly, historical human population density had minor effects in explaining deltaic habitat changes. Our preliminary results offer an analytical framework to integrate feedbacks between climate, environment, and humans that shaped the ecological trajectory of the delta.

GENERAL SESSION

GSD. Ecology Meets Evolution

Tuesday, 3 (11:00-12:30) • Wednesday, 4 (11:00-12:30) • Thursday, 5 (11:00-12:30)

Room: Restaurante

Plasticity facilitates rapid and flexible responses to environmental changes, challenging the traditional, linear views of evolution that emphasize gradual genetic changes over long periods. Instead, plasticity introduces a dynamic interplay between organisms and their environments, suggesting that evolution is not merely a process of natural selection acting on fixed genetic traits, but a complex, ongoing dialogue where organisms actively respond to and shape their ecological contexts. Phenotypes are not just passively encoded by genomes but are co-constructed through interactions with the environment and mediated by epigenetic mechanisms.

Key Questions:

- How do holistic approaches, combining molecular biology, genetics, development, physiology, behavior, and ecology, improve our understanding of evolution?

- How does ecology challenge traditional views of evolution?

Coordinators:

- **Paola Laiolo,** Instituto Mixto de Investigación en Biodiversidad (IMIB-CSIC-UniOvi)
- **Carlos Lara,** Instituto de Investigación en Cambio Global (IICG), Universidad Rey Juan Carlos (URJC)
- **Daniel Montesinos,** James Cook University
- **Guillermo Velo-Antón,** Universidade de Vigo (UVigo)
- **Jordi Voltas,** Universitat de Lleida (UDL).

GSD. Orals

[GSD-O-1]

Tuesday 3, morning (first): 11:00
Room: Cova dos libros

Functional intraspecific variation in the base water potential for seed germination along soil microclimatic gradients

Espinosa del Alba, Clara[1]; Cruz-Tejada, Diana[2]; Jiménez-Alfaro, Borja[3]; Fernández-Pascual, Eduardo[4]

(1) University of Oviedo; (2) University of Pisa; (3) University of Oviedo; (4) University of Oviedo

Correspondence e-mail: [espinosaclara@uniovi.es]

Intraspecific variation exists in a wide range of biological processes and is a key source of species adaptation to environmental changes. Intraspecific variation in the thermal thresholds for germination has been extensively studied. However, much less is known about intraspecific variation in water thresholds for seed germination. The extent and scale of intraspecific variation in the germination base water potential (?b i.e. the minimum amount of water required for germination) could have high ecological significance in water-limited ecosystems, but this significance has never been tested at microclimatic scales.

We tested the hypothesis that water thresholds for seed germination exhibit intraspecific variation along local microclimatic gradients in water-limited Mediterranean alpine ecosystems of the Iberian Peninsula (SW Europe). We sampled 18 subpopulations of Dianthus langeanus (Caryophyllaceae) with contrasting field-measured microclimatic conditions. Measuring germination responses to water stress with polyethylene glycol (PEG) solutions, we fitted hydro-time models to calculate the germination ?b of each subpopulation. We hypothesized that seeds collected from warmer and drier subpopulations had lower germination ?b (i.e. their germination was more drought-tolerant).

We found significant differences between subpopulations' ?b indicating intraspecific variation in germination responses to water stress. Seeds from warmer and drier subpopulations had lower ?b, meaning their germination was more drought-tolerant. These results suggest that germination base water potential is a trait with potential implications for individual phenology, reproduction, and fitness in water-limited ecosystems. The functional intraspecific variation recorded highlights the adaptive potential of seed germination to both current and future climate scenarios.

[GSD-O-2]

Tuesday 3, morning (first): 11:15
Room: Cova dos libros

A postfire drought during the main establishment phase of Cistus albidus populations select individuals of higher height, fruit production and water-use efficiency

Salesa Duro, David[1]; Santana Pastor, Víctor[2]

(1) Fundación CEAM; (2) Fundación CEAM - Universitat d'Alacant

Correspondence e-mail: [salesa@ceam.es]

Climate change is altering rainfall patterns lengthening summer droughts and thus reducing rainfall in spring and autumn. These wet seasons in Mediterranean ecosystems are crucial for plant species to recover after wildfires. This is of utmost importance for obligate seeders, as their re-establishment depends exclusively on their seeds and the germination conditions. However, we do not know if drought during these wet seasons during the post-fire recovery can act as a selective pressure at intra-specific level.

In three different sites we experimentally extended summer drought after fire by delaying its end towards Autumn (AutExcl) or bringing its onset forward in the following Spring (SprExcl). Seedlings were monitored during the first post-fire year and treatments reduced soil water content by 53% and 24% compared to Control, respectively. Key life-history (height and fruit production) and leaf traits related to water use efficiency (such as specific leaf area) were measured in regenerated Cistus albidus populations four and six years after the fire.

Seedlings from AutExcl were taller and produced more fruits in comparison to other treatments during the initial years post fire, when seedlings are more vulnerable. These individuals also exhibited lower SLA, which allowed for a more conservative use of water. These differences were not detected in SprExcl seedlings or in individuals that emerged later (winter). Our results suggest that a rainfall reduction when the main establishment phase occurs (autumn), could have exerted an intra-specific selection of individuals better adapted to succeed in more arid conditions.

[GSD-O-3]

Tuesday 3, morning (first): 11:30
Room: Cova dos libros

Global evolution of animal-mediated seed dispersal

Ramos-Gutiérrez, Ignacio[1]; Quintero, Elena[2]; Rodríguez-Sánchez, Francisco[3]

(1) Universidad de Sevilla; (2) Universidad de Sevilla; (3) Universidad de Sevilla

Correspondence e-mail: [ig.ramosgutierrez@gmail.com]

Ever since their appearance around 350 million years ago, seed plants have established mutualistic relationships with animals, relying on them for some vital processes, such as fertilizing their gametes (i.e. pollination) or dispersing their offspring (seed dispersal).

In this work we unveil the evolution of seed dispersal modes across the whole Spermatophyte Tree of Life and assess the historical and geographical drivers behind such processes.

We have collected a global fruit and seed traits database (FRUSEED) containing information on seed dispersal vectors for around 60,000 species. Using the most comprehensive phylogeny published to date, we have performed discrete trait evolution analyses to estimate the historical prevalence and transition rates between different dispersal modes throughout clades. Additionally, we evaluate such transitions in a paleoenvironmental and palaeogeographical context.

We have found that, as expected, the different ways in which plants disperse their seeds have evolved independently several times throughout their history. Far from being an evolutionarily fixed trait, the way in which plant lineages spread their seeds has changed throughout their history, transitioning back and forth from one to another. Nevertheless, the transition rates vary between clades, some of them being quite consistent on their means of seed dispersal, and others being more variable.

[GSD-O-4]

Tuesday 3, morning (first): 11:45
Room: Cova dos libros

What is necessary to take up a population? Insights from an invasibility experiment with rotifers

Arenas-Sánchez, Cristina[1]; Ortells, Raquel[2]; Carmona, María José[3]; García-Roger, Eduardo M.[4]; Montero-Pau, Javier[5]

(1) Cavanilles Institute of Biodiversity and Evolutionary Biology, University of Valencia; (2) Cavanilles Institute of Biodiversity and Evolutionary Biology, University of Valencia; (3) Cavanilles Institute of Biodiversity and Evolutionary Biology, University of Valencia; (4) Cavanilles Institute of Biodiversity and Evolutionary Biology, University of Valencia; (5) Cavanilles Institute of Biodiversity and Evolutionary Biology, University of Valencia

Correspondence e-mail: [cristina.arenas@uv.es]

Introduction. Dispersal is a fundamental process that enables organisms to colonize new environments. This process involves three stages: departure, transfer, and settlement. Settlement is particularly critical, as it depends on the interaction between the environmental conditions of the new habitat and the biological traits of both residents and immigrants. Although the specific role of some of these factors on settlement success has been extensively studied, our understanding of how they interact to influence settlement success remains limited.

Materials and Methods. In this study, we conducted a multifactorial experiment investigating the roles of migration rates, genetic diversity in the resident population, and the reproductive strategy of immigrants in settlement success. Using the facultatively sexual rotifer Brachionus plicatilis as a model, we established clones from two geographically distinct populations, one designated as the resident and the other as the immigrant, and conducted invasibility experiments in mixed cultures combining the above-mentioned factors. As the clones are morphologically indistinguishable, settlement success was assessed through whole-genome sequencing by identifying immigrant private alleles and tracking their frequency in the cultures.

Results and Discussion. High migration rates, low genetic diversity in the resident population, and an early induction of sexual reproduction in the immigrants significantly enhanced settlement success. The interaction among these factors was crucial. High migration rates exerted the greatest impact when paired with early sexual reproduction in immigrants, while low genetic diversity in the resident population was key for immigrants with delayed sex. These findings underscore the importance of multicausal approaches in understanding ecological and evolutionary processes in habitats with pre-existing populations.

[GSD-O-5]

Tuesday 3, morning (first): 12:00
Room: Cova dos libros

Growht form and phylogeny affect the scaling between nutrient and size-based traits of leaves along climatic and harshness gradients

Vaca Benito, Celia[1]; Ortega Moreno, Miguel Ángel[2]; Laiolo, Paola[3]; Obeso Suárez, José Ramón[4]

(1) Biodiversity Research Institute (CSIC, Universidad de Oviedo, Principado de Asturias); (2) Biodiversity Research Institute (CSIC, Universidad de Oviedo, Principado de Asturias); (3) Biodiversity Research Institute (CSIC, Universidad de Oviedo, Principado de Asturias); (4) Biodiversity Research Institute (CSIC, Universidad de Oviedo, Principado de Asturias)

Correspondence e-mail: [celiavb16@gmail.com]

Both intrinsic and extrinsic factors affect plant Leaf economic spectrum (LES), an ecological pattern that describes the relationships and trade-offs between leaf traits. LES relationships have been widely studied through different species, different organization levels and many biomes. However, the contribution of climate, especially low temperatures in mountains, as well as intrinsic factors such as intraspecific variation and plant growth form in these relationships have been poorly explored.

For this study, we sampled 39 sites distributed in a 2000 m elevation range across the Cantabrian Mountains, Spain, with sampling including mountaintops. We evaluated leaf area, dry weight, Specific leaf area (SLA), Leaf mass per area, and nutrients (C, N, P, and their ratios) over 212 individuals of 38 species. We analysed the influence of climate, growth form, intraspecific variation and phylogeny on the slopes of relationships between leaf traits, testing whether highland species have conservative strategies with respect to lowland species.

We found a weaker effect of climate than that of intrinsic factors and constraints on LES patterns. A substantial part of leaf trait variation was found at the intraspecific level. SLA was positively correlated with N but with a similar slope in plants from different elevations. Herbaceous plants compared to woody plants show deeper slopes among traits. Phylogeny significantly affected these relationships, and the partitioning of variation showed a large proportion of variance assigned to the family level. Intraspecific variation and phylogenetic constraints should be accounted for when analysing trait variation along elevational gradients.

[GSD-O-6]

Tuesday 3, morning (first): 12:15
Room: Cova dos libros

Simulated facilitation shapes intraspecific trait variation in Quercus ilex seedlings

Vizcaíno Palomar, Natalia[1]; Navarro Cano, Jose Antonio[2]; Goberna Estellés, Marta[3]; Benito Garzón, Marta[4]; Alía Miranda, Ricardo[5]

(1) ICIFOR; (2) INIA, CSIC (Madrid); (3) INIA, CSIC (Madrid); (4) INRAE-University Bordeaux; (5) ICIFOR-INIA, CSIC (Madrid)

Correspondence e-mail: [natalia.vizcaino@inia.csic.es]

Trait variation across a species' natural distribution is mainly driven by local adaptation and phenotypic plasticity mechanisms. In addition, plants growing under positive plant-plant interactions, i.e. facilitation, will also develop changes in traits. Facilitation operates across the whole plant's life cycle. However, it is particularly crucial during the early stages, as it promotes plant recruitment, especially in drought-stressed ecosystems. Although much research has been conducted on variation in facilitation-related traits, we do not yet know how facilitation-driven changes are spread between populations. To this end, we designed an experiment under semi-natural conditions to study natural recruitment at early stages, from seed to seedling, and facilitation. We evaluated the interaction between the intraspecific variation of Quercus ilex L. (4 populations, 40 families, total of 3,799 acorns), shrub facilitation (conditions simulating the presence or absence of Retama sphaerocarpa L.) and climate (ongoing summer vs. wet summer) on the performance of Quercus ilex seedlings. Using Kaplan-Meier analyses and linear mixed models, we assessed changes in patterns between populations in shoot emergence, and above and belowground traits during the seedling stage. Preliminary results showed that the probability of emergence was genetically determined, with the northern population emerging earlier than the other three. The facilitated acorns emerged faster but with no difference in seedling height after 16 weeks, suggesting the existence of belowground effects. These results suggest that facilitation alters intraspecific trait variation patterns with ecological consequences as a faster emergence could increase seedling recruitment success, an important bottleneck expected to worsen with climate change.

[GSD-O-7]

Wednesday 4, morning (first): 11:00
Room: Cova dos libros

Stress tolerance traits across a water availability gradient in Mediterranean shrublands

Soler Ruiz, Pol[1]; Castells Caballé, Eva[2]; Martínez Vilalta, Jordi[3]

(1) UAB - CREAF; (2) UAB - CREAF; (3) UAB - CREAF

Correspondence e-mail: [p.soler@creaf.uab.cat]

Trait-based ecology has emerged as a powerful tool to describe plant performance, with the ability to potentially predict vegetation responses to climate change using vegetation models. However, the predictive ability of functional traits remains limited, in part because traits that are more closely connected to relevant physiological processes, their coordination and local environmental context are often not considered.

Here we aimed to improve our understanding of plant responses to drought by exploring the variability and coordination of traits related to drought tolerance in shrub species along an environmental gradient of water availability.

Six shrubland species (Amelanchier ovalis, Arbutus unedo, Buxus sempervirens, Pistacia lentiscus, Rhamnus alaternus and Salvia rosmarinus) that commonly coexist in Mediterranean shrublands were selected from six sites along a water availability gradient in Catalunya (NE Iberian Peninsula). Measurements included widely studied traits such as leaf mass area (LMA) and stem-specific density, but also traits more strongly associated with plant water relations and drought tolerance such as in situ water potentials, water potential at turgor loss point, vulnerability to xylem embolism (P50), stem-specific hydraulic conductivity (Ks), branch capacitance and storage capacity, and minimum leaf conductance.

Our results show that most traits responded to water availability, with greater drought tolerance in more arid sites, confirming previous studies for forest species. In addition, our results show important interactions between trait changes and environmental factors related to climate and soils, highlighting the importance of accounting for environmental context in trait-based studies.

[GSD-O-8]

Wednesday 4, morning (first): 11:15
Room: Cova dos libros

Vrba was right: Implications of Pliopleistocene climate fragmentation on the biogeography of current mammals

Gamboa, Sara[1]; Galván, Sofía[2]; Varela, Sara[3]

(1) Universidade de Vigo; (2) Universidade de Vigo; (3) Universidade de Vigo

Correspondence e-mail: [sara.gamboa@uvigo.es]

Climate plays a vital role in shaping species distribution and evolution over time. Dr. Vrba's Resource-Use hypothesis proposed that regions with extreme temperature and precipitation conditions should harbor a higher number of climate specialist species due to greater historical fragmentation. In this study, we tested this hypothesis by investigating climate-induced fragmentation over the past 5 million years. Our results confirmed Vrba's prediction, showing that the number of climate specialist species increases with historical regional climate fragmentation, while the richness of climate generalist species decreases. This relationship is about 40% stronger than the correlation between current climate and species richness for climate specialist species, and 77% stronger for generalist species. These findings indicate that historical climate fragmentation plays a more significant role than current climate conditions in explaining mammal biogeography. The results offer empirical support for the importance of historical climate fragmentation and physiography in shaping the distribution and evolution of life on Earth.

[GSD-O-9]

Wednesday 4, morning (first): 11:30
Room: Cova dos libros

Linking Soil Parameters and Bioclimatic Variables to Corema album's Functional Traits across species distribution range

Jacinto, João[1]; Varela, Ana Rita[2]; Alegria, Carla[3]; Díaz-Barradas, Mari Cruz[4]; Máguas, Cristina[5]

(1) Centre for Ecology, Evolution and Environmental Changes (CE3C); (2) Instituto Nacional de Investigação Agrária e Veterinária, I.P. (INIAV); (3) Centre for Ecology, Evolution and Environmental Changes (CE3C); (4) Departamento de Biología Vegetal y Ecología, Universidad de Sevilla; (5) Centre for Ecology, Evolution and Environmental Changes (CE3C)

Correspondence e-mail: [jmantunesj@gmail.com]

Corema album, known as white crowberry, is a staple endemic species from the Iberian Peninsula found in coastal dune ecosystems. Its distribution ranges from Galicia to Gibraltar, with some discontinuities in the north and south of Portugal. The biogeography of this dioicous species encompasses several types of environments, from high levels of humidity to arid. In this work, we would like to investigate how soil parameters (e.g., pH, organic matter, cations, carbon, nitrogen) and bioclimatic variables (e.g., temperature, precipitation) are influencing plant functional traits (e.g., plant size, leaf isotopic signature d13C and d 15N, seed size) along its distribution range. We would also like to understand if these abiotic conditions are favouring any gender more than the other. This is especially important because in some areas, the species is decreasing in numbers and starting to take an endangered status, especially in Spain. After sampling 25 locations and around 300 plants along the Iberian Peninsula coast, our preliminary data suggests that these climatic drivers trigger site-specific responses along the biographical distribution of Corema album. In addition, some environmental conditions might be influencing both genders differently along this gradient. This robust approach will be important to understand plant-environment interactions, which could be critical for Corema album's conservation and habitat management.

[GSD-O-10]

Wednesday 4, morning (first): 11:45
Room: Cova dos libros

Exploring specialization as a driver for evolutionary processes on cliff ecosystems

Vlajos Gómez, Stela[1]; Eced, Carlos[2]; Tejero-Ibarra, Pablo[3]; Navarro, Luis[4]; M. Cañadas, Eva[5]; Lorite, Juan[6]; March Salas, Martí[7]

(1) Universidad Rey Juan Carlos; (2) Universidad de Granada; (3) Instituto Pirenaico de Ecología-CSIC; (4) Universidad de Vigo; (5) Universidad de Granada; (6) Universidad de Granada; (7) Universidad Rey Juan Carlos

Correspondence e-mail: [stela.vlajos.gomez@urjc.es]

Over millions of years, Mediterranean cliffs have acted as ecological and climatic refugia for numerous plant species, promoting the evolution of specialization to cliffs, fostering high phylogenetic diversity, and supporting an outstanding number of endemic taxa adapted to these environments. Despite their significant evolutionary and conservational value, the processes that drive plant diversification and specialization on cliffs remain poorly understood.

In this study, we focused on the diversification patterns linked to cliff-specialization for the vascular plants inhabiting the cliffs of the Iberian Peninsula and Balearic Islands. To do so, we used a phylogenetic reconstruction of 1700 taxa, obtained by combining 'Vphylomaker2' with published phylogenies and sequence information and the cliff-affinity assessment of these taxa, ranging from generalists to strictly specialized species. We also gathered distribution information (geographical and altitudinal range) and ecologically relevant traits for each taxon including plant size, seed-size, flowering period and pollination and dispersal characteristics.

After tracing the phylogenetic and spatial patterns of cliff-associated species, we identified past or recent diversification processes linked to cliff specialization. The phylogenetically controlled analysis, indicated a decrease in maximum plant size, seed size, and distribution range for taxa with stronger specialization to cliffs, showing patterns of trait evolution and strong phylogenetic signals related to cliff specialization. Our findings enhance the understanding of cliff specialization and its role as a driver of eco-evolutionary processes and patterns of endemicity in cliffs as critical ecosystems for biodiversity conservation.

[GSD-O-11]

Wednesday 4, morning (first): 12:00
Room: Cova dos libros

Phylogenetic patterns of species rarity and the relationship between rarity traits and speciation rates in terrestrial mammals

Divieso, Raquel[1]; Sánchez Meseguer, Andrea[2]; Pie, Marcio Roberto[3]

(1) Real Jardín Botánico; (2) Real Jardín Botánico (CSIC); (3) Universidade Federal do Paraná

Correspondence e-mail: [raqueldivieso@gmail.com]

Species rarity, here referred to the condition in which species traits are infrequent in a given spatial or ecological context, is a fundamental challenge for conservation biology and evolutionary ecology. We investigate the phylogenetic pathways of rarity in terrestrial mammals, to unravel the complex interplay of factors contributing to species rarity, and to shed light on the evolutionary processes shaping contemporary biodiversity. Using a large-scale phylogenetic dataset of 3,212 species, we explore the evolutionary heritability of rarity levels and forms, examine phylogenetic relationships between rarity axes, and test potential links between rarity traits and speciation rates. By employing the three-dimensional Rabinowitz rarity framework, we classify species rarity based on range size, population density, and habitat breadth. Phylogenetic signal analyses revealed significant conservatism in rarity forms and levels across species and orders, indicating a strong influence of phylogenetic history on rarity types. The primary findings of our model demonstrate a correlation between rarity traits, with population density negatively correlated with range size, and habitat breadth positively correlated with range size. Remarkably, speciation rates were inversely related to both range size and population density, suggesting that smaller ranges and populations might lead to higher speciation rates. Moreover, higher latitudes were associated with higher speciation rates. Our findings highlight the importance of incorporating phylogenetic history to understand the current distribution of species rarity and its implications for conservation. This study lays the groundwork for applying similar approaches to plant species, broadening our understanding of rarity across different taxonomic groups.

[GSD-O-12]

Wednesday 4, morning (first): 12:15
Room: Cova dos libros

Should I stay or should I go? Triggers of developmental acceleration in tadpoles

Rico-Millan, Rafael[1]; Liedtke, Christoph[2]; Gomez-Mestre, Ivan[3]

(1) Doñana Biological Station - CSIC; (2) Doñana Biological Station - CSIC; (3) Doñana Biological Station - CSIC

Correspondence e-mail: [rafael.rico@ebd.csic.es]

Organisms must adapt to dynamic environments. Phenotypic plasticity can be advantageous in heterogeneous conditions, as directed changes in the phenotype in response to environmental cues can result in an increase in fitness. However, plasticity requires fine assessment of environmental perturbations.

Many amphibian larvae inhabit temporary ponds which eventually dry out. As ponds dry up, multiple environmental factors such as water level, temperature, larval density change or resources availability simultaneously, and many can impact growth and developmental rate of amphibian larvae We conducted an experiment with spadefoot toad larvae (Pelobates cultripes) , a species capable of plastically accelerating development in response to ponds drying out, simulating each of these environmental factors to compare their relative impact on tadpole development, assessing their consequences on the juvenile stage .

We found that water level reduction and increased temperature both induced accelerated larval development whereas constant low water level and density manipulation had no significant effect. Developmental period was generally correlated with weight and fat reserves, except under reduced resources or decreased water levels, where juveniles were consistently smaller. Morphology was also affected by treatments, especially hind limb length, which was shortened as tadpoles accelerated their development.

Water level reduction seems to be a key cue, inducing the strongest acceleration but requiring considerable energy expenditure. Moreover, the different environmental factors experienced as larvae can have important effects on survival and fitness on subsequent life stages.

GSD. Posters

[GSD-P-1]

Tuesday 3
Discussion corner: Room 9

Implementation of (aided)phytoextraction in Pb/Zn mine tailings using hyperaccumulators intercropped with leguminous

Alvarez Lopez, Vanessa[1]; Alvarez-Lopez, Vanessa[2]; Rodriguez-Garrido, Beatriz[3]; Prieto-Fernández, Ángeles[4]; Trasar-Cepeda, Carmen[5]; Monterroso, Carmela[6]; Kidd, Petra[7]

(1) CICA - Interdisciplinary Centre of Chemistry and Biology - UDC; (2) CICA - Interdisciplinary Centre of Chemistry and Biology - UDC; (3) Misión Biolóxica de Galicia MBG-CSIC; (4) Misión Biolóxica de Galicia MBG-CSIC; (5) Misión Biolóxica de Galicia MBG-CSIC; (6) Cross-disciplinary Research Center in Environmental Technologies (CRETUS); (7) Misión Biolóxica de Galicia MBG-CSIC

Correspondence e-mail: [vanessa.alvarez.lopez@udc.es]

Introduction. Phytoextraction cultivates plants which are able to absorb high amounts of trace metals from soils. The process can be aided by the use of organic amendments or the intercropping of other species such as N-fixing species.

Material and methods. A field trial of (aided) phytoextraction was implemented in an abandoned Pb/Zn-mining area in the NW of Spain. The mine tailings were not amended or amended with composted municipal solid wastes. Replicate sub-plots were planted Cd/Zn-hyperaccumulator Noccaea caerulescens in monoculture or co-cropped with the leguminous Lotus corniculatus.

Results. Compost amendment improved soil properties and fertility but decreased soil metal availability. Both plant cover and compost addition increased soil enzymatic activities. After 3 years of plant growth, no significant changes in soil total metal concentrations were observed, however, significant reductions in available Zn concentrations were observed after cultivating N. caerulescens. Intercropping the hyperaccumulator with the legume was also efficient in increasing shoot metal concentrations.

[GSD-P-2]

Wednesday 4
Discussion corner: Room 9

Chemical convergence of specialized metabolites in native and invasive populations supports rapid evolution driven by aridity

Castells, Eva[1]; Sanchez-Martinez, Pablo[2]

(1) UAB - CREAF; (2) University of Edinburgh - CREAF

Correspondence e-mail: [eva.castells@uab.cat]

Plants synthesize a broad array of specialized chemical compounds that mediate their interactions with the surrounding environment. Some of this chemical diversity is functional and subject to natural selection, but the factors underlying chemical evolution at the intraspecific level remain largely unknown. To ascertain whether an observed variation reflects an adaptive response to environmental conditions it is necessary to exclude variation due to neutral, nonadaptive processes. Here, we combined chemical, environmental and genetic data to investigate the effect of aridity on the expression of chemotypes in the invasive shrub Senecio pterophorus.

We studied the variation in a group of specialized metabolites (pyrrolizidine alkaloids) from native populations spanning a cline of aridity and from three cross-continental introductions under natural and common garden conditions. We examined whether the relationship between chemistry and aridity was compatible with a process of adaptive differentiation using a new method that partitions the variance and covariance by controlling for the population neutral genetic structure (TrEvol R package).

We found a consistent shift in chemotype composition under increasing aridity in coherence with the alkaloid biosynthetic pathways. This pattern was independent of the neutral genetic structure and occurred along the environmental gradient in the native range and in a convergent manner in all nonnative regions, suggesting a chemical adaptation in response to aridity. Investigating how abiotic factors influence chemical evolution is key to elucidating the plant responses in future climatic scenarios and the cascading effects on other trophic levels.

[GSD-P-3]

Thursday 5
Discussion corner: Room 9

How much area do rock cliffs occupy? From 2D maps to 3D surfaces

Cirera Sancho, Alberto[1]; Palacio Blasco, Sara[2]; Deschamps Berger, Cesar[3]; Alonso, Esteban[4]; Tejero Ibarra, Pablo[5]

(1) Instituto Pirenaico de Ecología IPE-CSIC; (2) Instituto Pirenaico de Ecología IPE-CSIC; (3) Instituto Pirenaico de Ecología IPE-CSIC; (4) Instituto Pirenaico de Ecología IPE-CSIC; (5) Instituto Pirenaico de Ecología IPE-CSIC

Correspondence e-mail: [cireralberto@gmail.com]

Introduction. Rock cliffs are critical ecosystems due to their extreme environmental conditions, high levels of endemism, and unique species adaptations, serving as refuges for biodiversity. Despite their ecological significance, they are often perceived as rare or limited habitats. When represented on traditional two-dimensional maps, cliffs appear as narrow, insignificant lines, underestimating their actual spatial relevance. This study addresses a key question: what is the true surface area on these vertical or near-vertical rock faces when accounting for the third dimension?

Materials and Methods. This study develops a workflow to automatically map vertical rock cliffs within a selected study area. This model is based on a digital elevation model (DEM) derived from airborne LiDAR data to accurately detect and delineate cliffs, using a threshold to identify slope discontinuity. From these maps, we aim to calculate not only the horizontal projected area but also the actual surface area of rock cliffs and their proportion relative to the total land surface. The model will be validated through field observations and measurements. The validated model will be applied to the Pyrenees to examine how cliff surface area changes with altitude.

Results and Discussion. Preliminary results suggest a significant increase in cliff surface area when accounting for the vertical dimension in comparison to conventional two-dimensional representations. In the Pyrenees, we observe a correlation between elevation and the proportion of cliff surface area. The model's integration into a user-friendly program will enable its application to other regions, facilitating large-scale studies of these critical habitats.

[GSD-P-4]

Tuesday 3
Discussion corner: Room 9

Unveiling the genetic basis of floral seasonal phenotypic plasticity in the Moricandia genus

Perfectti, Francisco[1]; Gómez, José M.[2]; Armas, Cristina[3]; González Megías, Adela[4]; Sharma, Saloni[5]; Narbona, Eduardo[6]; Navarro, Luis[7]; Batanero, Gema L.[8]

(1) Universidad de Granada; (2) Estación Experimental de Zonas Áridas (EEZA-CSIC); (3) Estación Experimental de Zonas Áridas (EEZA-CSIC); (4) Universidad de Granada; (5) Universidad de Granada; (6) Universidad Pablo de Olavide; (7) Universidad de Vigo; (8) Universidad de Granada

Correspondence e-mail: [fperfect@ugr.es]

Phenotypic plasticity, the ability of organisms to modify their phenotype in response to environmental changes, is a widespread characteristic crucial for coping with fluctuating environments. It enables adaptations in morphology, behavior, and physiology, which are essential for survival in stressful conditions induced by climate change. Phenotypic plasticity involves dynamic changes in gene expression triggered by environmental cues. Transcriptomic studies help identify the genes and regulatory pathways activated in response to temporal or spatial environmental variations, providing insights into ecological acclimatization and short-term adaptation. Moricandia arvensis, a Mediterranean mustard, thrives in arid environments by altering its photosynthetic traits to withstand extreme summer conditions. It shows a notable floral polyphenism, producing distinct flower types depending on the season. This intraindividual phenotypic shift is accompanied by important transcriptional changes in leaves and flowers transitioning between seasons. Within the Moricandia genus, floral polyphenism is variable, and here, we analyzed gene expression in the flowers of all eight species within the genus, comparing transcriptomic profiles under experimental spring and summer conditions. This analysis has uncovered shared and species-specific gene expression patterns, identifying the genes involved in seasonal phenotypic plasticity. The studies reveal that each species exhibits unique transcriptomic responses but shares some molecular signatures. This research not only deepens our understanding of phenotypic plasticity within the Moricandia genus but also provides a valuable model for exploring the evolution of phenotypic plasticity. This knowledge advances our understanding of the relationship between gene expression, phenotypic traits, and the evolution of plasticity.

[GSD-P-5]

Wednesday 4
Discussion corner: Room 9

Continent-scale macroevolutionary insights from the last 23 million years of South American mammalian diversity

Buffan, Lucas[1]; Condamine, Fabien L.[2]; Stutz, Narla S.[3]; Boivin, Myriam[4]; Pujos, François[5]; Antoine, Pierre-Olivier[6]; Marivaux, Laurent[7]

(1) Institut des Sciences de l'Évolution de Montpellier; (2) Institut des Sciences de l'Évolution de Montpellier; (3) Institut des Sciences de l'Évolution de Montpellier; (4) Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET); (5) Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET); (6) Institut des Sciences de l'Évolution de Montpellier; (7) Institut des Sciences de l'Évolution de Montpellier

Correspondence e-mail: [lucas.buffan@umontpellier.fr]

South America is one of the most mammal-rich continents in the world. For centuries, macroecologists have investigated how such a unique mammalian fauna arose, but many grey zones still remain. Here, we investigated what the fossil record can tell about the build-up of the region's mammalian biodiversity. Using a vetted fossil database and cutting-edge Bayesian birth-death models accounting for several biases of the fossil record, we analysed the dynamics of South American mammal diversity and diversification (i.e., origination and extiction rates) throughout the last 23 million years. We carried out time-stratified multivariate analyses across three key time periods for the Neotropical palaeobiodiversity: (1) before and during the Middle Miocene climate optimum (ca. 23-13.82 Million years ago, Ma), (2) during the late Neogene climate cooling (ca. 13.82-2.58 Ma), and (3) during the Quaternary (ca. 2.58-0 Ma), following the onset of the Great American Biotic Interchange (GABI). We tested long-standing hypotheses regarding the likely biotic and abiotic drivers of the reconstructed macroevolutionary patterns. More precisely, we shed light on the role of Andean uplift, temperature and vegetation changes - three factors that have often been proposed to have greatly influenced South American biotic diversification thoughout this period. Additionnally, we intended to decipher potential inter-clade effects, particularly following the GABI, which witnessed the arrival of North American lineages into South American communities. Our research provides new insights towards continent-scale understanding of the establishment and the dynamics of a major hotspot for mammalian diversity worldwide.

[GSD-P-6]

Thursday 5
Discussion corner: Room 9

Taking advantage of the evolutionary slowness of chelonians: scanning the first genome of the Testudo genus

Mira Jover, Andrea[1]; Bourgeois, Yann[2]; Fritz, Uwe[3]; Rodríguez Caro, Roberto Carlos[4]; Giménez Casalduero, Andrés[5]; Graciá Martínez, Eva[6]

(1) Ecology Area. Universitat Miguel Hernández, Elx, Spain; (2) DIADE, University of Montpellier, CIRAD, IRD, Montpellier, France; (3) Museum of Zoology, Senckenberg Dresden, Dresden, Germany; (4) Departamento de Ecología, Universidad de Alicante, San Vicent del Raspeig, Spain; (5) Ecology Area. Universitat Miguel Hernández, Elx, Spain; (6) Ecology Area. Universitat Miguel Hernández, Elx, Spain

Correspondence e-mail: [andrea.mira@goumh.umh.es]

Introduction. Generating chromosome-level genome assemblies enhances conservation biology studies and increases the capacity to understand the genomic basis of evolution and ecological adaptations. Although long-read sequencing techniques are capable of producing high-quality reference genomes, they remain unaffordable or impractical for some laboratories or study systems. Taxonomic groups with high synteny, such as chelonians, can overcome these limitations by reference-guided assembly using a close relative genome. In this study, we sequenced the first chromosome-level genome assembly of Testudo graeca, one of the most iconic tortoises of the Mediterranean basin.

Methodology. We reconstructed a 2.3 Gb genome using Gopherus evgoodei as a reference and a toolkit of assembly software and demographic history reconstruction.

Results and discussion. Assembly results were similar to those of other chelonians (i.e., assembly statistics, number of coding genes and proportion of repeated regions), underscoring the value of using close related species to produce de novo assemblies when genomic resources are not available. Demographic history reconstruction based on the genome revealed a population decline and a recovery, that were consistent with previously suggested phylogeographic patterns for the species. The annotated genome offers the opportunity to get deeper into species evolutionary history, particularly on genomic consequences of Iberian southeast population expansion and North African range shifts (i.e., expansion load, demographic dynamics during past climatic events or ecological adaptations of the different lineages). It also provides a valuable resource for enhancing direct conservation efforts for the threatened populations of T.graeca, and increases the genomic resources available for the Testudinidae family.

[GSD-P-7]

Tuesday 3
Discussion corner: Room 9

Adaptation to drought following anthropogenic selection release: the case of Phoenix atlantica, a wild relative/feral derivative of the date palm crop (Phoenix dactylifera)

Cid, Jerónimo[1]

(1) Royal Botanic Gardens, Kew

Correspondence e-mail: [j.cid@kew.org]

The date palm (Phoenix dactylifera L.) is a keystone crop in subtropical and arid regions of the old world, but its sustainability is threatened by climate change. This challenge could be mitigated by breeding with wild relatives or feral populations. The endangered and endemic Cape Verde date palm (Phoenix atlantica A.Chev.) is thought to be among the closest relatives of the date palm, but its origin and taxonomic status remain unclear, with studies having recovered it either as a separate species or a feral date palm. In this study we investigated the genetics and morphology of P. atlantica through herbarium material and the use of type specimens to clarify its origin and standing with regards to the date palm.

We find support for a fascinating progenitor-derivative incipient speciation system, characterised by the release of anthropogenic selection and geographic isolation. The role of adaptation to drought remains unexplored, but given that P. atlantica inhabits saline coastal regions of the arid Cape Verde archipelago, the system could provide an ideal scenario to study ongoing adaptation to drought environments, with the potential to improve the conservation of P. atlantica and crop improvement of the date industry.

[GSD-P-8]

Wednesday 4
Discussion corner: Room 9

The influence of thermal resource aggregation on the genetic dynamics in a fragmented lizard population

Llanos Garrido, Alejandro[1]; Cruz Alonso, Verónica[2]

(1) URJC; (2) UAH

Correspondence e-mail: [alg4206@gmail.com]

Habitat fragmentation and climate change are major forces threatening biodiversity, with profound impacts on ecological and genetic processes. In a previous study, we demonstrated that the spatial clumping of thermal resources within forest fragments influences the thermoregulation of the Mediterranean lizard Psammodromus algirus. Here, we build upon these findings to explore how this spatial structuring of thermal resources impacts genetic diversity and gene flow at two spatial scales: within and among forest fragments.

Using genomic data, we estimate the genetic diversity harbored by forest patches as a function of the spatial distribution of thermal resources quantified through LiDAR-derived metrics. At the landscape scale, we assess the role of thermal resource aggregation in shaping genetic connectivity between patches, considering the thermal landscape as a potential barrier of dispersal. This two-scale approach highlights the intricate linkages between local thermal heterogeneity, demographic processes, and landscape-level gene flow, illustrating how thermal resource distribution shapes both genetic reservoirs and pathways of diversity in fragmented landscapes.

Our study contributes to understanding how the spatial clumping of thermal resources interacts to drive genetic patterns in fragmented populations, with implications for the conservation of ectotherms in the face of accelerating global change.

TECHNICAL SESSIONS

TSD.1. From Extinct to Extant: Integrating Palaeontological and Ecological Knowledge

Wednesday, 4 (12:45-14:15)

Room: Seminario 2

Understanding the full scope of biodiversity and ecosystem dynamics requires bridging the temporal and methodological gaps between palaeontology and ecology. The integration of these two disciplines promises to illuminate patterns of life that transcend time, offering a more comprehensive view of biodiversity through both evolutionary and ecological lenses.

By examining ancient ecosystems and their evolution, we gain insights into how past environmental changes influenced evolutionary trajectories and how historical extinction events relate to current biodiversity crises. Utilizing the fossil record to inform ecological theories—and vice versa—enhances our ability to predict future ecological outcomes amidst contemporary global challenges.

Advances in methodologies and theoretical frameworks are facilitating this interdisciplinary integration, highlighting the importance of a combined approach in reconstructing Earth's biological history and tackling conservation challenges.

This session will explore how merging palaeontological and ecological knowledge can offer crucial insights for understanding and preserving biodiversity in a rapidly changing world.

Organizers:

• **Iván Rey-Rodríguez,** Mapas Lab, UVigo

• **Sara Gamboa,** Mapas Lab, UVigo

• **Adriana Oliver,** Mapas Lab, UVigo

TSD.1. Orals

[TSD.1-O-1]

Wednesday 4, morning (second): 12:45
Room: Seminario 2

Information loss in the fossil record

Matamala-Pagès, Marta[1]; Castro-Insua, Adrián[2]; Oliver, Adriana[3]; Méndez-Quintas, Eduardo[4]; Sotelo, Graciela[5]; Rey-Rodríguez, Iván[6]; Galván, Sofia[7]; Gamboa, Sara[8]; Varela, Sara[9]

(1) Universidade de Vigo; (2) Universidade de Vigo; (3) Universidade de Vigo; (4) Universidade de Vigo; (5) Universidade de Vigo; (6) Universidade de Vigo; (7) Universidade de Vigo; (8) Universidade de Vigo; (9) Universidade de Vigo

Correspondence e-mail: [marta.matamala@uvigo.es]

Data from the fossil record have allowed (and continue to allow) the reconstruction of the palaeoenvironments and ecological niches occupied by different species over time. However, the large-scale fossil record is biased, which presents an important challenge for the interpretation of past evolutionary trajectories and climatic changes. In fact, these uncontrollable biases can lead to an incomplete view of diversity, affecting the ability to accurately reconstruct evolutionary trajectories and adaptive patterns. Thus, this work aims to identify the areas with the greatest potential for fossil preservation and to quantify the fossil information lost over time. To do so, we have combined: 1) climatic data of temperature and precipitation (from the HadCM3 model), 2) data from fossil observations (NOW database and PaleobioDB) and 3) layers of sedimentary areas (generalized global geological map compiled by Chorlton (2007)). The Köppen-Geiger climate classification was then applied to assign climatic categories to the different regions of the planet to compare which biomes have a lower potential for fossilisation and thus a higher loss of the fossil record over time. How much information is available for each biome across time?

[TSD.1-O-2]

Wednesday 4, morning (second): 13:00
Room: Seminario 2

Distribution of climate specialization in mammals: Resource-Use hypothesis or Mid-Domain effect?

Galván, Sofía[1]; Tarroso, Pedro[2]; Gamboa, Sara[3]; Varela, Sara[4]

(1) Universidade de Vigo; (2) BIOPOLIS CIBIO, Centro de Investigação em Biodiversidade e Recursos Genéticos, Universidade do Porto; (3) Universidade de Vigo; (4) Universidade de Vigo y Axencia Galega de Innovación (Oportunius)

Correspondence e-mail: [sofia.galvan@uvigo.gal]

Introduction. In this work, we explore the distribution of climate specialization in mammals. Since climate is proposed as one of the main drivers of the Latitudinal Biodiversity Gradient, we aim to test whether the distribution of species with different climate constraints are filtered by different processes. Based on the 'Resource-Use hypothesis' by Dr. Vrba, we hypothesize that climate specialists will indeed be limited by climate stability/fragmentation (depending on species' branch length). Furthermore, climate generalists' distribution will be more influenced by geography (detecting a 'Mid-Domain effect').

Material and methods. We integrated paleoclimatic information, mammal distribution maps, and phylogenetic data to study the biogeographic patterns of specialists, generalists and supergeneralists species. Equally, we also studied the climatic niche of each group, detecting potential differences between them.

Results and discussion. First, we observed that specialist and generalist species are unevenly distributed along the Earth. In this sense, we detected a latitudinal gradient in specialization, with lower latitudes gathering a higher proportion of specialist species. Regarding specialists, we indeed detected a higher richness in tropical, arid, and temperate zones, which can be related to their levels of fragmentation. However, a Mid-Domain effect for generalists was partially observed. In conclusion, this study seeks to reveal whether the geographic patterns of specialist and generalist species can unveil the evolutionary and geographic processes underlying them.

[TSD.1-O-3]

Wednesday 4, morning (second): 13:15
Room: Seminario 2

Body mass as a driver of isotopic niche overlap asymmetry in South American Oligocene mammals

Sanz Pérez, Dánae[1]; Hernández Del Pino, Santiago[2]; Cerdeño, Esperanza[3]; Hernández Fernández, Manuel[4]; Domingo, Laura[5]

(1) Universidad Complutense de Madrid; (2) IANIGLA, Centro Científico Tecnológico-CONICET-Mendoza; (3) IANIGLA, Centro Científico Tecnológico-CONICET-Mendoza; (4) Universidad Complutense de Madrid; (5) Universidad Complutense de Madrid

Correspondence e-mail: [dasanz01@ucm.es]

Isotopic studies of South American Oligocene faunas are limited. In order to fill this gap, this study focuses on the late Oligocene (~25 Ma) mammals from the Quebrada Fiera locality (Mendoza, Argentina) to infer paleodiets, explore trophic interactions, and evaluate potential niche partitioning or overlap among the taxa. We analyzed carbon (d13C) and oxygen (d18O) composition from 37 tooth enamel samples belonging to nine notoungulate and one pyrotheriid species. Isotopic niches were assessed using Bayesian stable isotope ellipses (SIBER) in R, complemented by QGIS due to the smaller sample sizes (n<10). Niche overlap was quantified through three metrics: total shared niche area, percentage of one species' niche overlapping with another's, and free area per taxon.

The d13C values show a dominance of C3 plant-based diets, indicating a landscape ranging from open woodlands to grasslands. Isotopic niche modeling shows substantial overlap among taxa, with asymmetrical overlap suggesting small species are more affected by this asymmetry than larger ones. Moreover, the largest mammals (Gualta and Pyrotherium) report the highest values of free area (36.0% and 35.7%), whereas the smallest mammal (Argyrohyrax) have only 14.4% of their isotopic niche area without overlapping. Additionally, our results indicate that larger species might have had a more generalist feeding strategy in terms of exploring wider environments and feeding on vegetation from different habitats. These findings highlight how body size influences ecological resilience and underline the importance of considering dietary specialization and habitat flexibility to understand niche dynamics in mammalian communities.

[TSD.1-O-4]

Wednesday 4, morning (second): 13:30
Room: Seminario 2

Volcanic lakes, a biodiversity crisis in the fossil record

Linares Martín, Adriana[1]; Blain, Hugues-Alexander[2]; Campeny, Gerard[3]; Gómez de Soler, Bruno[4]

(1) IPHES/URV; (2) IPHES/URV; (3) IPHES/URV; (4) IPHES/URV

Correspondence e-mail: [adrianalinares94@gmail.com]

The danger of a volcanic eruption is known throughout the history of the Earth, but there is another type of apparently quiet activity that is just as devastating. Maar lakes or volcanic lakes have always been subject to volcanic activity in the form of toxic gases emanating from the depths. Today, the dangerousness of these lakes is being studied and action plans for their regulation are being proposed. A perfect example is Lake Nyos in Cameroon where toxic gases caused death within a radius of 20 kilometers. The geological and paleontological record shows the recurrence of these phenomena over time and across the Earth. Studies carried out in several maar lakes from Europe (Messel in Germany, Pula in Hungary or Hajnácka in Slovakia) suggest the intoxication of volcanic gases as possible case of mortality. In Spain, these lakes are also represented by the maar-type fossil site of Camp dels Ninots in Girona. The excellent preservation of the fossil remains of the animals that inhabited the lake, and its surroundings allow us to suggest possible causes of death, including gas poisoning. This event would not only affect biodiversity but would also have important ecological implications. According to the principle of actualism, the study of these fossil volcanic lakes could serve as a reference for present-day lakes. Therefore, the preservation of fossil remains, as well as the geological record, could provide relevant information for understanding changes in biodiversity and the possible ecological impact that such an event could have today.

[TSD.1-O-5]

Wednesday 4, morning (second): 13:45
Room: Seminario 2

Past and future global diversity loss from anthropogenic bird extinctions

Sayol, Ferran[1]; Faurby, Søren[2]; Matthews, Thomas J.[3]

(1) CREAF; (2) University of Gothenburg; (3) University of Birmingham

Correspondence e-mail: [fsayol@gmail.com]

Understanding how extinction has occurred in the recent past is crucial to identify the main drivers of this process and design effective conservation practices to minimize global biodiversity loss. While previous research has identified extinction selectivity in certain species groups, most clades - particularly those known only from subfossil remains - lack comprehensive trait data. This gap limits our understanding of natural community structures and hinders efforts to trace biodiversity changes across space and time, including impacts on functional and phylogenetic diversity. To address this, we introduce AVOTREX, an open-access database compiling species traits for all birds known to have gone extinct over the last 130,000 years. Using this dataset, we quantify the loss of functional and phylogenetic diversity caused by past extinctions and project future declines. Our analysis reveals that at least 610 bird species have gone extinct, with human activity implicated in at least 92% of these cases. These extinctions have disproportionately reduced global avian functional space and eliminated ~3.3 billion years of evolutionary history. Island endemic species, representing 80% of known extinctions, have driven even greater losses in functional and phylogenetic diversity, underscoring the vulnerability of insular ecosystems. Projections indicate over 1,300 additional species could face extinction within the next two centuries, resulting in further significant declines in biodiversity. These findings underscore the profound consequences of the ongoing biodiversity crisis and emphasize the urgency of identifying and mitigating the ecological functions lost through extinction.

[TSD.1-O-6]

Wednesday 4, morning (second): 14:00
Room: Seminario 2

Ecological sustainability in human exploitation of bison during the Late Pleistocene at Gran Dolina TD10.2 (Sierra de Atapuerca, Spain)

Rodríguez-Gómez, Guillermo[1]; Rodríguez-Hidalgo, Antonio[2]; Saladié, Palmira[3]; van der Made, Jan[4]; Marín, Juan[5]; Ollé, Andreu[6]; Mosquera, Marina[7]; Bermúdez de Castro, José María[8]; Arsuaga, Juan Luis[9]; Carbonell, Eudald[10]

(1) Universidad Complutense de Madrid; (2) Instituto de Arqueología-Mérida (CSIC-Junta de Extremadura); (3) Institut Català de Paleoecologia Humana i Evolució Social (IPHES-CERCA); (4) Museo Nacional de Ciencias Naturales; (5) Universidad Nacional de Educación a Distancia; (6) Institut Català de Paleoecologia Humana i Evolució Social; (7) Institut Català de Paleoecologia Humana i Evolució Social; (8) Centro Nacional de Investigación sobre la Evolución Humana; (9) Universidad Complutense de Madrid; (10) Institut Català de Paleoecologia Humana i Evolució Social

Correspondence e-mail: [grodriguezgomez@ucm.es]

Introduction. Communal hunting of bison is a practice documented from the Middle Pleistocene to historic times, including among Native North Americans. During the Pleistocene, this strategy formed part of human subsistence behaviors. The TD10.2-BB level at Gran Dolina (Sierra de Atapuerca) preserves fossil evidence of this practice, with remains of at least 60 bison of various age classes. This study evaluates whether the exploitation of these bison by Pleistocene humans was ecologically sustainable.

Materials and Methods. To assess sustainability, we analyzed the bison mortality profile using dental remains, ternary diagrams, and life tables. Allometric equations were employed to estimate the mean body mass of the population and the potential energy yield.

Results and Discussion. Our analysis reveals a catastrophic mortality profile, with no selective bias toward specific age classes, indicating a natural herd composition. The life table suggests a growing bison population, supporting the hypothesis of sustainable exploitation without risking population collapse. The estimated energy yield from the bison could sustain large human groups for several days. However, the high protein content of bison meat may have limited its full dietary utilization. The availability of alternative resources in the ecosystem likely facilitated optimal use of bison carcasses, ensuring efficient resource management.

TSD.1. Posters

[TSD.1-P-1]

Wednesday 4
Discussion corner: Room 9

White-tailed Eagles (Haliaeetus albicilla) across ecosystems and time: Taphonomic and ecological insights from the Finnish archipelago to the Early Pleistocene Sima del Elefante site (Atapuerca)

Marqueta, Mario[1]; Laaksonen, Toni[2]; Núñez-Lahuerta, Carmen[3]; Huguet, Rosa[4]
(1) IPHES-CERCA; (2) University of Turku; (3) Universidad del País Vasco, Facultad de ciencia y tecnología; (4) IPHES-CERCA
Correspondence e-mail: [mmarqueta@iphes.cat]

Understanding predator-prey interactions provides a fundamental basis for comprehending the accumulation processes of fossil assemblages, thus offering deeper insights into palaeontological and zooarchaeological interpretations. Moreover, it enhances our understanding of present-day behavioural ecology. Based on neo-taphonomic analysis, this study aims to compare the ecological and behavioural aspects of the White-tailed Eagle (Haliaeetus albicilla) from the past (Early Pleistocene, Sima del Elefante, Atapuerca) and the present (Åland Archipelago, Finland). We analysed bones of prey consumed by White-tailed Eagles(WTE), focusing on the modifications caused by adult individuals and their offspring. The main prey items of this predator include ducks, gulls, cormorants, fish, and small mammals, showing beak-induced marks such as punctures and digestive damage. These observations were compared with Early Pleistocene bird assemblages from the Sima del Elefante site (Sierra de Atapuerca, Spain), where skeletal remains of the WTE appear frequently in several of its oldest stratigraphic units, along with evidence of its predatory activity on other birds. The results show evidence of distinctive taphonomic signatures produced by the WTE. This research highlights the ecological role of large raptors in shaping both modern and ancient ecosystems, particularly in environments where avian and aquatic fauna dominate, such as Sima del Elefante and the Åland Islands. Moreover, these insights contribute to a broader diachronic understanding of avian biodiversity and emphasise the importance of integrating palaeontological and ecological data for contemporary animal species.

[TSD.1-P-2]

Thursday, 5
Discussion corner: Room 9

Some, but not all processes biasing the fossil record decrease functional and taxonomic space

Castro-Insua, Adrián[1]; Galván, Sofía[2]; Sotelo, Graciela[3]; Gamboa, Sara[4]; Matamala-Pagès, Marta[5]; Oliver, Adriana[6]; Rey-Rodríguez, Iván[7]; Varela, Sara[8]

(1) Facultade de Bioloxía, Universidade de Vigo; (2) Facultade de Bioloxía, Universidade de Vigo; (3) Facultade de Bioloxía, Universidade de Vigo; (4) Facultade de Bioloxía, Universidade de Vigo; (5) Facultade de Bioloxía, Universidade de Vigo; (6) Facultade de Bioloxía, Universidade de Vigo; (7) Facultade de Bioloxía, Universidade de Vigo; (8) Facultade de Bioloxía, Universidade de VigoCorrespondence e-mail: [adrian.castro.insua@uvigo.gal]

Our limited knowledge of past biodiversity and ecological communities depends on the completeness of the fossil record, which is subject to multiple biases. Namely, the probability of fossilisation can vary among species due to factors such as their body size, range size, and the geology in their distribution range. Furthermore, there are human-related influences such as more fossil data associated to countries with a higher investment in science and studies prioritising some taxa over others. Here, starting with the current distribution of mammals as the ground truth, we quantified the functional space loss in a hypothetical future fossil record after accounting for these biases.

To model the biases, we filtered for regions with sediments and fossil sites, and sampled from the remaining species weighting for their body/range size and for taxonomic bias (according to data from the Paleobiology Database) under three sampling strengths (25%, 50%, 75%). To characterise the functional space, we obtained diet and body size information from the COMBINE database.

We found that larger carnivores are potentially better preserved than herbivores and omnivores of comparable size. A high percentage of carnivorans and even-toed ungulates are preserved, while marsupials and bats are more vulnerable, particularly with low sampling (25%). Body size and taxonomic biases are the ones that most affect taxonomic composition. With distortions of this magnitude, the real taxonomic composition of past communities can be extremely difficult to reconstruct using the current methods that try to account for sampling bias.

[TSD.1-P-3]

Tuesday 3
Discussion corner: Room 9

Small mammals as palaeoecological proxies: ecological specialization and evolutionary trends

Rey-Rodríguez, Iván[1]; Sotelo, Graciela[2]; Oliver, Adriana[3]; Castro-Insua, Adrián[4]; Galván, Sofía[5]; Gamboa, Sara[6]; Matamala-Pagès, Marta[7]; Sillero, Neftalí[8]; Varela, Sara[9]

(1) Centro de Investigación Mariña, Universidade de Vigo, MAPAS Lab., 36310 Vigo, Pontevedra, Spain; (2) Centro de Investigación Mariña, Universidade de Vigo, MAPAS Lab., 36310 Vigo, Pontevedra, Spain; (3) Centro de Investigación Mariña, Universidade de Vigo, MAPAS Lab., 36310 Vigo, Pontevedra, Spain; (4) Centro de Investigación Mariña, Universidade de Vigo, MAPAS Lab., 36310 Vigo, Pontevedra, Spain; (5) Centro de Investigación Mariña, Universidade de Vigo, MAPAS Lab., 36310 Vigo, Pontevedra, Spain; (6) Centro de Investigación Mariña, Universidade de Vigo, MAPAS Lab., 36310 Vigo, Pontevedra, Spain; (7) Centro de Investigación Mariña, Universidade de Vigo, MAPAS Lab., 36310 Vigo, Pontevedra, Spain; (8) Centro de Investigação em Ciências Geo-Espaciais, Faculty of Sciences, University of Porto, Portugal; (9) Centro de Investigación Mariña, Universidade de Vigo, MAPAS Lab., 36310 Vigo, Pontevedra, Spain)

Correspondence e-mail: [ivanreyrguez@gmail.com]

Small mammals —bats, insectivores, lagomorphs, and rodents— are traditionally used as proxies for inferring both the palaeoecological conditions and the age of a fossil site. To do this, we assume that small mammals have narrow climatic niches, meaning that finding certain species will allow us to infer the habitat of a fossil site. Also, we assume that small mammals have fast evolutionary rates, which allow us to establish the age of a fossil site based on the list of small mammal species. However, such characteristics might not be uniform among the group; for instance, while some species are adapted to specific habitats others thrive in several environments. Here, for the first time, we test these assumptions. We analyse the degree of climatic zone specialization of extant small mammals and how it relates to species-specific diversification rates, combining global small mammal distribution maps, climatic zone classification, and mammal phylogenies.

Our results show that Rodentia —the most species-rich mammalian order with 2334 species— has 907 climatic zone specialists, which cover all climatic zones and continents on Earth. Among the most diverse rodent families, Muridae stands out with 49% of specialists, mainly from the tropical climatic zone, while Cricetidae accounts for specialists from cold climatic zones. Climatic zone specialists also tend to show higher diversification rates than other species. Thus, following our results, not all small mammals but key species, such as rodent climatic zone specialists, can be used for inferring both paleoecology and age of a fossil site.

[TSD.1-P-4]

Wednesday 4
Discussion corner: Room 9

Spatial distribution of large mammals during the Late Pleistocene in the upper valley of the Lozoya River (Madrid, Spain)

Trejo, Beatriz[1]; Karampaglidis, Theodoros[2]; Arsuaga, Juan Luis[3]; Rodríguez-Gómez, Guillermo[4]

(1) Universidad Complutense de Madrid y Centro UCM-ISCIII de Evolución y Comportamiento Humanos; (2) Universidad de Castilla-La Mancha y Hebrew University of Jerusalem; (3) Universidad Complutense de Madrid y Centro UCM-ISCIII de Evolución y Comportamiento Humanos; (4) Universidad Complutense de Madrid y Centro UCM-ISCIII de Evolución y Comportamiento Humanos

Correspondence e-mail: [betrejo@ucm.es]

In the upper Lozoya River valley (Madrid, Spain), near Pinilla del Valle, are the Calvero de la Higuera sites, which provide evidence of Neanderthal settlements. This study aims to understand the Late Pleistocene environment of Neanderthals and the available animal resources by evaluating the potential distribution of nine large herbivorous mammals (Bos primigenius, Rupicapra pyrenaica, Capreolus capreolus, Cervus elaphus, Dama dama, Sus scrofa, Equus ferus, Stephanorhinus hemitoechus, and Castor fiber) recorded at the Cueva del Camino site (˜90 ka).

Distributions were modelled using Maxent software, which is employed for modelling species distribution, particularly when only presence data are available. We combined the presence data, derived from an estimation of the past distribution of species based on site locations in the Iberian Peninsula with records of these species, with the environmental variables obtained using the Pastclim package.

As a result, potential distribution maps were obtained for each species, showing areas of habitat suitability (from 0 to 1, with 1 indicating the highest suitability). These maps allow us to estimate herbivore population densities and prey biomass.

Preliminary results suggest that the Upper Lozoya Valley likely provided limited resources, which would have required highly mobile Neanderthal populations that did not remain permanently in the valley.

[TSD.1-P-5]

Thursday 5
Discussion corner: Room 9

PHYLOPYR: Reconstructing the phylogeny of Pyrenean angiosperms

Pérez-Serrano Serrano, María[1]; Güiza, Esther[2]; García, Ana[3]; Etxeberria, Mikel[4]; Mitxelena, Anais[5]; Pokorny, Lisa[6]; Viruel, Juan[7]; Catalán, Pilar[8]; Villaverde, Tamara[9]; Jiménez-Alfaro, Borja[10]; Pérez, Aaron[11]; Illa, Estela[12]; Pladevall, Clara[13]; Cambecèdes, Jocelyne[14]; Corriol, Gilles[15]; Murienne, Jérôme[16]; Calvo, Jorge[17]; Martínez Ortega, Montserrat[18]; Lorda, MIkel[19]; Ferrández, José Vicente[20]; Fernández, Olatz[21]; Carlón, Luís[22]; Cantu, Lise[23]; Hermosilla, Brais[24]; Agut, Agustí[25]; Nualart, Neus[26]; Fernández, Pol[27]; Pérez, Iván[28]; Hidalgo, Oriane[29]; Palacio, Sara[30]; Tejero, Pablo[31]

(1) Instituto Pirenaico de Ecología-CSIC; (2) Aranzadi Zientzi Elkartea; (3) Aranzadi Zientzi Elkartea; (4) Aranzadi Zientzi Elkartea; (5) Aranzadi Zientzi Elkartea; (6) Real Jardín Botánico de Madrid-CSIC; (7) Royal Botanic Gardens-Kew; (8) Universidad de Zaragoza; (9) Universidad Rey Juan Carlos; (10) Instituto Mixto de Investigación y Biodiversidad-CSIC y Universidad de Oviedo; (11) Universitat de Barcelona; (12) Universitat de Barcelona; (13) Andorra Recerca + Innovació; (14) CBN-Conservatoire Botanique National Pyrénées et Midi-Pyrénées; (15) CBN-Conservatoire Botanique National Pyrénées et Midi-Pyrénées; (16) CNRS- Universidad de Toulouse; (17) Universidad de Salamanca; (18) Universidad de Salamanca; (19) Instituto Pirenaico de Ecología-CSIC; (20) Instituto Pirenaico de Ecología-CSIC; (21) Instituto Pirenaico de Ecología-CSIC; (22) Jardín Botánico Atlántico- Gijón; (23) Conservatoire Botanique National Méditerranéen; (24) Jardín Botánico de Olárizu, Ayuntamiento de Vitoria-Gasteiz; (25) Jardín Botánico de Olárizu, Ayuntamiento de Vitoria-Gasteiz; (26) Instituto Botánico de Barcelona-CSIC Ajuntament de Barcelona; (27) Instituto Botánico de Barcelona-CSIC Ajuntament de Barcelona; (28) Instituto Botánico de Barcelona-CSIC Ajuntament de Barcelona; (29) Instituto Botánico de Barcelona-CSIC Ajuntament de Barcelona; (30) Instituto Pirenaico de Ecología-CSIC; (31) Instituto Pirenaico de Ecología-CSIC.

Correspondence e-mail: [maria.pserrano@ipe.csic.es]

Introduction. Phylogenomic diversity is a necessary and powerful tool to understand ecological and evolutionary processes. Unfortunately, still there is a long way to produce complete and detailed phylogenies of many territories, with the limitations that this implies for ecological research. The PHYLOPYR project aims to sequence the DNA of Pyrenean angiosperms, in order to reconstruct a phylogeny and unravel the phylogenetic diversity of the mountain chain.

Material and Methods. Promoted by the JACA and ARAN herbaria, PHYLOPYR combines scientific and citizen efforts to collect and analyze plant samples. Currently we are collecting only one population per taxon, trying to distribute the collected populations along the Pyrenees. 5 individuals per population are collected separately and preserved in Herbaria. One of the individuals becomes the molecular type, from which tissue is collected to conduct the sequencing protocol. Sequenced are produced following target capture sequencing with the universal probe set Angiosperms 353.

Results and Discussion. With this contribution we will present the progresses of the project, which by now has completed nearly 20% of the Pyrenean flora, providing details on the methodology, preliminary results and ways to contact, collaborate or use the produced sequence resources.

[TSD.1-P-6]

Tuesday 3
Discussion corner: Room 9

Soil chronosequence helps you to understand the multidimensional variation and evolution of soil nematodes. An opening with the genus Xenocriconemella in the Iberian Peninsula

Archidona Yuste, Antonio[1]; Cantalapiedra Navarrete, Carolina[2]; Clavero Camacho, Ilenia[3]; Criado Navarro, Inmaculada[4]; Nazaret Cuenca, Alba[5]; Palomares Rius, Juan E.[6]; León Ropero, Guillermo[7]; Martín Barbarroja, Jorge[8]; Liébanas, Gracia[9]; Castillo, Pablo[10]

(1) Insitute for Sustainable Agriculture (IAS-CSIC); (2) Insitute for Sustainable Agriculture (IAS-CSIC); (3) Insitute for Sustainable Agriculture (IAS-CSIC); (4) Insitute for Sustainable Agriculture (IAS-CSIC); (5) University of Jaen; (6) Insitute for Sustainable Agriculture (IAS-CSIC); (7) Insitute for Sustainable Agriculture (IAS-CSIC); (8) Insitute for Sustainable Agriculture (IAS-CSIC); (9) University of Jaen; (10) Insitute for Sustainable Agriculture (IAS-CSIC)

Correspondence e-mail: [antonio.archidona@ias.csic.es]

The comparison of morphological and molecular disparity is a useful tool for improving our evolutionary knowledge of clades. Indices of morphological disparity summarise the highly multivariate variation in morphology between species or other taxonomic levels within clades. Analogous indices of molecular disparity attempt to summarise cross-dimensional molecular variation. The divergence and convergence between morphological and molecular disparity indices provide indications of the different physical, ontogenetic or environmental constraints that clades may have experimented in the evolution of organisms. The amazing scenario and the high environmental variability offered by the extensive distribution of the genus Xenocriconemella in the Iberian Peninsula could be a starting point for this unexplored research on soil biodiversity, particularly in soil nematodes. This global genus has a special geographical emphasis on the Iberian Peninsula and mainly associated with Quercus species. Thus, we conducted an extensive sampling in the Iberian Peninsula across the most important areas of Quercus-dominated forests to cross-check morphology with molecular data. A total of 125 widely distributed populations covering a wide environmental variability (lithology and soil properties, vegetation and climate) were studied and a complete set of 371 individuals from the genus Xenocriconemella were characterized molecularly (COI, 28S and 18S) and morphologically (15 features). Here, we revealed soil chronosequence as a determinant factor in the multidimensional variation of Xenocriconemella populations along the Iberian Peninsula and illustrated how it is closely linked to evolutionary events within this genus. Definitely, this novel research establishes a pioneering starting point for evolutionary and biogeographical studies of soil-dwelling animals.

[TSD.1-P-7]

Wednesday 4
Discussion corner: Room 9

Evaluating the Middle to Upper Paleolithic transition at the Cova Eirós site (Lugo, Galicia, Spain) through estimates of carrying capacity and meat availability

Arones Abad, Marco Miguel[1]; Rodríguez-Gómez, Guillermo[2]; Bal-García, Hugo[3]; de Lombera-Hermida, Arturo[4]

(1) Universidad de Salamanca; (2) Universidad Complutense de Madrid, Centro UCM-ISCIII de Evolución y Comportamiento Humanos; (3) Universidad de Santiago de Compostela, CISPAC; (4) Universidad de Oviedo, CISPAC

Correspondence e-mail: [mmaronesabad@usal.es]

The site of Cova Eirós (Lugo, Galicia, Spain) is one of the most relevant sites for studying the transition from the Middle to the Upper Paleolithic in northwestern Iberia. The presence of Late Mousterian (Level 3, c. 41 ka cal BP) and Initial Upper Paleolithic (Level 2, c. 36 ka cal BP) archaeological levels allow us to understand the arrival of the first populations of Homo sapiens and the progressive disappearance of the Neanderthals in the Cantabrian region. In this sense, modelling trophic resources from the fossil record is a tool of great interest to bring a new perspective to this debate. In this study, we have compared both levels with estimates of the carrying capacity (CC) and available meat (TAB) of the mammalian paleocommunity using partially a paleosynecological model (PSEco) that incorporates survival and mortality profiles for the calculation of both parameters. Our results indicate that both carrying capacity and available meat were lower in Level 2 and highlight the importance of small and medium-sized mammals for the subsistence of both human groups, in contrast to larger ones. We also calculated optimal ecological densities (ind/km²) for the human populations based on prey biomass, yielding values similar to contemporary low-density hunter-gatherer societies. This suggests a fragmented context for both Neanderthal and Sapiens populations, potentially influenced by changes in the composition of the prey community.

[TSD.1-P-8]

Thursday 5
Discussion corner: Room 9

Terrestrial Mammals as a Climatic and Environmental Indicator: Insights from the Archaeopaleontological Site of Cova Eirós (Triacastela, Lugo, NW Iberia)

Bal-García, Hugo[1]; Rey-Rodríguez, Iván[2]; de Lombera-Hermida, Arturo[3]; Díaz-Rodríguez, Mikel[4]; Fernández-Rodríguez, Carlos[5]; Rodríguez-Álvarez, Xosé Pedro[6]; Fábregas Valcarce, Ramón[7]

(1) Universidade de Santiago de Compostela / CISPAC; (2) Universidade de Vigo / Universidade do Porto; (3) Universidad de Oviedo / CISPAC; (4) Universidade de Vigo / CISPAC; (5) Universidad de León; (6) Universitat Rovira i Virgili / IPHES; (7) Universidade de Santiago de Compostela / CISPAC

Correspondence e-mail: [balgarhugo@gmail.com]

In recent decades, the application of palaeoecological reconstruction to archaeological sites in the Iberian Peninsula has become increasingly significant, employing diverse methodologies to analyse sediments, plant remains, and faunal assemblages. These approaches provide critical insights into the environments inhabited by different species of the genus Homo, allowing for a deeper understanding of the ecological dynamics and adaptative strategies that were crucial for their survival. This study offers the most recent advancements in the palaeoecological reconstruction of Cova Eirós, a Late Pleistocene archaeopaleontological site located in the Eastern Mountains of Galicia (NW Iberia), through the implementation of two complementary methods. The first method, Bioclimatic Model (BM), enables the reconstruction of climatic parameters, such as temperature and precipitation, by assigning identified taxa to predefined biomes based on their ecological requirements. The second method, Habitat Weighting (HW), assesses the representativeness of various habitat types by comparing them to the known modern distributions of the taxa present at the site. Results indicate that occupation at Cova Eirós took place during an episode marked by colder and slightly drier than present conditions. The landscape was dominated by low-density woodland interspersed with open areas and complemented by rocky areas, reflecting a mosaic environment. These findings contribute to a more detailed understanding of the ecological contexts in which neanderthals and Anatomical Modern Humans (AMH) lived during the Late Pleistocene.

[TSD.1-P-9]

Tuesday 3
Discussion corner: Room 9

The impact of fossil biases on phylogenetic inferences: a simulation approach using mammals

Sotelo, Graciela[1]; Galván, Sofía[2]; Gamboa, Sara[3]; Castro-Insua, Adrián[4]; Chiarenza, Alfio Alessandro[5]; Dunne, Emma M.[6]; Jones, Lewis A.[7]; Matamala-Pagès, Marta[8]; Méndez-Quintas, Eduardo[9]; Oliver, Adriana[10]; Rey-Rodríguez, Iván[11]; Varela, Sara[12]

(1) Universidade de Vigo; (2) Universidade de Vigo; (3) Universidade de Vigo; (4) Universidade de Vigo; (5) University College London; (6) Friedrich-Alexander Universität Erlangen-Nürnberg; (7) University College London; (8) Universidade de Vigo; (9) Universidade de Vigo; (10) Universidade de Vigo; (11) Universidade de Vigo; (12) Universidade de Vigo

Correspondence e-mail: [graciela.sotelo@uvigo.gal]

Our understanding of past biodiversity and evolution relies on the incomplete and non-uniform fossil record, shaped by factors like sedimentation rates, species' range and body size, and biases in fossil sampling. This study quantifies the potential difference between evolutionary scenarios based on the fossil record and on complete phylogenies.

Taking current mammal distribution and phylogeny as baselines, we simulated fossil sampling by filtering species based on sediment availability, species traits (range/body size), and taxonomic biases under three filter strengths (25%, 50%, 75%). Lost species were pruned from the phylogeny, and the effects on diversification rates and trait evolution (body size and diet) were assessed.

Results show that body size and taxonomy significantly influence phylogenetic inferences, particularly under stringent filtering. The impact varies with traits, analysis methods, and mammal clades. This simplified approach highlights the potential distortion fossil record biases may impose on understanding biodiversity evolution, providing a lower bound of these effects.

TSD.2. Exploring Evolutionary Adaptation and Resilience Mechanisms to Environmental Change in the Ocean

Tuesday, 3 (12:45-14:15)

Room: Seminario 7

Marine organisms have evolved along distinct pathways that define their function, niche, and overall contribution to ecosystems. In the current context of global change, these evolutionary adaptations shape their ability to acclimate to shifting environmental conditions. The plasticity of molecular and physiological responses in marine organisms, as well as the versatility of symbiotic interactions, will either limit or enhance their capacity to thrive across diverse habitats and scenarios.

Building on this understanding, this session invites research that explores the plasticity of marine organisms at molecular, physiological, and phenotypic levels; symbiotic relationships as facilitators of adaptation to environmental shifts; and additional ways through which organisms, environmental factors, and biotic interactions collectively shape the evolution and acclimation of marine life. This includes, among others, studies on plastic changes in gene expression and biochemical composition, context-dependent interactions with and among microbes, and mechanisms that determine the success of organisms under changing environmental conditions. Understanding these processes provides insights into the status of marine organisms and ecosystems, fosters species adaptation, and offers tools for monitoring the resilience and sustainability of our oceans.

Organizers:

• **Pedro Beca Carretero,** Instituto de Investigaciones Marinas (IIM-CSIC)

• **María López Acosta,** Instituto de Investigaciones Marinas (IIM-CSIC)

• **Lucía Pita Galán,** Instituto de Investigaciones Marinas (IIM-CSIC)

TSD.2. Orals

[TSD.2-O-1]

Tuesday 3, morning (second): 12:45
Room: Seminario 7

Prokaryotic and eukaryotic microbiomes associated with blooms of the toxin-producing dinoflagellate Alexandrium minutum

Blanca-Sújar, Rocío[1]; Díaz-Alonso, Alexandra[2]; Costas-Selas, Cecilia[3]; Justel-Díez, Maider[4]; Nogueira, Enrique[5]; Álvarez-Salgado, Xose Antón[6]; Fernández Suárez, Emilio[7]; Teira, Eva[8]

(1) Centro de Investigación Mariña, Universidade de Vigo; (2) Centro de Investigación Mariña, Universidade de Vigo; (3) University of Copenhagen; (4) Centro de Investigación Mariña, Universidade de Vigo; (5) Centro Oceanográfico de Vigo, Instituto Español de Ocanografía; (6) Instituto de Investigacións Mariñas, Consejo Superior de Investigaciones Científicas; (7) Centro de Investigación Mariña, Universidade de Vigo; (8) Centro de Investigación Mariña, Universidade de Vigo

Correspondence e-mail: [rocio.blanca@uvigo.es]

Research on the abiotic factors driving Harmful Algal Blooms (HABs) has been intense in recent years. Comparatively, less attention has been paid to the role of biotic interactions between HAB species and their microbiomes on bloom formation and dynamics. Understanding these interactions is relevant, as many toxin-producing phytoplankton, such as Alexandrium minutum, rely on bacteria for essential compounds like vitamin B12. The presence of vitamin B-producing bacteria and other microbial groups involved in allelopathic interactions could play a significant role in A. minutum proliferation. We partially sequenced 16S and 18S rRNA genes from 98 samples collected during three A. minutum blooms in Baiona Bay (NW Spain). The prokaryotic community diversity increased at the onset of the bloom, with the free-living (passing through a 3 µm filter) fraction dominated by uncultured Rhodobacteraceae, and the particle-attached (retained in a 3 µm filter) fraction enriched with Synechococcales, Flavobacteriales, and Cellvibrionalles. The particle-attached prokaryotic community significantly differed during the A. minutum proliferation compared with pre- and post-bloom situations. Eukaryotic communities also shifted during blooms, with other dinoflagellates appearing alongside A. minutum. Diatoms, such as Chaetoceros sp., decreased significantly during the A. minutum blooms. These findings highlight the role of microbiome communities in A. minutum bloom dynamics, suggesting that specific bacterial and eukaryotic interactions influence their development and maintenance.

[TSD.2-O-2]

Tuesday 3, morning (second): 13:00
Room: Seminario 7

Using a trait-based approach to guide conservation actions: a case study of black coral and gorgonian assemblages in Cabo Verde

Gómez-Gras, Daniel[1]; Amaro, Teresa[2]; Ornelas, Tristan[3]; Viladrich, Núria[4]; Gori, Andrea[5]; Ledoux, Jean-Baptiste[6]; Linares, Cristina[7]

(1) Universitat de Barcelona; (2) University of Aveiro; (3) University of Aveiro; (4) Universitat de Barcelona; (5) Universitat de Barcelona; (6) Centro Interdisciplinar de Investigação Marinha e Ambiental, Universidade do Porto; (7) Universitat de Barcelona

Correspondence e-mail: [danielgomezgras@gmail.com]

Black coral and gorgonian assemblages are vital components of many marine ecosystems. Yet, they remain poorly studied in many regions, including the Cabo Verde Archipelago—a biodiversity hotspot undergoing rapid development. This lack of knowledge limits the establishment of conservation strategies that balance ecological preservation with local community needs. In this study, we employ a trait-based approach to characterize the habitat-provisioning capacities of black coral and gorgonian assemblages across Santo Antão Island, Cabo Verde. Specifically, we use three morpho-functional traits—skeleton type, size, and growth form—to analyze the functional composition, trait diversity, and trait dominance patterns of 14 assemblages across the island. Our results reveal spatial differences in trait composition across sites, with some dominated by large, bushy, and/or unbranched erect black corals with chitinous skeletons, and others by large to medium planar gorgonians with scleritic skeletons or a combination of traits. Notably, at certain sites, we observed especially diverse and structurally complex habitats that likely support key ecosystem services for local communities, such as enhancing the presence and abundance of commercially important species and providing stunning dive sites that attract sustainable diving tourism. These sites should be therefore suggested as conservation priorities. However, local stakeholders are also to be involved in prioritizing conservation areas, combining the knowledge acquired in this study with the specific needs and ecological knowledge of local communities. Such collaboration will facilitate the implementation of effective measures for the long-term conservation of marine ecosystems in Santo Antão.

[TSD.2-O-3]

Tuesday 3, morning (second): 13:15
Room: Seminario 7

Depth and Microbial Abundance Shape Evolutionary Dynamics of Sponge-Microbiome Symbiosis

Diez Vives, Cristina[1]; Lurgi, Miguel[2]; Montoya, Jose Maria[3]; Riesgo, Ana[4]

(1) National Center for Biotechnology; (2) Swansea University; (3) Theoretical and Experimental Ecology Station; (4) National Museum of Natural Sciences

Correspondence e-mail: [cristinadiezvives@gmail.com]

Symbiotic microbial communities in sponges play essential roles that have shaped their evolution since their origins. Sponges inhabit diverse aquatic environments, including both marine and freshwater ecosystems, spanning from intertidal zones to deep sea, and from tropical to polar regions. The abundance of symbiotic microbes varies greatly among sponges, classifying them as either low microbial abundance (LMA) or high microbial abundance (HMA) species. Host species-specificity strongly influences sponge microbial communities, with conspecific sponge from different locations harbouring similar microbiomes, distinct from cohabiting species. However, the extent to which microbiome composition correlates with host phylogeny, a phenomenon known as phylosymbiosis, remains unclear. Shallow-water HMA sponges show stronger signals of phylosymbiosis and co-evolution than LMA sponges, however, how these patterns compare between deep-sea and shallow-water sponges remains largely unexplored due to the rarity of direct comparative studies.

To address this, we analyszed 201 sponge species spanning 24 sponge orders, including 99 HMA sponges (31 deep and 68 shallow) and 102 LMA sponges (22 deep and 80 shallow). We evaluated the impacts of microbial abundance status, depth, geographic distance, and sponge phylogeny on microbiome composition to uncover the evolutionary dynamics and complexity of these microbial communities. Microbial abundance was the strongest driver of overall community composition. However, when considering the phylogenetic relatedness of microbiomes, depth exerted a greater influence, likely reflecting the distinct microbial communities available in deep-sea environments. Interestingly, deep-sea sponges were more diverse yet were compositionally more homogeneous compared to shallow-water sponges and displayed stronger signals of phylosymbiosis, underscoring the distinctive evolutionary dynamics of symbiosis in extreme habitats.

[TSD.2-O-4]

Tuesday 3, morning (second): 13:30
Room: Seminario 7

Temperature and Metabolism-Driven Variations in Refractory Dissolved Organic Carbon from marine macrophytes as a Potential Carbon Sink

YAamuza Magdaleno, Alba[1]; BRUN MURILLO, FERNANDO G.[2]; AZCÁRATE GARCÍA, TOMÁS[3]; JIMÉNEZ RAMOS, ROCÍO[4]; EGEA TINOCO, LUIS G.[5]; REUTER, HAUKE[6]; BECA CARRETERO, PEDRO[7]

(1) University of Cádiz; (2) University of Cádiz; (3) Marine Sciences of Barcelona (ICM-CSIC) and the University of Barcelona (UB); (4) University of Cádiz; (5) University of Cádiz; (6) Leibniz Zentrum für Marine Tropenforschung; (7) CSIC and University of Vigo

Correspondence e-mail: [alba.yamuza@uca.es]

Marine macrophytes, including algae and seagrasses, play a critical role in marine ecosystems by contributing to primary production and carbon cycling. One key mechanism is the exudation of dissolved organic carbon (DOC), with a portion classified as refractory DOC. This fraction resists microbial degradation, remaining stored in the ocean for extended periods and acting as long-term carbon sink.

In this study, we conducted controlled experiments to investigate the effects of warming and the presence of the invasive species Halophila stipulacea on DOC fluxes produced by marine macrophytes, evaluating at the same time whether temperature and metabolism explain refractory DOC characteristics. Native macrophyte species of the Bay of Cádiz were cultivated at three different temperatures (24°C, 26°C and 28°C), with and without the presence of Halophila stipulacea.

Our results showed that at higher temperatures, macrophytes exhibited reduced net production and increased respiration rates. Refractory DOC declined with rising temperatures, while labile DOC increased—both effects were significant. Similarly, DOC decomposition rates decreased under warming. These findings suggest that elevated respiration at higher temperatures limited the utilization of labile DOC for photosynthetic activity. Moreover, higher temperatures appear to affect the bioavailability of the DOC produced. For the first time, this study quantified daily refractory DOC production rates relative to carbon biomass content in photosynthetic tissues, estimating that macrophytes can produce around 3.6 g·m-2·d-1 of refractory DOC under current conditions. As global temperatures continue to rise, understanding these dynamics becomes crucial for predicting the future contributions of coastal ecosystems to long-term carbon sequestration.

[TSD.2-O-5]

Tuesday 3, morning (second): 13:45
Room: Seminario 7

Resilience in a changing ocean: Arbacia lixula's responses to natural pH gradients

Arranz, Vanessa[1]; Fernandez-Vilert, Robert[2]; Martin-Huete, Marta[3]; Schmütsch, Lea[4]; Pegueroles, Cinta[5]; González-Delgado, Sara[6]; Hernández, Jose Carlos[7]; Pérez-Portela, Rocio[8]

(1) Universitat de Barcelona; (2) Universitat de Barcelona; (3) Universitat de Barcelona; (4) Universitat de Barcelona; (5) Universitat Autonoma de Barcelona; (6) Universitat de Barcelona; (7) Universidad de la Laguna; (8) Universitat de Barcelona

Correspondence e-mail: [v.arranz@ub.edu]

Introduction. Ocean acidification (OA), driven by the increase in atmospheric CO2, presents a significant threat to marine biodiversity. By 2100, ocean acidity is predicted to rise by 100-150%, potentially disrupting half of marine species. The resilience, adaptability, and survival potential of marine organisms under OA conditions vary greatly across species, and the broader ecological consequences remain poorly understood. Marine CO2 vents, which create natural pH gradients over short geographical distances, serve as a proxy to study long-term OA effects and provide a glimpse into future ocean scenarios.

Material and methods. In this study, we focus on adult specimens of Arbacia lixula, an important echinoderm, collected from both ambient (pH 8.1) and CO2 vent sites (pH 7.4) along a natural pH gradient in La Palma, Canary Islands. We employed a multidisciplinary approach that integrates metabolic analysis, transcriptomics and microbiome profiling to uncover the biological mechanisms underpinning adaptation and plasticity to OA.

Results and discussion. We observed comparable respiration rates between organisms inhabiting ambient and low pH conditions; however, those in OA environments exhibited a pronounced transcriptomic response. This underscores the intricate biological traits that enable species to survive in rapidly changing environments. Additionally, a distinct microbial profile was identified in organisms from OA conditions compared to those in ambient conditions, highlighting the critical role of the holobiont in shaping adaptive responses. Our findings provide insight into the buffering systems and strategies used by A. lixula to cope with OA, contributing to our understanding of its resilience potential.

[TSD.2-O-6]

Tuesday 3, morning (second): 14:00
Room: Seminario 7

Dietary preference as a driver for venom composition in ribbon worms

Andrés Gómez, Elena[1]; Riesgo Gil, Ana[2]; Verdes Gorín, Aida[3]

(1) National Museum of Natural Sciences; (2) National Museum of Natural Sciences; (3) National Museum of Natural Sciences

Correspondence e-mail: [elena.andresg@uah.es]

Ribbon worms (Nemertea) are understudied active predators that use an eversible proboscis to inject toxins into their prey. The three main lineages —Hoplonemertea, Palaeonemertea, and Pilidiophora— show significant differences in proboscis morphology, hunting strategies and diet preferences. Recent studies investigating venom composition in nemerteans have identified lineage-specific toxins, suggesting that venom evolution in this group is highly divergent and that toxin cocktails may have evolved to target different prey. Furthermore, venom composition and potency are predicted to reflect ecological and evolutionary drivers relating to diet; thus, species with generalist diets show venoms with greater toxin diversity and potency against different taxa. Therefore, the venoms of species with taxonomically diverse diets might be better equipped to prey on novel species, facilitating their adaptation to changing environments.

To explore how dietary preferences can influence venom composition in nemerteans we conducted transcriptomic analyses. Using RNAseq-based Differential Gene Expression analyses, we characterized venom composition, toxin gene diversity, and expression patterns in eight nemertean species. This approach enabled us to compare toxin profiles and detect diet-related patterns in toxin composition. Our analysis revealed differences in nemertean venom, with hoplonemerteans primarily expressing neurotoxins and cytolytic peptides, optimized for immobilizing and consuming crustacean prey; while pilidiophoran and palaeonemertean venoms are characterized by metalloproteases and paralytic toxins tailored to hunt and digest annelid worms and small fishes.

Our study increases our knowledge on venom composition across ribbon worms, shedding light on how diet influences venom evolution and the the potential of nemerteans to adapt to global environmental changes.

TSD.2. Posters

[TSD.2-P-1]

Wednesday 4
Discussion corner: Room 9

Evolution of thermal tolerance in marine diatoms: Metabolic strategies under heat stress

Aranguren-Gassis, María[1]; Diz, Ángel P.[2]; Huete-Ortega, María[3]; Allen, Andrew[4]; Leles, Suzana G.[5]; Levine, Naomi M.[6]; Litchman, Elena[7]

(1) Centro de Investigación Mariña (CIM), Universidade de Vigo; (2) Centro de Investigación Mariña (CIM), Universidade de Vigo; (3) University of Cambridge; (4) Scripps Institution of Oceanography, University of California; (5) University of Southern California; (6) University of Southern California; (7) W. K. Kellogg Biological Station, Michigan State University

Correspondence e-mail: [aranguren@uvigo.gal]

In the past decade, numerous laboratory experiments have shown that marine phytoplankton can rapidly evolve high temperature tolerance when exposed to thermal stress, typically within a time frame of weeks to months. This evolutionary potential may help marine phytoplankton species survive under current and future global warming conditions. However, the impact of this adaptation on phytoplankton interactions with the environment and other organisms depends on how cellular metabolism changes during the evolutionary process.

To better understand the cellular strategies that allow for the emergence of thermo-tolerant populations, we analyzed the proteomic responses of a marine diatom, Chaetoceros simplex, to both thermal acclimation and evolutionary adaptation.

Our findings revealed that high temperature-tolerant populations adopt a conservative cellular strategy when acclimated to high, above-optimal temperatures, favoring recycling and reallocation of resources over the biosynthesis of new structures. While this approach provides an advantage for populations that have evolved high temperature tolerance under thermal stress, the shift towards resource reallocation may account for the lack of high-temperature adaptation when the cells face low nitrate availability.

TSD.3. Assessing the interplay between genetic and non-genetic mechanisms contributing to phenotypic variation and adaptation over time

Thursday, 5 (11:00-12:30); (12:45-14:15)

Room: Seminario 1

To understand how ecosystems respond to global change, we must understand how biological diversity and ecosystem function are maintained over time. One of the most crucial and pressing pursuits in this direction is to determine what causes communities and populations to be resilient to environmental change. Ecologists have long argued about multiple mechanisms by which local biodiversity might achieve greater temporal stability and thus support the temporal stability of ecosystem properties. Among these mechanisms, heritable differences in phenotype and phenotypic plasticity are important contributors to adaptation. Genetic diversity is assumed to allow populations to adapt to changing environmental fluctuations by offering a greater variety of phenotypes among which the most fit can be selected. However, the ability of an organism to modulate trait expression in response to the environment (i.e., phenotypic plasticity) is also heritable. Such induced responses can be of highly variable duration, from short-term transient modifications operating within the lifetime of individuals (within-generation plasticity) to inherited differences across generations (transgenerational plasticity). The relative effect of genetic vs. non-genetic mechanisms, including their temporal extent and to which extent they are triggered by different environmental drivers, largely remain to be assessed. It is unclear to which extent non-genetic effects are cumulative when environmental conditions are maintained across generations. We also do not know how reversible induced differences are when environmental conditions change. These questions require researchers to assess how the role of genetic diversity and/or diversity in non-genetic inheritance interacts with population stability over time. Another important task is to describe how such questions can be addressed experimentally. This symposium will gather diverse researchers who are working to understand the link between genetic and non-genetic effects on short- and long-term phenotypic variation within species and how genetic and non-genetic effects can be disentangled in natural populations.

The proposed symposium aims to synthesize the recent developments across different fields of research, connecting studies on genetic diversity, phenotypic diversity and non-genetic effects such as transgenerational plasticity. As such, we will assess topics like phylogenetics and phylogenomics, trait-based ecology and plant communities, epigenetics and transgenerational plasticity, functional genetics, and global change ecology in combination, with the aim of outlining unexplored areas of research that bridge these fields.

Organizers:

• **Francesco de Bello,** Centro de Investigaciones sobre Desertificación (CIDE-CSIC)

• **Javier Puy,** Estación Biológica de Doñana (EBD-CSIC).

TSD.3. Orals

[TSD.3-O-1]

Thursday 5, morning (first): 11:00
Room: Seminario 1

Sex matters: Transgenerational plasticity due to mycorrhiza gets hotter in sexual than clonal offspring of Fragaria vesca

Latzel, Vít[1]; Sammarco, Iris[2]; Janoušková, Martina[3]

(1) Institute of Botany of the Czech Academy of Sciences of the Czech Republic; (2) Institute of Botany of the Czech Academy of Sciences of the Czech Republic; (3) Institute of Botany of the Czech Academy of Sciences of the Czech Republic

Correspondence e-mail: [vit.latzel@ibot.cas.cz]

Transgenerational plasticity (TGP) allows plants to prepare their offspring for future environmental conditions. We investigated how TGP induced by arbuscular mycorrhiza—the most widespread plant-microbe mutualism—affects clonal and sexual offspring of Fragaria vesca. Specifically, we hypothesized that the ecological and evolutionary importance of TGP would differ between reproductive modes, depending on parental mycorrhizal status and phosphorus (P) availability.

In a two-generation greenhouse experiment, we exposed parent plants to factorial combinations of mycorrhizal status and high- or low-P availability. Their clonal and sexual offspring were grown in either parental or non-parental environments, and we evaluated TGP effects on mycorrhiza formation and plant performance.

Our findings revealed that TGP effects were generally stronger in sexually produced offspring. Parental mycorrhizal status conferred adaptive benefits when offspring experienced contrasting conditions: for example, mycorrhizal offspring performed better under high P, while non-mycorrhizal offspring benefitted from parental experience under low P. In contrast, TGP effects were less pronounced in clonal offspring, suggesting different evolutionary pressures acting on the two reproductive strategies.

These results highlight the nuanced interplay between reproductive modes, parental environmental experience, and offspring adaptability. The stronger TGP in sexual offspring may reflect their greater need to respond to variable environments, while clonal offspring rely more on immediate environmental cues. Our study underscores the importance of considering reproductive strategies and their interactions with environmental factors when exploring plant-symbiotic dynamics across generations.

[TSD.3-O-2]

Thursday 5, morning (first): 11:15
Room: Seminario 1

Epigenetically mediated phenotypic plasticity is predicted from plant life history and traits of the economics spectrum

Puy, Javier[1]; Medrano, Monica[2]; Alonso, Conchita[3]

(1) Universidad de Sevilla; (2) Estacion Biológica de Doñana; (3) Estacion Biológica de Doñana

Correspondence e-mail: [puy.javi@gmail.com]

Phenotypic plasticity is a key mechanism by which plants respond to changing or heterogeneous conditions. As phenotypic traits greatly differ between species, their magnitude of plasticity also greatly differ because of their different selective pressures. For example, plants distant in life-history or in the resource-use strategy are thought to differ in their plasticity. Efforts to predict phenotypic plasticity across plant species have mainly focused on estimating their realized environmental niche range. However, evaluating the phenotypic plasticity of related species could allow understanding variation in adaptive capacity and predict population responses to global change drivers.

In order to test whether functional traits values might be associated with phenotypic plasticity, we conducted an experiment where seven different species from the Erodium genus (Geraniaceae) with similar distribution but contrasting traits were exposed to two drivers of global change (extreme drought and nitrification) to quantify their maximum phenotypic plasticity and to what extent it was associated with changes in global DNA methylation.

We found that, although dependent of the life-history of the species, those ones with acquisitive traits (e.g. higher SLA) were associated with bigger phenotypic plasticity in biomass allocation, leaf morphology and physiology. We found, however, that the magnitude of epigenetic change induced by the environments was equal for all species. Our results show the potential of building predictive frameworks for phenotypic plasticity based on easily measured plant functional characteristics.

[TSD.3-O-3]

Thursday 5, morning (first): 11:30
Room: Seminario 1

Genetic variability and phenotypic assessment of the Erica tetralix group (Ericaceae)

Rodríguez Buján, Iván[1]; Fagúndez, Jaime[2]

(1) University of A Coruña; (2) Universidade da Coruña, Facultade de Ciencias, Campus da Zapateira s/n, 15071 A Coruña, España.

Correspondence e-mail: [ivan.bujan@udc.es]

Heathers included in the Erica tetralix group (E. tetralix, E. ciliaris, E. mackayana and E. andevalensis) show high disparities in their geographic distribution ranges and conservation concerns. These species form a robust clade within the heathers (Erica L.) of the northern hemisphere. They share traits such as low size, pluricellular glandular trichomes, and a preference for permanently wet conditions. However, their distribution ranges vary, from the widespread North Atlantic E. tetralix to the narrowly endemic E. andevalensis of southwestern Iberia. Moreover, hybridization occurs in northern areas between E. tetralix and E. ciliaris or E. mackayana, but not in overlapping southern populations.

This study presents a dataset of over 500 plants obtained from the distribution range of the four species. Most samples have been analyzed using SNPs (nextRAD sequencing). Furthermore, we conducted measurements on an array of morphological traits, encompassing macro- and micromorphological traits. The first results reveal insights into the biogeography, phylogenetic relationships and morphological variation at the species, population and individual levels, including: i) the biogeography of E. mackayana, which shows a clear pattern of recent multiple introduction events for the Irish populations; ii) both genetics and morphology support the species taxonomic level of E. andevalensis; and iii) the hybrids of E. tetralix and E. mackayana or E. ciliaris are intermediate in morphology and genotype, and are produced only in certain regions. Findings from this model group can aid in interpreting evolutionary and biogeographic patterns, such as northern recolonization by plants from southern refuges after the ice age.

[TSD.3-O-4]

Thursday 5, morning (first): 11:45
Room: Seminario 1

Drought-responsive eco-physiological and transcriptomic plasticity in a polyploid carnation

Balao, Francisco[1]; Rodríguez-Parra, Alba[2]; Picazo-Aragonés, Jesús[3]; López-Jurado, Javier[4]; Ashman, Tia-Lynn[5]; Barranco-Chamorro, Inmaculada[6]; Terrab, Anass[7]

(1) University of Seville; (2) University of Seville; (3) University of Seville; (4) University of Seville; (5) University of Tasmania; (6) University of Seville; (7) University of Seville

Correspondence e-mail: [fbalao@us.es]

Plasticity is a key trait for plant survival under environmental stress, particularly in polyploids. After whole genome duplication, increased genetic redundancy provides greater capacity for flexible trait expression, allowing them to respond adaptively to environmental stresses. Dianthus inoxianus is an endangered species native to the Doñana National Park (SW of Iberian Peninsula), an area characterized by arid Mediterranean conditions and extreme summer drought. It belongs to the polyploid complex of Dianthus broteri and represents the highest ploidy level within the complex, being a dodecaploid. It offers an ideal system to investigate how transcriptomic and eco-physiological plasticity interact under drought conditions.

Clones were grown under well-watered and extreme drought conditions for 18 days. Eco-physiological traits, such as relative water content, photosynthetic efficiency, photosynthetic pigments, and water potential, were measured. We quantified phenotypic plasticity using the RDPI index. Simultaneously, RNA sequencing (RNAseq) was performed to identify drought-responsive. Differential gene expression (DGE) analysis, gene ontology (GO) enrichment, and co-expression network analysis were used to assess plastic transcriptomic responses.

Dianthus inoxianus demonstrated considerable eco-physiological and transcriptomic plasticity under drought stress. The greatest phenotypic plasticity was observed in the water potential and photosynthetic pigments, congruently with their role on drought tolerance and protection against oxidative stress. However, relative water content showed the least plasticity, indicating its high drought adaptation by maintaining a relatively constant water content in tissues, even under water scarcity. These findings underscore the role of polyploidy in promoting plasticity at both transcriptomic and eco-physiological levels, supporting the species' resilience under water stress.

[TSD.3-O-5]

Thursday 5, morning (first): 12:00
Room: Seminario 1

Epigenetic and transcriptomic insights into transgenerational effects of wild strawberry (Fragaria vesca) under biotic interactions

Sammarco, Iris[1]; Beltrán-Torres, Gerson[2]; Janousková, Martina[3]; Latzel, Vít[4]

(1) Czech Academy of Sciences; (2) Czech Academy of Sciences; (3) Czech Academy of Sciences; (4) Czech Academy of Sciences

Correspondence e-mail: [Iris.Sammarco@ibot.cas.cz]

Transgenerational effects (TGE) enable plants to transmit environmental cues to their offspring, potentially facilitating adaptation to local conditions. These effects may be partly mediated by epigenetic mechanisms such as DNA methylation and may explain plant responses to both abiotic and biotic factors. While abiotic factors are well-studied, the role of biotic interactions—particularly with mutualistic and antagonistic microorganisms—remains underexplored. Such interactions are pivotal for species coexistence, biodiversity, and ecosystem functioning, and understanding their role in TGE could help predict ways to enhance ecosystem resilience and sustainable agricultural practices.

This study investigates how TGE mediated by plant-microorganism interactions influences gene expression and epigenetic modifications in clonal versus sexual offspring of an inbred Fragaria vesca line. We examine transcriptomic and DNA methylation changes in response to parental exposure to mutualists (mycorrhizal fungi) or antagonists (pathogenic microorganisms), as well as in their progeny grown in the presence or absence of microbial environments.

We hypothesize that clonal offspring retain epigenetic marks with greater fidelity and ecological significance than sexual progeny due to the absence of meiotic resetting. Additionally, we propose that inherited epigenetic modifications influence gene expression in the offspring, resulting in varying magnitudes of TGE between clonal and sexual offspring.

Our work aims to unravel the transcriptomic and epigenomic signatures underlying TGE in plants, shedding light on the mechanisms and evolutionary implications of plant adaptation to biotic interactions. These findings will provide a deeper understanding of how reproductive strategies shape TGE, with broad relevance for biodiversity and ecosystem resilience.

[TSD.3-O-6]

Thursday 5, morning (first): 12:15
Room: Seminario 1

Evolution of functional syndromes and phenotypic plasticity in a forest tree species

Ramírez-Valiente, José Alberto[1]; González-Martínez, Santiago[2]; Robledo-Arnuncio, Juan José[3]; Matesanz, Silvia[4]; Anadon-Rosell, Alba[5]; Martínez-Vilalta, Jordi[6]; López, Rosana[7]; Cano-Martin, Francisco Javier[8]

(1) ICIFOR-INIA-CSIC; (2) INRAE-Université de Bordeaux; (3) ICIFOR-INIA-CSIC; (4) Universidad Rey Juan Carlos; (5) CREAF, Universitat de Barcelona; (6) Universitat Autònoma de Barcelona, CREAF; (7) Universidad Politécnica de Madrid; (8) ICIFOR-INIA-CSIC

Correspondence e-mail: [jose.ramirez@inia.csic.es]

Studying functional variation across environments is key for understanding how resource-use strategies evolve. It is hypothesized that plants from mesic environments have evolved towards a more acquisitive strategy with high growth potential and phenotypic plasticity, while populations from harsher environments exhibit a conservative strategy with slower growth and better physiological performance under drier conditions. We tested this hypothesis through the phenotypical characterization of 14-year-old Pinus pinaster trees from twenty range-wide populations growing in two climatically contrasting common gardens. We measured twenty-one traits related to growth, leaf morphology, gas exchange, photochemistry, and hydraulics. Consistent with our hypothesis, we found that populations from mesic oceanic areas exhibited higher growth rates and higher allocation to leaf surface area under mesic conditions, along with greater plasticity in these traits. In contrast, xeric continental populations had better physiological status under drought. Together, our results provide evidence that climate drives the joint evolution of leaf and stem traits and their plasticity following an acquisitive-conservative axis of resource use, but also demonstrate that hydraulic and gas exchange traits are not correlated at an evolutionary scale and therefore can potentially evolve independently within species.

[TSD.3-O-7]

Thursday 5, morning (second): 12:45
Room: Seminario 1

Non-genetic effects of consistent across-generational stress on functional diversity

de Bello, Francesco[1]; Sobral, Mar[2]

(1) CIDE-CSIC; (2) University of Santiago de Compostela

Correspondence e-mail: [fradebel@ext.uv.es]

Introduction. Non-genetic heritable variations in phenotype—transgenerational plasticity—alter trait expressions within populations based on environmental conditions. Unlike genetic effects, plasticity is more easily reversible and shaped by parental environments. However, the cumulative reinforcement and reversibility of these non-genetic effects across generations remain poorly understood. We hypothesize that cumulative trait expression and its reversibility depend on the consistency of stress across generations.

Methods. Using wild radish, we conducted a three-generation experiment where cohorts experienced either consistent or variable environmental conditions, with or without herbivory by caterpillars.

Results and Discussion. Our findings demonstrate pronounced plastic responses in defense traits under herbivory, including increased trichome density and glucosinolate production. These responses accumulated across generations when cohorts experienced consistent conditions, leading to amplified defense trait expression and greater population trait variability. Thus, stability of stress across generations reinforced defense levels while also increasing variability in trait expression, enabling bet-hedging in unpredictable environments. Reversely, in stable and benign environments devoid of herbivory across generations, we observed diminished expression of plant defenses and diminished phenotypic disparities among individuals. This cumulative transgenerational plasticity resulted in non-genetic divergence in phenotypes among individuals exposed to repeated stress. Our results highlight how environmental stress constancy modulates trait expression and functional diversity in plant populations, offering insights into non-genetic contributions to ecological and evolutionary dynamics.

[TSD.3-O-8]

Thursday 5, morning (second): 13:00
Room: Seminario 1

Transgenerational plastic effects of resin tapping on seedlings of Maritime pine (Pinus pinaster)

Zas, Rafael[1]; Lema, Margarita[2]; Russey, Rumi[3]; Touza, Roberto[4]; Sampedro, Luis[5]

(1) Misión Biológica de Galicia - Consejo Superior de Investigaciones Científicas; (2) MBG-CSIC; (3) iCIFOR-INIA-CSIC; (4) MBG-CSIC; (5) MBG-CSIC

Correspondence e-mail: [rzas@mbg.csic.es]

Environmental maternal effects are known to affect the early performance of pine seedlings. Resin tapping of pine trees involves huge traumatisms and removes large amounts of carbon resources from the trees. Tapped trees plastically respond to this type of treatments with pronounced changes in defensive investment, growth and reproduction. Whether resin tapping can also trigger transgenerational plastic responses in the offspring remains, however, unexplored. To determine the influence of resin tapping on the new generation we grew seeds from resin-tapped and untapped mother trees of two mature pine forests in northwest Spain. Half of the seedlings were treated with Methyl jasmonate (MeJA) to boost induced defense mechanisms. No effect of resin-tapping was observed on seed weight, germination and early growth traits. Resin-tapping influenced, however, biomass allocation. Seedlings from tapped trees had higher root biomass fraction at the expense of less aerial growth than trees from untapped mother trees. MeJA application on the seedlings effectively boosted non-volatile resin (NVR), phenolics (PHE) and tannins (TAN). Constitutive levels of NVR were lower in the offspring of tapped trees while inducibility of NVR was unaffected by resin tapping. In the case of PHE and TAN, seedlings from tapped trees showed both significantly higher constitutive levels and lower inducibility than those from untapped trees. Differences in the offspring of tapped and untapped trees were largely consistent for the two original mother pine forests. Our results demonstrate relevant transgenerational effects of resin tapping that could be decisive for the success of natural regeneration processes on a context of global change.

[TSD.3-O-9]

Thursday 5, morning (second): 13:15
Room: Seminario 1

Extraordinary high prevalence and genetic diversity of Leucocytozoon (Haemosporida: Apicomplexa) parasites: the case of blue tits from Sierra Nevada, Spain

Garrido-Bautista, Jorge[1]; Harl, Josef[2]; Fuehrer, Hans-Peter[3]; Comas, Mar[4]; Smith, Steve[5]; J. Penn, Dustin[6]; Moreno-Rueda, Gregorio[7]

(1) University of Granada, Faculty of Sciences; (2) Institute of Pathology, University of Veterinary Medicine Vienna; (3) Institute of Parasitology, University of Veterinary Medicine Vienna; (4) Faculty of Sciences, University of Granada; (5) Konrad Lorenz Institute of Ethology, University of Veterinary Medicine Vienna; (6) Konrad Lorenz Institute of Ethology, University of Veterinary Medicine Vienna; (7) Faculty of Sciences, University of Granada

Correspondence e-mail: [jorgegarrido@ugr.es]

Haemosporidian parasites of the genus Leucocytozoon are widespread common in birds. Studies of wild bird populations have shown that Leucocytozoon prevalence and lineage diversity usually vary according to the environment, but no study has examined it at fine-scale and continuous habitats. Here, we investigated the genetic diversity of Leucocytozoon parasites infecting breeding blue tits (Cyanistes caeruleus) in a continuous Mediterranean woodland that extends over two mountain slopes and includes four forest types. We used two molecular approaches to analyse the diversity and infection intensity of Leucocytozoon: PCR and sequencing of the cytochrome b barcode region, and digital-droplet PCR. More than 90% of blue tits were positive for Leucocytozoon. Although parasite prevalence did not show a forest-dependent variation, the infection intensity did. Parasitized blue tits from the pine forest had the highest intensity, which depended on sex since males had fewer parasites than females in this forest. Twelve genetic lineages of Leucocytozoon were found. Most of the lineages were previously reported from tit (Paridae) species in Europe and Western Asia. One lineage (lPARUS20) was first reported for Southern Europe, while another lineage (lPARUS79) was previously reported only from North Africa (lPARUS79). Our results revealed that parasite intensity, but not prevalence, varied spatially at a fine scale, and blue tits harboured an extraordinary genetic diversity of Leucocytozoon parasites. Tolerance mechanisms against parasites, cross-species transmission between bird species, or vector (Simulium blackflies) shift to higher latitudes due to global change could explain this high Leucocytozoon diversity.

[TSD.3-O-10]

Thursday 5, morning (second): 13:30
Room: Seminario 1

Is phenotypic integration a constraint? Effects of heterozygosity and ploidy in phenotypic covariations in plant selfing populations

Olmedo-Castellanos, Carlos[1]; García-Muñoz, Ana[2]; Ferrón, Camilo[3]; Clo, Josselin[4]; Douet, Diane[5]; Abdelaziz, Mohamed[6]; Muñoz-Pajares, A. Jesús[7]

(1) University of Granada; (2) Rey Juan Carlos University; (3) Rey Juan Carlos University; (4) Université de Lille / CNRS; (5) Université de Lille / CNRS; (6) University of Granada; (7) University of Granada

Correspondence e-mail: [e.carlosolmedo13@go.ugr.es]

Mating systems in flowering plants vary from self-pollination (selfing) to crossed pollination (outcrossing). Pure selfing lines in populations have established gene interactions related with different expression patterns. One example of them is phenotypic integration, which refers to patterns of covariation between functionally related traits in an individual. Crossing between selfing lines could lead these interactions to break out, as new allele combinations appear. Phenotypic integration can be affected by a genome duplication, i.e., polyploidy. This might promote genetic instability and divergent selection due to cytotype differences, as well as increasing the new possible allele combinations. However, decoupling trait covariations can produce new phenotype combinations related with evolutionary potential as novelties in the population. Erysimum incanum, a Brassicaceae species from Iberian Peninsula and Morocco, represents a case study, as it has a highly selfing mating system with diploid, tetraploid and hexaploid populations. To explore this, we obtained controlled crosses for each ploidy in greenhouse between highly inbred lines and pure controlled selfing crosses, all of them grouped by familes. We measured phenotypic covariations between fitness components, flower and individual size traits. We studied as well evolvability, as the standardized genetic variance through families, of selfing groups to assess their evolutionary potential. We concluded that outcrossing breaks genetic correlations but are also influenced by ploidy. This scenario can be a chance of overcoming the phenotype limitations presented on selfing populations when new selective pressures act on them.

[TSD.3-O-11]

Thursday 5, morning (second): 13:45
Room: Seminario 1

Fire-driven phenotypic plasticity and genetic adaptation in Pinus halepensis Mill.: insights from genomic and phenotypic analyses

Gutierrez Larruscain, David[1]; G. Pausas, Juli[2]

(1) Desertification Research Centre; (2) Desertification Research Centre

Correspondence e-mail: [dglarruscain@gmail.com]

he hypothesis that disturbance regimes influence or enhance phenotypic variability in plants has recently been supported in the coniferous tree Pinus halepensis Mill. Guiote and Pausas (2023) provided the first field evidence of fire disturbance acting as a driver of precocity in plants. By assessing the age of first reproduction and cone serotiny in Aleppo pine populations across varying fire regimes, they found that populations experiencing recurrent and intense fire scenarios exhibited significantly more precocious individuals. In contrast, populations from regions with infrequent fire events showed delayed reproductive traits. In this study, we aim to unravel the genetic mechanisms underlying these phenotypic patterns. To this end, we genotyped and phenotyped 460 individuals from 12 populations previously analyzed by Guiote and Pausas (2023), using a Pinus halepensis SPET (Single Primer Enrichment Technology) panel. This approach yielded up to 40,000 SNPs from coding regions. To identify genetic signatures associated with fire-driven phenotypic plasticity and potential adaptations to disturbance regimes, we will conduct phenotypic-genotypic association studies, genomic prediction of phenotypes, and functional genomic analyses. This study aims to contribute to understanding the genetic mechanisms underlying phenotypic variability, particularly in response to fire-driven environmental pressures.

[TSD.3-O-12]

Thursday 5, morning (second): 14:00
Room: Seminario 1

Drought stress modulates subindividual trait variation and its underlying epigenetic mosaic in Mediterranean holm oak

Troyee, Anupoma Niloya[1]; Rodriguez Larrinaga, Asier[2]; Milcu, Alexandru[3]; Sobral, Mar[4];

(1) University of Santiago de Compostela; (2) eNeBaDa, Santiago de Compostela A Coruña University of Santiago de Compostela; (3) CNRS Ecotron; (4) University of Santiago de Compostela

Correspondence e-mail: [niloyatroyee@gmail.com]

Plant subindividual functional diversity (SFD) can fill in a big knowledge gap in ecology and evolution by detecting patterns of subindividual trait variation (STV) and subindividual epigenetic variation (SEV) triggered by changing climatic conditions. The contribution of SEV to phenotypic diversity has been vastly overlooked; however, understanding the association of SEV with subindividual plasticity can enable us to uncover how plants adapt their morphology and physiology to varying environmental conditions, such as drought. Here, we studied how drought influences STV and SEV in the Mediterranean holm oak (Quercus ilex) and its offspring along with plant fitness through carbon and water fluxes. We sampled 570 leaves (90 maternal from the Puéchabon forest in France, 480 offspring grown under controlled conditions at the Ecotron). We measured leaf traits and performed epigenomic analyses in 24 saplings with whole-genome bisulfite sequencing that resulted in the identification of differentially methylated regions (DMRs) using the Oak Genome database. We quantified STV and SEV using the coefficient of variation (CV) and Principal Component Analysis (PCA), followed by generalized linear and mixed models to evaluate the effects of drought treatments and kinship, with maternal identity included as a random factor. Our findings highlight the role of epigenetic mosaicism in shaping subindividual variation and its potential link to individual fitness under drought stress. The results provide insights into the adaptive potential of Q. ilex and other dominant Mediterranean tree species by showing that STV and SEV in plant traits may vary in response to current and transgenerational drought and can be used in conservation strategies to mitigate the impacts of climate change on Mediterranean forests.

TSD.3. Posters

[TSD.3-P-1]

Thursday 5
Discussion corner: Room 9

Exploring the role of selection for yield and seed size on the evolution of leaf traits in Brassica rapa

Díaz-Mulero, David[1]; Pablo-Carmona, Beatriz[2]; Matesanz, Silvia[3]; Milla, Rubén[4]

(1) Universidad Rey Juan Carlos; (2) Universidad Rey Juan Carlos; (3) Universidad Rey Juan Carlos; (4) Universidad Rey Juan Carlos

Correspondence e-mail: [david.diazm@urjc.es]

Crops represent a subset of approximately 1000 plant species, yet they hold significant value, providing the majority of human and livestock food. During domestication, certain traits evolved as a result of plant cultivation in anthropogenic environments and subjected to artificial selection. Traits such as plant sizes or characteristics related to resource-acquisition rates of leaves result from evolution under cultivation after domestication. Yet, we have limited understanding of the broader consequences of this transition of plants to agricultural settings, but we know that traits like yield may have pleotropic effects over other plant traits. In this contribution, we aim to reveal whether selection for crop yields or seed size promote specific leaf trait values common to domesticated plants.

We cultivated artificial populations of Brassica rapa Fast Plants® for five generations under four different selection regimes: individual plant yield, plant group yield under monoculture conditions, plant group yield under polyculture conditions and seed mass. After obtaining offspring from all generations, we established a common garden with the individuals from generations 1 and 5. We measured specific leaf area (SLA), leaf dry matter content (LDMC) and leaf size.

The results of the leaf traits obtained in the common garden experiment will be discussed to reveal if yield or seed mass selection promotes a change in leaf traits, with an emphasis on their ecological and evolutionary implications for our understanding of domestication.

[TSD.3-P-2]

Tuesday 3
Discussion corner: Room 9

Does temperature affect reproductive behaviour in male three-spined sticklebacks?

Fernández Pujó, Wendy[1]; Kim, Sin-Yeon[2]; Velando Rodríguez, Alberto[3]

(1) Universidad de Vigo; (2) Universidad de Vigo; (3) Universidad de Vigo

Correspondence e-mail: [wendy.fernandez.pujo@uvigo.gal]

There is growing evidence that temperature during growth and reproduction can strongly impacts the physiology and life history of ectotherms, thereby shaping their reproductive strategies. However, it is less well known whether animals can adaptively adjust their reproductive behaviors in response to increasing temperatures to enhance mating success and offspring survival. Here, we studied the impact of long-term exposure to increased temperatures on courtship and nest-building behaviours in male three-spined sticklebacks (Gasterosteus aculeatus). We hypothesize that the exposure to elevated temperatures during early growth and maturation alters these behaviours, which can affect reproductive outcomes. We established two experimental groups. The control fish were exposed to normal temperatures of their natural habitat, and the experimental fish were exposed to warmer temperatures (2°C higher). During the breeding season, we assessed nest size and structure, nuptial coloration and courtship behaviours in the control and experimental males. We predict that males exposed to higher temperatures would construct less compact nests to facilitate oxygen flow, and their courtship behaviour would involve more frequent fan displays, simulating strong ability for egg care and oxygenation. We also expect that the males exposed to higher temperatures would show a faster seasonal decrease in nuptial coloration due to increased costs of colour maintenance and courtship effort.

[TSD.3-P-3]

Wednesday 4
Discussion corner: Room 9

When the wilderness calls: evolution by feralization in almond (Prunus dulcis)

Insuasti Astudillo, Hernan Camilo[1]; Ocaña-Calahorro,, Francisco Javier[2]; Barea-Márquez, Andrés[3]; Berbel-Cascales, Modesto[4]; Rubio de Casas, Rafael Francisco[5]

(1) UNIVERSITY OF GRANADA; (2) University of Granada; (3) University of Granada; (4) University of Granada; (5) University of Granada

Correspondence e-mail: [hcinsuastia@ugr.es]

Introduction. The effects of crop domestication on the evolution of multiple plant traits have been well documented and characterized. Conversely, the reverse process of feralization, in which domestic populations spawn wild ones is much poorly understood. However, feral populations represent an invaluable resource both as natural evolutionary experiments and as breeding material. In this study, we analyzed the phenotypic and genotypic variation associated to the feralization of almonds (Prunus dulcis) across souther Spain to understand the ecological and evolutionary processes involved.

Materials and metods. We genotyped 331 individual trees from 29 pairs of crop-feral populations using 12 SSR markers to analyze the genetic diversity and population structure of P. dulcis. Additionally, we measured seven phenotypic fruit and seed traits in 145 of those same individuals. We then analyzed whether feralization was associated with pehnotypic variation in this dataset using Bayesian models that accounted for the genetic kinship among individuals.

Results and discussion. Overall, we detected very high levels of genetic diversity. Most of this variation was explained by differences between individuals, with less variance attributable to differences between localities and types (i.e., crop vs feral). Although allelic richness and expected heterozygosity were higher in feral than crop populations, results supported a panmictic scenario in which gene-flow between types is frequent and widespread. In spite of this limited genetic structure, our statistical models showed a clear effect of feralization on several traits, namely nut volume, shell density, and seed cianogenesis. These phenotypic differentiation is congruent with an scenario of natural selection, likely imposed during dispersal and seed establishment.

[TSD.3-P-4]

Thursday 5
Discussion corner: Room 9

Genomic Insights into Local Adaptations and Drought Resilience in Quercus suber across its Latitudinal Range

Viveiros Moniz, Melissa[1]; Sánchez Miranda, Angela[2]; Muñoz Pajares, Antonio Jesús[3]; Abdelaziz, Mohamed[4]; Matias, Luis[5]

(1) Department of Genetics, University of Granada (UGR), Spain; (2) Department of Plant Biology and Ecology, University of Seville (US), Spain; (3) Department of Genetics, University of Granada (UGR), Spain; (4) Department of Genetics, University of Granada (UGR), Spain; (5) Department of Plant Biology and Ecology, University of Seville (US), Spain

Correspondence e-mail: [melissamoniz@ugr.es]

To understand how plant populations adapt to climate change, it is crucial to explore both genetic factors and phenotypic responses that drive resilience. Drought conditions, intensified by climate change, pose significant challenges to plant species worldwide. Research has increasingly focused on how genetic and phenotypic diversity within populations contributes to resilience, with intraspecific variation in functional traits playing a key role in adaptation.

Cork oak (Quercus suber L.), an ecologically and economically significant species endemic to the Mediterranean, has experienced a dramatic reduction in woodland area, decreasing from 140,000 ha to 70,000 ha over the past 80 years. Recent studies investigating the decline of Q. suber aim to understand how climate change affects its distribution and viability. Populations of Q. suber exhibit latitudinal variation in response to environmental stressors, including drought, likely due to adaptations to specific conditions. This suggests certain populations may have developed genetic variants conferring resistance to drought within their latitudinal range.

This study characterized the genetic diversity of cork oak populations and compared genomic patterns across the species' complete latitudinal distribution. We resequenced genomic DNA from seven populations, spanning from the northern Iberian Peninsula to Morocco, to evaluate genetic structure and diversity across the transect. Our sequencing approach also enabled the investigation of genetic mechanisms underlying the varying drought tolerance among populations. The results reveal that these populations are genetically distinct, underscoring the critical role of local adaptations in shaping resilience to environmental stressors.

[TSD.3-P-5]

Tuesday 3
Discussion corner: Room 9

Genetic and plastic responses to water stress in native and introduced populations of Plantago lanceolata

Villellas, Jesus[1]; consortium, PLANTPOPNET[2]

(1) Universidad de Alcalá; (2) Trinity College Dublin

Correspondence e-mail: [jesus.villellas@gmail.com]

Anthropogenic introductions of species outside their native ranges are very common, but we are still far from completely understanding the ecological and evolutionary processes underlying such introductions. Here we carried out a common garden experiment with native and introduced populations of the cosmopolitan herb Plantago lanceolata, to evaluate genetic differentiation and plasticity in response to water stress. We sowed seeds from 10 native (European) populations and 7 introduced (North American) populations. Five months after germination, we monitored plant survival, growth and reproduction in abundant vs. limited water availability. Water stress conditions led, as expected, to lower survival and growth. Introduced populations showed, relative to native ones, higher plant growth and lower survival. These differences between regions, which were independent of water treatment, suggest a genetically fixed strategy of faster and shorter lives in introduced populations. Populations naturally growing in dry environments showed a tendency for reducing growth when subject to water stress, without this affecting survival, which suggests an adaptive strategy of plastic adjustment of growth to water conditions. In contrast, populations from wet environments showed a tendency for lower survival when subject to higher stress, apparently due to lower adaptive plasticity in size. Reproduction was residual so far in the experiment. Our results point to differences in life history strategies between native and introduced Plantago lanceolata populations. Our experiment also suggest both genetic and plastic responses to water availability across its European and North American ranges.

TSD.4. Intra-specific and intra-individual variation in a climate change contex

Monday, 2 (18:00-19:30)

Room: Auditorio

Tuesday, 3 (11:00-12:30)

Room: Seminario 6

Trait variation allows plant populations to adapt to diverse conditions and respond to increasing environmental pressures. The extent of this variation, known as intra-specific trait variation (ITV), is both a cause and a consequence of evolution, enhances ecological resilience to stressors, and influences the community structure as well as interactions with other organisms. While ITV research mostly focus on variation among individuals, recent studies have shown that intra-individual variation —an ITV research branch that studies the phenotypic variation occurring among repeated organs within individual plant genotypes— can affect evolutionary trajectories, contribute to functional diversity, and influence the dynamics of ecological communities. Despite being largely overlooked, intra-individual variation (also known as subindividual variation or diversity) can be the most important source of variation within plant populations, and provide crucial insights into plastic responses, epigenetics, resource allocation, adaptability, and population dynamics, especially in the climate change context. Understanding variation in important functional traits both among and within individuals is critical for advancing in fields such as evolutionary ecology, physiology, ecosystem functioning, and agriculture.

The objective of this session is to emphasize the need for greater attention to intra-specific, and specifically intra-individual, variation, presenting novel approaches and research themes that uncover their ecological, functional, and evolutionary significance. By focusing on inter- and intra-plant differences, we aim to encourage new perspectives on how plants and associated biotic interactions respond to dynamic and changing environments.

Attendees interested in the evolutionary and functional implications of intra-specific and intra-individual variation, and in new fields associated with biotic interactions, epigenetic modifications, phenotypic plasticity, or crop science, will find this session particularly valuable.

Organizers:

• **Francesco de Bello,** Centro de Investigaciones sobre Desertificación (CIDE-CSIC)

• **Javier Puy,** Estación Biológica de Doñana (EBD-CSIC).

• **Martí March Salas,** Instituto de Investigación en Cambio Global (IICG-URJC), Universidad Rey Juan Carlos

• **Charlotte Møller,** Botany and Mycology Unit, Finnish Museum of Natural History, University of Helsinki

TSD.4. Orals

[TSD.4-O-1]

Monday 2, evening: 18:00
Room: Auditorio

Genome size shapes trait variation and responses to environmental change in Arabidopsis thaliana

Gómez Fernández, Alicia[1]; Violle, Cyrille[2]; Vasseur, François[3]

(1) Centre d'Ecologie Fonctionnelle et Evolutive; (2) Centre d'Ecologie Fonctionnelle et Evolutive; (3) Centre d'Ecologie Fonctionnelle et Evolutive

Correspondence e-mail: [alicia.gf1990@gmail.com]

Genome size varies widely within species, but its role in trait diversity and phenotypic plasticity remains uncertain. Here, we estimated the genome size of 552 Arabidopsis thaliana accessions and investigated its variation and composition in relation to latitude and climate across the species' Eurasian range. We also compiled accession-level data on vegetative and reproductive traits, and on their flexibility in response to stress. Our analysis revealed that accessions with larger genomes had larger plant and seed sizes and longer life cycles, but grew more slowly and allocated less to reproduction. In addition, large-genomed accessions were more prevalent in warmer, isothermal areas with limited water availability, whereas smaller-genomed accessions predominated across all environments and exhibited greater trait variation and flexibility. These findings highlight the functional role of genome size and its close association with ecological strategies in this model plant species.

[TSD.4-O-2]

Monday 2, evening: 18:15
Room: Auditorio

Syndromes in responses to warming: linking phenology and physiology at the intraspecific level

Morales-Castilla, Ignacio[1]

(1) Universidad de Alcalá

Correspondence e-mail: [ignacio.moralesc@uah.es]

Introduction: Adapting agriculture to a warming climate requires cost-effective strategies that leverage existing intra-specific diversity within crop species. A promising approach uses varietal or genotypic diversity, based on the assumption that different varieties exhibit distinct responses to climate, offering a spectrum of adaptation options. This is the case of winegrapes, an example of a crop with large variability in phenological and physiological traits among varieties. Information on these traits is key to matching best suited varieties to different climate regimes, but measuring some of the traits (i.e., physiology) is often not feasible. Thus, knowing if phenological and physiological traits correlate in a way that allows one to serve as a proxy for the other would be helpful.

Methods: I examined correlations among intra-specific phenological and physiological responses to temperature using understudied varieties of Iberian winegrapes. To do so, I fitted Bayesian hierarchical models contrasting phenological observations collected over several decades against experimental data on the heat tolerance of eighteen varieties from Spain and Portugal. Analyses were repeated for three key phenological stages: budbreak to flowering, flowering to veraison and veraison to harvest.

Results & Discussion: The findings reveal non-random relationships between phenology and thermal physiology that were stronger for the phenophase exposed to the warmest temperatures. Notably, earlier varieties, usually assumed to be less suited to warmer climates, started exhibiting damage at lower temperatures, but patterns were unclear for later varieties. These results underscore the potential of phenological sensitivity to partially inform physiological damage, bearing in mind that phenology and heat tolerance provide complementary, rather than interchangeable, information. Integrating both dimensions offers a more comprehensive approach to assessing thermal stress risks and climate suitability, with applications extending beyond winegrapes to other crops.

[TSD.4-O-3]

Monday 2, evening: 18:30
Room: Auditorio

Evolutionary potential in multivariate environments: How warming and competition interact with drought to shape the potential response to selection in a Mediterranean shrub

Ramos-Muñoz, Marina[1]; Blanco-Sánchez, Mario[2]; Pías, Beatriz[3]; Ramírez-Valiente, José Alberto[4]; Benavides, Raquel[5]; Escudero, Adrián[6]; Matesanz, Silvia[7]

(1) Universidad Rey Juan Carlos; (2) Netherlands Institute of Ecology (NIOO-KNAW); (3) Universidad Complutense; (4) ICIFOR-INIA, CSIC; (5) Universidad Politécnica de Madrid; (6) Universidad Rey Juan Carlos; (7) Universidad Rey Juan Carlos

Correspondence e-mail: [marina.ramosm@urjc.es]

Drought is the main selective pressure in the Mediterranean, but plant populations experience a combination of abiotic and biotic conditions in natural conditions. Evaluating the adaptive potential of plant populations is key to predict whether they will adapt to new climate change conditions. Adaptive evolution requires phenotypic selection and genetically-based phenotypic variation within populations. However, both adaptive traits (i.e., those affecting fitness) and the presence of genetic variation may vary with environmental conditions. Although the potential response to selection to a particular selective pressure may be modified by concomitant stresses, we still lack robust information about how it varies under realistic conditions. Using a multivariate common garden, we quantified whether the potential response to selection varied across five experimental treatments combining levels of water availability, temperature and intraspecific competition. We sampled 21 maternal families in each of two populations at the extremes of the geographical and climatic distribution of the Mediterranean gypsophile Helianthemum squamatum. We measured eco-physiological and reproductive fitness traits. In each treatment, we identified adaptive trait values using selection analyses and quantified the presence of quantitative genetic variation. We found that individuals from both populations with earlier flowering phenologies in all treatments, and with acquisitive foliar trait values under more stressful environments, had higher reproductive fitness. Furthermore, the intensity of selection was higher but quantitative genetic variation was reduced as stress level increased, which could limit evolution under stressful conditions. Our study shows the importance of evaluating populations' adaptive potential under realistic environments in a climate change context.

[TSD.4-O-4]

Monday 2, evening: 18:45
Room: Auditorio

Phenotypic plasticity of water-related traits reveals boundaries to the adaptive capacity of a dominant European grass species under increased drought

Volaire, Florence[1]; Cardozo, Geronimo Agustin[2]; Hidalgo-Galvez, Maria Dolores[3]; Barkaoui, Karim[4]

(1) CEFE - Montpellier; (2) INIA, Área de Pasturas y Forrajes, Treinta y Tres, 33000, Uruguay; (3) CEAM, E-03690 Sant Vicent del Raspeig, Alicante & Seville Univ, Spain; (4) AMAP, Univ Montpellier, CIRAD, CNRS, INRAE, IRD, Montpellier, France

Correspondence e-mail: [florence.volaire@cefe.cnrs.fr]

Phenotypic plasticity may contribute to plant adaptation under increasing drought.

Changes of abundance of the perennial grass Bromopsis erecta, were monitored in plants from shallow and deep soils of a Mediterranean rangeland in southern France, over a decade including a 5-year increased summer drought treatment leading to significant plant cover degradation. The year after the treatment, we measured water-related traits of B. erecta under full irrigation in field and common garden experiments. We investigated trait plasticity by reaction norms to former levels of summer water stress and correlated trait levels to species abundance changes over the former decade. We detected trait plasticity only for leaf dry matter content (LDMC), revealing that the resource strategy of B. erecta became more conservative with higher LDMC. No plasticity was found for osmotic potential or specific leaf area. The variability of other traits was ascribed to the possible lagging effect of previous water stress and was associated more with soil depth than with previous summer drought intensity.

The abundance decline of B. erecta, which dropped from 20% to around 5% in shallow soils, was not associated with the plasticity of LDMC but was negatively correlated to variations in membrane damage of the leaf bases which are the surviving organs. Plants previously exposed to the most severe summer drought also had the most sensitive leaf base membranes, a possible sign of maladaptive trait plasticity in the population. This key trait response reveals boundaries to the adaptive capacity of this perennial grass to survive pluriannual drought.

[TSD.4-O-5]

Monday 2, evening: 19:00
Room: Auditorio

When it Gets Drought: How Lupinus angustifolius Adapts to Dry Times

Celdrán Fernández, Carlos[1]; Jiménez López, Francisco Javier[2]; Rubio Teso, María Luisa[3]; González Benítez, Natalia[4]; Molina Cobos, María Carmen[5]; Iriondo Alegría, José María[6]; Lara Romero, Carlos[7]; García Fernández, Alfredo[8]

(1) Universidad Rey Juan Carlos; (2) Universidad Rey Juan Carlos; (3) Universidad Rey Juan Carlos; (4) Universidad Rey Juan Carlos; (5) Universidad Rey Juan Carlos; (6) Universidad Rey Juan Carlos; (7) Universidad Rey Juan Carlos; (8) Universidad Rey Juan Carlos

Correspondence e-mail: [carlos.fceldran@urjc.es]

Drought intensification is a well-documented consequence of global climate change. Rising food insecurity and projected declines in agricultural yields underscore the urgent need for research into drought adaptation strategies. Our study focuses on Lupinus angustifolius, a crop wild relative native to the Iberian Peninsula, aiming to understand their adaptation to diverse environmental conditions and their potential for enhancing crop resilience using a multidisciplinary approach.

Using climate modeling, we identified distinct regions across the Peninsula to optimize intra-collection variability in our sampling strategy. Intrapopulation phenotypic diversity was assessed through a common garden experiment, while collection-site soils and endophytic microbiomes were analyzed using metagenomics approaches to identify biotic factors influencing drought adaptation.

Our findings propose a straightforward methodology to distinguish Lupinus angustifolius populations based on climatic data. The results suggest that populations from different regions have evolved distinct adaptation strategies to drought, with their associated microbiomes co-evolving alongside the plants. This integrative approach highlights the role of both genetic and microbial factors in plant resilience and provides valuable insights for breeding programs aimed at developing drought-tolerant crops.

[TSD.4-O-6]

Monday 2, evening: 19:15
Room: Auditorio

Assessing genetic differentiation and plasticity patterns to temperature throughout the worldwide distribution of Lemna minor: insights into climate change responses

Blanco Sanchez, Mario[1]; Verhoeven, Koen J. F.[2]

(1) Netherlands Institute of Ecology (NIOO-KNAW); (2) Netherlands Institute of Ecology (NIOO-KNAW)

Correspondence e-mail: [M.BlancoSanchez@nioo.knaw.nl]

Climate change is altering temperature and precipitation patterns worldwide, causing a wider variety of environmental conditions and compromising the long-term persistence of plant populations. Under a climate change scenario, phenotypic plasticity has been proposed as a crucial mechanism to cope with the higher climatic variability and unpredictability. Nevertheless, because the expression of quantitative genetic variation is environmentally dependent, genetic differentiation in each environment may differ, which is also reflected in differences in the plasticity patterns. Therefore, evaluating phenotypic plasticity patterns, how genetic differentiation varies between ecologically relevant environmental conditions, and the ecological factors underlying such variation is needed to understand the responses to climate change. Using a common garden experiment with the clonal duckweed species Lemna minor, we evaluated how differentiation in performance varied across four temperatures that the species encounters across its distribution. Specifically, we evaluated how the performance of 20 L. minor clonal lines varied between 18, 23, 28 and 33°C. Our results showed that genetic differentiation in performance varied across conditions, meaning that plasticity patterns of the clonal lines were also different. Nevertheless, such differences in performance and plasticity were not associated with the climate of origin of these lines, which may pinpoint a major role of other ecological conditions operating at smaller scales and/or neutral evolutionary processes in such differentiation. Overall, our results will enhance our understanding of the importance of phenotypic plasticity to cope with the increased temperature of climate change.

[TSD.4-O-7]

Tuesday 3, morning (first): 11:00
Room: Seminario 6

Patterns of intraspecific and intraindividual trait variation in trees along experimental diversity gradients

Castro Sánchez-Bermejo, Pablo[1]; Haider, Sylvia[2]

(1) Martin Luther University Halle-Wittenberg; (2) Leuphana University of Lüneburg

Correspondence e-mail: [pablo.castro@idiv.de]

While functional traits contribute to understand tree functioning and ecosystem processes in forests, recent studies suggested that trees respond to species diversity by modifying functional trait expression and emphasized the importance of examining trait variation within species (intraspecific) and even within individuals (intraindividual). Here, we explored how different aspects of intraspecific and intraindividual trait variation respond to tree species richness.

We collected leaves in 1,520 individual trees from 33 species in two tree diversity experiments located in different climatic zones, BEF-China (subtropical China) and MyDiv (temperate Germany), and used leaf spectroscopy to predict functional traits linked to main leaf strategies. We studied changes in trees' main trait values, intraindividual variability, and population intraspecific variability in response to tree species richness. Additionally, by incorporating hierarchical sources of trait variation, we assessed the effect of intraspecific and intraindividual trait variation to community functional diversity.

Results showed that trees shifted traits toward an acquisitive strategy (e.g. increased specific leaf area) and reduced intraindividual variability with increasing tree richness. In addition, conspecific trees became more similar with increasing tree diversity. Intraspecific and intraindividual variation enhanced functional richness and divergence, respectively, particularly in mixed-species communities.

These findings suggest that intraspecific and intraindividual trait variation enable adjustment to forest stands with different levels of tree species richness. Given its responses and contribution for functional diversity, we advocate that future frameworks in community ecology should integrate these dimensions of trait variation to better understand ecosystem dynamics and improving our understanding on how traits influence ecosystem functioning.

[TSD.4-O-8]

Tuesday 3, morning (first): 11:15
Room: Seminario 6

Intraindividual trait coordination in tundra clonal shrubs along a latitude gradient

Anadon-Rosell, Alba[1]; Bog, Manuela[2]; Casanovas, Amanda[3]; Fernández-Martínez, Marcos[4]; García-Cervigón, Ana Isabel[5]; Illa, Estela[6]; Kreyling, Jürgen[7]; Martínez Martínez, Patricia[8]; Ninot, Josep M.[9]; Pacheco-Solana, Arturo[10]; Pérez-Haase, Aaron[11]; Song, Xin[12]; Wilmking, Martin[13]; Martínez-Vilalta, Jordi[14]

(1) CREAF; (2) University of Greifswald; (3) CREAF; (4) CREAF; (5) Universidad Rey Juan Carlos; (6) Universitat de Barcelona; (7) University of Greifswald; (8) Universidad Rey Juan Carlos; (9) Universitat de Barcelona; (10) Università di Padova; (11) Universitat de Barcelona; (12) CREAF; (13) University of Greifswald; (14) CREAF

Correspondence e-mail: [a.anadon@creaf.uab.cat]

Introduction: The study of plant trait covariation has emerged as a powerful tool to identify trade-offs that reflect ecological strategies. While trait covariation research has mainly developed at inter- and intraspecific levels, intraindividual trait covariation has been largely overlooked. Yet, the extent to which traits coordinate within the individual is essential to unveil individual strategies that ultimately drive population dynamics, community and ecosystem functioning, and their responses to climate change. In a context of global shrub encroachment, particularly pronounced in cold ecosystems, understanding shrub functioning through the study of trait covariation is of uttermost importance.

Materials and Methods: We sampled four widespread dwarf shrub species, Dryas octopetala, Empetrum hermaphroditum, Vaccinium myrtillus and Vaccinium uliginosum in three locations along a latitude gradient, from the Pyrenees to northern Sweden. At each location, we selected four clones of each species and sampled five ramets within each clone. For each ramet, we measured height, total leaf biomass, the Huber value, leaf and stem elemental composition, and stem xylem anatomical parameters. Moreover, we measured leaf area, specific leaf area and leaf dry matter content in five leaves of each ramet.

Results and Discussion: Preliminary results shed light on the intraindividual patterns of trait covariation in the studied shrubs. Differences between species, locations and genotypes along the latitude gradient reflect distinct strategies and their relationship with the environment. Moreover, the comparison between trait covariation at interspecific, intraspecific and intraindividual levels emphasize the importance of including intraindividual studies to understand plant strategies driving population dynamics and community and ecosystem functioning.

[TSD.4-O-9]

Tuesday 3, morning (first): 11:30
Room: Seminario 6

Evolutionary and temporal patterns of intra-individual variation and trait means in Hypericum perforatum: a resurrection approach

Møller, Charlotte[1]; March-Salas, Martí[2]

(1) University of Helsinki; (2) University Rey Juan Carlos-ESCET

Correspondence e-mail: [charlottemoeller93@gmail.com]

Ongoing climatic changes are pressuring plant species to either adapt or move their area to avoid decline or extinction over time. Lately, recent studies have highlighted the functional and evolutionary significance of intra-individual variation (IIV) and its potential role in plant resilience to ongoing climate challenges. For instance, higher IIV could provide important building blocks for adaptation to spatial and temporal environmental heterogeneity and enhance developmental plasticity, ultimately promoting an increased resilience to climate change. These important evolutionary patterns and strategies driven by IIV remain scarcely explored, yet resurrection experiments are a powerful approach to study them. To study the evolutionary and temporal patterns of IIV and trait means, we conducted a resurrection experiment in a greenhouse using historical populations (ancestors) of Hypericum perforatum as well as their recently collected counterparts (descendants) from the same locations. We measured important phenological, vegetative, physiological, and floral traits at the organ-level over one growing season to obtain trait means and IIV. Preliminary results show earlier flowering as well as greater IIV in flowering start in descendants. Furthermore, leaf length was not only greater but also more variable in descendants. Physiological traits (chlorophyll, nitrogen status, flavanols, anthocyanins) appeared constant between ancestors and descendants both in trait means and IIV. The higher amount of IIV found in phenological and vegetative traits in descendants indicate that populations might evolve due to climate change towards increased intra-individual phenotypic plasticity. Overall, these insights sheds light on how plants have been adapting intra-individually in response to changing climatic conditions.

[TSD.4-O-10]

Tuesday 3, morning (first): 11:45
Room: Seminario 6

Intra-individual variation in phenology and selection on individual flowering schedules

Valdés Rapado, Alicia[1]; Ehrlén, Johan[2]

(1) University of Oviedo; (2) Stockholm University

Correspondence e-mail: [valdesalicia@uniovi.es]

1) Intra-individual trait variation is widespread in plants due to their modular nature and production of iterated homologous structures. For example, many plants produce multiple flowers within a season, with a large variation in flower opening dates within an individual. The distribution of flower opening dates within an individual can affect resource provisioning, competition among flowers, biotic interactions, and reproductive success, and can be the subject of natural selection.

2) Using data from the perennial herb Lathyrus vernus over three years, we assessed intra-individual variation in flower opening dates, and the effects of flower position within and among inflorescences on reproductive success and seed predation, as well as phenotypic selection on flowering schedules of individuals.

3) Intra-individual variation in flower opening dates was generally larger than differences among individuals. Basal flowers and racemes opened earlier and set more fruit than distal, and basal flowers experienced higher seed predation. Differences in reproductive success among but not within racemes were related to phenology. At the individual level, there was no net selection on mean flowering date, but selection favored plants with higher variance in opening dates in one year, and with highly asymmetric flowering schedules in two years. Our work highlights the often overlooked role of intra-individual variation in phenology and reproductive success, showing that this variation might be an important target for natural selection. More generally, our results stress the importance of considering entire trait distributions to understand the evolution of traits that are expressed multiple times within individuals.

[TSD.4-O-11]

Tuesday 3, morning (first): 12:00
Room: Seminario 6

On vegetal individuality and intra-plant diversification. Historical synthesis of an ontological problem

Lazcano Vázquez, Roque[1]; López Silvestre, Federico[2]; Sobral, Mar[3]

(1) Universidade de Santiago de Compostela; (2) Universidade de Santiago de Compostela (USC); (3) Universidade de Santiago de Compostela (USC)

Correspondence e-mail: [roqelazcanovazquez@gmail.com]

The objective of this presentation is to show some of the results of my research on the history of ideas related to within-plant variation and the multiple ontology of vegetal organisms. The individuality of plants is a subject of discussion in current controversies such as that of the units of selection, but they tend to ignore both the tradition of these problems, and the origin of the concepts involved in them. Not even the main monographs that have collected the controversy until now (Steinheil 1836; Braun 1851; White 1979; Clarke 2012) go beyond the literature of the 18th century. Only Guédès (1969-73), Gerber (2013, 2018), and, above all, the recent thesis of Hiernaux (2018), not yet published, has attempted to overcome this disconnection with its philosophical antiquity. On the other hand, the numerous publications that address biological individuality in general tend to focus on humans and other animals, without delving into the particularities of plants. The same thing happens, broadly speaking, with the historiography of theories linked to epigenetics and Evo-Devo. My work consists of tracing, in the technical and philosophical literature, the ancient operational contexts in which these conceptions originated (grafting practice, transplantation of cuttings, cross-fertilization, hybridization, embryological and morphological comparation, etc.), as well as the different ontological theories in which they were integrated, analyzing their subsequent variations due to new scientific-technological and doctrinal contexts (microscopy, evolutionism, etc.). With this perspective I aim to provide historical depth to the contemporary debate on intra-organismic epigenetic diversification and plant evolution.

[TSD.4-O-12]

Tuesday 3, morning (first): 12:15
Room: Seminario 6

Plant-size modulates the morpho-physiological adjustments of Pinus halepensis saplings under field-simulated climate change

Paneghel, Mara[1]; Torné, Gil[2]; Voltas, Jordi[3]; Alday, Josu[4]; Coll, Lluís[5]

(1) Universitat de Lleida; (2) Universitat de Lleida; (3) Universitat de Lleida; (4) Universitat de Lleida; (5) Universitat de Lleida

Correspondence e-mail: [mara.paneghel@udl.cat]

In water-limited Mediterranean forests, climate change threatens plant performance, with critical consequences for post-fire regeneration dynamics, especially for small-sized seedlings. To understand plants capacity to buffer against environmental changes, we studied the effects of climate change, simulated with open-top chambers, on the plasticity and covariation of morpho-physiological water-use related traits in post-fire saplings of Pinus halepensis. Between June and November 2022, we selected 112 P. halepensis saplings of heterogeneous size (10-60 cm) subjected to two temperature treatments (T: climate change simulation; C: natural conditions). We measured pre-dawn and midday water potential (?pd, ?mid), leaf mass area (LMA), leaf and stem water use efficiency (WUE), stem relative water content (RWC), stem and root nonstructural carbohydrates (NSC), root mass fraction (RMF) and specific root length (SRL). Saplings in T had lower ?mid, LMA, WUE, RWC and stem NSC, indicating higher water stress under simulated climate change. Plant size positively affected ?pd, ?mid, leaf WUE and RWC, but had a negative effect on RMF. A PCA analysis revealed two main axes of trait coordination: the first axis related to water status and use at the leaf and stem level, and the second axis related to root traits. Saplings aligned along the horizontal axis, with larger C saplings having higher WUE and RWC than smaller T saplings, while smaller C saplings and larger T ones converged in the middle. While simulated climate change is detrimental to saplings performance under drought, increased plant size appears to mitigate its effect, increasing plant fitness after fire.

TSD.4. Posters

[TSD.4-P-1]

Wednesday 4
Discussion corner: Room 10

Intraplant variation in floral temperature of the summer-blooming thistle Centaurea calcitrapa (Asteraceae)

Herrera Maliani, Carlos M.[1]

(1) Estación Biológica de Doñana, CSIC

Correspondence e-mail: [herrera@ebd.csic.es]

The dry ground typical of summer Mediterranean environments precludes evaporative cooling and originates a steep vertical gradient of air temperature. I hypothesized that this microclimatic gradient could induce subindividual variation in the floral temperatures of summer-blooming plants with canopies close to the ground. Since flower temperature can influence pollinator visitation, and the viability and performance of pollen and ovules, intraplant heterogeneity in floral temperature could eventually translate into heterogeneity in pollinator visitation and differential reproductive success. The hypothesis was tested on plants of Centaurea calcitrapa (Asteraceae, Cardueae), a summer-blooming thistle found in open, disturbed Mediterranean habitats. A sample of 25 flowering individuals were marked in a population at 1450 m elevation in the Sierra de Cazorla (Jaén province, southeastern Iberia). The temperature inside (Tin) and outside (air 2 cm away, Tout), and height above ground, were measured on individual capitula borne by marked plants. Height of capitula above ground was also measured in a large random sample from unmarked plants, keeping separate records from those which were and were not being visited by some bee at the moment of being approached for height measurement. Variation in Tin and Tout among capitula of the same plant was substantial, explaining 42% and 33% of population-wide variance, respectively. Intraplant thermal variation mostly occurred along the vertical axis, internal and external temperatures declining with height above the ground. Bee pollinators visited preferentially the higher, cooler capitula. Results support a role of small-scale microclimatic heterogeneity as a mechanism producing intraplant variation.

[TSD.4-P-2]

Thursday 5
Discussion corner: Room 10

How do neutral and adaptive processes affect the genetic and plastic components of intraspecific variability in a widespread conifer?

Voltas Velasco, Jordi[1]; Shestakova, Tatiana A.[2]; di Matteo, Giovanni[3]; Díaz, Raquel[4]; Zas, Rafael[5]

(1) University of Lleida (Spain); (2) University of Lleida (Spain); (3) Research Centre for Agriculture and Environment (CREA) - Italy; (4) Centro de Investigación Forestal de Lourizán (Spain); (5) Misión Biológica de Galicia (MBG-CSIC) (Spain)

Correspondence e-mail: [jordi.voltas@udl.cat]

There is a lack of information about the contribution of genetic adaptation and plasticity to intraspecific variability in long-lived plants. In addition, there is a need to better understand the relevance of neutral versus adaptive processes determining such divergence. We examine the impact of phylogeography and climate on genetic and plastic changes, and their interdependence in fitness-related traits of Pinus pinaster. The study analyses four neutral classifications and two climate-based categorisations of 123 range-wide populations to assess their capacity to summarise the genetic and plastic effects of height growth and survival in 15 common gardens. The plasticity of height and differential survival are interpreted through mixed modelling, which accounts for heteroscedasticity in the dataset. The analysis indicates that phylogeographic classifications offer a slightly more robust explanation than climate categorisations. This suggests that neutral processes are as important as isolation by climate as a driver of evolutionary divergence in this species. The most effective phylogeographic classification comprises eight groups, which collectively account for 92% (height) and 52% (survival) of phenotypic variability. This includes both between-group mean differentiation and differential expression across trials. For growth, there is a predictable response to different environments, which is described by different reaction norm slopes. These slopes are unrelated to between-group mean differentiation. The latter differences (amounting to ~40% among groups) have a significant impact on intraspecific performance across trials. Local adaptation is evident for genetic groups tested in their native environments. The analytical framework presented here is useful to guide future work on range-wide studies.

[TSD.4-P-3]

Tuesday 3
Discussion corner: Room 10

Morphological and physiological responses of three pine species to drought and resin yield

Carvalho, Ana[1]; Moreira, Xoaquín[2]; Poceiro, Silvana[3]; Lago-Núñez, Beatriz[4]; Campelo, Filipe[5]; Nabais, Cristina[6]

(1) Centre for Functional Ecology, Associate Laboratory TERRA; (2) Misión Biológica de Galicia (MBG-CSIC); (3) Misión Biológica de Galicia (MBG-CSIC); (4) Misión Biológica de Galicia (MBG-CSIC); (5) Centre for Functional Ecology, Associate Laboratory TERRA; (6) Centre for Functional Ecology, Associate Laboratory TERRA

Correspondence e-mail: [apcarvalho@uc.pt]

Resin production plays a crucial role in tree defense, acting as a protective mechanism against pathogens and mechanical injuries. This process varies across tree species and is influenced by factors such as genetics, growth, age, and environmental conditions. While climate has a notable effect on resin production, the relationship between climate, growth, and resin yield for different species remains poorly understood.

In this study, we investigated the effects of drought and resin extraction on growth and physiology of saplings of three pine species: Pinus pinaster, P. pinea, and P. halepensis. The saplings were subjected to four treatments: control without resin yield (C+NRY), control with resin yield (C+RY), water exclusion without resin yield (WE + NRY), and water exclusion with resin yield (WE + RY). Over one growing season, we measured total height, diameter, water potential (?), stem relative water content (RWC), and resin yield.

Results showed that P. pinaster was consistently taller than the other species, while P. halepensis was shorter across all treatments. Interestingly, P. halepensis showed greater height under drought conditions. Diameter growth was greater for P. pinaster and P. pinea in control treatments, with no significant differences in P. halepensis. RWC declined and ? increased throughout the season, but autumn rainfall reversed these trends. Resin yield was lowest in P. halepensis, while P. pinea produced the most resin, particularly under drought conditions, with WE + RY treatments yielding the highest resin output across species.

[TSD.4-P-4]

Wednesday 4
Discussion corner: Room 10

Intraspecific variability in seed weight and viability, and seedling growth in the narrow endemic Iberodes littoralis subsp. gallaecica

Sanchez Vilas, Julia[1]; González Campoy, Josefina[2]; Retuerto Franco, Rubén[3]

(1) Universidade de Santiago de Compostela; (2) Universidade de Santiago de Compostela, Facultade de Bioloxía; (3) Universidade de Santiago de Compostela, Facultade de Bioloxía

Correspondence e-mail: [julia.sanchezvilas@gmail.com]

Introduction. Coastal ecosystems are highly vulnerable to climate change, and endemic species restricted to these habitats are especially at risk of declining due to their usually limited dispersal ability and specialised habitat requirements. The conservation of coastal ecosystems, including native vegetation, is therefore critical. Studying seed traits like seed mass and germination is essential for effective conservation, supporting plant recruitment, and ensuring the persistence of rare species amid environmental changes.

Material and Methods. Here, we aimed to improve our understanding of the seed ecology of Iberodes littoralis subsp. gallaecica - an endemic and rare annual herb that only grows in a few coastal dune systems in NW Spain- by investigating variability across populations and years. We collected seeds from five populations over seven years, weighed them and germinated them in two substrates with different nutrient levels (sand and sand with added peat) in the glasshouse.

Results and Discussion. Seed age negatively affected germination and growth, suggesting that seed viability declines over time, emphasising the importance of using fresh seeds in restoration efforts. Seed mass affected the germination probability, suggesting that selecting heavier seeds may improve success rates, though population-specific variations indicate the need for tailored strategies. The substrate effects reveal that while sand+peat reduces germination, it accelerates germination time and supports better plant growth, suggesting that adding organic matter could enhance early establishment and growth in restoration projects. Overall, these findings emphasise the importance of considering seed age, mass, population-specific traits, and substrate composition to optimise restoration programs and ensure the long-term success of coastal ecosystem recovery.

[TSD.4-P-5]

Thursday 5
Discussion corner: Room 10

Living on the Edge: Exploring the patterns and mechanisms of thermal acclimation in Mediterranean shrublands

Didion-Gency, Margaux[1]; Soler, Pol[2]; Castells, Eva[3]; Martinez-Vilalta, Jordi[4]

(1) Centre de Recerca Ecològica i Aplicacions Forestals (CREAF); (2) Centre de Recerca Ecològica i Aplicacions Forestals (CREAF); (3) Universitat Autònoma de Barcelona (UAB); (4) Centre de Recerca Ecològica i Aplicacions Forestals (CREAF)

Correspondence e-mail: [m.didion@creaf.cat]

Global warming and more frequent heat waves push plants closer to their thermal limits, altering tree carbon uptake and growth. Therefore, investigating thermal acclimation mechanisms is essential to understand and predict future vulnerability.

To investigate this, we studied six shrubland communities (Amelanchier ovalis Medik., Arbutus unedo L., Buxus sempervirens L., Pistacia lentiscus L., Rhamnus alaternus L., and Salvia rosmarinus Spenn.) across a temperature gradient in Catalonia, Spain, which encompasses much of their global distribution. We measured leaf dark-adapted fluorescence (Fv/Fm), leaf thermal thresholds (i.e., critical temperature, Tcrit; temperature causing a 50% reduction of Fv/Fm, T50; and maximum tolerable temperature, Tmax), leaf optimal assimilation temperature (Topt), leaf thermal safety margin (TSM), and leaf gas exchange (assimilation, A; stomatal conductance, gs; and transpiration, E).

Although we found that Topt increased as conditions became warmer, highlighting a possible heat tolerance of the populations studied. We also observed a decrease in Fv/Fm, T50, and Tmax, as well as TSM closer to 0 as conditions became progressively warmer, suggesting that the shrubs communities are operating close to their thermal limits. Moreover, we found a decoupling of A vs. gs and E at high temperatures, suggesting a Rubisco deactivation under warmer conditions. Thus, incorporating thermal acclimation into climate change research could provide valuable insights into shrubs distribution range shift, as well as the importance of incorporating gas exchange decoupling at extreme temperatures into models for more accurate predictions of transpiration.

[TSD.4-P-6]

Tuesday 3
Discussion corner: Room 10

Predicting pine resin investment through aerial multispectral imaging

Lombardi, Erica[1]; Lema, Margarita[2]; Santini, Filippo[3]; Varela, Calixto[4]; Touza, Roberto[5]; Gloria, Bustingorri[6]; Sampedro, Luis[7]; Zas, Rafael[8]

(1) Misión Biológica de Galicia - CSIC; (2) Misión Biológica de Galicia - CSIC; (3) DIAGRAM Digital Agriculture Management; (4) ENXEÑERIA FORESTAL ASEFOR SL; (5) Extracción de Resina Tousa; (6) Misión Biológica de Galicia - CSIC; (7) Misión Biológica de Galicia - CSIC; (8) Misión Biológica de Galicia - CSIC

Correspondence e-mail: [elombardi@mbg.csic.es]

Pine resin production is a complex, resource-intensive process with significant environmental and economic importance. Resin flow is influenced by both constitutive defences, and induced defences. In Pinus pinaster, resin is under genetic control, with fast-growing populations generally showing lower resin production. However, the sources of variation of resin production is far from being well understood. The relative contribution of genetic and environmental effects on resin production can be studied by resin tapping techniques in multi-environmental common gardens, but this approach is highly costly and time-consuming. Therefore, in this study, we used a high-throughput phenotyping tool (HTPT) to predict resin flow. To this end, we assessed resin flow and took multispectral images on a multi-environment common garden trial (seven trials located in North West Spain) over three field campaigns (June, July and September 2019). The primary objective of this study was to assess genetic variability and plasticity between sites and over the summer season in resin flow and in vegetative indexes related to plant health, vigour and chlorophyll content (i.e. RedEdge, NDVI, TCARI/OSAVI, NPCI) and their possible relationships.

Preliminary results demonstrated that vegetation indexes and resin flow exhibited significant variation among populations, between sites, and across the three field campaigns. However, genotype by environment interactions were not consistent for all traits analysed. The integration of multispectral data was undertaken with the objective of identifying vegetation indexes potentially related to resin production. The aim was to utilise a HTPT to quantify resin flow and its genetic variability and plasticity of P. pinaster.

[TSD.4-P-7]

Wednesday 4
Discussion corner: Room 10

Basal metabolic rate constraint home range size in a wild rodent

Espinosa-Manjón, Irene[1]; Lorenzo-Vélez, Marco[2]; Malo, Aurelio F.[3]

(1) University of Alcalá; (2) University of Alcalá; (3) University of Alcalá

Correspondence e-mail: [irene.espinosam@uah.es]

Understanding how animals use their environment requires consideration of a key ecological parameter: home range size (HRS), defined as the area an animal utilises for essential activities such as foraging, resting, and reproducing. HRS has been shown to influence individual fitness by affecting access to resources and mates, as well as exposure to energetic and predation costs. Basal metabolic rate (BMR), the minimum energy required for survival under optimal conditions, governs the rate of resource uptake, transformation, and allocation to survival and reproduction__thereby influencing fitness. Two contrasting hypotheses have been proposed regarding the relationship between BMR and HRS. The increased-intake hypothesis posits that individuals with higher BMR require larger home ranges to meet their elevated energetic demands. In contrast, the compensation hypothesis suggests that such individuals may exhibit smaller home ranges due to limited energy available for activities beyond maintenance. To investigate this relationship, we studied a monitored population of wood mice (Apodemus sylvaticus). Individuals were tagged, and oxygen (O2) and carbon dioxide (CO2) exchange was measured to calculate BMR as the rate of oxygen consumption (ml/h), corrected for body size. Using mobile recording stations, we accurately tracked spatio-temporal activity and estimated home range size using the minimum convex polygon (MCP) method. Our results reveal a general negative relationship between BMR and both peripheral and core home range sizes. These findings support the compensation hypothesis, suggesting that individuals with higher basal metabolic rates may be constrained to smaller home ranges due to energetic limitations.

GENERAL SESSION

GSE. Are We at a Global Tipping Point? Biodiversity Conservation and Ecosystem Services Sustainability

Tuesday, 3 (11:00-12:30); (12:45-14:15) • Wednesday, 4 (11:00-12:30); (12:45-14:15) • Thursday, 5 (11:00-12:30); (12:45-14:15)

Room: Auditorio

Framing our current ecological crisis as a “global tipping point” acknowledges the profound and potentially irreversible changes facing our planet. We must deepen our understanding of the complex, interdependent processes that contribute to biodiversity loss and ecosystem degradation. There is a critical need to foster a sense of ecological responsibility and care, recognizing that sustainable solutions require fundamental changes in how we relate to the natural world and to each other. This necessitates questioning the underlying socio-economic systems that drive environmental degradation. We need a multifaceted, interdisciplinary, and deeply ethical response to ensure the sustainability of biodiversity and ecosystem services for generations to come.

Key Questions:

• How do we include socio-economic factors in addressing biodiversity conservation and ecosystem sustainability?

• What fundamental changes are required in our relationship with the natural world?

Coordinators:

• **David Álvarez Fernández,** Universidad de Oviedo (UniOvi)

• **Rafael Barrientos,** Universidad Complutense de Madrid (UCM)

• **Raquel Benavides,** Universidad Politécnica de Madrid (UPM)

• **Verónica Ferreira,** Universidade de Coimbra (UC)

• **Teresa Gimeno,** Centre de Recerca Ecològica i Aplicacions Forestals (CREAF-UAB)

• **María Gómez Brandón,** Universidade de Vigo (UVigo)

• **Margarita Lema,** Misión Biolóxica de Galicia (MBG-CSIC)

• **Alejandra Morán-Ordóñez,** University of Bern (UNIBE).

GSE. Orals

[GSE-O-1]

Tuesday 3, morning (first): 11:00
Room: Auditorio

The effect of increasing temperature on ecosystem recovery dynamics: an experiment with plant communities

Porras Gómez, Javier[1]; Granjel, Rodrigo[2]; Huang, Mengjiao[3]; Magrach, Ainhoa[4]; Montoya, Daniel[5]

(1) Basque Centre for Climate Change (BC3); (2) Basque Centre for Climate Change (BC3); (3) Basque Centre for Climate Change (BC3); (4) Basque Centre for Climate Change (BC3); (5) Basque Centre for Climate Change (BC3); (6)

Correspondence e-mail: [javier.porras@bc3research.org]

Ecosystem restoration (ER) has been proposed as the main tool to alleviate ecosystem degradation and its associated loss of biodiversity and functionality. However, while ER has proven to be effective in many instances, a large variation of restoration outcomes worldwide has hindered its ability to become a predictive and globally-applicable science. Specifically, we lack knowledge about the mechanisms underlying recovery dynamics at the community scale, the differentiation between these dynamics and natural assembly processes driven by seasonality, and the general scarcity of experimental studies in ER. This knowledge gap is further compounded by climate change and its expected impacts on ecosystem functioning, biodiversity, and the resilience of communities undergoing restoration. Here, we describe the results from an experiment aimed at understanding the effects of increasing temperatures on ecosystem recovery dynamics. To this end, we applied a controlled perturbation to an herbaceous plant community and used open-top chambers (OTCs) to manipulate temperature, resulting in three treatments (perturbation, warming and the combination of warming and perturbation). We monitored species richness, abundance, biomass, and functional traits within these communities for two years. Temporal dynamics of all these variables before and after the perturbation were quantified to explore recovery rates and trajectories of recovering communities and their response to temperature. Preliminary results show that richness overestimates recovery, that perturbation is the primary driver of changes in species composition and functional diversity, and that the combination with warmer temperatures appears to slow down the recovery process. This is one of the first experimental studies that jointly addresses the climate crisis and ecosystem restoration.

[GSE-O-2]

Tuesday 3, morning (first): 11:15
Room: Auditorio

Fire refugia and microsite conditions determine post-fire recovery of black pine forests

Méndez-Cartín, Ana Lucía[1]; Coll, Lluis[2]; Krawchuk, Meg[3]; Gelabert, Pere[4]; Fontova-Muste, Anna[5]; Ameztegui, Aitor[6]

(1) Centre de Ciencia y Tecnologia Forestal de Cataluña; (2) Joint Research Unit CTFC-AGROTECNIO-CERCA; (3) Oregon State University; (4) Universitat de Lleida; (5) University of Lleida; (6) Joint Research Unit CTFC-AGROTECNIO-CERCA)

Correspondence e-mail: [analucia.mendez@ctfc.cat]

New fire regimes challenge the post-fire recovery of non-serotinous species such as Pinus nigra, having different regeneration patterns and abundances across its distribution. Here we assess the main biophysical drivers – seed source availability, plant community interactions, water/nutritional constraints – influencing the mid-term post-fire regeneration of P. nigra in Catalonia. We addressed the role of biophysical variables on the abundance of P. nigra, both inside and outside unburned forest patches – also called fire refugia. We identified fire refugia in the landscape integrating aerial orthoimages and ALS-LiDAR in a SVM classification model. We surveyed the abundance of regeneration in 270 five-meter-radius-plots located both inside and outside refugia. We built two identical zero-inflated negative binomial models to compare the role of biophysical drivers over post-fire regeneration inside and outside refugia. We found that fire refugia plays a sheltering role by neutralizing the negative effect aridity has on post-fire regeneration. At higher aridity fire refugia allows seedlings and saplings to grow better compared to the same conditions outside refugia. Meanwhile, outside refugia, shrub cover plays a key role determining abundance of regeneration by shifting its effect from facilitative to competitive depending on the aridity levels and percentage of shrub cover. Our study shows that the effect of seed availability on the abundance of regeneration is lower than that of microsite conditions, hinting that in the future seed availability alone will not be enough to sustain black pine post-fire recovery.

[GSE-O-3]

Tuesday 3, morning (first): 11:30
Room: Auditorio

Advancing research, innovation and entrepreneurship on urban forestry: the UFOREST project

Ferrandiz Rovira, Mariona[1]; Basnou, Corina[2]; Florido, Florencia[3]; Haverbeck, Daniela[4]; Pesquer, Lluís[5]; Pino, Joan[6]

(1) CREAF; (2) CREAF; (3) CREAF; (4) UAB; (5) CREAF; (6) CREAF-UAB

Correspondence e-mail: [mariona.ferrandiz@uab.cat]

Urban forests are Nature-Based Solutions to mitigate climate change, enhance urban biodiversity, and improve air quality and well-being in cities. The Erasmus+UFOREST project ("European Alliance on Interdisciplinary Learning and Business Innovation for Urban Forests Project"; www.uforest.eu/), fostered collaboration among businesses, universities, and research centers to innovate urban forestry practices. Through case studies, training, and international partnerships, UFOREST aimed to promote Europe's capacity for advancing urban forests.

The project adopted a multidisciplinary approach, integrating disciplines such as urban planning and architecture, forestry and urban ecology, and socio-economic and information technologies. UFOREST produced 20 case studies on urban forestry best practices across Europe and developed three reports on training needs, innovation factors, and action plan guidelines. Training initiatives included two online courses, a specialized in-person school, and four professional workshops. The UFOREST Alliance, an online platform with over 350 members, was also created to share knowledge and foster collaboration.

Key achievements include widely accessed resources, highlighting the importance of interdisciplinary efforts in advancing urban forestry innovation. Over 1,200 participants from 81 countries engaged in training activities. Additionally, UFOREST launched four new urban forests in European cities, involving over 320 participants. One of these forests was developed at the Autonomous University of Barcelona, where four teams from the in-person school designed a climate refugia. Their challenge was to provide forest-based ecosystem services, promote biodiversity and ensure sustainable water use. These accomplishments demonstrate how urban forests can address socio-ecological challenges and contribute to healthier, greener cities while inspiring ongoing efforts globally.

[GSE-O-4]

Tuesday 3, morning (first): 11:45
Room: Auditorio

Hidden impacts of the invasive plant Tradescantia fluminensis on soils: implications for restoration of invaded areas

Rodriguez, Jonatan[1]; Rodríguez, Jonatan[2]; González-Outeiriño, Felipe[3]; Francés-Alcántara, Sandra[4]; Piñeiro-Juncal, Nerea[5]

(1) CRETUS, Universidade de Santiago de Compostela; (2) CRETUS, Universidade de Santiago de Compostela; (3) Universidade de Santiago de Compostela; (4) Universidade de Santiago de Compostela; (5) Universidade de Vigo

Correspondence e-mail: [jon.rodriguez.parra@gmail.com]

Tradescantia fluminensis is a highly invasive clonal plant that significantly alters soil properties in the riparian ecosystems. Its presence can lead to increased accumulation of organic matter, altering soil pH and nutrient cycling. This potentially creates conditions that favor its persistence while inhibiting the establishment of native species. However, its effects on carbon and nitrogen stocks and its influence on the functional diversity of soil microorganisms remain unclear. This study aims to evaluate the effects of T. fluminensis on above- and belowground biomass productivity, carbon and nitrogen accumulation, and soil microbial functional diversity. To this end, we conducted a field study using five transects with different gradients of invasion density to compare invaded and non-invaded plots in four riparian sites of the northwestern Iberian Peninsula. In each plot, we studied vegetation and soil properties, soil microbial functional diversity and possible feedbacks between them. We found that T. fluminensis negatively affects both native vegetation and aboveground biomass productivity and favors soil organic matter accumulation. This implies changes in soil properties and impairs soil microbial functionality, affecting their metabolism and diversity. Considering all analyzed variables, we found that T. fluminensis acts as a generalist species, showing no strong association with any specific condition in the studied riparian sites. In contrast, several native plant species appear to maintain direct relationships with soil properties and the functionality of soil microorganisms. Consequently, we recommend urgent action to control and, if possible, eradicate T. fluminensis to restore riparian zones and promote the recovery of native ecosystems.

[GSE-O-5]

Tuesday 3, morning (first): 12:00
Room: Auditorio

Do global warming and biotic interactions affect the ecosystem functions provided by dung beetles? A temperature controlled experiment

Dueñas-Rojas, Almudena[1]; Cuesta, Eva[2]; Trapero, Lucía[3]; M.C. Santos, Ana[4]

(1) Universidad Autónoma de Madrid; (2) Universidad Autónoma de Madrid; (3) Universidad Autónoma de Madrid; (4) Universidad Autónoma de Madrid

Correspondence e-mail: [almudena.duenas@uam.es]

The order and timing of species arrival during community assembly can influence species interactions and affect ecosystem functioning. Furthermore, in the context of climate change, rising temperatures could also have an important effect on different ecosystem services. We performed laboratory experiments to evaluate whether temperature increase and species interactions alter the ecosystem functions provided by dung beetles (Coleoptera, Scarabaeoidea), a group of insects that uses dung to feed and reproduce, focusing on dung removal and seed dispersal. For this purpose, two acclimatized chambers were used: a control chamber with day and night temperatures similar to those recorded outdoors, and a warmed chamber with 4ºC more than the was set in the control chamber. Each chamber had total of 54 experimental units consisting in a bucket filled with sand and topped with 100gr of ivermectin-free cow dung. Four individuals were added at the beginning of the experiment, and four more after 24h in each unit control to simulate different order of establishment. Ten replicates were used for each species combination in each temperature treatment, with combinations including individuals of two different species or of the same species. Preliminary results showed significant differences in dung removal rates between temperature treatments, being higher in the warmer conditions. However, no significant differences were observed regarding the order of arrival and species interactions. These results may indicate the resilience of these insects to global warming. However, climate change may have negative consequences on other biological aspects of their life cycle.

[GSE-O-6]

Tuesday 3, morning (first): 12:15
Room: Auditorio

Plant evolutionary history is largely underrepresented in European seed banks

Molina Venegas, Rafael[1]; Carta, Angelino[2]

(1) Estación Biológica de Doñana; (2) Universita di Pisa)

Correspondence e-mail: [rafmolven@gmail.com]

Considering the alarming prospect of at least two in five plant species facing extinction, it is urgent to identify unsecured phylogenetic branches within the plant Tree of Life and adopt appropriate conservation strategies. While conventional seed banking has the potential to safeguard a large part of world's flora, the scarcity of phylogenetically informed ex-situ conservation programmes poses a challenge to effective plant conservation. Leveraging an extensive dataset of seed collections across 109 European seed banks, our study reveals that current collections capture a phylogenetically diverse subset of the European flora. However, they safeguard between 43.29% to 66.40% of the maximum possible phylogenetic diversity suggesting that specific major branches of the plant phylogeny in Europe remain unprotected. To address this gap, we introduce a novel quasi-deterministic method to generate a list of unbanked species, prioritized by evolutionary significance. Although this approach can enhance the evolutionary quality of seed bank collections, biological, technical, and practical constraints may limit conventional seed banking for some of these priority species. We advocate for an enhanced coordination among conservation facilities, and the integration of phylogenetic perspectives with advancements in ex situ conservation techniques beyond conventional seed banking, to effectively conserve plant evolutionary heritage.

[GSE-O-7]

Tuesday 3, morning (second): 12:45
Room: Auditorio

Integrated spatial planning for photovoltaic expansion: balancing renewable energy, agriculture, and biodiversity

Hermoso, Virgilio[1]; Bota, Gerard[2]; Brotons, Lluis[3]; Morán-Ordóñez, Alejandra[4]

(1) Estación Biológica de Doñana; (2) Centre de Ciencia i Tecnologia Forestal de Catalunya; (3) CREAF; (4) University of Lausanne

Correspondence e-mail: [virgilio.hermoso@ebd.csic.es]

The global expansion of photovoltaic production is driven by efforts to mitigate climate change. However, unplanned growth often leads to conflicts with other land uses, particularly agriculture and biodiversity conservation. This study emphasizes the urgent need for strategic planning to minimize these conflicts while meeting photovoltaic development targets. Using Catalonia (NE Spain) as a case study, we identified priority areas for photovoltaic development while considering critical zones for agriculture and biodiversity. Three planning scenarios were explored: setting targets at a regional scale, distributing targets by county based on energy demand, and allocating targets by land availability.

The results reveal that photovoltaic targets could only be achieved when setting targets at the whole of Catalonia scale, although leading to heterogeneous distribution of development efforts and associated impacts on agriculture and biodiversity across counties. Setting targets for each county based on energy demand was far from achieving the regional photovoltaic development target, driven by the limited land available in some highly urbanised counties, where energy demand concentrates. On the other hand, setting targets based on area available within each led to the most equitable distribution of potential impacts of photovoltaic development, while also approaching the regional photovoltaic development target.

This analysis highlights the importance of adequate planning to align photovoltaic expansion with land use sustainability. Strategic frameworks are essential to ensure that photovoltaic development supports energy transition goals without undermining agricultural productivity or biodiversity conservation.

[GSE-O-8]

Tuesday 3, morning (second): 13:00
Room: Auditorio

Evaluating landscape connectivity in terrestrial vertebrate populations: linear infrastructures, wildlife crossings and ecological corridors

Giménez Casalduero, Andrés[1]; Graciá Martínez, Eva[2]; Rodríguez-Caro, Roberto Carlos[3]; Valdivieso Ros, Carmen[4]; Anadón Herrera, José Daniel[5]; Wiegand, Thorsten[6]; Jiménez Franco, María Victoria[7]

(1) Universidad Miguel Hernández de Elche; (2) Universidad Miguel Hernández de Elche; (3) Universidad Miguel Hernández de Elche; (4) Universidad Miguel Hernández de Elche; (5) Instituto Pirenaico de Ecología (IPE-CSIC); (6) Helmholtz Centre for Environmental Research (UFZ, Germany); (7) Universidad Miguel Hernández de Elche

Correspondence e-mail: [agimenez@umh.es]

Habitat loss and fragmentation are among the main threats to biodiversity. These processes generate isolation of vertebrate populations, even causing local extinctions. Therefore, it is necessary to assess the loss of landscape connectivity, as well as different potential mitigation measures such as wildlife crossings and ecological corridors, for their impact on long-term population viability of terrestrial vertebrates. These aspects are so far poorly studied, although relevant for species conservation and habitat management. The objectives of this study are: 1) to assess the effects of habitat fragmentation on the population viability of terrestrial vertebrates; 2) to analyse whether different mitigation measures such as wildlife crossings and ecological corridors may improve population viability.

For this purpose, we used as a study case a species of limited movement, Testudo graeca, in a fragmented area of southeastern Spain. The methodological approach was based on a simulation experiment with different landscape scenarios, using an individual-based model, STEPLAND, which reproduces the movement and demography of T. graeca.

Our results show that the highway development significantly decreases the viable population area of T. graeca. The mitigation of this effect by wildlife crossings does not result in a statistically significant improvement. However, the implementation of ecological corridors significantly increases the viable areas for the species, being even greater when implemented together with wildlife crossings. We consider this design to be robust, providing results that can be extrapolated to other vertebrate species and responding to management and conservation needs in terms of connectivity and population viability.

[GSE-O-9]

Tuesday 3, morning (second): 13:15
Room: Auditorio

Exploiting hydraulic trait variability in circum-Mediterranean firs for increased adaptation of Abies alba forests to drought

Acuña-Míguez, Belén[1]; Copie, Alice[2]; Lefèvre, François[3]; Scotti, Ivan[4]; Scotti-Saintagne, Caroline[5]; Jean, Florance[6]; Mencuccini, Maurizio[7]; Delzon, Sylvain[8]; Cochard, Hervé[9]; Torres-Ruiz, José M.[10]; Hernando, Sonia[11]; Martin-St Paul, Nicolas K.[12]

(1) INRAE-URFM; (2) INRAE-URFM; (3) INRAE-URFM; (4) INRAE-URFM; (5) INRAE-URFM; (6) INRAE-URFM; (7) CREAF & ICREA; (8) INRAE-BIOGECO; (9) Université Clermont Auvergne-INRAE; (10) IRNAS-CSIC; (11) CREAF; (12) INRAE-URFM

Correspondence e-mail: [belacumig@gmail.com]

Abies alba (silver fir) is a major keystone species from both economic and ecological perspectives in many European areas. However, it has a low drought resistance and has experienced important dieback episodes, particularly in drought-prone areas. In contrast, other circum-Mediterranean firs have shown either greater resistance to and/or recovery from drought events. Our aim is to elucidate if there is a potential of resilience for this species in (1) its phenotypic intraspecific variability or (2) in the phenotypic variability encountered in closely related Mediterranean firs able to hybridise with silver fir. To carry out this study, we measured a panel of hydraulic traits (resistance to xylem embolism (P50), leaf minimum conductance (gmin), branch-level Huber value (Hv), leaf water potential at turgor loss (Ptlp)), specific leaf area (SLA) and wood density (WD) in 10 Abies alba populations in Europe and 7 circum-Mediterranean fir species (Abies borisii-regii, Abies bormmuelleriana, Abies cephalonica, Abies cilicica, Abies normanniana, Abies numidica and Abies pinsapo) in a common garden in France. Then, we estimated the intraspecific variability in the risk of hydraulic failure for each species using the SurEau model. Differences in drought resistance among populations of Abies alba and among Mediterranean firs in relation to trait variability, supported a potential of adaptation for silver fir. Our preliminary results suggested that gmin interspecific variability in circum-Mediterranean firs drives these differences. These results shed light on how Mediterranean firs could bring solutions to the current dieback observed in silver fir, either by replacement or through assisted gene flow.

[GSE-O-10]

Tuesday 3, morning (second): 13:30
Room: Auditorio

Combined effects of land-use- and climate-driven stressors on stream fungi and organic matter decomposition

Gutiérrez Cánovas, Cayetano[1]; Viza, Aida[2]; Fenoy, Encarnación[3]; Abril, Meritxell[4]; Álvarez-Cabria, Mario[5]; Arias-Real, Rebeca[6]; Arnanz, Christian[7]; Barquín, José[8]; Bruder, Andreas[9]; Calore, Red[10]; Donázar, Íñigo[11]; Fernandes, Isabel[12]; García-Meseguer, Antonio J.[13]; Lupon, Anna[14]; Martinez-Sanz, Itxaso[15]; Menéndez, Margarita[16]; Muñoz, Isabel[17]; Pascoal, Cláudia[18]; Tomás-Martín, Marina[19]

(1) Global Change Research Institute - University Rey Juan Carlos (IICG-URJC); (2) University of Barcelona; (3) University of Almería; (4) BETA Technological Centre- University of Vic- Central University of Catalunya; (5) IHCantabria - Instituto de Hidráulica Ambiental de la Universidad de Cantabria; (6) National Museum of Natural Sciences (MNCN-CSIC); (7) Universidad Autónoma de Madrid; (8) IHCantabria - Instituto de Hidráulica Ambiental de la Universidad de Cantabria; (9) University of Applied Sciences and Arts of Southern Switzerland; (10) University of Applied Sciences and Arts of Southern Switzerland; (11) University of Sevilla; (12) Centre of Molecular and Environmental Biology (CBMA) - University of Minho; (13) University of Murcia; (14) Center for Advanced Studies of Blanes (CEAB-CSIC); (15) University of Barcelona; (16) University of Barcelona; (17) University of Barcelona; (18) Centre of Molecular and Environmental Biology (CBMA) - University of Minho; (19) Universidad Autónoma de Madrid

Correspondence e-mail: [cayetano.gutierrez@urjc.es]

Introduction. Stream microbial communities play critical roles in sustaining ecosystem functions and services. Aquatic fungi are particularly important in breaking down recalcitrant terrestrial organic matter entering streams, converting it into energy and nutrients that support higher trophic levels. However, it remains unclear how the combined effects of land-use and climate- driven stressors impact fungal biodiversity and function in streams.

Material and methods. Using data from a two-year survey of 63 Iberian stream sites, we investigated the combined effects of land-use and climate-driven stressors on fungal biodiversity, based on taxonomic and functional trait data, and two key functions: fungal biomass accrual and organic matter decomposition. Functions were evaluated in both sediment and surface compartments to capture potential differential effects. Using a multi-model inference approach, we evaluated the effect and importance of six stressor types—organic carbon enrichment, inorganic nutrient enrichment, deoxygenation, thermal stress, drying stress, riparian degradation and hydrology.

Results and discussion. Our findings indicate that organic carbon enrichment positively affects fungal functions and biodiversity, whereas thermal and drying stresses and riparian degradation are negatively correlated with fungal biodiversity and surface functions. Stressor effects were primarily additive, with limited interactions. Surprisingly, nutrient enrichment had weak effects, likely reflecting minimal nutrient limitation in Iberian streams. Our study demonstrates that fungal biodiversity and functions are impacted by multiple stressors that are expected to intensify with global change. These findings highlight the urgent need for mitigation strategies that protect non-charismatic biodiversity and the services it supports.

[GSE-O-11]

Tuesday 3, morning (second): 13:45
Room: Auditorio

Linking physiological mechanisms with soil properties to unravel tree vulnerability in radiata pine plantations

Esteban, Raquel[1]

(1) University of Basque Country (UPV/EHU)

Correspondence e-mail: [raquel.esteban@ehu.eus]

European forestry has increasingly adopted intensive management practices, such as clear-cutting, to meet the rising global demand for wood. However, these practices, compounded by drought conditions, contribute to nutrient depletion, soil degradation, and reduced photosynthetic capacity, threatening ecosystem stability. The complex interplay between plant health, leaf and soils nutrients, that regulates tree performance remains poorly understood, particularly in long-lived tree species. This is especially relevant in Pinus radiata D. Don plantations, where soil nutrient depletion frequently challenges ecosystem sustainability. This study aims to link physiological mechanisms with soil properties to unravel tree vulnerability in P. radiata plantations.We compared two management practices during the dry summer of 2022: (i) managed plantation (clear-cutting rotations) and (ii) non-managed plantations (abandoned for over 35 years). Soil nutrient characterization and tree health were assessed through phytohormone profile, photosynthetic performance, and leaf nutrient status. i) Both plantations, despite contrasting management practices, exhibited down-regulation of the photosynthetic apparatus, with similar functionality in the photosynthetic system. ii) Although this similarity in photosynthetic function, we found a trade-off in managed trees that depended on soil nutrient availability for physiological regulation. Whereas non-managed trees displayed long-term acclimation that allowed them to maintain the functioning of their photosynthetic apparatus independently of soil nutrient availability through nutrient remobilization. iii) In managed trees, the phytohormone melatonin played a crucial role in regulating leaf nutrient status and physiological performance. The deeper understanding of the crosstalk of physiological mechanisms and soil/leaf elemental composition provides insights into improving forest plantations management.

[GSE-O-12]

Tuesday 3, morning (second): 14:00
Room: Auditorio

Impacts of high-severity wildfires on soil fungal communities and soil functioning

Santiesteban, Amara[1]; Hornos, Zeus[2]; Rincón, Ana[3]; Aponte, Cristina[4]

(1) ICIFOR-INIA-CSIC; (2) ICIFOR-INIA-CSIC; (3) ICA-CSIC; (4) ICIFOR-INIA-CSIC

Correspondence e-mail: [amara.santiesteban@inia.csic.es]

The recovery of forests after high-severity wildfires is linked to the survival and viability of soil fungi. In this study, we evaluated the impact of the 2021 Navalacruz wildfire (Ávila) on Pinus sylvestris L. forests, focusing on these fungal communities.

Soil samples were collected at two depths (topsoil: 0-5 cm; subsoil: 5-10 cm) from unburnt areas, areas burned at low severity (intact canopies), and areas burned at high severity (completely scorched canopies). High-severity plots were further categorized by slope (moderate/steep) to assess potential synergistic effects of fire severity and steep slopes. Soil analyses included: physicochemical properties, activity (microbial biomass, acid phosphatase activity) and fungal indicators (ergosterol), grouped into soil functions, as well as fungal community diversity (ITS1, Illumina MiSeq).

The results showed that (1) soil functioning significantly decreased in the topsoil, with fungal community shifts also evident in the subsoil; (2) the Ascomycota/Basidiomycota ratio followed a gradient, with Ascomycota being the predominant phylum in high-severity burnt areas; and (3) the genus Pyronema dominated in burnt areas, while Russula was more abundant in unburnt areas. These findings underscore the importance of considering soil fungal communities in post-fire management and multifunctionality restoration strategies.

[GSE-O-13]

Wednesday 4, morning (first): 11:00
Room: Auditorio

Twenty-year effect of sewage-sludge fertilization in a Mediterranean grassland: impact on species composition, functional groups and interrelation with climate

Valerio, Mercedes[1]; Ibáñez, Ricardo[2]; Lepš, Jan[3]; Götzenberger, Lars[4]

(1) University of South Bohemia in Ceské Budejovice, Czech Republic; (2) Universidad de Navarra, Pamplona, España; (3) University of South Bohemia in Ceské Budejovice, Czech Republic; (4) University of South Bohemia in Ceské Budejovice, Czech Republic

Correspondence e-mail: [mercedesvaleriog@gmail.com]

Introduction. Mediterranean semi-natural grasslands are biodiversity hotspots currently threatened by land-abandonment and climate change, including increased frequency of drought events, soil erosion and resulting desertification. Soil amendment with sewage sludge is considered a sustainable practice to increase soil fertility and avoid erosion in Mediterranean grasslands, though detailed studies on its long-term effects on vegetation dynamics are still missing. Understanding how sewage-sludge fertilization affects Mediterranean grasslands is of multifaceted interest, from perspectives of waste management, ecosystem conservation, and vegetation ecology.

Material and methods. Using different RDA ordination techniques, we analyzed the vegetation dynamics of a grazing-excluded, semi-natural Mediterranean grassland over 20 years (2004-2023) in response to a single sludge fertilization event in 2003. We studied the persistence of the effects of fertilization, the long-term temporal trajectory of the community, the response of species with different functional traits and from different functional groups, and the influence of fertilization on the interannual vegetation response to temperature and precipitation.

Results and discussion. Our findings reveal significant alterations in community species composition lasting over two decades following the fertilization event, ultimately impacting long-term successional trends. However, the effects of fertilization seem to start decreasing in the last three years. Fertilization favors annuals with higher Specific Leaf Area. Moreover, it influences the interannual response of species composition to summer drought differently depending on the functional group and traits of the species studied. These results highlight the importance of long-term studies to understand the impacts of anthropogenic activities on the dynamics of Mediterranean grasslands.

[GSE-O-14]

Wednesday 4, morning (first): 11:15
Room: Auditorio

Arthropod abundance is most strongly driven by crop and semi-natural habitat type rather than management in an intensive agricultural landscape in the Netherlands

Litovska, Iryna[1]; van der Plas, Fons[2]; Kleijn, David[3]

(1) Wageningen University; (2) Wageningen University; (3) Wageningen University

Correspondence e-mail: [iryna.litovska@wur.nl]

The intensification of agriculture is one of the main causes of arthropod declines. To halt this decline, changes in farming practices and management of surrounding habitats may therefore be needed. A key challenge is to identify which changes in management approaches are most effective in restoring biodiversity. Therefore, this study examines arthropod abundance and diversity in different agricultural and semi-natural habitats, and among different management types. Arthropods were sampled three times in spring and summer of 2022 and 2023 with emergence traps in 128 sites in an intensively farmed area in Western Netherlands. These sites included a variety of crops as well as semi-natural habitats. Our study showed that arthropod abundance and diversity was lower in crop habitats compared to semi-natural habitats, with strong variation among crop species. Notably, alfalfa, spelt, spring and winter wheat supported comparable arthropod levels to semi-natural habitats. In crop fields, most field management variables showed no significant relationship with arthropods. The number of days after cultivation was an exception, and was positively related to total arthropod abundance, Hymenoptera and Collembola abundances, and Coleoptera family diversity. Within semi-natural habitats, number of days after mowing was positively related to total arthropod abundance, Diptera, Hemiptera and Hymenoptera abundances, and Hemiptera family diversity. Additionally, plant cover was positively related to total arthropod abundance. Overall, our findings suggest that crop species and management practices that increase plant cover in spring and early summer are increasing arthropod abundance and, to a lesser extent, higher-taxa diversity in intensively farmed agricultural landscapes.

[GSE-O-15]

Wednesday 4, morning (first): 11:30
Room: Auditorio

Effects of climate and land-use change on satellite-derived primary production in temperate mountain grasslands: insights from the Spanish Pyrenees

Arroyo, Antonio I.[1]; Pueyo, Yolanda[2]; Gaspar, Mario[3]; Cruz-Amo, Lydia[4]; Anadón, José D.[5]

(1) Instituto Pirenaico de Ecología (IPE), CSIC; (2) Instituto Pirenaico de Ecología (IPE), CSIC; (3) Instituto Pirenaico de Ecología (IPE), CSIC; (4) Instituto Pirenaico de Ecología (IPE), CSIC; (5) Instituto Pirenaico de Ecología (IPE), CSIC; (6))

Correspondence e-mail: [aiarroyo@ipe.csic.es]

Introduction. Mountain grasslands are high-nature-value ecosystems supporting diverse plant communities and multiple ecosystem services, but they are increasingly threatened by changes in land use and climate. Understanding how they respond to these drivers is essential for their sustainable management and conservation.

Material and methods. This study investigates the long-term primary production dynamics and responses to climate and land-use change in mountain grasslands of the Spanish Pyrenees. Specifically, annual NDVI time series (1984-2023) from Landsat imagery were built for subalpine and alpine grasslands managed as grazing systems and subalpine abandoned grasslands.

Results and discussion. Higher annual NDVI values were associated with reduced snowfall and rising minimum temperatures, likely due to longer growing seasons. In contrast, lower annual NDVI values coincided with increased maximum temperatures, suggesting potential hydric stress. Different grassland types were affected differently by these processes. Climate change exerted a net negative effect on primary production in alpine and subalpine grazed grasslands, but a positive effect in abandoned grasslands. Nevertheless, a long-term increase in primary production was observed across all grassland types, particularly in abandoned grasslands, possibly due to carbon or nitrogen fertilization and plant succession.

Primary production in alpine grasslands showed resistance to precipitation variability, whereas subalpine grazed grasslands were highly sensitive to temperature and precipitation changes. In abandoned grasslands, woody encroachment decoupled primary production from climatic drivers, leading to increased resistance but reduced resilience to climate variability.

Our results underscore the dual threat of climate change to managed mountain grasslands: it hampers productivity while exacerbating woody encroachment in abandoned areas.

[GSE-O-16]

Wednesday 4, morning (first): 11:45
Room: Auditorio

Assessing the impacts of urbanization on stream ecosystem services through a temporal perspective: historical versus recent cities

Lemes da Silva, Aurea Luiza[1]; Schmitt, Rafael[2]; Calapez, Ana Raquel[3]; Sousa, Maria Carolina[4]; Almeida, Salomé[5]; Feio, Maria João[6]

(1) GeoBioSciences, GeoTechnologies and GeoEngineering (GeoBioTec) Research Centre; (2) GeoBioSciences, GeoTechnologies and GeoEngineering (GeoBioTec) Research Centre; (3) Marine and Environmental Sciences Centre; (4) Institute for Systems Engineering and Computers at Coimbra(INESCC), Department of Civil Engineering; (5) GeoBioSciences, GeoTechnologies and GeoEngineering (GeoBioTec) Research Centre; (6) Marine and Environmental Sciences Centre (MARE)

Correspondence e-mail: [aurealuizalemes@gmail.com]

Freshwater ecosystems and the services they provide have been significantly impacted by urbanization and economic activities inherent to human development. Such economic activities are often responsible for reducing ecosystem services (ES) provided by streams. To understand how the economic model categories influence the ecosystem services loss provided by urban streams, we studied thirty streams in two cities, Aveiro and Coimbra, in central Portugal. Each stream site was assessed in terms of urbanization degree through imperviousness coverage area (IMD), as well as several indicators of Provisioning, Regulation, and Cultural services. Additionally, we identified the main local economic activities in each city. Pearson correlation analysis showed a negative relationship between IMD and Regulating ES indicators (air quality and pollination), and a positive relationship between IMD and Cultural ES indicators (education, cognitive development, and therapeutic services). The two cities presented distinct local economic sectors. Aveiro exhibited a higher proportion of activities linked to manufacturing industries, local business and tourism, while in Coimbra activities related to health and agriculture prevailed. A PCA analysis segregated the two cities and demonstrated a higher impact on riparian zone and morphological condition of Aveiro streams with consequent lower scores for Regulating and Cultural services, being the greater scores found in Coimbra. It is essential to assess the effect of economic activities on nature degradation, to reveal their true impact on ES loss and emphasize the need to move towards an economic system that values nature, rather than putting it at risk.

[GSE-O-17]

Wednesday 4, morning (first): 12:00
Room: Auditorio

2,000 years of genomic recovery from pre-Columbian agriculture in the Amazon

Moreno Mateos, David[1]; Malaquias Costa, Flaviane[2]; Zucchi, Maria Immaculada[3]; Clement, Charles[4]

(1) University of Oxford; (2) University of São Paulo - ESALQ; (3) Secretariat of Agriculture and Food Supply of São Paulo State; (4) Instituto Nacional de Pesquisas de Amazonia

Correspondence e-mail: [david.morenomateos@ouce.ox.ac.uk]

Understanding ecosystem recovery requires timescales of study that capture the speed of ecosystem change, which mostly involves hundreds to thousands of years. To address this, we used pre-Columbian former farmlands where Brazil nut trees were selected and grown for thousands of years. Since the Spanish and Portuguese colonization of the area, much of the local populations disappeared leaving large tracks of land formerly cultivated, abandoned and recovering. Some Brazil nut tree populations in the Amazon region have then been recovering for long periods without human intervention. In this project, we are comparing the genomes of populations of those formerly selected Brazil nut trees, with wild populations and with heavily selected populations using a whole genome sequencing approach. We have found selection signatures changing between young (200 years) and old (500 years) trees, indicating that the release from domestication is affecting the descendants from those original trees brought by the initial indigenous peoples within a few hundred years. The next steps are to determine what functions are changing using annotated reference genomes, and finally determine what functions are key to ensure resilient (e. g., to drought or herbivory) populations to be used in restoration efforts throughout the Amazon.

[GSE-O-18]

Wednesday 4, morning (first): 12:15
Room: Auditorio

Planning wildlife crossing structures using mountain lion road crossing events vs. roadkills

Barrientos, Rafael[1]; Guillermo, Fandos[2]; Vickers, Winston[3]; Longcore, Travis[4]; Waetjen, Dave[5]; Nájera, Fernando[6]; Shilling, Fraser[7]

(1) Universidad Complutense - Fac CC Biológicas; (2) Universidad Complutense; (3) University of California Davis; (4) University of California Los Angeles; (5) University of California Davis; (6) University of California Davis; (7) University of California Davis

Correspondence e-mail: [rbarrientos@ucm.es]

The current expansion of the road network is reaching unprecedented levels aimed to accelerate economic development and territorial expansion of human settlements, facilitating the transportation of people and goods. However, roads have several pervasive impacts on wildlife, such as pollution, habitat loss, roadkills or being barrier to animal movement. The most common mitigation action to minimize roadkill and barrier effect is the placement of wildlife barrier crossing structures. However, these public investments may not be completely effective if their placement is not carefully chosen. From an ecological point of view, two contentious alternatives arise: a) to preserve movement corridors; or b) to mitigate road sections with high rates of roadkills. We used telemetry data from 90 mountain lions (Puma concolor) and 74 roadkills from California to explore similarities and dissimilarities between crossing points and roadkill hotspots to inform the best places for mitigation. We identified mountain lion road crossing locations (based on 5min intervals) by intersecting the movement paths with the road network and compared them to random locations in the road corridor. We included potential explanatory variables like terrain slope, distance to the nearest scrubland, distance to the nearest forest, distance to the nearest grassland, distance to the nearest urban area and distance to the nearest water point as well as artificial light at night, traffic flow and mule deer habitat suitability to compare crossing points with random locations and with roadkill points.

[GSE-O-19]

Wednesday 4, morning (second): 12:45
Room: Auditorio

Under pressure: a plant's introduction pathway is associated with the invasion of environmentally stressful conditions

Riera, Marc[1]; Chytrý, Milan[2]; Melero, Yolanda[3]; Sáez, Llorenç[4]; Attorre, Fabio[5]; Axmanová, Irena[6]; Biurrun, Idoia[7]; Bonari, Gianmaria[8]; Buldrini, Fabrizio[9]; Delbosc, Pauline[10]; Dengler, Jürgen[11]; Jandt, Ute[12]; Jansen, Florian[13]; Jiménez-Alfaro, Borja[14]; Pielech, Remigiusz[15]; Pyšek, Petr[16]; Šibíková, Maria[17]; Pino, Joan[18]

(1) CREAF (Centre de Recerca Ecològica i Aplicacions Forestals), Spain; (2) Masaryk University, Czech Republic; (3) Universitat de Barcelona, Spain & CREAF, Spain; (4) Universitat Autònoma de Barcelona (UAB), Spain; (5) Sapienza University of Rome, Italy; (6) Masaryk University, Czech Republic; (7) University of the Basque Country UPV/EHU, Spain; (8) University of Siena, Italy; (9) Università di Bologna, Italy; (10) Conservatoire Botanique National Sud-Atlantique, France; (11) Zurich University of Applied Sciences, Switzerland & University of Bayreuth, Germany; (12) iDiv Leipzig & Martin Luther University Halle Wittenberg, Germany; (13) University of Rostock, Germany; (14) University of Oviedo, Spain; (15) Jagiellonian University in Kraków, Poland; (16) Czech Academy of Sciences & Charles University, Czech Republic; (17) Slovak Academy of Sciences, Slovak Republic; (18) Centre de Recerca Ecològica i Aplicacions Forestals & Universitat Autònoma de Barcelona, Spain

Correspondence e-mail: [m.riera@creaf.uab.cat]

The successful invasion by non-native plants requires overcoming geographical and environmental filters. Key factors in overcoming the geographical filter are introduction pathways: processes that transport non-native plants, including intentional (e.g. gardening) and unintentional ones (e.g. global trade). Knowledge of introduction pathways provides a great opportunity for preventive management, yet the relationship between pathways and overcoming environmental filters remains unclear. Here, we test how introduction pathways are associated with the invasion of stressful environmental conditions (elevation, salinity, drought and oligotrophy) while accounting for confounding variables (land-cover, habitat type, country) through Generalized Linear Mixed Models. We gathered data of 220 non-native plants recorded in nearly 62,000 vegetation plots across Europe. We show that intentional pathways were associated with the invasion of dry habitats, whereas unintentional pathways were associated with the invasion of saline and high-elevation habitats. Moreover, anthropogenic disturbance favoured invasion by unintentional pathways, while forest habitats were mostly invaded through intentional ones. Our results probably reflect pathway-specific differences in functional traits and human uses. Unintentionally introduced plants comprise many ruderals with high dispersal abilities, and thus may reach remote high-elevation areas and benefit disproportionately from disturbances at high-elevation and saline sites. In contrast, many pre-adapted stress-tolerators have been introduced intentionally for xeriscaping, possibly facilitating the invasion of dry habitats. Our work demonstrates that preventive management needs to tackle both intentional and unintentional pathways.

[GSE-O-20]

Wednesday 4, morning (second): 13:00
Room: Auditorio

Vegetation and water as nature-based solutions for the restoration of urban ecosystem functions

Hernández Agüero, Juan Antonio[1]

(1) Vrije Universiteit Amsterdam

Correspondence e-mail: [hernandezaguer@gmail.com]

Urbanisation is considered to be one of the land-use changes causing the greatest human-induced habitat loss, with a wide range of associated environmental problems such as air and water pollution, biotic homogenisation, habitat fragmentation or the creation of urban microclimates such as urban heat islands. The latter has been suggested to have a major impact on urban biodiversity and ecosystem functioning. The creation of vegetated and watered areas can be used as a nature-based solution to mitigate the effects of these heat islands and restore the natural functioning of urban ecosystems. In this study I intend to test the effectiveness of vegetation and water infrastructure in restoring the functioning of urban ecosystems. Forty oak trees were selected along an urbanisation-vegetation-water gradient in a densely populated city to assess the effectiveness of vegetation and water infrastructure in reducing urban microclimate and its impact on ecosystem functioning. Specifically, I studied foliar insect herbivory and avian invertebrate predation on artificial caterpillars monthly during a seven-month seasonal experiment. I also studied leaf phenology and intra-specific functional diversity, and the synchrony of bird-mediated trophic cascades. In total, more than 5,000 leaves and 700 monthly bird-caterpillar interactions were analysed. The effectiveness of vegetation and water as a nature-based solution to urban microclimate impacts is discussed, along with the applicability of these proposed nature-based solutions in urban areas.

[GSE-O-21]

Wednesday 4, morning (second): 13:15
Room: Auditorio

Evaluating the effects of global warming on dung beetle diversity and ecosystem functions through field experiments

Cuesta, Eva[1]; Kuhn-Pérez, Sofía[2]; Peco, Begoña[3]; Cabrero-Sañudo, Francisco José[4]; Dueñas-Rojas, Almudena[5]; Grzechnik, Sandra[6]; Jiménez-Fernández, Inés[7]; León, Lorena[8]; Sánchez, Javier[9]; Zarzo-Arias, Alejandra[10]; Santos, Ana M.C.[11]

(1) Universidad Autónoma de Madrid; (2) Universidad Autónoma de Madrid; (3) Universidad Autónoma de Madrid; (4) Universidad Complutense de Madrid; (5) Universidad Autónoma de Madrid; (6) Universidad Complutense de Madrid; (7) Universidad Complutense de Madrid; (8) Universidad Autónoma de Madrid; (9) Universidad Autónoma de Madrid; (10) Universidad Autónoma de Madrid; (11) Universidad Autónoma de Madrid

Correspondence e-mail: [eva.cuesta@uam.es]

Dung beetles (Coleoptera, Scarabaeoidea) play critical roles in ecosystems, contributing to the decomposition and burial of excrement and the secondary dispersal of seeds, among others. Ongoing climate change is one of the main drivers of the current biodiversity crisis, but there are still open questions on how it will affect ecosystem functioning. We performed field experiments in three regions of the Sierra de Madrid (Spain) to evaluate whether the temperature increase in the proximity of the dung affects dung beetle diversity, and also dung removal and seed burial. This was done using different types of open top chambers (OTCs): (i) plastic OTCs: made of PVC, which increases temperatures inside them approximately 2°C; and (ii) net OTCs made of net, with no temperature increase. In addition, we used control experimental units (dung) without any type of structure around it. Each treatment (plastic OTCs, net OTCs and noOTCs) was used to measure the loss of dung and seeds from 300 g of ivermectin-free cow dung during 72 hours. Additionally, dung beetle biodiversity was measured using baited pitfall traps. Preliminary results suggest no significant differences in dung beetle abundance and species richness between treatments, and also no differences in dung removal and seed dispersal. There were however regional differences in terms of the amount of dung that was removed. These findings highlight potential regional differences in community and ecosystem responses to global warming, and raise questions about the biodiversity-ecosystem functioning relationship under future climate scenarios.

[GSE-O-22]

Wednesday 4, morning (second): 13:30
Room: Auditorio

Particulate and Mineral-Associated Organic Carbon as Indicators of Soil Carbon Stock Vulnerability in mature and secondary ecosystems in Tenerife (Canary Islands)

Rodríguez Arvelo, Felipe[1]; Sierra Cornejo, Natalia[2]; Rocafull Pérez, Elena[3]; Otto, Rüdiger[4]; Fernández-Palacios, Jose María[5]; de Nascimento Reyes, Lea[6]

(1) Universidad de La Laguna, Avda. Astrofísico Francisco Sánchez, s/n, 38200 La Laguna, Canary Islands,; (2) Universidad de La Laguna, Avda. Astrofísico Francisco Sánchez, s/n, 38200 La Laguna, Canary Islands,; (3) Universidad de La Laguna, Avda. Astrofísico Francisco Sánchez, s/n, 38200 La Laguna, Canary Islands,; (4) Universidad de La Laguna, Avda. Astrofísico Francisco Sánchez, s/n, 38200 La Laguna, Canary Islands,; (5) Universidad de La Laguna, Avda. Astrofísico Francisco Sánchez, s/n, 38200 La Laguna, Canary Islands,; (6) Universidad de La Laguna, Avda. Astrofísico Francisco Sánchez, s/n, 38200 La Laguna, Canary Islands

Correspondence e-mail: [frodriguezarvelo@gmail.com]

Soils store three times more carbon than vegetation, making them the largest organic carbon pool in terrestrial ecosystems. However, the enhancement of carbon fluxes from soils to the atmosphere due to climate change makes this reservoir vulnerable. Soil organic carbon (SOC) vulnerability to be lost can be determined by its storage form: as mineral-associated organic matter (MAOM) (more persistent in time), or particulate organic matter (POM) (more vulnerable to degradation). This information is especially important for oceanic islands ecosystems due to its inherent fragility. Additionally, most habitats in the Canary Islands experience a Mediterranean climate characterized by seasonal water deficits, rendering their soils highly susceptible to degradation in a context of rising temperatures and decreasing rainfall. To determine the magnitude and vulnerability of SOC stocks in the soils of Tenerife, we studied five shrub ecosystems and five forest ecosystems, both mature and secondary, distributed across the climatic gradient. For each site, we collected soil cores down to a depth of 30 cm, dividing them into two subsamples (0–10 cm and 10–30 cm). We estimated SOC, MAOM, and POM per unit area. We assessed differences between ecosystems, depths and determined the drivers of soil organic carbon stocks by relating them to the plant community, temperature, precipitation and elevation. The results provide valuable information about ecosystem functioning with high relevance for climate change mitigation plans in the Canary Islands. This data on existing carbon pools will contribute to the formulation of strategies aimed at preserving or enhancing these critical carbon stocks.

[GSE-O-23]

Wednesday 4, morning (second): 13:45
Room: Auditorio

Temporary ponds under pressure: agricultural intensification and climate change impacts

Arnanz, Christian[1]; Soto-García, Pablo[2]; Tomás-Martín, Marina[3]; Serrano, Laura[4]; Díaz-Paniagua, Carmen[5]; Florencio, Margarita[6]

(1) Universidad Autónoma de Madrid; (2) Universidad Autónoma de Madrid; (3) Universidad Autónoma de Madrid; (4) Universidad de Sevilla; (5) Estación Biológica de Doñana; (6) Estación Biológica de Doñana

Correspondence e-mail: [christian.duge@gmail.com]

Introduction. Temporary ponds in the Mediterranean region are recognized as priority habitats for conservation due to their ecological significance. However, they have often been overlooked and they face significant threats, including anthropogenic activities, climate change, and biological invasions. To address this gap, we compiled an extensive temporary pond cartographic database, and explored physical impacts, hydrological dynamics, and the conservation status of temporary ponds to address conservation challenges.

Materials and Methods. We assessed pond locations, physical impacts, and the inundation/drying status of a subset of temporary ponds (N=888) through visual interpretation of Google Earth imagery. We also applied a spatial Generalized Linear Mixed Model (GLMM) to explore the probability of finding water in the ponds over a long-term temporal trend (2000-2022), using AEMET observational data (accumulated precipitation and maximum temperatures) and observed physical impacts as explanatory variables. Additionally, to assess the relationship of these physical impacts on biotic and abiotic variables, we sampled 104 temporary ponds along a latitudinal gradient over peninsular Spain (spring 2021, 2022).

Results and Discussion. Visual interpretation revealed that over 50% of pond edges and 20% of basins were impacted by ploughing, while 24% of sampled ponds showed evidence of anthropogenic pollution, reflecting agricultural intensification as the prevalent impact. Our findings reveal a trend of decreasing probability of finding water in temporary ponds over the 22 years studied. Both physical impacts (agricultural) and climate, were significant variables explaining this desiccation pattern. These results highlight the urgent need for conservation planning, including the development of guidelines for agricultural practices that prioritize the preservation of temporary ponds.

[GSE-O-24]

Wednesday 4, morning (second): 14:00
Room: Auditorio

Using National Forest Inventory data to enhance mortality estimations

Aguirre, Ana[1]; Cañellas, Isabel[2]; Alberdi, Iciar[3]; Moreno Fernández, Daniel[4]

(1) Universidad Politécnica de Madrid; (2) CSIC-INIA-CIFOR; (3) CSIC-INIA-CIFOR; (4) CSIC-INIA-CIFOR

Correspondence e-mail: [ana.aguirre@upm.es]

Introduction: When national or regional assessments of forest mortality are required, National Forest Inventories (NFIs) are the core information source, due to their systematically remeasured plots distribution in which every tree is identified. Some NFIs, as the Spanish one (SNFI) do not distinguish between natural mortality and harvested trees, although since 2014 the addition of a new code improved this differentiation.

The main objective of this study is to identify the best approach to identify natural losses and salvage logging, enabling estimates prior to 2014 using all the available data from the permanent plots of the SNFIs.

Material and methods: The data considered are those of the NFI permanent plots for which the new code was implemented and the data of the same plots from the previous cycle. Three approaches were compared to identify natural losses: i) traditional SNFI code to identify dead trees left in the forest; ii) SNFI information related to forest types, stand management data and tree vitality indicator; and iii) the new SNFI code that identify natural mortality.

Results and discussion: Results reveal that the proposed approach - combining SNFI information about forest stand management and/or tree vitality – improves the estimation of forest mortality in terms of volume, depending on tree species. This proposed approach enables the identification of whether a lost tree between two SNFI cycles is due to harvesting or natural mortality in cycles without the new code, although salvage logging is hard to differentiate, requiring auxiliary information like disturbance identification.

[GSE-O-25]

Thursday 5, morning (first): 11:00

Room: Auditorio

Freshwater mussel holobionts constitute prokaryotic diversity reservoirs mediating crucial ecosystem functions

Picazo, Félix[1]; Tirado, Andrés[2]; Reis, Joaquim[3]; Muñoz-Hernández, Jahir[4]; Martínez-Moreno, Silke[5]; León-Palmero, Elizabeth[6]; Abellán, Pedro[7]; López-Rodríguez, Manuel Jesús[8]; Moreno, José Luis[9]; Reche, Isabel[10]; Peralta-Maraver, Ignacio[11]

(1) University of Granada (Spain); (2) University of Granada (Spain); (3) Marine and Environmetal Sciences Centre-MARE (Portugal); (4) University Mayor-Santiago (Chile); (5) University of Granada (Spain); (6) Princeton University (USA); (7) University of Seville (Spain); (8) University of Granada (Spain); (9) University of Castille-La Mancha; (10) University of Granada (Spain); (11) University of Granada (Spain)

Correspondence e-mail: [fpicazo@ugr.es]

Introduction. Within the variety of animal-microbiome interactions, hosts establish symbiotic relationships with epibiotic and endobiotic microorganisms, resulting in biological entities known as holobionts. Despite extensive research highlighting the crucial role of freshwater invertebrates in ecosystem functioning, our understanding of those functions occurring at the holobiont level remains limited. We here characterize the epi- and endosymbiotic microbiome of 3 endangered native freshwater mussel species together with the invasive Corbicula fluminea and identify the ecosystem functions they mediate.

Material and methods. We collected shell biofilm and muscle samples from freshwater mussels, as well as water and sediment samples, in 14 localities from 5 different Iberian river basins covering a wide gradient of trophic status. After DNA extraction, we sequenced the V4-V5 region of archaeal and bacterial 16S rRNA gene. We then obtained the amplicon sequence variants (ASV) table and predicted the potential functions in which the microbiomes are involved.

Results and discussion. We found that both tissues, the shell and the muscle, harbor exclusive microbial communities which are different from those found in the surrounding water and sediment. Interestingly, these communities were significantly less diverse in the invasive Corbicula fluminea. Moreover, shell and muscle microbiomes showed a high potential of being involved in key ecosystem functions, such as those related to carbon and nitrogen cycles. In summary, our results shed light on ecosystem functions occurring at holobiont level in freshwaters, as well as show that the endangered freshwater mussels act as archaea and bacteria diversity reservoirs.

[GSE-O-26]

Thursday 5, morning (first): 11:15

Room: Auditorio

Influence of Macrolichens on Invertebrate Richness and Diversity in restored and mature Mediterranean Forests

Fernández-Prado, Noelia[1]; Martínez Moreno, Isabel[2]; Escudero Alcántara, Adrián[3]; García-Cervigón, Ana I.[4]; Aragón Rubio, Gregorio[5]

(1) Universidad Rey Juan Carlos; (2) Instituto de Investigación en Cambio Global (IICG-URJC), Universidad Rey Juan Carlos; (3) Instituto de Investigación en Cambio Global (IICG-URJC), Universidad Rey Juan Carlos; (4) Instituto de Investigación en Cambio Global (IICG-URJC), Universidad Rey Juan Carlos; (5) Instituto de Investigación en Cambio Global (IICG-URJC), Universidad Rey Juan Carlos

Correspondence e-mail: [noelia.fernandezp@urjc.es]

Introduction. Forest biodiversity relies on habitat heterogeneity at various spatial scales. Epiphytic species, such as lichens, contribute to this heterogeneity, serving as refuge and food for many arthropods. However, the impact of lichens on invertebrate richness, diversity, and ecological interactions is not well understood.

Material and Methods. This study evaluates the richness and diversity of invertebrates associated with different macrolichen species in restored and mature Mediterranean forests. We examined 30 forests, including Pinus reforestations and mature forests. Five individuals from each of 15 macrolichen species (e.g., Anaptychia ciliaris, Hypogymnia farinacea, Melanelia glabra, Platismatia glauca, Parmelia tiliacea, Pseudoevernia furfuracea, Usnea hirta) were collected per forest. Over a year, 455 macrolichen samples were randomly collected each season, and all arthropods were identified at the order level.

Results and Discussion. Preliminary analyses identified 23 distinct arthropod groups associated with macrolichens, with Acarina, Collembola, and Psocoptera being the most abundant. Arthropod assemblages varied significantly between macrolichen species and between restored and mature forests. Our findings underscore the importance of large epiphytic lichens in supporting rich and abundant arthropod communities in restored Mediterranean forests. Promoting the recovery of these lichen species aids in conserving diverse invertebrate groups and overall forest biodiversity.

[GSE-O-27]

Thursday 5, morning (first): 11:30
Room: Auditorio

Unearthing challenges: effects of Carpobrotus species on soil properties and microbial communities in coastal ecosystems globally

Pérez Diz, Marta[1]; Morillo, Jose A.[2]; Rodríguez-Addesso, Berea[3]; González, Luís[4]; Brundu, Giuseppe[5]; D'Antonio, Carla M.[6]; Le Roux, Johannes J.[7]; López, Lúa[8]; Rodríguez Parra, Jonatan[9]; Pyšek, Petr[10]; Novoa, Ana[11]

(1) Faculty of Biology, Universidade de Vigo; (2) Estación Experimental de Zonas Áridas del CSIC (EEZA-CSIC), Spain; (3) Faculty of Science and Engineering, Macquarie University, Australia; (4) Faculty of Biology, Universidade de Vigo; (5) Università degli Studi di Sassari, Sardegna, Italy; (6) University of California, Santa Barbara, USA; (7) Faculty of Science and Engineering, Macquarie University, Australia; (8) California State University, San Bernardino, USA; (9) Faculty of Biology, Universidade de Santiago de Compostela, Spain; (10) Institute of Botany of the Czech Academy of Sciences, Pruhonice, Czech Republic.; (11) Estación Experimental de Zonas Áridas del CSIC (EEZA-CSIC), Spain

Correspondence e-mail: [marta.perez.diz@uvigo.es]

Coastal ecosystems face increasing pressure from invasive alien plants, with Carpobrotus species being particularly problematic. These taxa are known to alter soil conditions and influence the structure and diversity of soil microbial communities in invaded regions.

This study investigates how Carpobrotus species impact soil characteristics, as well as bacterial and fungal diversity and community composition, across 17 populations from Europe and USA (introduced range), and South Africa (native range). At each location, soil samples were collected from invaded and uninvaded areas, with three replicates per site to account for spatial variability. Soil physico-chemical properties, such as pH and nutrient levels, were analyzed to evaluate changes associated with Carpobrotus presence. Additionally, DNA metabarcoding was employed to assess the composition and diversity of bacterial and fungal communities in relation to invasion.

Our findings highlight significant differences in soil properties and microbial communities between invaded and uninvaded areas, both within and across regions. Notably, shifts in bacterial and fungal communities suggest that Carpobrotus species may drive substantial changes in soil microbiomes, potentially altering ecosystem processes. This comprehensive analysis sheds light on the ecological consequences of Carpobrotus invasions across a variety of geographical contexts and their implications for ecosystem functionality.

[GSE-O-28]

Thursday 5, morning (first): 11:45
Room: Auditorio

Assessing the role of management and restoration actions on the Iberian wetlands' capacity for GHG emissions abatement

Camacho, Antonio[1]; Rochera, Carlos[2]; Morant, Daniel[3]; Picazo, Antonio[4]

(1) University of Valencia; (2) University of Valencia; (3) University of Valencia; (4) University of Valencia

Correspondence e-mail: [antonio.camacho@uv.es]

Preserving or restoring the natural conditions of most types of wetlands may influence the biogeochemical processes that are related to GHG exchanges with the atmosphere. In the Iberian Peninsula, wetlands and shallow lakes are widely distributed, with coastal wetlands usually bigger whereas there are thousands of smaller inland wetlands, mostly freshwater but also athalassohaline systems. Originally, the natural features of each wetland type (e.g. salinity, hydrological pattern, trophic status, etc.) regulate the rates of biogeochemical processes, and particularly those involved in the exchanges of GHG. When the natural conditions are degraded, there is commonly an alteration of the rates of these exchanges, mainly by shifts in the main biological determining processes, such as carbon fixation by photosynthesis, and carbon release by respiration, both aerobic and anaerobic, the later also including methanogenesis. Usually, the degradation of natural conditions is also associated with an increase in the release of GHG by wetlands, in such a way that adequate management and/or restoration practices may increase the capacity of wetlands to GHG emissions abatement and C-sequestration. Through field experiments, we have assessed the benefits of specific management/restoration actions potentially improving the capacity of wetlands for atmospheric GHG reductions. Among these, those involving vegetation management were the most effective, whereas actions on soil could also improve the wetlands mitigation capacity but much less than the former. The recovery of the natural flooding patterns offered somewhat contradictory results, as the interplay between positive and negative feedbacks provides more complex responses to this type of action.

[GSE-O-29]

Thursday 5, morning (first): 12:00
Room: Auditorio

Growth and survival analysis of Pinus sylvestris and Pinus nigra seedlings from different provenances planted in two different stands of P. sylvestris after regeneration cuttings: evaluation of facilitative effects

de Frutos, Sergio[1]; Casals, Pere[2]; Teruel, Miguel[3]; Baiges, Teresa[4]; Palero, Noemí[5]; Coll, Lluís[6]

(1) Centre de Ciència i Tecnologia Forestal de Catalunya; (2) Centre de Ciència i Tecnologia Forestal de Catalunya; (3) Centre de Ciència i Tecnologia Forestal de Catalunya; (4) Centre de la Propietat Forestal; (5) Centre de la Propietat Forestal; (6) Universitat de Lleida

Correspondence e-mail: [sergio.defrutos@upm.es]

The new climatic conditions expected under climate change scenarios would generate changes in the species composition and structure of forest stands, including processes of altitudinal and latitudinal migration of forest species. Establishing assisted migration trials could anticipate the evaluation of the performance of provenances coming from more xeric conditions, helping in the assesment of the consequences of these interventions and informing future management plans. With this objective, during the spring of 2018 two demonstration plantations were established in natural Pinus sylvestris stands in the Catalan Pre-Pyrenees (Lladurs and Gósol, Lleida). Both stands were subjected to group selection system cuttings in 2011. We planted 120 seedlings per gap (60 distributed within the gap and 60 in the surroundings, under canopy) in 6 gaps (3 in each location), using two species (P. sylvestris and P. nigra) and two provenances per species (local and a more Mediterranean one). Additionally, we evaluated two different microhabitat conditions in terms of light and water availability by planting seedlings both under shrubs and outside them. Our results showed that the seedlings located at higher altitudes (Gósol) had better survival, as did those planted under the protection of shrubs. Seedlings under shrub cover also grew taller. The local species (and provenance) exhibited robustness under current conditions, and P. nigra could be a suitable option for restoration and species diversification efforts even in stands where it is not currently present.

[GSE-O-30]

Thursday 5, morning (first): 12:15
Room: Auditorio

Ecophysiological keys to the success of a range-expanding species in threatened coastal habitats of Doñana National Park

Díaz Antunes-Barradas, Maria Cruz[1]; Gallego-Fernández, Juan Bautista[2]; Fernández-Martínez, Mario[3]; Jiménez-Carrasco, Carmen[4]; Zunzunegui, María[5]

(1) University of Seville; (2) University of Sevilla; (3) University of Seville; (4) University of Seville; (5) University of Seville

Correspondence e-mail: [diaz@us.es]

Range-expanding species or neonatives are native plants which spread outside their original range due to recent climate or human-induced environmental changes. Retama monosperma was planted near the Guadalquivir estuary and due to changes in the sedimentary regime and helped by different animal vectors has undergone an exponential growth threatening different endemic species and critical habitats of the dune system.

We believe that the morpho-physiological traits of R.monosperma might contribute for its expansive behaviour. In this study we record the seasonal responses of Retama in comparison with 3 woody species of the dunes (Juniperus phoenicea, J.macrocarpa and Pinus pinea) in two sites with different underground water availability near the Punta del Malandar (Doñana). Measurements of water relations, leaf traits, leaf conductance, fluorescence, stable isotopes and shoot elongation were done in 12 individuals of each species.

The results of the repated-measures ANOVA show that there are differences between species and the interaction species x season is significant for RWC, shoot elongation, photochemical efficiency and stable isotopes. Our results evidence that Retama has a higher shoot elongation than the other species and higher leaf water content and photochemical efficiency in summer. Additionally, stable isotopes have shown that d15N values are close to zero in R. monosperma which suggests its atmospheric-N fixing capacity, while the other species present negative values.

The combination of these morpho-physiological traits in combination with the dispersion activity of the different mammal species which eat the fruits might contribute for the fast spread of R. monosperma.

[GSE-O-31]

Thursday 5, morning (second): 12:45
Room: Auditorio

Citizeen: A Digital Path to Healthier Ageing and Nature Preservation

Serra, Sónia R. Q.[1]; Feio, Maria João[2]

(1) University of Coimbra. Marine and Environmental Sciences Centre-MARE/ Aquatic Research Network-ARNET; (2) University of Coimbra. Marine and Environmental Sciences Centre-MARE/ Aquatic Research Network-ARNET

Correspondence e-mail: [soniarqs@ci.uc.pt]

The ageing population is growing globally, emphasizing the need for "age-friendly" societies and technologies that support active and healthy ageing. Citizeen, a co-created Android application developed within the Pharaon project (PHArA-ON Horizon 2020), was designed to reconnect urban inhabitants, particularly older adults, with blue and green areas. This digital platform promotes sensory stimulation, knowledge exchange, and increased awareness for the sustainable management of natural areas. Citizeen was tested during the Coimbra pilot in Portugal, part of a large-scale study involving over 100 participants, including 19 older adults, 17 volunteers, and 6 caregivers. The success of Citizen was assessed considering the evolution of the participants over 6 months in several aspects: quality of life (EQ-5D-3L/CarerQoL-7D), social isolation (UCLA Loneliness Scale), perceived stress (PSS-10), and mental well-being, following the Attention Restoration Theory (ART). Results showed trends of decreased loneliness and improved quality of life, though not statistically significant, particularly for caregivers. ART-related nature properties, such as a sense of refuge and fascination, increased among participants, regardless of demographics. Perceived stress increased, especially among younger users (<50 years) and women, likely due to midlife responsibilities, but decreased with age as older adults acquired better stress-management skills and resources. Additionally, the older adults recruited, who remained active, managed stress more effectively. Extending the pilot duration and participant diversity could enhance outcomes, highlighting the need for early reconnection with nature to prevent dependence and promote well-being across all life stages. Citizeen demonstrates the potential of integrating technology and nature for sustainable, age-friendly urban environments.

[GSE-O-32]

Thursday 5, morning (second): 13:00
Room: Auditorio

Rehabilitation and monitoring of novel ecosystems in a solar power plant in semi-arid Spain

Tormo Blanes, Jaume[1]; Iranzo, Esperanza C.[2]; Reiné, Ramón[3]; Pradas, Mario[4]; Zuazu, Mercedes[5]; Arnal, Ismael[6]; Vega, Adrián[7]; Nieves, Andrés[8]; Nicolau, José Manuel[9]

(1) Universidad de Zaragoza; (2) Centre de Recerca Ecològica i aplicacions Forestals (CREAF); (3) Universidad de Zaragoza; (4) Universidad de Zaragoza. Escuela Politécnica Superior; (5) Universidad de Zaragoza. Escuela Politécnica Superior; (6) Universidad de Zaragoza. Escuela Politécnica Superior; (7) Universidad de Zaragoza. Escuela Politécnica Superior; (8) Universidad de Zaragoza. Escuela Politécnica Superior; (9) Universidad de Zaragoza

Correspondence e-mail: [jtormo@unizar.es]

In recent years, renewable energy infrastructure has grown significantly in Spain. However, this expansion must align with biodiversity conservation, ecosystem services provision, and traditional agricultural practices. To address this challenge, we are studying the functioning of these new ecosystems to inform their rehabilitation and management.

At a 2000-hectare photovoltaic park cluster in semi-arid Spain, we are collaborating with GALP on a pilot project which includes grazing, aromatic plant cultivation, and the creation of hedges and forested islands for ecological restoration. In parallel, we have started conducting a long-term study to evaluate the impacts of solar infrastructure and restoration efforts on ecological processes, birds, arthropods, vegetation, and ecosystem services.

Preliminary results show that plant communities are experiencing an increase in generalist species. The shade of solar panels influences vegetation, either increasing or decreasing cover, depending on the specific solar park. Bird species composition is notably different inside and outside the panel-covered areas, with more homogeneous communities and generalist species within the park. No significant differences in soil biological activity have been detected so far.

Restoration actions, have been successful in establishing vegetation, although their broader ecosystem impacts are still unclear. Our work aims to identify strategies for the restoration and sustainable management of these 21st-century novel ecosystems, providing valuable insights into their development and ecological integration.

[GSE-O-33]

Thursday 5, morning (second): 13:15
Room: Auditorio

Assessment of biological soil crust (biocrust) through an integrative analysis of the metabolites, nematodes, and soil biological and physicochemical properties

Criado Navarro, Inmaculada[1]; Cantalapiedra Navarrete, Carolina[2]; Martín Barbarroja, Jorge[3]; León Ropero, Guillermo[4]; Castillo Castillo, Pablo[5]; Archidona Yuste, Antonio[6]

(1) IAS-CSIC – Instituto de Agricultura Sostenible-CSIC; (2) IAS-CSIC – Instituto de Agricultura Sostenible-CSIC; (3) IAS-CSIC – Instituto de Agricultura Sostenible-CSIC; (4) IAS-CSIC – Instituto de Agricultura Sostenible-CSIC; (5) IAS-CSIC – Instituto de Agricultura Sostenible-CSIC; (6) IAS-CSIC – Instituto de Agricultura Sostenible-CSIC

Correspondence e-mail: [icriado@ias.csic.es]

Biocrusts occur globally in ecosystems where plants are typically sparse and allow sunlight to reach the soil surface, they are especially predominant in natural drylands, and important ecosystem services have been attributed to them. The millimeter-thick topsoil formations arise from the complex interaction between soil materials and the microbial communities that inhabit them. Soil metabolomics is an emerging and powerful approach connecting soil chemistry, biology, and ecology. Thus, in this study, a total of 56 plots, 20 m x 20 m in size, were surveyed in an arid natural area located in Almeria, Andalusia (Southeastern Spain). For each plot, biocrusts and bulk soils (40-70 cm depth) were described through untargeted metabolomic analysis (LC-QTOF), soil nematode diversity, and physicochemical and biological properties. Data analysis revealed a significant homogenization in both biocrust and bulk soils due to environmental factors, although this homogenization becomes more noticeable at deeper zones. Results indicated that biocrust and bulk soils are linked, however, they were different in their metabolite expression. Additionally, metabolomic analysis revealed that the samples exhibited a spatial pattern. Furthermore, the metabolomic fingerprints of the soils were found to be highly correlated with their other properties. We also tentatively attributed soil-specific metabolites to potential functional pathways, although complementary proteomic, genomic, and transcriptomic approaches would be needed to provide definitive supporting evidence. In conclusion, integrating soil metabolomics with other soil analyses has proven to be a powerful approach for uncovering interactions within the soil food web, and has enhanced our understanding of the biocrust.

[GSE-O-34]

Thursday 5, morning (second): 13:30
Room: Auditorio

Greenhouse gas emissions from Posidonia oceanica beach wrack

Agueda Aramburu, Peru[1]; Flecha Saura, Susana[2]; Marba, Nuria[3]; Hendriks, Iris E.[4]

(1) Institut Mediterrani d'Estudis Avançats (IMEDEA-CSIC); (2) Instituto de Ciencias Marinas de Andalucía (ICMAN-CSIC); (3) Institut Mediterrani d'Estudis Avançats (IMEDEA-CSIC); (4) Institut Mediterrani d'Estudis Avançats (IMEDEA-CSIC)

Correspondence e-mail: [pagueda@imedea.uib-csic.es]

Introduction: In the Mediterranean Basin, meadows of the endemic seagrass Posidonia oceanica (L.) Delile (Posidoniaceae, Alismatales) are among the most effective documented habitats for carbon storage and primary production. The many ecosystem services (ES) they provide are seldom restricted to the living plant; at the end of the growing season, dead leaves are released from the rhizomes and part accumulates on the coastlines, building up dense structures that also deliver several ES, including shoreline protection by dissipation of wave energy and food provision and habitat to numerous fish species, when drifted back to sublittoral areas. Their presence on the shorelines, however, not only leads to socioeconomic issues due to management conflicts in visited areas, but also have been found to be hotspots of greenhouse gas emissions, particularly carbon dioxide (CO2) and methane (CH4).

Materials and Methods: Here we present measured CO2 and CH4 fluxes in monthly incubations from accumulations of the endemic seagrass Posidonia oceanica on beaches under high and low anthropogenic pressure in Mallorca, Balearic Islands. We deployed a closed incubation chamber connected to a CO2/CH4/H2O gas analyser on damp and dry seagrass wrack.

Results and Discussion: Preliminary results suggest a high variability and dependence of GHG fluxes on local temperature, salinity, light availability and humidity, conditions that affect decomposition by the microbial community. A two-year sampling plan will allow us to analyse the seasonality of the normalised fluxes and the evolution of the wrack extension, shedding some light on the debate around the correct procedure for local seagrass wrack management.

[GSE-O-35]

Thursday 5, morning (second): 13:45
Room: Auditorio

Temporal dynamics of richness, composition and phylogenetic change across ecosystems

Ontiveros, Vicente J.[1]

(1) Universidad Politécnica de Madrid

Correspondence e-mail: [vicente.jimenez.ontiveros@gmail.com]

Introduction. Ecological communities exhibit dynamic changes over time, with community composition and richness fluctuating over long timescales. Despite increasing availability of longitudinal studies, our understanding of temporal biodiversity dynamics remains limited, and few synthesis efforts span diverse ecosystems. Existing studies reveal the absence of systematic trends in richness, consistent species turnover, and regulated diversity— patterns broadly consistent with the Equilibrium Theory of Island Biogeography (ETIB). Hence, it is imperative to critically examine recently derived expectations from ETIB by utilizing extensive databases of community temporal dynamics.

Material and methods. I developed a computational pipeline specifically designed to assess temporal changes in ecological communities. Using species presence-absence data from longitudinal studies, the pipeline establishes expectations for the dynamics of species richness, community composition, and phylogenetic structure. The pipeline involves both analytical expectations for richness and compositional change, and simulations in the case of phylogenetic structure. I applied this framework to BIOTIME, a global database of biodiversity time series.

Results and discussion. Preliminar results indicate that while species richness is well recovered by ETIB, compositional and phylogenetic change tends to show idiosyncratic results. Remarkably, this represents the first comprehensive test of ETIB as a null model for biodiversity change. ETIB provides a critical baseline for understanding biodiversity dynamics, offering a robust framework for practitioners and monitoring efforts. Understanding systematic deviations from ETIB across ecosystems will advance our comprehension of temporal dynamics in ecological communities.

[GSE-O-36]

Thursday 5, morning (second): 14:00
Room: Auditorio

Growth responses to drought of primary producers in Pinus pinaster ecosystems

Barreiro Verea, Olga[1]; Sangüesa Barreda, Gabriel[2]; Madrigal González, Jaime[3]

(1) EiFAB-iuFOR, University of Valladolid; (2) EiFAB-iuFOR, University of Valladolid; (3) iuFOR-ETSIIA, University of Valladolid

Correspondence e-mail: [olga.barreiro22@uva.es]

Climate change poses a significant challenge to Mediterranean ecosystems. The increasing frequency and intensity of droughts severely affect vital functions, such as the growth of primary producers. However, different species may exhibit varying responses to drought, which can contribute to ecosystem stability by employing adaptive strategies that compensate for one another. Our main objective is to determine whether primary producer species in these ecosystems exhibit divergent growth responses to drought as it would be hypothesized in a species portfolio. To address this, we analyzed growth synchrony among multiple species over time and assessed the impact of climatic variables on growth. We focused on Pinus pinaster, Lavandula stoechas, Helichrysum italicum, Cladonia rangiformis, Corynephorus canescens, Erodium cicutarium, and Sedum amplexicaule within Pinus pinaster-dominated sandy ecosystems in Cuéllar, Spain. We constructed novel individual-based ecological correlation networks and linear mixed models to evaluate growth responses to temporal climatic variability. Our preliminary results revealed that growth patterns were not taxonomically modular but instead varied significantly among individuals. Moreover, water balance was the primary driver of growth, with increased water availability consistently enhancing growth. In this highly water-limited ecosystem, the growth responses of primary producers are synchronized, with water availability being the key determinant. This finding suggests that the expected biodiversity portfolio effect does not occur in such a limiting environment. In conclusion, droughts exacerbate growth reductions and threaten ecosystem stability, emphasizing the vulnerability of these arid-adapted ecosystems to ongoing climate change.

GSE. Posters

[GSE-P-1]

Tuesday 3
Discussion corner: Room 5

A race against extinction: the challenge to overcome the Linnean amphibian shortfall in tropical biodiversity hotspots

Carné Constans, Albert[1]; Vieites Rodriguez, David[2]; Sánchez-Vialas, Alberto[3]; Lansac, Claudia[4]; Moreno, Miriam[5]; de la Riva, Ignacio[6].

(1) Science & Business//Museo Nacional Ciencias Naturales (MNCN), CSIC; (2) Instituto de Investigaciones Marinas (IIM), CSIC; (3) Museo Nacional de Ciencias Naturales (MNCN), CSIC; (4) Museo Nacional de Ciencias Naturales (MNCN), CSIC; (5) Biodiversity Research Institute (IMIB), University of Oviedo-Principality of Asturias-CSIC, Mieres; (6) Museo Nacional de Ciencias Naturales (MNCN), CSIC.

Correspondence e-mail: [albert.carne@mncn.csic.es]

Introduction. Global biodiversity faces severe anthropogenic threats, with alarming extinction projected rates. In parallel, most of Earth's diversity remains undescribed, meaning countless species may vanish before being documented. Therefore, it is urgent to discover and describe as many species as possible to achieve a representative global inventory and ensure effective conservation. Amphibians, the most endangered vertebrates, exemplify this challenge: while threatened species numbers rise, new species descriptions rapidly increase, and hundreds of candidate species are flagged annually, especially in the tropics, the most threatened regions.

Material and Methods. We used Madagascar's amphibian fauna —one of the best-studied tropical regions for amphibians— to quantify the unassessed species richness, analyzing 10,873 mitochondrial sequences alongside previously published bioacoustics, distributional, morphological, and nuclear data. Additionally, we analyzed the metadata from all anuran species described since 2000 across four tropical regions to quantify the time required to describe new frog species.

Results and discussion. In Madagascar, besides the 413 described species, we identified 310 divergent lineages qualifying as candidate species. Most occur in well-studied regions, suggesting many more remain undiscovered in under-sampled areas. Incorporating this undescribed diversity could shift conservation priorities and improve the resource allocation. Moreover, it takes 11.3 years on average to describe a frog species since the first specimen is collected, exacerbating the so-called taxonomic impediment. The pace of frog species descriptions is too slow to keep up with the current biodiversity crisis. To win the race against extinction, we must prioritize and accelerate the discovery and description of undescribed species.

Keywords. Tropical hotspots, species delimitation, amphibians, Linnean and Wallacean shortfalls.

[GSE-P-2]

Wednesday 4
Discussion corner: Room 5

Unravelling the short- and mid-term effects of climate change on plant community dynamics in Mediterranean dehesas: a functional trait perspective

Pérez Ramos, Ignacio Manuel[1]; Gallego Tévar, Blanca[2]; Hidalgo Gálvez, María Dolores[3]; Delgado Galán, Andrés[4]; Cambrollé Silva, Jesús[5]; Matías Resina, Luis[6]; Alba Gutiérrez, Manuela[7]; Moreira Tomé, Xoaquín[8]; Martins Noguerol, Raquel[9]

(1) Instituto de Recursos Naturales y Agrobiología de Sevilla (IRNAS, CSIC); (2) IRNAS (CSIC) and University of Seville; (3) Fundación Centro de Estudios Ambientales del Mediterráneo (CEAM); (4) IRNAS, CSIC; (5) University of Seville; (6) University of Seville; (7) IRNAS, CSIC; (8) Misión Biológica de Galicia, CSIC.; (9) University of Seville

Correspondence e-mail: [imperez@irnase.csic.es]

Climate change is profoundly affecting terrestrial ecosystems, with the Mediterranean basin being particularly vulnerable to rising aridity driven by increasing temperatures and reduced precipitation. However, not all species respond in the same way to forecasted aridity due to their differing capacities for adaptation to changing conditions. These interspecific differences in response to warming and/or drought might result in relevant shifts in plant community dynamics. We designed a manipulative field experiment to evaluate the short- and mid-term effects of increased temperature and reduced precipitation on the reproductive fitness of four herbaceous species typical of Mediterranean dehesas. Additionally, we measured key functional traits after one and seven years of the climatic manipulation to characterize the diversity of adaptation strategies to cope with climate change. Experimental warming and drought significantly impacted plant performance, with effects varying by species and sampling year. For example, Calendula arvensis and Erodium moschatum reduced viable seed production under short-term warming, while the latter species increased its reproductive ability after seven years of drought. These species-specific changes triggered shifts in plant community composition, with mid-term warming reducing the abundance of two out of the four study species. These species exhibited functional adaptations to climate change, such as increased SLA, plant height and leaf phenolic content in response to warming. However, these effects were less pronounced after seven years, likely due to an acclimation process. Our results highlight the complex effects of climatic stressors on plant community dynamics, emphasizing the need of considering species-specific strategies to fully understand their ecological consequences.

[GSE-P-3]

Thursday 5
Discussion corner: Room 5

Dung beetle diversity and ecosystem functions in Azorean pastures amid climate change

Coelho dos Santos, Ana Margarida[1]; Dueñas-Rojas, Almudena[2]; Cuesta, Eva[3]; Parmentier, Laurine[4]; Leite, Abrão[5]; Borges, Paulo A.V.[6]

(1) Universidad Autónoma de Madrid; (2) Universidad Autónoma de Madrid; (3) Universidad Autónoma de Madrid; (4) Universidade Dos Açores; (5) Universidade Dos Açores; (6) Universidade Dos Açores

Correspondence e-mail: [ana.margarida.c.santos@gmail.com]

The benefits humanity received from nature are known as ecosystem services and are the by-product of ecosystem functions (EF) that regulate the biological and geochemical characteristics of ecosystems. Biodiversity is an important driver of EF, and so ongoing climate change contributes not only to current biodiversity crisis, but also to large reductions of EFs. Many EF and associated ecosystem services are performed by insects. Dung beetles (Coleoptera, Scarabaeoidea) perform many EFs associated with their coprophagous habits, being key to ecosystem productivity. We explore the effects of climate change on dung beetle diversity and dung removal, on pastures of the Azores archipelago (Portugal), which constitute neobiotas. To achieve this, we performed field experiments in Faial, Pico and Terceira Islands, using three treatments: (i) increased temperature (achieved using open top chambers – OTC, plastic structures of PVC in which average daily temperature increase ~2ºC); (ii) non-warming OTCs (made of net); and (iii) natural conditions (i.e. with no OTC). In each treatment, we used 300 gr of ivermectin-free cow dung that was left in the field for 72 hours. Afterwards, we collected the remaining dung to obtain the fresh and dry weight. We also sampled dung beetle diversity in these three treatments, using baited pitfall traps. The number of species found was very low and composed on non-native species. Dung removal was similar between all treatments, although there were differences between islands. These results indicate that some EFs might be resilient to future climate warming and challenge our knowledge about the biodiversity-ecosystem functioning relationship.

[GSE-P-4]

Tuesday 3
Discussion corner: Room 5

LivingSoiLL: Healthy Soil to Permanent Crops Living Labs

Alonso-Crespo, Inés M.[1]; Domínguez, Jorge[2]; Carlos, Cristina[3]

(1) Universidad de Vigo; (2) Universidad de Vigo; (3) Universidade de Trás-os-Montes e Alto Douro

Correspondence e-mail: [inesmaria.alonso@uvigo.gal]

Soil degradation is a major challenge for agricultural land across the European Union, mainly due to the intensification of agricultural practices. Mitigating this problem requires urgent changes in soil management strategies. To develop effective approaches to soil monitoring, restoration, and protection, it is essential to incorporate the perspectives of stakeholders, including farmers, scientists, businesses, policymakers, and citizens.

"LivingSoiLL Healthy Soil to Permanent Crops Living Labs" is a Horizon Europe project that is funded by the European Commission under the Grant Agreement 101157502 within the framework of the EU Mission 'A Soil Deal for Europe'. The project addresses soil degradation through a network of five Living Laboratories (LL) in Portugal, Spain, France, Italy, and Poland. These labs focus on permanent crops (vineyards, olive groves, chestnut, hazelnut, and apple orchards) and involve 50 experimental sites and 10 lighthouses. With the active participation of more than 2,000 local actors, the project employs collaborative methods, encouraging co-creation, co-implementation, and (digital) co-testing of solutions. These methods aim to reduce soil erosion, improve soil structure, minimise the impact of fertilisers and pesticides, increase water storage capacity, and enhance soil biodiversity and resilience.

Launched in June 2024 for 4.5 years, LivingSoiLL will promote sustainable practices to improve soil health and ecosystem services. It will foster knowledge exchange among stakeholders and develops policy recommendations for sustainable soil management in permanent crops, focusing on reducing soil erosion and ensuring long-term agricultural sustainability.

[GSE-P-5]

Wednesday 4
Discussion corner: Room 5

The potential impact of non-selective Vespa velutina trapping devices in agricultural settings: the case of vineyards

R. Lueje, Yaiza[1]; Fagúndez, Jaime[2]; J. Servia, María[3]

(1) Facultade de Ciencias; (2) Facultade de Ciencias, Universidade da Coruña; (3) Facultade de Ciencias, Universidade da Coruña

Correspondence e-mail: [y.rlueje@udc.es]

The yellow-legged hornet Vespa velutina Lepeletier, 1836 is already a well-known invasive species in different areas of the world. The most documented impact is its predation on honeybees, but fruit production has been also reported to be affected by this species. Vineyards in northwest Spain have reported yield losses by V. velutina in recent years, and bait trapping, despite its low selectivity, is a popular method in the area. Contrastingly, there is an increasing interest in the promotion of environmentally friendly practices in vineyards, including those that promote insect conservation. In this work we have investigated the management practices of V. velutina control in two wine producing areas of Galicia (NW Spain), where trapping of hornets is a common method used by producers. In particular, we investigated which factors, from the type of trap to the season of the year, influence the effectiveness and potential environmental impact of traps used in vineyards. Results are consistent with previous findings on the effectiveness and potential impact of liquid baited traps, and confirm that the type of trap has a strong influence on the captures of V. velutina and by-catch. However, by-catch can differ notably between wine producing areas. We urge deeper analyses and discussion on the side effects of trapping.

[GSE-P-6]

Thursday 5
Discussion corner: Room 5

Big ecological challenges in small wine producing areas

Servia, María J.[1]; R. Lueje, Yaiza[2]; Fagúndez, Jaime[3]

(1) Faculty of Science, University of A Coruña; (2) Faculty of Science, University of A Coruña; (3) Faculty of Science, University of A Coruña

Correspondence e-mail: [maria.servia@udc.es]

Small wine producing areas bring diversity and singularity to the wine market, and they are valuable assets to an industry where uniqueness and linkage to elements of terroir meet the desires of wine lovers. Many small wineries (SW) are also actively promoting and adopting organic practices, contributing to enhancing biodiversity and ecosystem services. However, SW frequently require higher investments to produce quality wines, thus taking high risks in the competitive wine market. A big challenge is that these risks can be increased by attacks of diverse organisms that cause yield losses, fuelling heated debates on the management of those species and the conservation of biodiversity. In this work we present a first attempt of quantifying yield losses by birds, wild boar and the invasive hornet Vespa velutina in a historical small wine producing area in NW Spain (Betanzos, A Coruña), where present cultivation surface is under 10 Ha (6 wineries officially operating at present). We review the methods that are being tested in the area for the mitigation of those yield losses, ranging from the use of nets or electrical fences, to cheap homemade insect traps. We also present the pros and cons of each method in view of the experience of wine producers and our research results. Worries and expectations of wine producers facing these ecological challenges are discussed, and we highlight opportunities for future research.

[GSE-P-7]

Tuesday 3
Discussion corner: Room 5

The hidden Natura 2000 network: protected subterranean species and habitats across Europe

Pallarés, Susana[1]; Mammola, Stefano[2]; Sánchez Fernández, David[3]

(1) Universidad de Murcia; (2) Water Research Institute (IRSA), National Research Council (CNR), Verbania, Italy; (3) Universidad de Murcia

Correspondence e-mail: [susana.pallares@um.es]

Introduction. The Natura 2000 network (N2000) is Europe's primary legal tool for biodiversity conservation. However, the extent to which it provides an effective protection to some key ecosystems, such as subterranean habitats, remains unaddressed. We aim to: i) identify and map the 'subterranean N2000 network' - sites specifically designated for subterranean habitats or species; ii) compare it to areas containing subterranean habitats across Europe; and iii) assess the conservation degree and threats affecting these sites.

Material and methods. As part of the Biodiversa+ project Darco (The vertical dimension of conservation: A cost-effective plan to incorporate subterranean ecosystems in post-2020 biodiversity and climate change agendas), we have explored the 2022 EU official public N2000 database and compiled data on the subterranean habitats and species present in each N2000 site, along with reported impacts, conservation and management statuses from EU Member States.

Results and discussion. Only 9% of EU subterranean habitats are directly protected within the subterranean N2000 network, while an additional 13% overlap with protected areas not specifically designated for subterranean elements. Therefore, while the main subterranean habitats types and a few subterranean species (mostly bats) are listed in the Habitats Directive annexes as criteria for N2000 site designation, the protection of subterranean biodiversity in Europe remains deficient. Subterranean habitats are increasingly threatened and urge to be included in global biodiversity targets and climate change agendas. Our work lays the groundwork for further research testing the effectiveness of the N2000 network to protect this often-overlooked vertical dimension of biodiversity.

[GSE-P-8]

Wednesday 4
Discussion corner: Room 5

Formal education shaping the perception of ecological systems among environmental technicians and managers in Spain

Hernández Correas, Ester[1]; Escudero Alcántara, Adrián[2]; Montesinos Navarro, Alicia[3]

(1) Instituto de Investigación en Cambio Global - Universidad Rey Juan Carlos (IICG-URJC); (2) Instituto de Investigación en Cambio Global - Universidad Rey Juan Carlos (IICG-URJC); (3) Centro de Investigaciones sobre Desertificación (CIDE-CSIC)

Correspondence e-mail: [ester.hcorreas@urjc.es]

Nature conservation can be considered a social issue, as people decide what, when, and how to conserve. Consequently, our perceptions of species, populations, or ecosystems are crucial in this process, since those viewed less favorably receive less conservation support. Arid ecosystems or drylands, exemplify this, as they are usually undervalued despite their ecological significance. Within this framework, environmental managers and technicians directly influence ecosystem conservation, making them a key group to evaluate for potential biases and the factors shaping these views. We hypothesize that a more anthropocentric perspective derived from practical, production-oriented training could lead to poorer perceptions of arid environments compared to other environments, whereas individuals with training in basic sciences will not exhibit this bias.

To test this, we conducted an online semi-structured survey among 150 environmental professionals in Spain with higher education qualifications. Perceptions of arid environments were assessed across four aspects: affinity for landscape aesthetics, emotions evoked, quality of life attributed, and cultural ecosystem services valued. Educational backgrounds were categorized into two groups (basic science vs applied training) based on the participants reported degrees , with additional control and demographic data collected.

The results revealed significant differences in perceptions of environments across educational backgrounds. Professionals with basic science training consistently rated arid environments more favorably than those from applied fields, and with less contrast compared to other environments across all four aspects studied. This information highlights the influence of educational background on environmental perceptions and underscores the need to address these biases in conservation strategies.

[GSE-P-9]

Thursday 5
Discussion corner: Room 5

Epiphytic lichens as early-warning indicators: Functional trait responses to environmental stressors

Montoya Ruiz, Antonio Manuel[1]; Hurtado, Pilar[2]; Gómez Álvarez, Ernesto[3]; Martínez, Isabel[4]

(1) Universidad Rey Juan Carlos; (2) Universidad Rey Juan Carlos; (3) Universidad Rey Juan Carlos; (4) Universidad Rey Juan Carlos

Correspondence e-mail: [antoniommr96@gmail.com]

Global change drivers, including climate change, habitat fragmentation and management intensity, significantly influence forest structure and microclimate, altering the environmental context for organisms inhabiting these ecosystems. Epiphytic lichens, living on tree trunks, act as early-warning indicators due to their poikilohydric and poikilothermic nature. These characteristics make their physiological activity highly dependent on external environmental conditions, as they lack mechanisms for active temperature regulation, photosynthetic control, nutrient uptake or gas exchange. Consequently, characterizing functional trait variability is critical to understanding species' responses to changing environmental conditions. This study evaluates inter- and intraspecific trait variability of epiphytic lichens across climatic, fragmentation and management gradients in Mediterranean oak forests. We investigated the variation in traits related to photosynthetic activity, water balance, nutrient uptake and radiation balance in five lichen species (Evernia prunastri, Lobarina scrobiculata, Nephroma laevigatum, Melanelia glabra and Parmelina tiliacea). We collected over 600 individuals (four per tree, 20 per species per forest) within 24 Quercus pyrenaica forests in two climatic areas from Montes de Toledo and Sistema Central, with varying fragmentation and management intensity. We used linear models to examine trait variability and its relationship with environmental conditions. Preliminary results suggest significant inter- and intraspecific trait variation. Differences among species, influenced by their photobiont type and colour, were observed. Certain species exhibited greater intraspecific variability, with some traits proving more sensitive to environmental factors. We can infer that management intensity and climate are the variables that most influence the variation in the functional traits analysed.

[GSE-P-10]

Tuesday 3
Discussion corner: Room 5

Spotting the big predator: exploring the spatial and temporal trends of hunters in Spain

Blanco-Aguiar, Jose A[1]; Fernández-López, Javier[2]; Illanas, Sonia[3]; Vicente, Joaquin[4]; Acevedo, Pelayo[5]

(1) IREC (CSIC-UCLM-JCCM); (2) IREC (CSIC-UCLM-JCCM); (3) IREC (CSIC-UCLM-JCCM); (4) IREC (CSIC-UCLM-JCCM); (5) IREC (CSIC-UCLM-JCCM)

Correspondence e-mail: [joseantonio.blanco@uclm.es]

Hunters, due to their numbers and widespread presence across territories, represent one of the primary predators of wildlife, potentially affecting both target prey populations and broader ecosystems. Despite this, their spatio-temporal dynamics have received limited academic attention. This study examines hunting and firearm license data to analyze spatial patterns and trends among hunters across various regions of Spain during the last three decades of the 20th century. The research evaluates the applicability of complementary analytical techniques, including cluster analysis, minimum/maximum autocorrelation factor analysis (MAFA), and dynamic factor analysis (DFA), to address short, non-stationary, multivariate datasets.

The findings reveal a declining trend in the number of hunters, with distinct regional patterns identified through time series analysis. Cluster analysis delineated four principal geographical areas with similar trends in hunting activities: highly populated urban areas, the northern and southern Iberian plateaus, and the Cantabrian Mountains. These spatial patterns were closely associated with environmental and socio-economic factors.

The use of time-series indicators, combined with advanced analytical tools, highlights their utility in understanding the complex spatio-temporal dynamics of hunting activities and the natural resources they influence. This approach provides valuable insights into the interplay between human activity and ecological systems, offering a framework for more informed wildlife management and conservation policies.

[GSE-P-11]

Wednesday 4
Discussion corner: Room 6

Functional Changes in Plant Communities During Post-Wildfire Regeneration

Prieto Aguilar, Iván[1]; de la Riva, Enrique G.[2]; Fernández Guisuraga, José Manuel[3]; Maluenda Garín, Clara[4]; Pinto Prieto, Rayo[5]; Beltrán Marcos, David[6]; Marcos Porras, Elena[7]; Tárrega García-Mares, Reyes[8]; Calvo Galván, Leonor[9]

(1) University of León; (2) University of León; (3) University of León; (4) University of León; (5) University of León; (6) University of León; (7) University of León; (8) University of León; (9) University of León

Correspondence e-mail: [iprietoaguilar@gmail.com]

The functional regeneration of ecosystems following wildfires mainly depends on the fire severity, but these effects could also be dependent on, and interact with, the plant community composition of these ecosystems, which shapes regeneration strategies along with the traits of plant species. This study evaluates functional changes at the species and community levels (CWM) two years after a large wildfire in Mediterranean plant communities dominated by Pinus pinaster, Quercus ilex, and Cistus ladanifer. Results indicated that species regenerating after severe wildfires have lower heights with lower leaf and stem dry matter contents, coupled with higher chlorophyll and carotene concentrations, but only in Pinus-dominated communities. The other two ecosystems did not show clear plant functional traits regeneration patterns in relation to fire severity. At the community level, wildfire severity resulted in communities with higher specific leaf area (CWMSLA) and lower plant height (CWMheight). The significant interaction between fire severity and ecosystem type suggests that the degree of functional change varies across ecosystems. Notably, while individual traits are significantly altered, compensatory dynamics in species composition and community structure appear to mitigate these effects at the community level, except for SLA and plant height, preserving overall functional integrity, at least during early stage regeneration. These findings highlight the importance of ecosystem-specific resilience mechanisms in shaping post-fire recovery and underscore the role of functional traits in understanding plant community responses to disturbance in Mediterranean landscapes.

TECHNICAL SESSIONS

TSE.1. Anthropogenic Disturbances and Global Change: Impacts on Biodiversity and Ecosystem Services

Monday, 2 (18:00-19:30) • Tuesday, 3 (11:00-12:30)

Room: Seminario 7

Tuesday, 3 (12:45-14:15)

Room: Balconada

The accelerating pace of anthropogenic disturbances, coupled with global climate change, poses a significant threat to biodiversity and ecosystem services across terrestrial, marine, and freshwater ecosystems. This session will explore the direct and indirect effects of major disturbances, including drought, wildfires, urbanization, and resource overexploitation. These disturbances disrupt ecological balance, leading to habitat loss, species extinction, and diminished ecosystem services such as pollination, water purification, and carbon sequestration.

The session will also highlight cutting-edge monitoring techniques which are crucial for assessing the impacts of these disturbances. Focusing on innovative tools enable more precise tracking of changes in biodiversity and ecosystem health, aiding in the development of adaptive management strategies.

By understanding these dynamics, we aim to foster dialogue on mitigating the adverse effects of human activities and climate change, ultimately promoting sustainable practices that preserve biodiversity and ecosystem functionality for future generations.

Organizers:

• **Inmaculada (Ada) Álvarez-Manzaneda,** Department of Ecology, University of Granada

• **Nuria Pistón,** Department of Ecology, University of Granada; Silke Martínez-Moreno, Department of Ecology, University of Granada.

TSE.1. Orals

[TSE.1-O-1]

Monday 2, evening: 18:00
Room: Seminario 7

Unraveling biodiversity and cultural values: a case study in rural Spain

El Ghafraoui, Youssra[1]; Quintas-Soriano, Cristina[2]; Salazar Galvez, Beatriz[3]

(1) Andalusian Center for Global Change-Hermelindo Castro (ENGLOBA); (2) Andalusian Center for Global Change-Hermelindo Castro (ENGLOBA); (3) Department of Biology and Geology

Correspondence e-mail: [ye808@ual.es]

Introduction. Rural ecosystems offer key contributions to people's well-being and are considered cultural landscapes due to long-standing human-nature interactions. These interactions have shaped diverse worldviews, cosmologies, and narratives that reflect relationships between people and the environment. Resulted in a variety of worldviews, cosmologies and narratives that reflect the relationships between people and the natural environment. The concept of biocultural diversity, emerged as a way to emphasize the significance of life's diversity in all its forms—biological, cultural, and linguistic—and to show how these forms of diversity are connected and have co-evolved in parallel within complex social-ecological systems.

Material and methods. This research aims to propose a methodological approach to investigates the relationship between natural areas and cultural practices in rural Spain, focusing on Almería province. Specifically, our study aims to (1) examine biodiversity trends over the past 50 years and assess their impact on nature's contributions to people, and (2) identify local ecological knowledge associated with biodiversity components and explore the importance of cultural values linked to them.

Results and discussion. Our predicted results will highlight the tendency of biodiversity (positive, negative or neutral) due to land-use changes, rural abandonment, and human activities. Thus, we hypothesize that land use change transformations will influence both ecosystems and cultural values, associated with biodiversity. Furthermore, local ecological knowledge will play a key role in maintaining cultural values and fostering resilience in the rural region. Promoting biocultural approaches can help bridge the gap between biodiversity conservation and preserving cultural values, ensuring socio-ecological resilience for the future conservation of rural areas.

[TSE.1-O-2]

Monday 2, evening: 18:15
Room: Seminario 7

Enhancing Structural Beta Complexity to Promote Biodiversity in Managed Forests

Massó Estaje, Clàudia[1]; Claßen, Alice[2]; Steffan-Dewenter, Ingolf[3]

(1) Julius-Maximilians-Universität Würzburg; (2) Julius-Maximilians-Universität Würzburg; (3) Julius-Maximilians-Universität Würzburg

Correspondence e-mail: [claudia.masso-estaje@uni-wuerzburg.de]

The homogenization of temperate forests due to intensive management and timber production has contributed to significant biodiversity loss, particularly at the landscape scale (y-diversity). This phenomenon, driven by reductions in structural heterogeneity, limits species diversity and ecosystem functions. Despite its importance, experimental studies addressing the relationship between a-, ß-, and y- diversity at large scales and under real-world conditions remain scarce. To address this gap, we conducted a pioneering experiment investigating whether the Enhancement of Structural Beta Complexity (ESBC) – through silvicultural interventions or natural disturbances – can counteract forest homogenization and increase biodiversity.

Our study was conducted across 11 temperate forest districts in Germany, encompassing a total of 234 experimental patches (50x50m each). ESBC treatments were applied to increase heterogeneity in canopy cover and deadwood resources, while control districts with homogeneous structures were included for comparison. Hoverflies (Syrphidae), were sampled using standardised pan trapping during three seasonal intervals to assess the effects of increased a- and ß-diversity on y-diversity.

Our results, analysed using a novel meta-analytic framework, revealed that heterogeneous forest landscapes exhibit higher y-diversity of hoverflies compared to homogeneous ones, with taxonomic diversity showing the strongest response, followed by phylogenetic and functional diversity. The enhancement of forest structure was particularly beneficial for rare species, highlighting the potential of ESBC to mitigate biotic homogenization.

This study represents the first large-scale experimental approach to directly manipulate ß-diversity in forests, providing unprecedented insights into the feasibility of restoring landscape heterogeneity through targeted management practices. By integrating ß-diversity into forest management strategies, our findings offer actionable solutions to conserve biodiversity and ecosystem functions in production forests under changing climatic conditions.

[TSE.1-O-3]

Monday 2, evening: 18:30
Room: Seminario 7

A novel approach measuring long-term social and environmental benefits through ecosystem services supply driven by new aeration turbine technology development in hydropower plants

Arenas, Marta[1]; Lucas, Alberto[2]; de Ozaeta, Jana[3]; Ciruelos, María[4]; Real, Montserrat[5]; Noguero, Jordi[6]

(1) AECOM Spain DCS; (2) AECOM Spain DCS; (3) AECOM Spain DCS; (4) AECOM Spain DCS; (5) AECOM Spain DCS; (6) AECOM Spain DCS

Correspondence e-mail: [marta.arenasromasanta@aecom.com]

Maintaining regulatory environmental flows downstream of hydropower plants (HPP) currently poses constraints for their safe and cost-efficient operation. Differences in oxygen content between the upper and lower layers within the water column, as well as between upstream and downstream of the HPPs, can impact physicochemical parameters and ecological status/potential of water bodies and linked terrestrial ecosystems. This effect is exacerbated during summer months, when thermal stratification occurs in reservoirs, leading to anoxic conditions in the bottom waters.

Ecosystem services (EESS) supply depends on biodiversity stock, ecosystem flows and productivity, all of them impacted by the oxygen content of water, among other factors. Therefore, social and ecological benefits driven by EESS supply are expected to change with HPP operational interventions in the long-term, as part of a socio-ecological system.

SHERPA Project aims to develop and validate innovative technologies for current HPPs refurbishment, such as advanced air injection systems and new runner designs.

The Project also ambitions to find out a sound set of KPIs to measure whether the Project technology implementation can drive a long-term positive impact on biodiversity and social benefits. This article presents the approach to define this set of KPIs, focused on water bodies but also on the linked riverine habitats. They are being developed linking both physicochemical and ecological indicators to EESS supply baseline measurements and simulations. Novelties such us the use of eDNA survey outputs and digital twin tools are also presented. Challenges and limitations identified at this early stage of the Project are considered useful for the scientific and technical community.

[TSE.1-O-4]

Monday 2, evening: 18:45
Room: Seminario 7

Long-Term Integrative Monitoring Tool for Assessing Drought Impacts on Biodiversity

Puig-Gironès, Roger[1]; Real, Joan[2]

(1) Universitat de Barcelona; (2) Universitat de Barcelona

Correspondence e-mail: [rogerpuiggirones@gmail.com]

Anthropogenic climate change poses a significant threat to biodiversity by altering environmental conditions, primarily through rising temperatures and shifting precipitation patterns. Species may adapt locally or migrate to more favourable environments to maintain suitable conditions. However, understanding these effects requires integrative monitoring tools capable of detecting long-term changes. The Biodiversity Monitoring Centre is dedicated to advancing long-term biodiversity monitoring, enabling the assessment of phenomena like drought on species, habitats, and ecological processes that shape a region's biodiversity.

Using this tool, we have evaluated the impact of over three years of drought on various biodiversity components in Sant Llorenç del Munt i l'Obac Natural Park and its trophic network. After eight years of monitoring, we observed that drought has affected all aspects of biodiversity, from vegetation and habitat structure to carnivores and birds of prey. While the drought does not equally impact all components, it remains a powerful driver of ecosystem change.

As droughts intensify, some habitats initially exhibit higher resilience, but their capacity to provide essential resources diminishes over time. This underscores the presence of climate refugia and the adaptability of Mediterranean biodiversity to prolonged droughts and extreme weather events. Effective conservation strategies should not only protect individual habitats but also focus on enhancing landscape connectivity. Creating ecological corridors between habitats is essential for promoting species movement and survival as environmental conditions continue to change.

[TSE.1-O-5]

Monday 2, evening: 19:00
Room: Seminario 7

A trait-based approach to optimize urban green infrastructure for air pollution mitigation

Pistón, Nuria[1]; Motos, Carlos[2]; Cariñanos, Paloma[3]; Zamora, Regino[4]

(1) University of Granada; (2) University of Granada; (3) University of Granada; (4) University of Granada

Correspondence e-mail: [nuriapiston@ugr.es]

Introduction. Cities face unique ecological challenges due to intense anthropogenic pressures, including environmental changes and urban landscaping practices. Urban Green Infrastructure (UGI) provides essential Nature Contributions to People (NCP), such as air purification and habitat creation, but designing UGI to maximize these benefits requires understanding the mechanisms by which NCP are provided. One promising approach to enhance particulate matter (PM) mitigation is investigating specific plant functional traits that influence PM accumulation. Structural leaf traits are known to affect PM retention, but a broader evaluation of traits is needed. BioCiTrees, a study conducted in Granada, Spain, a Mediterranean city with high pollution levels, addresses these gaps by evaluating the relationship between diverse plant traits and PM accumulation.

Material and Methods. We selected 23 native and exotic urban tree species with diverse traits, focusing on their functional contributions to air purification. Field surveys were conducted in García Lorca Park in September 2024. Leaf traits such as specific leaf area (SLA), leaf dry matter content (LDMC), and roughness were measured alongside whole-plant traits. PM accumulation was quantified by collecting and weighing particulate matter from leaf surfaces. We modeled the relationship between traits and NCP using boosted regression trees. This approach identified the functionality needed for maximizing NCP provision.

Results and Discussion. Preliminary results revealed significant associations between specific traits and air purification potential. The findings highlight the importance of functional traits for optimizing UGI. BioCiTrees offers a scalable framework for sustainable urban planning, supporting the One Health approach by integrating environmental and public health objectives.

[TSE.1-O-6]

Monday 2, evening: 19:15
Room: Seminario 7

The role of structural heterogeneity and fire severity in Mediterranean post-fire landscape dynamics

Blanco-Rodríguez, Miguel Ángel[1]; Ametezgui, Aitor[2]; G. Alday, Josu[3]; Lecina-Diaz, Judit[4]; Pineda-Zapata, Sara[5]; Coll, Lluís[6]

(1) Forest Science and Technology Centre of Catalonia (CTFC); (2) Universitat de Lleida; (3) Universitat de Lleida; (4) Technical University of Munich; (5) University of Eastern Finland; (6) Universitat de Lleida

Correspondence e-mail: [mblancorodriguez@hotmail.com]

Global change is posing significant challenges to Mediterranean forests, driven by the increasing frequency of high-severity wildfires and the ongoing process of landscape homogenization, which heightens the risk of large-scale fires. To address these challenges, it is critical to explore how wildfire characteristics, such as fire severity, drive changes in landscape heterogeneity. This study aimed to (1) assess the influence of pre-fire landscape patterns on post-fire landscape composition and configuration and (2) evaluate the impact of fire severity variability on changes in landscape heterogeneity. Using a novel land cover database, fire severity data and landscape metrics (SHDI, Mean Patch Area), we analyzed changes across 225 landscapes within 45 fire perimeters that burned between 2002 and 2004 in continental Spain. Our findings revealed that landscapes with greater pre-fire heterogeneity exhibited higher stability in both composition and configuration compared to more homogeneous areas. Additionally, we identified a significant interaction between fire severity and pre-fire landscape configuration: high variability in fire severity reduced the size of small and medium pre-fire patches while increasing the size of previously larger patches. These results provide valuable insights into the medium-term effects of fire on landscape composition and configuration highlighting the importance of fire severity variability as a key factor in shaping post-fire landscape structure.

[TSE.1-O-7]

Tuesday 3, morning (first): 11:00
Room: Seminario 7

Climate-Driven Regime Shifts and Biodiversity Loss in Island Lake Ecosystems: Evidence from the Azores Archipelago

Gonçalves, Vitor[1]; Pla-Rabes, Sergi[2]; Matias, Miguel[3]; Vázquez Loureiro, David[4]; Marques, Helena[5]; Bao, Roberto[6]; Buchaca, Teresa[7]; Hernández, Armand[8]; Giralt, Santiago[9]; Sáez, Alberto[10]; Simpson, Gavin[11]; Nogué, Sandra[12]; Raposeiro, Pedro[13]

(1) CIBIO, Research Centre in Biodiversity and Genetic Resources - Polo Açores; (2) Universitat Autònoma de Barcelona; (3) Museo Nacional de Ciencias Naturales; (4) GRICA Group, Centro Interdisciplinar de Química e Bioloxía (CICA); (5) CIBIO, Research Centre in Biodiversity and Genetic Resources - Polo Açores; (6) GRICA Group, Centro Interdisciplinar de Química e Bioloxía (CICA); (7) Integrative Freshwater Ecology (CEAB-CSIC); (8) GRICA Group, Centro Interdisciplinar de Química e Bioloxía (CICA); (9) Geosciences Barcelona (GEO3BCN) CSIC; (10) Department of Earth and Ocean Dynamics, UB-Geomodels Research Institute, Universitat de Barcelona; (11) Department of Animal and Veterinary Sciences, Aarhus University; (12) Universitat Autònoma de Barcelona, Bellaterra; (13) CIBIO, Research Centre in Biodiversity and Genetic Resources - Polo Açores

Correspondence e-mail: [vitor.mc.goncalves@uac.pt]

Global warming drives abrupt regime shifts in freshwater ecosystems, yet regional-scale ecosystem responses remain poorly understood. To address this gap, we analyzed diatom sedimentary records spanning the last 170 years from five lakes on São Miguel Island (Azores Archipelago). Using hierarchical generalized additive models, we identify an island-wide regime shift in diatom communities around 1982 CE, coinciding with Northern Hemisphere temperatures exceeding 0.35°C above the 20th-century mean. This shift is characterized by a loss of benthic diatom diversity and dominance of small, planktonic species, driven by warming-induced changes in lake stratification and mixing regimes. Regionally, diatom diversity declined by 27%, reflecting species losses and functional homogenization across lake ecosystems in the island. While individual lakes exhibited varying responses influenced by local anthropogenic impacts (e.g., eutrophication, fish introduction), the overriding regional coherence highlights climate warming as the principal driver. Our findings highlight the vulnerability of island freshwater ecosystems to global climate change, exacerbated by historical human disturbances. This work emphasizes the importance of multi-lake, regional-scale approaches for understanding ecosystem resilience and biodiversity loss, providing a framework for conservation and restoration strategies in freshwater systems under climate stress.

[TSE.1-O-8]

Tuesday 3, morning (first): 11:15
Room: Seminario 7

Unravelling the spatial and temporal variability of natural disturbances in European forests

Miguel Romero, Sofia[1]; Lines, Emily[2]; Tanase, Mihai[3]; Viana-Soto, Alba[4]; Senf, Cornelius[5]; Ruiz- Benito, Paloma[6]

(1) Universidad de Alcalá; (2) University of Cambridge; (3) Universidad de Alcalá, Colegios; (4) Technical University of Munich; (5) Technical University of Munich; (6) Universidad de Alcalá, Colegios

Correspondence e-mail: [sofia.miguelr@uah.es]

Introduction. The impact of natural disturbances in European forests is increasing due to intense and prolonged droughts, more severe and frequent storms and fires, and large-scale insect outbreaks. Although there is a comprehensive understanding of forest disturbance dynamics in Europe (i.e., usually small-scale, stand replacing events with increasing frequency), the spatio-temporal variation of disturbance regimes from different natural agents has not been consistently compared at large scales.

Material and methods. Here, we used the Landsat-derived European Forest Disturbance Atlas database, to characterise the spatial and temporal variability of natural disturbances, including fires and windthrow/insect damage. Using the unsupervised clustering approach of Gaussian finite mixture models, we identified forests with similar disturbance patterns and compared their variability within and between biomes over three time periods (1985-1997, 1998-2009 and 2010-2023).

Results and discussion. The observed patterns of natural disturbances varied across space and time depending on the agent. Fire patterns were significantly different in the Mediterranean than in the temperate and boreal biomes, with higher percentage of forest disturbed and lower severity. Patterns of windthrow/insect damage in temperate forests differed from those in Mediterranean and boreal forests, with bigger areas affected and increased variability. Over time, the Mediterranean-type fire patterns occupied regions further north while the temperate-type windthrow/insect damage patterns extended towards the boreal and Mediterranean regions. Our results provide a better understanding of disturbance dynamics and their spatial and temporal variability, which is essential for quantifying the novelty of disturbance regimes in Europe.

[TSE.1-O-9]

Tuesday 3, morning (first): 11:30
Room: Seminario 7

Assessing Nature's Contributions to People in the River Gambia: the impacts of seawater intrusion

Solórzano, Ana[1]; Daffeh, Fabakary[2]; Peris Fons, Kim[3]; Marong, Fatoumata[4]; Camara, Abdoulie[5]; Gibba, Faback[6]; Bah, Momodou[7]; AM Touray, Ousman[8]; Nkamnebe, Amuzo[9]; Jallow, Mamodou[10]; Sanz Yus, Diego[11]; Ruiz Mallén, Isabel[12]; Ojea, Elena[13]; Cañedo-Argüelles, Miguel[14]; Catalán, Núria[15]; Rodríguez-Lozano, Pablo[16]

(1) IDAEA-CSIC, Spain; (2) School of Arts and Sciences, University of The Gambia, The Gambia; (3) Instituto de Diagnóstico Ambiental y Estudios del Agua (IDAEA), CSIC, Spain; (4) Gambia Environmental Alliance, The Gambia; (5) Ministry of Environment and Climate Change, The Gambia; (6) School of Arts and Sciences, University of The Gambia, The Gambia; (7) University of The Gambia, The Gambia; (8) University of The Gambia, The Gambia; (9) GREAT Institute, The Gambia; (10) Ministry of Fisheries & Water Resources, The Gambia; (11) Instituto de Diagnóstico Ambiental y Estudios del Agua (IDAEA), CSIC, Spain; (12) Universitat Oberta de Catalunya, Barcelona, Spain; (13) Future Oceans Lab, Universidad de Vigo, Spain; (14) Instituto de Diagnóstico Ambiental y Estudios del Agua (IDAEA), CSIC, Spain; (15) Center for Advanced Studies of Blanes (CEAB-CSIC), Spain; (16) Universidad Autónoma de Madrid, Madrid, Spain

Correspondence e-mail: [anasolel17@gmail.com]

Seawater intrusion promoted by climate change is a growing global issue with significant consequences for natural systems and human communities. In The Gambia, seawater has advanced up to 250 km upstream, leading to a complex socio-ecological challenge. Using the IPBES framework on Nature's Contributions to People (NCPs), rooted in the ecosystem services framework, we assess positive (material, non-material, and regulating) and negative NCPs of the river Gambia to local communities, and explore how seawater intrusion impacts those NCPs. We conducted 90 individual semi-structured interviews on 9 communities along the salinity gradient: three in seawater dominated zone, three in the brackish transition, and three in the permanently freshwater zone. Interviews were conducted by a mixed team of local and non-local researchers using multiple languages (Mandinka, Fula, Wolof, and English) to people connected to the river (e.g. fishermen, rice farmers, fish sellers) and community representatives, ensuring gender parity. Results show that the most widespread positive NCPs provided by the River Gambia were "food and feed" and "regulation of freshwater quantity, location and timing", both crucial for local livelihoods, while non-material NPCs were less commonly perceived. Negative NCPs such as salinization, erosion, human-wildlife conflicts, and drowning, underscore challenges faced by these communities. Notably, salinization impacts the provision of NCPs by the River Gambia, posing a significant threat in vital activities such as rice cultivation. By relying on local knowledge, these findings advance knowledge on the NCPs provided by the River Gambia and guide policy efforts to develop adaptation strategies to seawater intrusion.

[TSE.1-O-10]

Tuesday 3, morning (first): 11:45
Room: Seminario 7

Current and potential carbon storage of shrublands in Tenerife, Canary Islands

Rocafull Pérez, Elena[1]; Otto, Rüdiger[2]; Sierra Cornejo, Natalia[3]; Rodríguez Arvelo, Felipe[4]; Suárez, Isabel[5]; Fernández-Palacios, José María[6]; de Nascimento, Lea[7]

(1) University of La Laguna; (2) University of La Laguna; (3) University of La Laguna; (4) University of La Laguna; (5) University of La Laguna; (6) University of La Laguna; (7) University of La Laguna

Correspondence e-mail: [erocafull@fg.ull.es]

Terrestrial ecosystems, primarily forests, are the most important carbon sinks. In arid regions, however, shrublands also contribute substantially to carbon stocks. In the Canary Islands, shrublands cover approximately 50% of the land area, but there is virtually no information on their plant cover and biomass. This study aims to quantify the current contribution of Canarian shrublands to carbon storage and assess their potential for future sequestration, taking Tenerife as a model island. 102 plots of 400 m² each, representing nine plant communities, were characterised by measuring plant cover and aboveground biomass per unit area. Biomass of the most frequent and abundant scrub species was estimated through allometric equations built using volumetric data. Predictive models were developed to map carbon storage across the island's shrublands, incorporating climatic factors. Results were compared to the potential storage, estimated from the Canary Islands' potential vegetation map. Although shrublands store one-seventh (599 000 t C) of the carbon stored by forests (4 008 000 t C) in Tenerife, their importance lies in their extensive distribution area and potential for further development, since mature communities accumulate more biomass per unit area than secondary scrublands. Data on carbon storage is key to guiding management strategies that maximise carbon footprint compensation in the Canaries. Additionally, the developed allometric equations will provide a non-destructive method for calculating biomass in future studies. Beyond their natural value, the potential for carbon sequestration service performed by native shrublands underscores the importance of conserving and restoring natural and degraded scrublands in the Canaries.

[TSE.1-O-11]

Tuesday 3, morning (first): 12:00
Room: Seminario 7

Pasture resilience: phenological patterns, ecosystem services and critical thresholds in the face of climate change

Espírito Santo, Maria[1]; Oliveira, Maria Alexandra[2]; Nunes, Alice[3]; Serrano, Helena C.[4]; Silva, João Nuno[5]; Vaz, Pedro[6]; Eça, Pedro[7]; Cotrim, Helena[8]; Branquinho, Cristina[9]

(1) Centro de Ecologia, Evolução e Alterações Ambientais; & CHANGE; (2) Centro de Ecologia, Evolução e Alterações Ambientais; & CHANGE; (3) Centro de Ecologia, Evolução e Alterações Ambientais; & CHANGE; (4) Centro de Ecologia, Evolução e Alterações Ambientais; & CHANGE; (5) INESC-ID, Instituto Superior Técnico; (6) Centro de Ecologia, Evolução e Alterações Ambientais; & CHANGE; (7) Centro de Ecologia, Evolução e Alterações Ambientais; & CHANGE; (8) Centro de Ecologia, Evolução e Alterações Ambientais; & CHANGE; (9) Centro de Ecologia, Evolução e Alterações Ambientais; & CHANGE

Correspondence e-mail: [mmsanto@fc.ul.pt]

The seasonal dynamics of vegetation, in rain-fed permanent pastures, are largely influenced by regional climates, rendering these systems particularly susceptible to climate change. Alterations in pasture phenology can significantly impact the ecological functions that underpin primary productivity and the delivery of key ecosystem services such as carbon uptake. Understanding the environmental and anthropogenic drivers of variations in pasture phenology and ecosystem service delivery is critical to identifying vulnerable areas, mitigating risks, and sustaining ecological functions.

We examined annual phenology trends of permanent pastures along a climate gradient, using high-resolution remote sensing data and the XGBoost machine learning algorithms, to model its underlying climatic, topographic, edaphic, and anthropogenic drivers. We additionally quantified regulating and provisioning ecosystem services along the climate gradient, from field data on soil microbiome, pollinators, birds, and plant communities.

As a result, we identified three distinct regional clusters based on variations in the timings of the growing season and productivity metrics, predominantly influenced by bioclimatic variables, particularly summer temperatures, alongside climate, soil, and topography controls of water availability. We also identified drivers of ecosystem service delivery. Critical thresholds in the relationships between phenological groupings and ecological drivers indicated tipping points that could lead to ecosystem shifts. Our findings highlight the vulnerability of pasture ecosystems to climate change and advance our understanding of their ecological drivers. This knowledge can guide predictions of climate-induced impacts on ecosystem services, informing adaptive management strategies, to enhance resilience.

[TSE.1-O-12]

Tuesday 3, morning (first): 12:15
Room: Seminario 7

Recent decline of little bustard population in Spain is linked to agricultural intensification

Pachón, Marina[1]; Martínez-López, Javier[2]; Cañizares, José Antonio[3]; Cañizares, David[4]; Casas, Fabián[5]; Traba, Juan[6]; Morales, Manuel Borja[7]; Alcaraz-Segura, Domingo[8]; Picazo, Félix[9]

(1) Universidad de Granada; (2) Universidad de Granada; (3) Sociedad Albacetense de Ornitología; (4) Universidad Autónoma de Madrid; (5) Universidad de Granada; (6) Universidad Autónoma de Madrid; (7) Universidad Autónoma de Madrid; (8) Universidad de Granada; (9) Universidad de Granada

Correspondence e-mail: [marina.pme@gmail.com]

Farmland birds are among the most threatened group of terrestrial organisms. Their populations have experienced a severe decline due to agricultural intensification during the last decades. One of the most affected species is the little bustard (Tetrax tetrax), whose western breeding range is mostly concentrated in mainland Spain. After a dramatic population decline of nearly 50% during the past decade, it has been categorized as “endangered” in the Spanish Catalogue of Endangered Species. Despite clear evidence of this significant population decline, studies linking this trend to recent land-use changes remain scarce. Here, we analyze trends in the little bustard populations, land-use changes, and their relationships during the 21st century in Spain.

[TSE.1-O-13]

Tuesday 3, morning (second): 12:45
Room: Balconada

Assessing vulnerability of relevant sites for amphibian conservation through spatiotemporal analyses of global change factors in Europe

Tarjuelo, Rocío[1]; Ascensao, Fernando[2]; Aragón, Pedro[3]

(1) National Museum of Natural Science (CSIC); (2) Universidade de Lisboa; (3) National Museum of Natural Science (CSIC)

Correspondence e-mail: [rocio.tarjuelo@gmail.com]

Amphibians are among the most imperiled vertebrates, threatened by habitat loss and climate change. Here, we identified Relevant Sites for Amphibian Conservation (RSAC) in Europe, defined as areas having the highest taxonomic diversity and/or presence of endangered species. We determined the RSAC vulnerability to two major global change drivers, climate warming and road density. We examined temporal trends of temperature and precipitation over the past 40 years and the spatial distribution of roads, and integrated this information into a threat-level index to yield risk maps. We identified 525 UTMs, half of which are in Central and Eastern Europe and have high species richness and the highest levels of threat. The other half, distributed along the Mediterranean Basin, has high levels of endemism and occurrence of threatened species. Mean annual temperatures increased in almost all RSAC, but increments were smaller in the Mediterranean and Atlantic regions. RSAC in the Mediterranean showed changes towards shorter droughts and increasingly extreme rainfall, whereas RSAC in Central and Eastern Europe presented trends toward lower daily precipitation and fewer days of uninterrupted rainfall. The highest concentration of roads in RSAC of Central Europe and coastal areas of the Mediterranean may exacerbate the impacts of climatic changes, depleting populations and inhibiting population range shifts. The threat-level index was significantly lower within RSAC with high coverage of the Natural 2000. The observed regional differences in global change threats condition the actions needed to halt amphibian biodiversity loss.

[TSE.1-O-14]

Tuesday 3, morning (second): 13:00
Room: Balconada

Farmland abandonment and season drive scavenging dynamics in livestock-rewilded landscapes

Daza, Rocío R.[1]; Acebes, Pablo[2]; Olea, Pedro P.[3]

(1) Universidad Autónoma de Madrid; (2) Universidad Autónoma de Madrid; (3) Universidad Autónoma de Madrid

Correspondence e-mail: [dazaruizroci@gmail.com]

Introduction: Farmland abandonment is a widespread tendency across European mountain regions, which is triggering habitat encroachment through shrub regeneration and natural afforestation. However, its impact on vertebrate scavenger communities and ecological processes, such as the removal of small carcasses, remain poorly understood.

Material and methods: Through an experimental paired-plot design (grazed vs. abandoned-rewilded habitats), we monitored 99 small carcasses over two seasons (summer and winter) in traditional livestock grazing systems in the Guadarrama Mountains (central Spain) exposed to farmland abandonment. We evaluated how the composition and structure of the scavenger community as well as scavenging dynamics of small carcasses responded to habitat encroachment and seasonal changes.

Results and discussion: Habitat encroachment following farmland abandonment significantly altered the composition of the scavenger community and the ecosystem service of carrion removal. Rewilded habitats supported less diverse scavenger communities, with fewer species and individuals, dominated by mammalian facultative scavengers. In grazed habitats, almost all carcasses were consumed within five days, while in rewilded areas, carrion removal was 2.35 times slower, with longer detection, consumption, and removal times. Seasonal changes amplified these differences, with winter bringing more diverse, bird-rich scavenger communities, but also longer carrion removal times, especially in grazed habitats. Our study shows that farmland abandonment alters small carrion scavenging dynamics, reducing the effectiveness of carrion removal services and impairing bird scavengers, some of which are of conservation concern.

[TSE.1-O-15]

Tuesday 3, morning (second): 13:15
Room: Balconada

Comparative assessment of restored mine sites based on an integrative ecological quality index

Navarro Cano, Jose Antonio[1]; Muñoz Maluenda, Cristian[2]; Moya Pérez, Juan Miguel[3]; Esteve Selma, Miguel Ángel[4]

(1) INIA-CSIC; (2) Universidad de Murcia; (3) Universidad de Murcia; (4) Universidad de Murcia

Correspondence e-mail: [jantonio.navarro@inia.csic.es]

Introduction. Metal mining operations produce billions of tonnes of wastes during the ore processing annually, which are disposed in mine tailings. These sites keep soil metal contents above biological toxicity thresholds many years after abandonment. Metals can be transferred to other trophic levels from primary producers. Moreover, the physical infertility of tailings makes them prone to high rates of erosion, posing a threat for ecosystems. New restoration programs of these structures might first learn from previous restoration projects.

Material and Methods. Here we estimated the trajectory and current ecological status of 10 mining sites that were rehabilitated through different techniques in SE Spain across 30 years. For comparison, we quantified nine physical, chemical and biological parameters that were weighted to get a final Tailing Ecological Quality Index (TEQI). Thus, TEQI summarizes in a single value an overall estimate of the restoration success of the sites.

Results and Discussion. The NDVI, rate of annual plant cover increase and closeness to an undisturbed matrix were pivotal determinants of TEQI, thus contributing to an improved physical and ecological environment. The high bioaccumulation of metals in some of the studied plants advised against using them in future restoration projects without an effective waste isolation. The results indicated that a higher (and more expensive) intervention level did not guarantee a higher success compared to less complex (and cheaper) studied methods. This ecological index can be used as an integrative assessment method for other disturbed and restored ecosystems through fitting the relative weight of each component.

[TSE.1-O-16]

Tuesday 3, morning (second): 13:30
Room: Balconada

Road crossing structures can play a significant role for the connectivity of vertebrate populations in semi-arid protected areas

Bruno, Daniel[1]; Jiménez-Franco, María Victoria[2]; Estal-Daries, Goodwill[3]; Pujante-Expósito, Nuria[4]; Pérez-García, Juan Manuel[5]; Rodríguez-Caro, Roberto Carlos[6]; Graciá, Eva[7]; Giménez, Andrés[8]

(1) Universidad Miguel Hernández de Elche; (2) Universidad Miguel Hernández de Elche; (3) Universidad Miguel Hernández de Elche; (4) Universidad Miguel Hernández de Elche; (5) Universidad Miguel Hernández de Elche; (6) Universidad Miguel Hernández de Elche; (7) Universidad Miguel Hernández de Elche; (8) Universidad Miguel Hernández de Elche

Correspondence e-mail: [dbrunocollados@um.es]

Roads and railways are a major cause of habitat fragmentation with negative effects on the connectivity of vertebrate populations, particularly on threatened species. Road transversal structures could act as wildlife crossings, but they have been scarcely evaluated. Their effectiveness could vary depending on species traits, construction features and environmental factors. They can be ineffective for reptiles with limited movement ability as the spur-thighed tortoise (Testudo graeca), a threatened species by habitat fragmentation. To date, no evidence exists of T. graeca using intentional (specifically designed) or non-intentional (e.g. drainages) wildlife crossings. We evaluated the functionality of road crossing structures for vertebrates in two protected areas of Almería using camera traps, with a particular focus on species with conservation interest. We assessed spatial (crossing selection), seasonal and diurnal patterns during 2023-2024.

Camera traps recorded a total of 40 vertebrate species (16 mammals, 19 birds, and 4 reptiles) across 43 monitored crossings, including T. graeca—marking the first global evidence using wildlife crossings. In general, the individual crossings were more frequent in short and wide ones, suggesting an aversion to tunnel-like conditions. Temporal patterns showed higher terrestrial vertebrate activity during May–June and September–October, with mammals predominantly nocturnal and reptiles diurnal, as expected.

Testudo graeca, was detected using short passages without steps and with vegetation nearby in low-traffic roads. However, no individuals were detected on high-traffic roads as highways. Most crossings were detected on drainage structures, highlighting the need for specifically designed wildlife passages to optimize habitat connectivity for vulnerable species.

[TSE.1-O-17]

Tuesday 3, morning (second): 13:45
Room: Balconada

Dependency and behaviour of wintering Ring Ouzels on water points in an arid ecosystem in the Canary Islands

Burgos, Tamara[1]; González-Varo, Juan P.[2]; Illera, Juan Carlos[3]; Nogales, Manuel[4]; Rumeu, Beatriz[5]

(1) Universidad de Cádiz; (2) Universidad de Cádiz; (3) Universidad de Oviedo; (4) IPNA-CSIC; (5) Universidad de Cádiz

Correspondence e-mail: [tamaraburgos44@gmail.com]

Water is an essential resource that is particularly limiting in arid environments, where it is scarce and unpredictable. For birds, water is essential not only for hydration but also for thermoregulation through drinking and bathing. While most studies on avian water use focus on species-level patterns, individual-level data remain scarce. The Ring Ouzel (Turdus torquatus), a regular winter visitor to the high mountains of Tenerife (Canary Islands), is an ideal study species to investigate intra-specific water dependence in harsh environments. Thus, we examine the importance of water in the activity and drinking behavior of a key Ring Ouzel population in the Teide National Park. From December to March, camera traps were deployed at three water points during the species' wintering period. We recorded bird visits, water-drinking frequency, bathing behavior, and time spent at water points. Additionally, individual visits were identified by recognizing the individuals previously ringed (n = 9). A total of 2755 independent visits were recorded, with water consumption occurring in 65% of visits. Differences in visitation frequency and drinking behavior were observed among water points and individuals. Interactions between individuals revealed dominance behaviors, with some birds defending access to water resources. These findings highlight the critical dependence of Ring Ouzels on water in this arid ecosystem. Since the Canary Islands mark the southwestern range limit for this migratory species, climate change could alter migratory patterns and disrupt seed dispersal for endangered and endemic plants. Ensuring water availability is essential to conserving this vulnerable population and its ecological functions.

[TSE.1-O-18]

Tuesday 3, morning (second): 14:00
Room: Balconada

Scaling forest recovery: the governance of AI-powered precision restoration

Morales de Rueda, Fernando[1]; Kruger Nyasulu, Maganizo[2]; Castro Gutiérrez, Jorge[3]

(1) University of Granada; (2) Stockholm Resilience Center, Stockholm University; (3) University of Granada

Correspondence e-mail: [fernandomdr@ugr.es]

Introduction. The escalating biodiversity and climate crises underscore the urgency of implementing large-scale ecosystem restoration to counteract global forest degradation. However, high restoration costs and the lack of scalable methodologies pose significant barriers. Precision restoration, leveraged by artificial intelligence, offers a transformative and cost-effective solution to improve efficiency and accuracy in restoration efforts. This paper explores the critical need for governance frameworks to guide AI-driven restoration, ensuring the alignment of global restoration goals with local ecological and social contexts.

Materials and Methods. We analyze AI applications and governance practices across large-scale ecosystem restoration initiatives. Using qualitative case studies, we assess the integration of top-down and bottom-up approaches, equitable access to technology, and participatory governance. Our approach aims to distill actionable principles for scaling precision restoration across sectors and landscapes.

Results and Discussion. Key recommendations include fostering multi-stakeholder collaboration to bridge top-down policies with bottom-up participation, ensuring equitable resource distribution, and building local capacities. These principles are critical for addressing challenges in sustainability, knowledge sharing, and scalability. Precision restoration offers a promising pathway to meet international forest restoration targets, but its success depends on the development of robust governance systems that balance technological innovation with social inclusivity. Furthermore, creating financial incentives for precision restoration—adapted to nature's timeframes and focused not solely on the number of trees planted but also on ecosystem functionality—is essential for encouraging widespread adoption and success.

TSE.1. Posters

[TSE.1-P-1]

Tuesday 3
Discussion corner: Room 2

The role of terrestrial vertebrate scavengers in the utilization of waterfowl hunting carcasses in a Mediterranean wetland

Pessano Serrat, Tatiana[1]; Sebastián González, Esther[2]; Orihuela Torres, Adrián[3]

(1) Universidad Miguel Hernández; (2) Universidad de Alicante; (3) Universidad de Alicante

Correspondence e-mail: [tapesse@gmail.com]

Vertebrate scavengers play a crucial role in ecosystems by stabilizing food webs, accelerating nutrient recycling, and eliminating potential disease sources. In El Hondo Natural Park (SE Spain), a wetland of international importance for birds, periodic mortality events occur, such as the hunting of waterfowl. Uncollected hunting remains create predictable pulses of carrion utilized by different scavenger species. This study describes the community of terrestrial vertebrate scavengers and their patterns of consumption of carrion that simulates hunting in El Hondo. Thirty-nine waterfowl carcasses were placed after hunting events in three areas adjacent to the hunting reserves, and their consumption was monitored with camera traps. We recorded seven species of vertebrate scavengers, highlighting the role of the red fox (Vulpes vulpes) and the brown rat (Rattus norvegicus) as the main carrion consumers, although the latter showed lower efficiency, increasing the persistence time of carrion in the ecosystem. We also identified other vertebrate species, such as insectivorous birds, that consumed invertebrates attracted by the carrion. The results demonstrated that waterfowl hunting remains are used by a diverse community of vertebrates in wetlands. Additionally, our results suggest that hunting in protected areas can favour the presence of invasive species, such as the brown rat. This highlights the need to adequately manage the interactions between human activities and scavenger communities for the effective conservation of threatened ecosystems that are essential for biodiversity, such as wetlands.

[TSE.1-P-2]

Wednesday 4
Discussion corner: Room 2

Insect frass as a potential organic fertilizer to preserve soil health

Gómez-Brandón, María[1]; Bessigamukama, Dennis[2]; Probst, Maraike[3]; Klammsteiner, Thomas[4]; Su, Jian-Qiang[5]; Zhu, Yong-Guan[6]; Tanga, Chrysanthus Mbi[7]

(1) University of Vigo; (2) International Centre of Insect Physiology and Ecology, Nairobi, Kenya; (3) University of Innsbruck, Austria; (4) University of Innsbruck, Austria; (5) Institute of Urban Environment, Chinese Academy of Sciences; (6) Research Center for Eco-Environmental Sciences, Chinese Academy of Sciences; (7) International Centre of Insect Physiology and Ecology, Nairobi, Kenya

Correspondence e-mail: [mariagomezbrandon@gmail.com]

Introduction. The use of insects to convert low-value organic waste into high-quality larval biomass for food and feed has been gaining ever more significant attention. Insect frass fertilizer, the main residual stream of this bioconversion process, is emerging as a sustainable and novel input for improving soil health and crop production. However, research attention on its safety and microbial properties has yet to surface. Here, we sought to evaluate the composition and functionality of bacterial and fungal communities as well as the pathogenic and heavy metal content of frass fertilizers generated from eight insect species that were mass-produced at the International Centre of Insect Physiology and Ecology (Nairobi, Kenya)

Material and Methods. The concentration of heavy metals in the frass fertilizers was assessed by microwave-assisted acid digestion; and the determination of pathogenic bacteria including Escherichia coli, Bacillus cereus, faecal coliforms, Clostridum perfringens and Salmonella spp. by cultivation methods on selective media according to ISO standard methods. Microbiome analyses were performed through DNA extraction and ITS/16S marker gene amplicon sequencing on Illumina MiSeq.

Results and Discussion. Our results revealed the absence of Salmonella spp. in the frass fertilizers produced by all insect species, while the levels of other pathogens and heavy metals were within permissible limits for organic fertilizers. We found that 79 – 86% of the variations in bacterial and fungal communities in the frass samples were influenced by the species of insect used. Functional profiling also showed that bacteria were associated with antibiotic and phytohormone synthesis which reinforces the potential usefulness of insect frass as a valuable organic material.

[TSE.1-P-3]

Thursday 5
Discussion corner: Room 2

"What else?" Pinus pinea: survivors under extreme conditions. The case of the Llobregat Delta

Carmona Cruz, María[1]; Gutiérrez Merino, Emilia[2]; Hevia Cabal, Andrea[3]; Sánchez Salguero, Raúl[4]

(1) Universitat de Barcelona; (2) Universitat de Barcelona; (3) Universidad de Sevilla; (4) Universidad Pablo de Olavide

Correspondence e-mail: [mariacarcru@gmail.com]

Introduction. The Llobregat Delta (NE Spain), a site of national and international biodiversity importance, hosts habitats like Pinus pinea forests on fossil dunes. Despite its protection under the Natura 2000 Network, urbanization and land use changes have degraded these ecosystems. This study explores how climate change and competition influence the growth dynamics of these stressed coastal forests.

Material and methods. The study was conducted in two Pinus pinea stands located in Mediterranean coastal forests of the Llobregat Delta. Sampling was performed comparing dense vs. sparse stands in two sites. Five trees per site were sampled using a Trephor every 20–25 days over a period of two calendar years to monitor pace and pattern of tree ring formation. Both sites shared similar environmental conditions, including sandy soils, a saline phreatic water table, and marked interannual precipitation variability.

Results and Discussion. Our results showed that the sparser stand trees had more cells and wider tree rings. Additionally, these trees exhibited a longer growing period compared to those in denser stands. Environmental factors, particularly extreme hotter drought during 2022–2023, contributed to noticeable differences. Trees in the sparser stand were more sensitive to these conditions. Finally, our findings showed changes in the xylogenesis process, which could provide insights into how Pinus pinea could be adapted to survive under increasingly extreme environmental conditions.

[TSE.1-P-4]

Tuesday 3
Discussion corner: Room 2

Integrating multiple landscape management strategies to optimize conservation under climate and planning scenarios

Cánibe Iglesias, Miguel[1]; Hermoso, Virgilio[2]; Azevedo, João C.[3]; Campos, João C.[4]; Salgado-Rojas, José[5]; Sil, Ângelo[6]; Regos Sanz, Adrián[7]

(1) Doñana Biological Station (EBD-CSIC); (2) Doñana Biological Station (EBD-CSIC); (3) Mountain Research Centre - Polythecninc Institute of Bragança; (4) Centre For Research in Geospace Science - University of Porto; (5) Centre of Science and Forest Technology of Catalonia; (6) Research Centre in Biodiversity and Genetic Resources - University of Porto; (7) Misión Biológica de Galicia (MGB-CSIC

Correspondence e-mail: [miguel.canibe@ebd.csic.es]

Introduction. Climate and land-use change require careful application of management strategies, such as rewilding or traditional farming, which can be guided by systematic conservation planning. However, a single management strategy is often not enough to address the needs of heterogeneous landscapes. This study aims to secure biodiversity and ecosystem service supply under minimum fire hazard by combining management strategies under different climate scenarios and management priorities in the 'Meseta Ibérica' – Europe's largest Transboundary Biosphere Reserve.

Methods. As spatial inputs, we used the projected distributions of 207 species, 4 ecosystem services and fire hazard for the year 2050 under four management strategies (Afforestation, Rewilding, Traditional farming and Agroforestry) and two climate RCPs (4.5 and 8.5). Using the prioritization tool 'Prioriactions', we identified the areas where each management strategy would contribute most effectively towards achieving the management goals, obtaining spatial configurations integrating the four strategies. We tested the approach under three planning scenarios representing different management goals (Equally Weighted, Forest Maximizing and Open Maximizing).

Results and discussion. Using this novel approach, our simulations identified optimal areas for the allocation of each management strategy, including core areas that were stable across scenarios. These areas ensured that most management goals were achieved under an ideal management strategy when conservation goals were balanced across species and services, avoiding heavy trade-offs. Higher targets for forest species and carbon sequestration required a landscape dominated by afforestation, whereas prioritising open habitats and agriculture required a landscape dominated by traditional farming under RCP4.5 and rewilding under RCP8.5, with much higher fire hazard in this last case. Our study demonstrates that Meseta Ibérica can support a wide variety of habitats for biodiversity and ecosystem services, but doing so requires targeted management action to develop towards a sustainable and resilient landscape in the long term.

[TSE.1-P-5]

Wednesday 4
Discussion corner: Room 2

Short- and long-term changes after fire in the structure of Erica australis L. shrubland in Os Ancares (Lugo)

Cruz, Óscar[1]; Mourente, Roberto[2]; Roces-Díaz, José Valentín[3]; Reyes, Otilia[4]

(1) EPSE, University of Santiago de Compostela, Campus Terra, Lugo 27002, Spain; (2) Biology Faculty, University of Santiago de Compostela, Campus Vida, Santiago de Compostela, Spain; (3) University of Oviedo - CSIC - Principality of Asturias; (4) Biology Faculty, University of Santiago de Compostela, Campus Vida, Santiago de Compostela, Spain

Correspondence e-mail: [oscar.cruz@usc.es]

Shrublands cover large areas in Spain, and their current lack of use makes them susceptible to degradation processes and prone to large forest fires. Future climate change scenarios predict a transformation in fire behaviour, with fires becoming more intense, more severe and the fire season longer. The most extensive heathlands throughout the western peninsular are the montane and dense red heather (Erica australis) heathlands, located altitudinally from sea level up to 2000 m above sea level.

This study focuses on the SCI Ancares-Courel, where a forest fire burned 730 ha in 2006. Vegetation sampling was carried out 1, 2 and 17 years after fire. Recovery was quantified by recording vertical structure, overall horizontal cover and the most abundant woody species.

Abundant vegetation cover was detected between 0 and 50 cm and there was a notable increase in the cover of all strata between the two surveys considered, especially in the first vertical stratum (0-25 cm), which 17 years later showed cover values of almost 75%. One year after the fire, the cover corresponding to the empty soil was 66%, decreasing in the second year to 42% and 17 years later to 9%. Among the dominant woody species, E. australis, Erica cinerea L., Erica umbellata L. and Genista tridentata L. were recorded.

[TSE.1-P-6]

Thursday 5
Discussion corner: Room 2

Ground-dwelling spiders respond to post-fire logging strategies: A trait-based analysis in Mediterranean forests

Vilalta-Clapés, Quel[1]; Puig-Gironès, Roger[2]; Pons, Pere[3]; Bellvert, Adrià[4]

(1) Universitat de Girona; (2) Universitat de Barcelona; (3) Universitat de Girona; (4) CNR-IRSA

Correspondence e-mail: [quel.vilalta@udg.edu]

After most Mediterranean wildfires, complete wood extraction (conventional logging, CL) is performed for economic profitability. However, little is known about the effects of post-fire treatments on ecosystems, particularly on arthropods. Recently, a sustainable logging (SL) protocol has been developed to extract burned wood while minimizing habitat impact.

Here, we used a trait-based approach to analyze the effects of two post-fire treatments on vegetation and ground-dwelling spider communities in the northeastern Iberian Peninsula. In a 31-ha burned area, we applied two treatments (CL and SL) and left an untreated area (No Intervention, NI). Vegetation was sampled using 7 transects per treatment, and ground-dwelling spiders were collected annually with pitfall traps from 2017 to 2020, with an additional sampling year in 2023. Spiders were identified to species level when possible and assigned to functional traits. We applied generalized linear mixed models (GLMMs) to test the effects of treatments and years post-fire on vegetation recovery, spider abundance, and functional traits. Additionally, we assessed how vegetation influenced spider communities.

Results indicate that vegetation recovery was greater under SL compared to CL. Moreover, spider abundance appeared positively associated with areas of reduced vegetation. Additionally, our results suggest that SL treatments benefit spiders with forest-habitat-related traits. These findings suggest that sustainable logging may offer ecological benefits in post-fire forest management by promoting vegetation recovery and creating habitats that resemble those in no-intervention areas

[TSE.1-P-7]

Tuesday 3
Discussion corner: Room 2

Do population characteristics influence the germination response to fire? The case of Cistus salvifolius L. and Cistus psiloseplus Sweet. from two separate localities

Reyes, Otilia[1]; F. Riveiro, Sheila[2]; Cruz, Óscar[3]

(1) Biology. USC; (2) Biology. USC; (3) EPSE. USC

Correspondence e-mail: [otilia.reyes@usc.es]

Cistus salvifolius L. and Cistus psilodepalus Sweet. are two species that produce seeds with a hard, water-impermeable seed coat. Such seeds usually show physical dormancy of germination which can be broken by an agent that breaks the germination coat, e.g. fire. However, the degree of dormancy may vary from one population to another.

In this work we set out to evaluate the effect of the population origin on the response of both species to fire. For this purpose, we selected seeds of both Cistus species from two separate locations: the island of Ons in the PNMT Islas Atlánticas de Galicia and the locality of Salvaterra do Miño (Pontevedra). There are 50 km in a straight line between the two locations, but one of them is an island and the other is inland on the mainland. The seeds were subjected to heat, smoke, ash and charcoal treatments, which simulated the effects of a forest fire.

Both species showed stimulation of germination by moderate heat shocks and inhibition by high heat shocks and high ash concentrations. In the case of C. psilosepalus no differences were detected between seeds from both origins, however in C. salvifolius seeds from the inland population (Salvaterra) experienced higher germination control and higher germination percentages with smoke treatments than seeds from the island of Ons. These results open the door to further research, including genetic research.

[TSE.1-P-8]

Wednesday 4
Discussion corner: Room 2

Two sides of the same coin: Germinative response to fire in two Ericaceae species

Mourente, Roberto[1]; Cruz, Óscar[2]; F. Riveiro, Sheila[3]; Reyes, Otilia[4]

(1) Universidade de Santiago de Compostela; (2) EPSE, USC; (3) Biology, USC; (4) Biology, USC

Correspondence e-mail: [roberto.mourente@rai.usc.es]

Currently, the wildfire regime is changing due to climate change. Its trend is associated with greater frequency, intensity, and extent. These types of disturbances have an impact on the seed bank stored in the soil, as they alter its germination behavior. This affects the survival of the species and, consequently, the recovery of the ecosystem. Ericaceae are a family that has developed various adaptations to fire and have been well-studied in regions such as South America and Australia. This study focuses on the germination behavior of two Ericaceae species: Erica erigena R. Ross and Vaccinium myrtillus L. An experiment was designed in which various fire-related treatments were applied, including heat shocks, smoke exposure, ash, and charcoal. In this way, the germination percentage and speed of both species were determined. E. erigena is resilient to wildfires, as its germination is remarkably stimulated by heat shocks of 110ºC and by exposure to smoke. Conversely, V. myrtillus is highly sensitive, as most fire-related factors inhibit its germination. Both species showed very different germination responses to fires. In a future scenario with increased fire exposure, V. myrtillus could experience reduced reproductive capacity and a more restricted distribution. On the other hand, E. erigena can withstand these changes in the fire regime and may even benefit from these new scenarios.

[TSE.1-P-9]

Thursday 5
Discussion corner: Room 2

Modelling the effects of post-abandonment strategies on water resources and soil carbon stocks in Mediterranean mountains: application of RHESSys and CarboSOIL

Cortijos López, Melani[1]; Muñoz Rojas, Miriam[2]; Zabalza Martínez, Javier[3]; Llena, Manel[4]; Lasanta, Teodoro[5]; Nadal Romero, Estela[6]

(1) Instituto Pirenaico de Ecología (IPE-CSIC); (2) Universidad de Sevilla; (3) Instituto Pirenaico de Ecología; (4) Universidad de Lleida; (5) Instituto Pirenaico de Ecología; (6) Instituto Pirenaico de Ecología

Correspondence e-mail: [melani@ipe.csic.es]

Introduction. Farmland abandonment, caused by rural depopulation, is one of the primary forces of change affecting Mediterranean mountain regions since the mid-20th century. The consequences of this abandonment on ecosystem services remain highly uncertain, making their study and understanding especially important in the context of Global Change.

Material and methods. This study investigates how three post-abandonment management strategies—shrub clearing for pasture creation and agroforestry; secondary succession; and afforestation—could impact water resources and soil carbon storage in the future. The Leza Valley (Iberian System) was selected as the representative study area, and the IPCC's SSP2-4.5 climate scenario (the most likely according to current emission trends and regulations) was chosen. Two predictive models were used: RHESSys for streamflow projections, and CarboSOIL for soil carbon storage assessment. Additionally, two study periods were defined: the medium-term future (2035-2065) and the long-term future (2070-2100).

Results and discussion. The results revealed an increase in soil carbon storage across all management strategies, with afforestation achieving particularly notable gains. Shrub clearing and agroforestry emerged as the most beneficial strategy for streamflow projections, with an increase of over 40% by the end of the century. The interdisciplinary analysis, combined with the predictive models, proved to be a crucial and necessary tool for planning and decision-making in a Global Change scenario.

[TSE.1-P-10]

Tuesday 3
Discussion corner: Room 2

Recurrent wildfires disrupt soil microbial communities and increase soil carbon emissions in Atlantic shrublands

García Carmona, Minerva[1]; Sánchez-García, Carmen[2]; Girona-García, Antonio[3]; Salgado, Lorena[4]; Muñoz-Rojas, Miriam[5]; Santín, Cristina[6]

(1) University of Miguel Hernández de Elche; (2) Swansea University; (3) Biodiversity Research Institute (IMIB), CSIC-University of Oviedo-Principality of Asturias; (4) INDUROT, University of Oviedo; (5) IRNAS-CSIC; (6) Biodiversity Research Institute (IMIB), CSIC-University of Oviedo-Principality of Asturias

Correspondence e-mail: [minerva.garciac@umh.es]

Under the current human-induced global change, wildfires are becoming more frequent in many regions, altering ecosystem functioning. Fire-driven ecosystem imbalances can result in more carbon emitted, with positive feedback to global warming. Soil microbial communities are key drivers of ecosystem carbon fluxes, but their resilience to increasing fire recurrence remains poorly understood.

We examined the effects of recurrent wildfires on soil microbial communities in shrublands of NW Spain (Allande, Principality of Asturias), where fires are typically human-driven. Soils (0–5 cm depth) with increasing fire recurrence (0–4 fires over 40 years) were incubated for 90 days. To stimulate the soil microbial response, ash was added (1/10 w/w to fresh soil) as a microbial substrate commonly found in fire-prone environments. Microbial activity was measured by basal respiration, and community composition (fungi and bacteria) analyzed by metabarcoding.

Our results reveal profound shifts in microbial composition and functional response with increasing fire recurrence. Soils that remained unburned or burned once over the last 40 years exhibited similar microbial communities, whereas soils with higher fire recurrence (2–4 fires) showed higher alpha diversity and community dissimilarity. Ash addition amplified these differences, with the strongest response in soils observed with the highest fire recurrence. Elevated respiration rates in soils burned 4 times suggest accelerated mineralization of soil organic carbon. These results highlight that increased fire frequency disrupts microbial composition and carbon cycling, indicating vulnerability to carbon loss in fire-prone ecosystems. Understanding these dynamics is essential for predicting long-term soil resilience under changing fire regimes.

[TSE.1-P-11]

Wednesday 4
Discussion corner: Room 2

Bushfire effects on soil biodiversity and functions across contrasting ecosystems: arid grasslands, peatlands and mediterranean woodlands

Rocha, Francisco[1]; Machado de Lima, Nathali[2]; Ondik, Mercedes[3]; Lucas-Borja, Manuel Esteban[4]; Ooi, Mark[5]; Muñoz Rojas, Miriam[6]

(1) IRNAS-CSIC; (2) UNSW Sydney; (3) UNSW Sydney; (4) UCLM; (5) UNSW Sydney; (6) IRNAS-CSIC

Correspondence e-mail: [francis2work@gmail.com]

Climate change is causing warmer and drier conditions, leading to more frequent droughts and extended fire seasons, which are further amplifying the threat of bushfires. These changes are leading to a severe loss of above and belowground biodiversity and increased risk of soil degradation. Soil microorganisms control important ecosystem functions, e.g. nutrient cycling, plant productivity and climate regulation. However, we still know little about the impacts of bushfire on soil microbial communities. This presentation will highlight findings from field studies conducted in three contrasting Australian ecosystems, i.e., an arid grassland-shrubland in the Pilbara region (NW Australia), a peatland ecosystem in the upper Blue Mountains (New South Wales), and a Mediterranean woodland in Kangaroo Island (South Australia). These areas were impacted by bushfires and subject to different land management practices (mining and grazing). We collected soil samples from all areas (burnt and control) and conducted physicochemical and microbiological analysis including microbial abundance, community composition and diversity (through DNA extraction and amplicon sequencing of 16S rRNA/ITS genes). Here we evidence that both fire and land management have critical impacts on the soil microbial taxonomic and functional diversity (bacterial and fungal communities) driving changes in soil nutrient contents (C, N), among other key soil functions. These results highlight the key role of soil microbial communities as environmental indicators and provide a basis for future applied initiatives in conservation and restoration. We will also discuss the potential applicability of seed enhancement technologies such as biopellets, for conservation and restoration in burnt areas.

[TSE.1-P-12]

Thursday 5
Discussion corner: Room 2

Footprints or treads: an experimental assessment of the environmental impacts of trail running and mountain biking in a Mediterranean mountain

Gomez-Prieto, Francisco[1]; Benayas, Javier[2]; Faucha, Miguel[3]; Tejedo, Pablo[4]; Escudero, Adrián[5]; Leung, Yu-Fai[6]; Justel, Ana[7]

(1) Universidad Autónoma de Madrid; (2) Universidad Autónoma de Madrid; (3) Universidad Autónoma de Madrid; (4) Universidad Autónoma de Madrid; (5) Universidad Rey Juan Carlos; (6) North Carolina State University; (7) Universidad Autónoma de Madrid

Correspondence e-mail: [francisco.gomezp@estudiante.uam.es]

In recent years, the rise of outdoor sports activities has become one of the main challenges for managing protected natural areas. The lack of scientific knowledge about the ecosystem impacts of these activities can lead to misguided decision-making. This study focuses on two sports that have gained significant popularity in Spain the last decades: trail running and mountain biking. An experimental design was implemented to assess their effects.

The study was conducted in a mid-mountain forest clearing in La Pedriza (Sierra de Guadarrama National Park). Transects were established and subjected to varying levels of impact from both sports. The impacts and subsequent recovery were measured at four time points over the course of one year, using a series of biotic and abiotic indicators: soil compaction, vegetation measures (total cover, Simpson's index and community composition), and the abundance of free-living microarthropods and colony-forming units of bacteria.

The results point out that soil compaction and vegetation cover are the most significantly affected indicators. However, vegetation shows greater recovery compared to soil compaction, in which those effects persist over the long term. The marked seasonality of the Mediterranean climate plays a crucial role in modulating or mitigating these impacts over time. Furthermore, no significant differences in effects were observed between the two sports.

[TSE.1-P-13]

Tuesday 3
Discussion corner: Room 2

From Connectivity to Fragmentation: Understanding Biodiversity Patterns in Aquatic Networks

Equisuany, Anna[1]; Olmo, Carla[2]; Cunillera-Montcusí, David[3]; Boix, Dani[4]; Amore, Valentina[5]; Martín, Luís[6]; Quintana, Xavier D.[7]; Sala, Jordi[8]; Tornero, Irene[9]; Gascón, Stéphanie[10]

(1) University of Girona; (2) University of Girona; (3) HUN-REN Centre for Ecological Research; (4) University of Girona; (5) University of Girona; (6) University of Girona; (7) University of Girona; (8) University of Girona; (9) University of Girona; (10) University of Girona

Correspondence e-mail: [anna.equisuany@udg.edu]

Spatial connectivity and dispersal are key drivers of metacommunity assembly, shaping patterns of biodiversity across landscapes. However, changes in ecosystem connectivity, such as habitat fragmentation, represent a significant threat to these dynamics and the maintenance of biodiversity. In this study, we experimentally created three distinct metacommunity networks to investigate how different types of landscape fragmentation affect biodiversity at local and regional scales. Firstly, we created a centrality-isolation gradient within each metacommunity and analyzed how it shapes diversity and species composition. Secondly, we fragmented communities by disrupting connectivity in two of the metacommunities and evaluated their effects at local and regional scales. We used DNA metabarcoding to assess prokaryotic and eukaryotic biodiversity responses to the centrality-isolation gradient and fragmentation consequences. In the first part of the experiment, we observed a relationship between alpha diversity values and the centrality-isolation gradient, with species richness decreasing with isolation. The second part revealed that fragmented metacommunities exhibited greater compositional differences, and that beta diversity values increased in isolated communities. Our results demonstrate that both connectivity gradients and habitat fragmentation play pivotal roles shaping community assembly at local and regional scales. This underscores the need to consider spatial and temporal connectivity in ecological studies to better understand biodiversity patterns.

[TSE.1-P-14]

Wednesday 4
Discussion corner: Room 2

The role of spatial modularity determining metacommunity composition at local scale

Boix, Dani[1]; Equisuany, Anna[2]; Cunillera-Montcusí, David[3]; Quintana, Xavier D.[4]; Sala, Jordi[5]; Gascón, Stéphanie[6]

(1) University of Girona; (2) University of Girona; (3) HUN-REN Centre for Ecological Research; (4) University of Girona; (5) University of Girona; (6) University of Girona

Correspondence e-mail: [dani.boix@udg.edu]

The major role of environment, biotic interactions, and dispersal in defining metacommunity assembly is greatly acknowledged. However, the distribution of habitats within a landscape can largely change the strengths of these forces. In this sense, spatial modularity of habitat can play a role in community assembly favouring or diminishing these forces among the nodes of the same module more than with the nodes of the other modules. In this work we aim to unravel the relevance of pond network modularity and its impact on main metacommunity forces. To study this we performed a field study in a pond network in which ponds are distributed in modules. We sampled macroinvertebrate community and we measured water and pond characteristics. We checked three hypothesis in this study: 1) pond community composition will be more explained by spatial modularity than habitat characteristics, since not high differences in environmental filters exist among the ponds of all the network; 2) the relevance of spatial modularity w

[TSE.1-P-15]

Thursday 5
Discussion corner: Room 2

The Multifunctionality Index as an Integrated Measure to Evaluate the Impact of Disturbances on Ecosystem Services

Calvo, Leonor[1]; Fernández Guisuraga, Jose Manuel[2]; Marcos Porras, Elena[3]; Prieto Aguilar, Iván[4]

(1) University of Leon; (2) Faculty of Biological and Environmental Sciences; (3) Faculty of Biological and Environmental Sciences; (4) Faculty of Biological and Environmental Sciences

Correspondence e-mail: [leonor.calvo@unileon.es]

The multifunctionality index (MFI) is a comprehensive metric designed to assess the combined performance of multiple ecosystem services (ES) within a given area. This index is particularly valuable for evaluating the impacts of disturbances on ecosystem functionality and service provision. By integrating multiple ecosystem services into a single measure, the MFI captures synergies and trade-offs among services, offering a holistic understanding of ecosystem dynamics.

Forest fire severity is a key indicator of the impacts on soil and vegetation, and, consequently, on ecosystem functioning. In this context, applying the MFI could be a crucial tool for decision-making, helping to prioritize areas affected by high severity for post-fire recovery actions. The objective of this study is to demonstrate the importance of multifunctionality indices in evaluating changes in ecosystem services caused by fire severity across different ecosystem types.

We selected three large and extreme wildfires: Sierra de la Culebra Fire (Zamora, June 2022; 25,228 ha), Ladrillar/Monsagro Fire (Cáceres/Salamanca, July 2022; 11,927 ha), and Navalacruz Fire (Ávila, August 2021; 22,444 ha). For each wildfire, we evaluated vegetation and soil indicators to define ecosystem functions and services: climate regulation and erosion protection (regulating ecosystem services); primary production, photosynthesis, soil fertility, nutrient cycling, and soil quality (supporting ecosystem service); woody species diversity and aesthetic value (cultural ecosystem services); grass for livestock and wood production (provisioning ecosystem services). The combination of these functions and services was used to define ecosystem multifunctionality. The results will provide critical insights for prioritizing areas that require post-fire restoration interventions.

[TSE.1-P-16]

Tuesday 3
Discussion corner: Room 2

Roadsides as pollinator refuges in agricultural landscapes

D'Amico, Marcello[1]; Ruiz-Borrero, Antonio José[2]; Rivilla, Juan Carlos[3]; Rodríguez, Carlos[4]; Román, Jacinto[5]; Revilla, Eloy[6]; Ascensão, Fernando[7]

(1) Doñana Biological Station CSIC; (2) Doñana Biological Station CSIC; (3) Doñana Biological Station CSIC; (4) Doñana Biological Station CSIC; (5) Doñana Biological Station CSIC; (6) Doñana Biological Station CSIC; (7) University of Lisbon

Correspondence e-mail: [damico@ebd.csic.es]

Introduction. Human activities, such as agricultural intensification, significantly modify landscapes, leading to habitat destruction and fragmentation, key drivers of the global decline in pollinators. This study hypothesizes that habitats along roadsides and field margins can provide critical resources and refuges for pollinator communities, particularly in intensive agricultural areas.

Material and methods. Our study area was the Greater Doñana Ecosystem, in southwestern Spain. We established a 1-km² sampling grid with three land-use types: natural, extensive agriculture, and intensive agriculture. From this grid, we randomly selected 72 cells (24 per land use) to survey floral cover and pollinator abundance. In each cell, we set up three 40-meter-long parallel transects: one along the roadside, one in the field margin, and one in the matrix. Each transect included five 1-m² sampling plots spaced 10 meters apart. Surveys were conducted in three rounds from February to June.

Results and discussion. Pollinator abundance was higher in plots with greater floral cover. Our hypothesis was confirmed, as roadsides and field margins served as key refuges in intensive agricultural areas. However, pollinator abundance was higher along roadsides with low to medium traffic volumes, while field margins consistently supported more pollinators than roadsides, even when floral cover was accounted for. To sustain pollinator communities and the ecosystem services they provide, we recommend how to prioritize efforts to preserve, develop, and restore roadsides and, especially, field margins in areas with low to medium traffic, where their effectiveness is maximized.

[TSE.1-P-17]

Wednesday 4
Discussion corner: Room 2

Aridity and habitat type shape aboveground cavity-nesting solitary bee communities in olive agricultural landscapes

González-Robles, Ana[1]; Tarifa, Rubén[2]; Pérez, Antonio J.[3]; López-Orta, Antonio[4]; Salido, Teresa[5]; Herrera, José M.[6]; Rey, Pedro J.[7]

(1) Universidad de Jaén; (2) Estación Experimental de Zonas Áridas (EEZA-CSIC); (3) Universidad de Jaén; (4) Universidad de Jaén; (5) Universidad de Jaén; (6) Instituto de Investigación Vitivinícola y Agroalimentaria (IVAGRO), Universidad de Cádiz; (7) Universidad de Jaén

Correspondence e-mail: [agrobles@ujaen.es]

Introduction. Understanding how anthropogenic habitat degradation and increasing aridity due to climate change impact on insect communities is currently an important conservation issue. In particular, the decline of wild bee populations is a major concern in agricultural landscapes, which cover 44% of the Earth's surface. In this study, we examine how cavity-nesting solitary bee communities vary as a function of habitat and herb cover/richness (as proxies for farming intensification), and aridity (a proxy for rising temperatures and decreased rainfall) in olive agricultural landscapes across the Iberian Peninsula, where semiarid areas will dramatically increase along s. XXI.

Materials and methods. We sampled cavity-nesting solitary bee communities in 22 olive farms using bee trap nests (8 nests/farm). Within farms, we distinguished olive fields and adjacent semi-natural patches as habitat types. Herb cover and richness were recorded in the neighborhood of the nests. Aridity (ranging from 0.27 to 0.69) was obtained using the Global Aridity Index.

Results and discussion. Aridity and habitat type were the main drivers of variation in bee communities across farms. While bee species communities were generally similar across farms, species such as Osmia caerulescens and Osmia latreillei were associated with more arid localities. Moreover, O. caerulescens apparently prefer semi-natural patches, while O. latreillei was mainly linked to olive fields. Our results highlight the importance of maintaining remnant semi-natural patches within olive agricultural landscapes and promoting landscape heterogeneity to conserve the diversity and functionality of bee communities in Mediterranean olive groves.

[TSE.1-P-18]

Thursday 5
Discussion corner: Room 2

Preliminary results of the monitoring of the insect community in a periurban section of the Manzanares River (Madrid, Spain)

Mellado, Sergio[1]; Carbajosa González, Juan[2]; Villar López, Diego[3]; García Sánchez-Colomer, Manuel Ramón[4]

(1) Centre for Studies and Experimentation in Public Works (CEDEX); (2) Universidad Autónoma de Madrid (UAM); (3) Centre for Studies and Experimentation in Public Works (CEDEX); (4) Centre for Studies and Experimentation in Public Works (CEDEX)

Correspondence e-mail: [sergio.ibarra@cedex.es]

Introduction. This study evaluates insect communities as part of a monitoring campaign that started in 2023 to assess the recovery of the ecological and hydrological continuity in an ecologically degraded section of the Manzanares River located on the outskirts of the municipality of Madrid, Spain. Water from three large wastewater treatment plants reaches the river through outlets which disrupt the continuity of the gallery forest. We use insect communities as they are indicators of changes in soil, water, and air quality.

Material and methods. Airborne insects were collected using a vehicle-mounted trap. Monthly sampling was carried out since March 2023. We drove up and down a concrete road near the riverbank for a total of 10 km. Two transects were inspected on foot, identifying epigean invertebrates. Meteorological data was gathered for each sampling day. Pollinators and other taxa of interest (black flies or invasive species) were separately classified and analysed.

Results and discussion. We collected a total of 1284 flying insects belonging to 11 different orders. Pollinators, while not the most abundant, are the heaviest of flying insects. The most shocking finding is that insects were more abundant during autumn and winter months. Our main hypothesis is that air humidity is the limiting factor for small insects whilst heat benefits heavier flying insects such as bees, wasps, or hoverflies (Syrphidae) which are pollinators and were present independently of air humidity. Diversity in ground transects appears to be dependent on humidity levels.

[TSE.1-P-19]

Tuesday 3
Discussion corner: Room 2

Seed germination responses in abandoned semi-natural montane heathlands under laboratory-simulated conditions

Valbuena, Luz[1]; Taboada, Angela[2]; García-Llamas, Paula[3]; Ordás-Diez, Lara[4]; Rivera-Martínez, Raquel[5]

(1) Universidad de León; (2) Area of Ecology, University of León, E-24071 León, Spain.; (3) Dep. of General and Specific Didactics and Educational Theory, Univ. of León, E-24007, León, Spain; (4) Area of Ecology, University of León, E-24071 León, Spain.; (5) Area of Ecology, University of León, E-24071 León, Spain.

Correspondence e-mail: [luz.valbuena@unileon.es]

Rear-edge populations, located at the margins of a species' distribution, are critical for biodiversity and ecosystem resilience under global environmental change. Montane Calluna vulgaris heathlands, at the rear-edge of their distribution, have historically relied on management practices such as grazing, burning, and cutting to maintain biodiversity. These practices promoted Calluna rejuvenation through seed germination, preserving the heathlands. However, land abandonment and management cessation have led to ageing Calluna populations, threatening their persistence due to competition with grasses and encroaching shrubs/trees (e.g., Betula pubescens, Pinus sylvestris). Additionally, nitrogen accumulation from airborne deposition further compromises Calluna performance.

This study assessed the rejuvenation potential of these heathlands under simulated scenarios of fire severity, nitrogen deposition, and increased competition due to grass proliferation. Seeds were collected from three mature (>40-year-old) Calluna-heathlands and subjected to treatments including thermal shocks (60, 90, 120, and 150 ºC; exposure times: 5 and 15 min), nitrogen fertilisation, and absence of light. Seed germination rates (%) and times (weeks) were measured for Calluna vulgaris and Erica tetralix.

Results showed significantly lower germination rates for both species after 150 ºC shocks, as well as under nitrogen fertilisation and light absence. Germination time increased only for Erica tetralix under dark conditions. These findings highlight the vulnerability of rear-edge Calluna-heathlands to environmental stressors and the need for targeted restoration measures. Effective interventions can mitigate the impacts of land abandonment and promote the persistence of these ecosystems at their southernmost distribution limit.

[TSE.1-P-20]

Wednesday 4
Discussion corner: Room 2

How does forest management affect terrestrial vertebrates? A global review

Gilabert Cerdà, Sergio[1]; Belda Antolí, Antonio[2]; Bonet Jornet, Andreu[3]; Morant Echevarría, Jon[4]; Morcillo Julià, Luna[5]; Orihuela-Torres, Adrian[6]; Pérez-Granados, Cristian[7]; Soliveres Codina, Santiago[8]; Sebastián González, Esther[9]

(1) University of Alicante; (2) Estación Científica Font Roja Natura UA; (3) University of Alicante; (4) University of Alicante; (5) University of Alicante; (6) University of Alicante; (7) Forest Science and Technology Center of Catalonia; (8) University of Alicante; (9) University of Alicante

Correspondence e-mail: [sergio.gilabert1992@gmail.com]

Introduction. Forest management can increase resilience to climatic extremes, enhance conservation value, or foster win-win scenarios that balance conservation and sustainable exploitation. However, such management strategies may have varying effects depending on different groups of organisms, potentially undermining their crucial role on biodiversity conservation. Identifying the most viable practices that do not harm the fauna that inhabits managed forest areas is of great importance to promote sustainable development. We reviewed the literature on the impact of various forest management treatments on different vertebrate groups. We evaluated consistencies in their effects, and their dependency on the type of biome, type of treatments, management objectives, origin of the area or predominant tree family.

Materials and Methods. We conducted a systematic review on forest management effects on vertebrates across a wide range of habitats subject to forest management, from grasslands to mature forests and anthropogenic ecosystems, including forest plantations or restored degraded areas. We analyzed the impacts of various treatments including thinning, clearcutting, restoration, grazing, fire, chemical control, and their combinations.

Results and discussion. We identified 1,731 instances of forest treatments effects on terrestrial vertebrates across 117 studies. Of these, 35.1% (n=608) were negative, 37.8% (n=665) were positive, 26.7% (n=465) showed no apparent effect, and 0.17% (n=3) exhibited unimodal responses. The results show that restoration treatments yielded the highest number of positive effects on different vertebrate groups, while thinning or clearcutting generally have negative effects. This review provides valuable insights into the most effective forest treatments for biodiversity conservation for various species groups.

[TSE.1-P-21]

Thursday 5
Discussion corner: Room 2

Landscape simplification impact in spiders taxonomic diversity within olive groves

Tarifa, Rubén[1]; Pérez-Gómez, Álvaro[2]; González-Robles, Ana[3]; López-Orta, Antonio[4]; Salido, Teresa[5]; Pérez, Antonio J.[6]; Herrera, José M.[7]; Márquez, Francisco J.[8]; Rey, Pedro J.[9]

(1) Estación Experimental de Zonas Áridas (CSIC); (2) Estación Biológica de Doñana (CSIC); (3) Universidad de Jaén; (4) Universidad de Jaén; (5) Universidad de Jaén; (6) Universidad de Jaén; (7) Universidad de Cádiz; (8) Universidad de Jaén; (9) Universidad de Jaén

Correspondence e-mail: [atricapilla.15@gmail.com]

The olive grove is the permanent tree crop with the greatest area of cultivation in Europe and has huge potential for biodiversity in the Mediterranean region. However, the natural areas that accompany this crop have undergone a drastic reduction and homogenization in recent decades. This could impact not only the diversity it maintains at the landscape scale, but also the diversity it harbors within the crop field.

Here, we used the spider communities inhabiting olive grove fields and their adjacent natural areas, in 28 farms distributed across the Iberian Peninsula, to test how the area of natural habitats and the olive grove area, the diversity of land uses and the proportion of other crops at the landscape scale (1 km radius) affected within-crop spider genus diversity (alpha), beta diversity (between both habitats) and regional gamma diversity. In addition, we also explored how the vegetation cover of the olive grove affected the diversity components of spider community diversity.

We detected 10,015 spiders belonging to 126 genera. The alpha diversity of spiders within the crop field increased with the presence of natural areas at the landscape scale. Spider communities between olive grove habitat and semi-natural remnants were more similar (reduced beta diversity) as the proportion of olive grove and other landscape-scale crops increased. In addition, we detected that regional-scale diversity (gamma) was reduced as land-use diversity decreased. Our findings reveal the need to conserve and maintain natural areas in agroecosystems, as well as to encourage landscape heterogeneity to maintain species diversity within the crop field and at the regional level.

[TSE.1-P-22]

Tuesday 3
Discussion corner: Room 2

Protocols and advice for an integrated management of temporary ponds in peninsular Spain

Soto García, Pablo[1]; Arnanz, Christian[2]; Tomás-Martín, Marina[3]; Fernández-Zamudio, Rocío[4]; Serrano, Laura[5]; Alcorlo, Paloma[6]; Florencio, Margarita[7]

(1) Universidad Autónoma de Madrid (UAM), Madrid, Spain.; (2) Universidad Autónoma de Madrid (UAM), Madrid, Spain.; (3) Universidad Autónoma de Madrid (UAM), Madrid, Spain.; (4) Estación Biológica de Doñana, CSIC, Sevilla, Spain.; (5) Universidad de Sevilla, Spain.; (6) Universidad Autónoma de Madrid (UAM), Madrid, Spain.; (7) Estación Biológica de Doñana, CSIC, Sevilla, Spain.

Correspondence e-mail: [pablo.soto@uam.es]

Temporary ponds play a crucial role in biodiversity conservation, acting as stepping stones in pondscapes and harboring singular species. These ponds have been degraded over recent decades, facing threats as biological invasions, climate change and anthropogenic disturbances. The ClimaRiskinPond project sampled more than 200 temporary ponds across peninsular Spain from 2021 to 2024, developing a comprehensive methodology, addressing biotic and abiotic factors.

We selected the ponds along the latitudinal gradient, trough visual interpretation of Google Earth, PNOA and Sentinel imagery, identifying physical impacts, hydroperiod and inundation status. We conducted sampling based on pond size and microhabitat heterogeneity, from the edges to the deep areas. The macroinvertebrate and amphibian assemblages were sampled using dipnetting (1 mm mesh size). Zooplankton and ostracods were sampled filtering a volume of water (50 µm mesh size) and using integrated benthic samples (140 µm mesh size), respectively. Aquatic vegetation was characterized in-situ and pressed. We measured physicochemical variables in-situ (electrical conductivity, pH, dissolved oxygen concentration and turbidity), and took samples of the water column for posterior laboratory analyses (chlorophyll-a, dissolved inorganic phosphorous, total phosphorous, nitrate, nitrite, ammonium concentrations and alkalinity).

We identified several limitations and provided evidence-based recommendations to enhance the efficiency of sampling protocols, such as: establish a specific entity that integrates different aspects of territorial governance, the development of a satellite-derived hydroperiod layer, an adjustable protocol shared by researchers and administrations entities, and the creation of a long-term network to assess the anthropogenic pressures through multi-taxa monitoring of temporary ponds.

[TSE.1-P-23]

Wednesday 4
Discussion corner: Room 2

Land use transformations as drivers of wildlife population trends in mainland Spain

Acevedo, Pelayo[1]; Molina, Bianca[2]; Blanco-Aguiar, Jose Antoni[3]; Illanas, Sonia[4]; Fernández-López, Javier[5]

(1) Instituto de Investigación en Recursos Cinegéticos IREC (CSIC-UCLM-JCCM); (2) Instituto de Investigación en Recursos Cinegéticos IREC (CSIC-UCLM-JCCM); (3) Instituto de Investigación en Recursos Cinegéticos IREC (CSIC-UCLM-JCCM); (4) Instituto de Investigación en Recursos Cinegéticos IREC (CSIC-UCLM-JCCM); (5) Instituto de Investigación en Recursos Cinegéticos IREC (CSIC-UCLM-JCCM)

Correspondence e-mail: [pelayo.acevedo@uclm.es]

In recent decades, land use changes have transformed the land surface. Few studies have focused on the effects of these changes in modulating wildlife population dynamics. We aimed to relate land use changes to species trends of wild ungulates, lagomorphs and red-legged partridge.

To describe the most relevant transformation processes, we used CORINE land cover accounting layers for three time periods 2000-2006, 2006-2012 and 2012-2018 . These processes were urbanization (UR), conversion between crops (CA), abandonment of agricultural land (AA), deforestation (DF), reforestation (RF), conversion between natural covers (CR) and forest fires (FG). On the other hand, we estimated the slopes of species trend (from 2013-14 to 2017-2018), for Capra pyrenaica (?=0.44), Capreolus capreolus (?=0.52), Cervus elaphus (?=0.41), Sus scrofa (?=0.65), Oryctolagus cuniculus (?=0.03), Lepus sp. (?=-0.25) and Alectoris rufa (?=0.08) from collected hunting statistics. We modeled specific trends based on current climate and land uses in mainland Spain at province level and related the residuals to the abovementioned transformations.

Not all species responded equally to the transformations, although they were mostly able for accounting significant variation in trends. There is a negative effect of DF on the trend of C. capreolus (R2=0.16**) and a positive effect of FG on Lepus sp. (R2=0.11*). The trend of O. cuniculus was negatively associated with CR (R2=0.11·). Overall, the results showed that beyond the direct shifts in the distribution range of wild species, the transformation of land can explain the population trends experienced by some of these species.

TSE.2. Understanding the potential of managed ecosystems to mitigate climate change from an ecological perspective

Wednesday, 4 (11:00-12:30)

Room: Seminario 6

Land use change and the degradation of agroecosystems due to industrial agricultural practices is a major driver of biodiversity loss and greenhouse gas emissions. Impact attribution, however, often lacks an ecological context to make such attributions more accurate.

There is great potential to mitigate these problems by adopting ecological principles in agriculture, but only if impacts are attributed fairly to prevent counterproductive measures and trade-offs are also considered.

The objective of this session is to present case studies on mitigation in agroecosystems, studies that integrate Ecology in Agricultural Sciences to improve our understanding of ecosystem processes and interactions that contribute to mitigation, integrated assessments that consider the trade-offs of mitigation measures, as well as the application of ecological approaches for fair impact attribution.

This session is aimed at anyone interested in exploring the usefulness of ecological science approaches for climate change mitigation research.

Organizers:

• **María Almagro Bonmatí,** IFAPA Camino de Purchil, Área de Ingeniería y Tecnología Agroalimentaria

• **Pablo Manzano,** Basque Centre for Climate Change (BC3)

• **Daniel Ortiz Gonzalo,** Department of Geosciences and Natural Resource Management, Terrestrial ecosystems, University of Copenhagen.

TSE.2. Orals

[TSE.2-O-1]

Wednesday 4, morning (first): 11:00
Room: Seminario 6

Global warming will speed up carbon and nitrogen losses from decomposing plant residues by photodegradation in semiarid Mediterranean agroecosystems

Almagro Bonmatí, María[1]; Colombo, Sergio[2]; Santos, Rosemery[3]; Triano Cornejo, Ana[4]; Castro Rodriguez, Juan Castro Rodríguez[5]

(1) IFAPA Camino de Purchil; (2) IFAPA Camino de Purchil; (3) Escola Superior de Agricultura Luiz de Queiroz – Universidade de Sao Paulo; (4) IFAPA Camino de Purchil; (5) IFAPA Camino de Purchil

Correspondence e-mail: [maria.almagro.bonmati@juntadeandalucia.es]

The Common Agricultural Policy promotes the adoption of cover crops in woody crops to protect the soil against erosion and increase its organic matter content. However, it is unclear which is the best management practice for cover crops (brush cutter vs cultivator) to restore semiarid agricultural soils through carbon (C) and nitrogen (N) storage. This is because we still need to quantify the relative contribution of photo-degradation by solar UV radiation (that promotes direct losses of C and N from plant residues to the atmosphere) and microbial degradation (that promotes C and N inputs storage into soils) to cover crop decomposition and its implications for semiarid soil C and N balances.

To address this question, two parallel experiments were designed to assess the effects of global warming, solar UV radiation, and soil management, on the decomposition rates of cover crops. Litterbags containing different species were placed either on the soil surface, exposed or not to solar UV radiation, or buried into four semiarid soils representing a pedoclimatic gradient. After eight months, decay rates, C and N losses, microbial biomass and activity were estimated.

Solar UV radiation speed up cover crop decomposition rates and C and N losses by 20% under ambient conditions, and by 32% under warming. According to this, it is preferable to manage cover crops using a cultivator instead a brush cutter to avoid C and N losses through photodegradation while favoring soil C and N storage by microorganisms, thereby promoting positive C and N balances in semiarid agricultural soils.

[TSE.2-O-2]

Wednesday 4, morning (first): 11:15
Room: Seminario 6

Greenhouse gas emissions from wetland and paddy rice: a contextualization under an ecological lens

Martínez-Eixarch, Maite[1]; Pérez-Méndez, Néstor[2]; Manzano, Pablo[3]

(1) IRTA; (2) IRTA; (3) Basque Centre for Climate Change (BC3)

Correspondence e-mail: [maite.martinezeixarch@irta.cat]

Introduction. Biogenic methane constitutes a large portion of the footprint associated with livestock and cropping systems. Flooded rice agroecosystems are important sources of methane given the anaerobic decomposition of organic matter. Similarly, the anoxic soil in wetlands explains the large contribution of these natural systems to global methane emissions.

Flooded rice fields are semi-natural wetlands sharing functional similarities with natural wetlands including carbon cycling. Both systems are important methane sources while also potential sinks of soil (blue) carbon. Since most of the lowland rice fields have been converted from natural wetlands, attributing all emissions to anthropogenic methane – i.e., the “technosphere” – should be questioned, for some of these emissions are natural and inevitable – “ecosphere” – and shouldn’t be included in national GHG inventories.

Methods. We reviewed data from the Ebro Delta (Spain), and the Rhône Delta (France), two main wetland regions in Western Mediterranean, where both natural wetlands and rice paddies are interspersed. We characterized methane emission rates across time and soil carbon stock in both wetland types, allowing us to compare emission patterns and carbon budget between natural and rice fields.

Results. Methane emissions were high in both rice paddies and in natural wetlands flooded with freshwater. Soil carbon stocking is also promoted in such situations, highlighting the complexity of assessing the carbon budget in these wetland-like ecosystems. Our results highlight the need to consider ecosphere greenhouse gas emissions from the transformed natural ecosystem as a reference baseline emission to fairly evaluate food system impacts, especially when rewilding and natural ecosystem restoration are proposed as a climate mitigation strategy.

[TSE.2-O-3]

Wednesday 4, morning (first): 11:30
Room: Seminario 6

Impact of climate change mitigation strategies in rice farming on biodiversity and agroecosystem multifunctionality

Echeverría-Progulakis, Sebastián[1]; Martínez-Eixarch, Maite[2]; Llevat, Raul[3]; Jornet, Lluís[4]; Viñas, Marc[5]; Carreras-Sempere, Mar[6]; Guivernau, Miriam[7]; Sorribas, Xavier[8]; Expósito Creo, Alejandro[9]; Matamoros, Lluís[10]; Borrul, Josep[11]; Català-Forner, Mar[12]; Pérez-Méndez, Néstor[13]

(1) IRTA - La Ràpita; (2) IRTA - La Ràpita; (3) IRTA - Amposta; (4) IRTA - La Ràpita; (5) IRTA - Torre Marimon; (6) IRTA - Torre Marimon; (7) IRTA - Torre Marimon; (8) University of Castelldefels; (9) University of Castelldefels; (10) IRTA - La Ràpita; (11) IRTA - La Ràpita; (12) IRTA - Amposta; (13) IRTA - Amposta

Correspondence e-mail: [secheverriap@gmail.com]

Water-saving irrigation strategies have been globally implemented as climate change mitigation and adaptation practices in rice agroecosystems due to their effect decreasing methane emissions and water inputs. While these topics have been frequently studied in ecosystem management research, there is a lack of knowledge regarding their outcomes in terms of agroecosystem multifunctionality. Here we implemented a field-scale experiment to assess the effects of different water-saving irrigation practices (CF: constant flooding; MSD: mid-season drainage; and AWD: alternate wetting and drying) on i) the diversity of aquatic organisms across taxonomical groups (soil microorganisms, soil nematodes, macroinvertebrates, amphibians, decapods and fish), ii) the provisioning of multiple ecosystem services (carbon sequestration capacity, organic matter decomposition, weed and pest control, climate change mitigation, and grain yield) and iii) the biodiversity-multifunctionality links. Our results show contrasting effects across taxonomical groups, with some groups being favored by alternative irrigation strategies (e.g., microbial communities) while others being negatively affected (e.g., amphibians). Despite confirming a positive effect of AWD on climate change mitigation, we found a negative impact from a broader multifunctionality perspective. For instance, we found impaired carbon sequestration capacity, biological pest control, organic matter decomposition and grain yield in AWD, when compared to CF-managed fields. MSD was identified as a more conciliatory strategy, enhancing both biodiversity and multifunctionality. Finally, our analyses show decoupled outcomes between biodiversity and multifunctionality, as suggested by the no relationship between taxonomical diversity and multifunctionality indexes. We encourage further studies on potential trade-offs these strategies may cause between biodiversity conservation and ecosystem multifunctionality.

[TSE.2-O-4]

Wednesday 4, morning (first): 11:45
Room: Seminario 6

Opportunities to enhance long-term soil carbon storage in dehesas: an analysis of management change effects on carbon fluxes and fractions

Carrascosa Becerril, Alejandro[1]; Moreno Marcos, Gerardo[2]; Morales, Sara[3]; Frade, Cristina[4]; Igual, Mariano[5]; Valverde, Ángel[6]; Rolo Romero, Víctor[7]

(1) Universidad de Extremadura; (2) Universidad de Extremadura; (3) Universidad de Extremadura; (4) Instituto de recursos naturales y agrobiología de Salamanca (IRNASA); (5) Instituto de recursos naturales y agrobiología de Salamanca (IRNASA); (6) Instituto de recursos naturales y agrobiología de Salamanca (IRNASA); (7) Universidad de Extremadura

Correspondence e-mail: [alejandro_carrascosa@unex.es]

In the Iberian Peninsula there are more than 4 million hectares of dehesa whose potential for carbon storage depends on abiotic (climate, soil properties...), biotic (soil microbiota, vegetation characteristics...) and management factors. In this work we analyzed the effect of grazing exclusion (GE), legume enrichment (LRP) and rotational grazing (RT) on CO2 fluxes (NEE, GPP and RECO) and soil organic carbon fractions, compared to the conventional continuous grazing (CT).

We analyzed soil samples from 188 plots with different management and distributed along an environmental gradient. Particulate organic carbon (POC), mineral-associated organic carbon (MAOC), nutrient content, texture, pH and microbial communities (with PLFAs) were measured. On each plot, we also assessed vegetation functional traits (leaf and root), aboveground productivity and chemical properties. In addition, carbon fluxes were measured monthly on 60 of these plots for 2 years using portable flux chambers.

We found that management exerted important effects on carbon stocks and fluxes, partly through changes in vegetation characteristics, microbial communities and soil fertility. RT reduces NEE (indicating greater carbon sequestration) and increases MAOC stocks by 11% compared to CT. LRP increased GPP, but also RECO, and showed no significant effect on carbon stocks compared to CT. GE increased NEE and decreased POC stocks by 20% relative to CT. These results support the implementation of rotational grazing in Mediterranean grasslands to increase the mineral-associated carbon stock, which is less vulnerable to environmental changes. On the other hand, exclusion or abandonment of grazing could lead to a reduction in carbon stocks.

[TSE.2-O-5]

Wednesday 4, morning (first): 12:00
Room: Seminario 6

Key drivers of soil organic carbon dynamics in Quercus ilex L. dehesas of Extremadura

Torres Fernández del Campo, Judit[1]; Cañellas, Isabel[2]; Moreno-Fernández, Daniel[3]; González, Isabel[4]; Sánchez Gimeno, Benjamín[5]; Gómez-Giménez, Marta[6]; Guennet, Bertrand[7]; Moreno, Gerardo[8]; Hernández Mateo, Laura[9]

(1) Instituto de Ciencias Forestales, INIA-CSIC; (2) Instituto de Ciencias Forestales, INIA-CSIC; (3) Instituto de Ciencias Forestales, INIA-CSIC; (4) Instituto de Ciencias Forestales, INIA-CSIC; (5) INIA-CSIC; (6) Remote Sensing & Geospatial Analytics, GMV; (7) Laboratoire de Géologie, École normale supérieure, CNRS, PSL Univ., IPSL; (8) Universidad de Extremadura; (9) Instituto de Ciencias Forestales, INIA-CSIC

Correspondence e-mail: [judit.torres@inia.csic.es]

Introduction. Agroforestry systems have the potential to act as carbon sinks, largely influenced by their management and environmental conditions. However, these ecosystems show considerable spatial variability in their soil organic carbon (SOC). This study focuses on identifying key variables that influence SOC dynamic in Quercus ilex L. dehesas in Extremadura, aiming to better understand the processes that regulate it.

Methods. The process-based models YASSO15 and RothC were used to estimate SOC dynamics based on biomass data from trees, shrubs, and recruits across 491 plots from the National Forest Inventory (NFI) of Q. ilex-dominated dehesas in Extremadura, considering three NFI cycles: NFI2 (1991), NFI3 (2001) and NFI4 (2017). Climate information from CHELSA dataset was also incorporated into the process-based models. We used field SOC data from level 1 plots of the ICP-Forests Network (1995, 2008) to validate YASSO15 and RothC. SOC balance was calculated at plot level and analyzed using an explanatory model to identify significant variables associated with its variation. These variables, also derived from NFI data, include tree density, regeneration density, tree health, mortality rates, distance to the nearest rural settlement, and the occurrence of extreme climatic events.

Results and Discussion. The process-based models proved to be useful tools for evaluating SOC dynamics in Q. ilex dehesas. Results highlight variables such as regeneration to play a crucial role in SOC balance. We propose that agroforestry management practices aimed at protecting and promoting natural regeneration could significantly enhance the capacity of these ecosystems to function as effective carbon sinks.

[TSE.2-O-6]

Wednesday 4, morning (first): 12:15
Room: Seminario 6

Alternative views of climate metrics in livestock rangelands under herbivore ecology perspectives

Manzano, Pablo[1]; del Prado, Agustín[2]; Pardo, Guillermo[3]

(1) Basque Centre for Climate Change - BC3; (2) Basque Centre for Climate Change - BC3; (3) Basque Centre for Climate Change - BC3

Correspondence e-mail: [pablo.manzano@bc3research.org]

Introduction. Due to methane being a residual output of cellulose fermentation in the rumen, grazing livestock is considered a high emitter of greenhouse gases (GHGs), with more industrialized livestock keeping systems being regarded as less emission-intensive per unit of product. In addition, grazing livestock is often considered a net deforestation source, incurring into high Carbon Opportunity Costs. Both views, however, disregard the analogous role to wild ungulate herbivores that grazing livestock, especially if mobile, can have. To start quantifying such perspective is an urgent task that merges ecology with environmental accounting.

Methods. We studied two systems, one in Tanzania (Serengeti) and one in Spain (Montes de Toledo), where rich wild ungulate herbivore communities have been preserved and can be compared with local mobile pastoralist food systems. We used a combination of Life Cycle Analysis, in the Spanish case, and a calculation of emissions through Tier 1, 2a, 2b and allometric following IPCC guidelines.

Results. East African and European wild herbivore systems have a different degree of preservation, which impacts their emissions. The East African system, with a powerful guild of grazing ruminants, reaches emissions per km² that are comparable to the ones of the mobile pastoralist system. In the case of Spain, an impoverished herbivore guild dominated by intermediate feeders reaches, however, significant emissions that are up to 30% of the mobile pastoralist system – in turn, intensified through European agrarian practices.

TSE.2. Posters

[TSE.2-P-1]

Tuesday 3
Discussion corner: Room 3

Landscape and water management interaction effect on aquatic biodiversity and pest control in rice

Muñoz Escribano, Alejandro[1]; Alcaraz, Carles[2]; Pérez-Méndez, Néstor[3]

(1) IRTA Amposta; (2) IRTA La Ràpita; (3) IRTA Amposta

Correspondence e-mail: [alejandro.munoz@irta.cat]

Invasive pest species in agroecosystems are among the main drivers of crop loss worldwide. Rice fields are highly biodiverse agroecosystems because of their permanent flooding that provide freshwater habitat to a broad range of organisms. However, this is also exploited by invasive pests such as the rice water weevil (Lissorhoptrus oryzophilus), recently introduced in the Ebro Delta. The alternate wetting and drying strategy (AWD) aims to reduce pest damage but it is expected to trade off aquatic biodiversity, including natural predators. There is no information on how this affects biological pest control. Moreover, the effectiveness of local management practices may be mediated by landscape complexity.

The aim of this thesis is to investigate landscape and water management interactions and how they affect aquatic biodiversity and pest control in rice. Firstly, available literature will be synthetized to understand how this interaction shapes farmland biodiversity, pest abundance and pest suppression. Field experiments will evaluate weevil control, changes in aquatic natural enemy communities and rice yield under different water management regimes (AWD vs. conventional). Predator exclusion experiments will quantify their contribution to pest regulation. A landscape gradient approach will be used to assess how landscape complexity modulates these interactions.

The results of this thesis will serve to design regional scale control plans from a spatially explicit perspective that better reconcile the fight against invasive pest species, the conservation of aquatic biodiversity, the provision of ecosystem services, and rice production.

[TSE.2-P-2]

Wednesday 4
Discussion corner: Room 3

Predicting and Quantifying Methane Ebullition in Rice Fields Using Machine Learning

Estruch, Carme[1]; Alvarez, Nil[2]; Divina, Federico[3]; Garcia Torres, Miguel[4]; Ibañez, Carles[5]

(1) Eurecat; (2) Eurecat; (3) Universidad Pablo de Olavide; (4) Universidad Pablo de Olavide; (5) Eurecat

Correspondence e-mail: [carme.estruch@eurecat.org]

Introduction. Rice paddy fields are a major source of global methane (CH4) emissions, contributing an estimated 20–24%. Methane is released through two continuous pathways—diffusion and plant-mediated transport—and through ebullitive events, characterized by sudden bursts of gas. While continuous emissions are well understood, predicting ebullition remains a challenge due to its stochastic nature. This study assesses the performance of machine learning (ML) algorithms in predicting and quantifying the presence of methane bubbles to improve emission models.

Methods. Data were collected from rice paddies in the Riet Vell natural reserve (Delta de l'Ebre, Spain) using a closed-chamber method coupled with an IRGA system (LI-COR 7810). Environmental parameters were recorded. Ebullitive events were identified while continuous fluxes were calculated by excluding bubble-related data.

The ML analysis followed two stages:

1. Prediction of Bubble Presence/Absence: Tested models included Decision Tree, Naïve Bayes, Random Forest, Neural Networks, and SVM.

2. Quantification of Ebullitive Fluxes: Regression models, including Random Forest Regressor, were applied.

To address dataset imbalance, techniques such as SMOTE, Random oversampling and ADASYN were implemented, and feature selection was performed to optimize model performance.

Results. Combining balancing techniques and feature selection significantly enhanced model accuracy. A tree-based algorithm showed promise for predicting ebullition and estimating methane fluxes.

Conclusion. ML algorithms offer a robust approach to predicting and quantifying methane ebullitive emissions, improving the accuracy of CH4 emission models and supporting targeted mitigation strategies in rice agriculture.

TSE.3. Ensuring the ecological effectiveness of the EU Common Agricultural Policy 2023-2027

Thursday, 5 (15:30-17:00)

Room: Balconada

Agriculture in Europe has been largely driven by the Common Agricultural Policy (CAP). Its last reform will be enforced from 2023 to 2027, and it seeks to be socially fairer, greener and more performance-based than previous periods. Adaptive management, including compulsory direct evaluation of environmental effectiveness, is a key new feature of the current CAP. This session will present current state of research aimed at developing evaluation and monitoring tools to ensure CAP effectiveness to improve biodiversity and its associated ecosystem services. Spanish and Portuguese case studies are especially relevant due to its disproportionate share of agrosystem biodiversity within Europe, as well as recent basic and applied research on it.

Organizers:

• **Mario Díaz,** Department of Biogeography and Global Change (BGC-MNCN), Museo Nacional de Ciencias Naturales, CSIC

• **Elena Velado Alonso,** Functional Agrobiodiversity & Agroecology Group, Georg-August University Göttingen

• **Sonia Roig-Gómez,** Departamento de Sistemas y Recursos Naturales, Universidad Politécnica de Madrid.

TSE.3. Orals

[TSE.3-O-1]

Thursday 5, after lunch (third): 15:30
Room: Balconada

The new funding structure of the Common Agricultural Policy (CAP) 2023-2027: implications for biodiversity conservation

Díaz, Mario[1]; Roig, Sonia[2]; Velado-Alonso, Elena[3]

(1) Museo Nacional de Ciencias Naturales; (2) Universidad Politécnica de Madrid; (3) Georg-August University Göttingen

Correspondence e-mail: [Mario.Diaz@ccma.csic.es]

Agriculture in Europe has been largely driven by the Common Agricultural Policy (CAP), whose main aim is to ensure food security while maintaining a fair standard of living to farmers. After reaching food security, environmental and rural development issues became key strategic goals of the CAP, although they have never been evaluated systematically. The last CAP reform (2023-2027) seeks to be socially fairer, greener and more performance-based than previous periods, on the basis of a new 'Green Architecture' of subsidies. Member States have now designed their own CAP Strategic Plans with explicit environmental goals aligned with the EU Directives and strategies (Green Deal, Farm-to Fork strategy, etc.). Compulsory direct evaluation of the environmental effectiveness of Strategic Plans, and adaptive change of Plans according to evaluations, is a key new feature of the current CAP. Here we will outline the Green Architecture of the current CAP, how has it been incorporated to the Spanish Strategic Plan, and how the Spanish government is evaluating its biodiversity goals with the scientific support of the CSIC. Selected examples of ongoing initiatives will complement the Symposium, discussing the pros, cons and potential of current CAP for European biodiversity conservation.

[TSE.3-O-2]

Thursday 5, after lunch (third): 15:45
Room: Balconada

Biodiversity conservation under the Common Agricultural Policy (CAP) 2023-2027: the AGRIAMBIO proposal for monitoring its effectiveness

Clemente Orta, Gemma María[1]; Diaz, Mario[2]; Torre, Salustiano[3]; Concepción, Elena D.[4]

(1) MNCN (CSIC); (2) MNCN (CSIC); (3) MNCN (CSIC); (4) Universidade do Porto

Correspondence e-mail: [gemma.clemente@mncn.csic.es]

The Spanish Strategic Plan for the implementation of the CAP 2023-2027 includes interventions aimed explicitly to protect biodiversity and its associated ecosystem services. Under the current CAP framework, Member States are required to evaluate the effectiveness of these interventions in achieving their objectives and to modify them if they fall short. We are developing, under the MAPA-CSIC-funded Thematic Platform AGRIAMBIO (www.pti-agriambio.csic.es), a sampling and analytical protocol to evaluate whether the application of interventions improve biodiversity indicators (e.g., farmland birds, landscape features, pollinators, weeds, and other species protected by the EU Birds and Habitats Directives) in comparison to appropriate controls at both the regional and national levels. The protocol will propose census and pairing methodologies, sample sizes, sampling efforts, and the geographical distribution of samples. It will also provide guidance on distribution of sampling effort among citizen science initiatives and professional monitoring platforms.

[TSE.3-O-3]

Thursday 5, after lunch (third): 16:00
Room: Balconada

Enablers and barriers for the uptake of carbon farming in Dehesa agroforestry and Mediterranean rainfed cereal cropping systems in Spain

Hernández Mateo, Laura[1]; Torres, Judit[2]; Santín, Ines[3]; Moreno, Gerardo[4]; Muñoz, Jose Luis[5]; Gómez Gimenez, Marta[6]; Goberna, Marta[7]; Gabriel, Jose Luis[8]; Declich, Andrea[9]; Colonnello, Claudia[10]; Sánchez-Moreno, Sara[11]; Cañellas, Isabel[12]; Sánchez, Benjamín[13]

(1) CSIC; (2) ICIFOR-INIA, CSIC; (3) INIA, CSIC; (4) Universidad de Extremadura; (5) IVEI- AISEAM; (6) GMV; (7) INIA, CSIC; (8) INIA, CSIC; (9) K&I; (10) K&I; (11) INIA, CSIC; (12) ICIFOR-INIA, CSIC; (13) INIA, CSIC

Correspondence e-mail: [lauhmateo@gmail.com]

Introduction: Current carbon farming (CF) policies are designed to mitigate greenhouse gas emissions, but their success depends on farmer's adoption of alternative CF practices. Considering the upcoming regulation of the voluntary carbon market (VCM) in Europe, this work identifies the barriers and opportunities regarding the application of CFPs in Mediterranean semiarid rainfed cereal crops and dehesa agroforestry systems in Spain around three topics: CFPs, VCM, and monitoring, reporting and verification (MRV) methodologies for soil carbon assessment.

Methods: Data was acquired in a two-stage process involving 50 selected stakeholders representing key actors related to the uptake of CFPs, including landholders/farmers unions, national and regional administration, auditors of VCM-related projects, experts in MRV and researchers.

Results and discussion: The key identified barriers were related to the low and slow C stocking potential of Mediterranean agroecosystems, lack of long-term reference/baseline information, lack of financial support for both the adoption of CFPs and MRV methods, VCM associated bureaucratic burdens and costs, potential associated yield reductions, lack of farmers' knowledge/experience on how to adopt CFPs to specific pedoclimatic conditions, and the potential incompatibility of CAP-incentives with the EU Carbon Farming Removal Certification Framework scheme (EU CRCF). Some opportunities included increasing economic incentives to investigate and reduce knowledge gaps, harmonizing regulation and MRV methods, simplification of requirements and procedures associated to VCM and MRV, launching Living Labs as tools to accelerate the adoption of CF practices, enhancing the association between farmers to reduce risk when adopting CFPs and the environmental co-benefits related to CFPs.

[TSE.3-O-4]

Thursday 5, after lunch (third): 16:15
Room: Balconada

How many European bees can benefit if we boost pollinator conservation in farmlands?

Bartomeus, Ignasi[1]

(1) EBD-CSIC

Correspondence e-mail: [nacho.bartomeus@gmail.com]

Introduction: Despite the expansion of agricultural areas being a clear threat to biodiversity, sustainable management of productive landscapes also offers opportunities for their conservation. In particular, pollinating insects, including thousands of species of bees, are a key target group since their conservation is linked to a vital ecosystem service provision, the pollination of wild plants and crops. Indeed, the conservation of pollinators in agricultural systems is gaining momentum, for example, under the EU Common Agricultural Policy. However, the proportion of bee fauna potentially benefiting from these actions, in comparison to targeting other habitats, is unknown. Hence, it is urgent to provide policymakers with a rigorous assessment of the effects that different conservation policies can have on bee conservation.

Methods: We synthesize more than 20 agricultural conservation studies across the EU and quantified the diversity of bee species visiting the crop and visiting other plants species benefited by the conservation actions. Then, we compare those numbers with the regional pool of species, including those in occurring in natural areas bu using rarefaction curves.

Results and Discussion: While only a small fraction of bees visit the cultivated crops, more than 50% of the bee fauna occur withing agricultural areas when considering interventions such as flower stripes and field margins. Interestingly, this species include endemic and rare species, highlighting the potential of agricultural conservation actions to protect a wide fraction of bee biodiversity. If agricultural conservation measures can maintain a high proportion of pollinators, including threatened species, redoubling efforts in these landscapes is fully justified, especially as they are the dominant habitat type in many countries, therefore, it is imperative to know what percentage of pollinators can be conserved in agricultural landscapes, especially of threatened pollinators to develop informed effective conservation policies.

[TSE.3-O-5]

Thursday 5, after lunch (third): 16:30
Room: Balconada

Successful green cover establishment for beneficial arthropods in orchards is influenced by farm management intensity

Ploeg, Remco[1]; Rodriguez Ballesteros, Alberto[2]; Bartomeus, Ignasi[3]; Kleijn, David[4]; Scheper, Jeroen[5]; Velado-Alonso, Elena[6]

(1) Wageningen University & Research; (2) Wageningen University & Research; (3) Estación Biológica de Doñana; (4) Wageningen University & Research; (5) Wageningen University & Research; (6) Estación Biológica de Doñana

Correspondence e-mail: [remco1.ploeg@wur.nl]

Due to their permanent nature and large proportion of uncultivated area, orchards provide a promising opportunity for restoration measures to support biodiversity. Green covers are a commonly applied agri-environmental measure in orchards, but their effectiveness in supporting biodiversity is variable. Among other things, mediating effects of orchard management intensity possibly cause this variability in outcomes. The ecological contrast hypothesis predicts that the biggest effect on biodiversity is most easily created in those places where it is degraded most by intensive management. However, biodiversity is also known to decrease exponentially with management intensity, leading to the prediction that recovery is slowest in intensively managed sites.

By seeding flowering green covers in part of the alleyways of 15 stone fruit orchards differing in management intensity, we tested if the effect of the green cover on biodiversity is influenced by management intensity. Biodiversity metrics included several beneficial arthropod groups that have the potential to deliver valuable ecosystem services to orchards, such as pollination and pest control. Compared to the alleyways that were not sown, green covers increased abundance and species richness of all arthropod groups under all levels of management intensity. However, the effect size on pollinators significantly increased with management intensity, caused by an increase in abundance and species richness in green covers with management intensity. Potential causes of this positive response to management intensity, differences between species groups, as well as implications on agri-environmental measure allocation, will be discussed.

[TSE.3-O-6]

Thursday 5, after lunch (third): 16:45
Room: Balconada

Predicting biodiversity-driven ecosystem services in agricultural landscapes

Morán López, Teresa[1]; Miñarro, Marcos[2]; Jiménez-Albarral, José Javier[3]; Illera, Juan Carlos[4]; García García, Daniel[5]

(1) Universidad de Oviedo; (2) Servicio Regional de Investigación y Desarrollo Agroalimentario (SERIDA); (3) Servicio Regional de Investigación y Desarrollo Agroalimentario (SERIDA); (4) Universidad de Oviedo; (5) Universidad de Oviedo

Correspondence e-mail: [moranteresa@uniovi.es]

Evaluating the environmental sustainability of agricultural management practices is one of the goals of the new Common Agricultural Policy. In this context, inferring the ecological drivers of biodiversity conservation and ecosystem services is key to design effective actions. We often estimate the impact of management in the light of changes in community-level metrics (e.g., functional diversity). However, if species differ in their response to management (due to their environmental niche) or in their functional effects (due to their abundance or capabilities to deliver services), community metrics may not be sensitive enough.

We design a joint species model that predicts community-assembly and service provision following the “effect-response” trait framework (JSM-Ser, hereafter). We tested model performance with in silico experiments and field data of pest control by birds in apple orchards of the Asturian region. JSM-Ser accurately predicted communities and services in simulated and real datasets. In apple orchards, it detected environmental features with an overall positive effect for birds (i.e., high canopy covers within apple plantations), and others with opposed effects across species (i.e., forest cover in the orchard vicinity and orchard size). For instance, maintaining a high forest cover favors insectivorous birds, but decreases the presence of species more prone to cross open habitats. Pest control depended on the abundance of insectivorous birds, increasing in orchards with forest in the surroundings and dense apple tree canopies. Overall, our work evidence that retaining information at the species level allows us to better predict service provision in agroecosystems and design targeted actions.

TSE.3. Posters

[TSE.3-P-1]

Wednesday 4
Discussion corner: Room 3

Methodological approach to assess efectiveness of manual and cattle-driven clearing in extensive livestock grazing in the Madrid region (Spain)

Fernández-Soleto, Patricia[1]; Márquez-Barrenechea, Ana[2]; Arredondo-Cereceda, María[3]; García-Díez, Víctor[4]; López-Santiago, César A.[5]; González, José A.[6]; M. Azcárate, Francisco[7]; Hevia, Violeta[8]; García-Llorente, Marina[9]

(1) Universidad Autónoma de Madrid; (2) Universidad Autónoma de Madrid; (3) Universidad Autónoma de Madrid; (4) Universidad Autónoma de Madrid; (5) Universidad Autónoma de Madrid; (6) Universidad Autónoma de Madrid; (7) Universidad Autónoma de Madrid; (8) Universidad Autónoma de Madrid; (9) Universidad Autónoma de Madrid

Correspondence e-mail: [patricia.fernandezs@uam.es]

Knowledge and management of the productive sector on soil, water and biodiversity directly influences agroecosystems quality. Therefore, it is essential for enhancing ecosystem services, to quantify sustainable agricultural practices effectiveness through indicators, for the development of comprehensive support systems such as the Rural Development Programmes (RDPs) and the eco-schemes of the Common Agricultural Policy (CAP).

Here, we aim to test biodiversity indicators potential to monitor and evaluate CAP measures, centered in the role of livestock in fire prevention and plant biomass reduction. Our case study is located in Sierra Norte of the Madrid Region, where we selected three extensive livestock systems. We implemented three treatments in each of them: manual shrub clearing; manual shrub clearing and cattle-driven clearing; and no cattle and no clearing (control). The indicators are measured in a time frame of one year, before and after the clearing.

The impact is assessed through seedbank, vegetation structure and earthworms sampling. The seedbank is measured by germinating extracted soil samples. After washed and sieved, the samples are spread in potting soil in a greenhouse. Emerged seedlings are identified, counted, and removed from the tray. The vegetation structure is measured by ground cover and tree/shrub density among others. Earthworm biomass and abundance is assessed through the mustard extraction method.

Gathering indicators for assessing the impact is essential for policies, as well as for maintenance of ecosystem services such as improving soil fertility, carbon sequestration, and reducing fire risk while promoting cultural knowledge.

[TSE.3-P-2]

Wednesday 4
Discussion corner: Room 7

SUS-SOIL: Promoting Sustainable Soil and Subsoil Health through Agroecology for a Thriving Future

Ferreiro-Domínguez, Nuria[1]; Couso-Viana, Ana[2]; Rodríguez-Riguero, Francisco Javier[3]; Vázquez-Miramontes, Diego[4]; Santiago-Freijanes, José Javier[5]; Mosquera-Losada, María Rosa[6]

(1) Higher Polytechnic Engineering School; (2) Higher Polytechnic Engineering School; (3) Higher Polytechnic Engineering School; (4) Higher Polytechnic Engineering School; (5) Higher Polytechnic Engineering School; (6) Higher Polytechnic Engineering School

Correspondence e-mail: [nuria.ferreiro@usc.es]

According to the EU Soil Strategy, 60-70% of soils in the European Union are unhealthy and undergoing severe degradation, particularly affecting topsoils and depleting subsoil health, which reduces ecosystem service delivery. However, subsoil knowledge remains limited despite its critical importance. SUS-SOIL is a 4-year, multidisciplinary project that will develop 15 Subsoil-Living Labs (LLs) to inventory, analyze, and benchmark different agroecological subsoil management (ASM) practices and land uses. The project will assess their impacts on subsoil spatial variations and dynamics, aiming to combine ASM practices in rural and urban areas within a global context. SUS-SOIL aims to raise awareness among land managers and authorities about subsoil threats, support EU agroecological transformation, and improve ecosystem services, water security, and climate change mitigation in rural and urban ecosystems. Key outcomes include: (1) developing a subsoil/soil monitoring database (S-DB) interoperable with LUCAS and ESDAC databases, (2) analyzing long-term ASM land use and management for three soil types per LL and its relationship with rural and urban ecosystem services, including modeling, (3) creating farm idiotypes per LL that combine ASM best practices to enhance ecosystem service provision at the regional level, (4) developing a Subsoil Decision Support Tool (S-DST) addressing soil degradation and relevant business models, and (5) proposing a subsoil policy strategy framework to promote ASM best practices.

TSE.4. Forest mortality and die-off responses to global change

Thursday, 5 (11:00-12:30) ; (12:45-14:15)

Room: Balconada

Forests are critical ecosystems for human well-being acting as net carbon sinks worldwide. However, increased tree mortality and die-off events are being observed worldwide and it could not only compromise the role of forests as carbon sinks but also alter the distribution patterns of many species, especially as these events are expected to increase in the future. In many cases, decaying and mortality events are underlined by extreme climatic conditions, such as more intense and frequent hotter droughts, but they are usually triggered and exacerbated by other factors such as pests and pathogens. Currently, our ability to understand and predict these events and their ecological consequences is still limited. In this session we aim to discuss advances in the study of the responses of forests to climate change, particularly about the patterns and processes associated with climate-induced tree mortality and die-off, from both an ecophysiological and ecological perspective, to further apply this knowledge to improve forest management.

Organizers:

• **Paloma Ruiz Benito,** Universidad de Alcalá

• **Antonio J. Pérez Luque,** Institute of Forest Sciences (ICIFOR), INIA-CSIC

• **José M. Torres-Ruiz,** Instituto de Recursos Naturales y Agrobiología de Sevilla (IRNAS) - CSIC

TSE.4. Orals

[TSE.4-O-1]

Thursday 5, morning (first): 11:00
Room: Balconada

Forest die-off and species climatic niche

Lloret, Francisco[1]; Pérez-Navarro, Maria Ángeles[2]; Margalef-Marrase, Jordi[3]; Jaime, Luciana[4]; Batllori, Enric[5]

(1) CREAF, UAB; (2) CREAF; (3) CIDE (CSIC); (4) U. Lleida; (5) U. Barcelona

Correspondence e-mail: [francisco.lloret@uab.cat]

Climatic conditions determining forest die-off events can distinctly be experienced by different species according to their climatic requirements. The species' climatic niche framework allows to analyze die-off and subsequent regeneration across species distribution ranges or in comparison to co-occurring species. Here we summarize a set of studies applying this framework to explain spatial-temporal patterns of forest die-off and their associated dynamics.

Species' realized climatic niches are built by combining information on populations' occurrences and climatic variables. Multivariate techniques allow to calculated kernel density functions where core and edge zones -corresponding to optimal and limit climatic conditions, respectively- are identified. Different distance metrics are applied to characterize populations' position within the climatic niche, depicting their degree of centrality or marginality at a given time. Niche metrics can be scale-up to community level by weighting the abundance of co-occurring species.

We used niche metrics to characterize species vulnerability according to their populations' location in the species niche, analyze temporal patterns of tree growth leading to eventual mortality, assess the interaction with pests and stand structural features derived from management legacies, and model forest resilience and dynamics after die-off episodes. Die-off vulnerability is not restricted to marginal populations living close to the niche limit, but it is also observed in core or central populations. Regardless of historical climate, current extreme events induced by climate change may drive populations to the drier edge of the climatic niche and push forests towards higher dominance of species living in more arid climate.

[TSE.4-O-2]

Thursday 5, morning (first): 11:15
Room: Balconada

Drought-induced die-off alters vegetation diversity across climatic gradients in Catalan Pinus sylvestris forests

Chowdhury, Faqrul Islam[1]; Maria Espelta, Josep[2]; Margalef-Marrase, Jordi[3]; Jaime, Luciana[4]; Lloret, Francisco[5]

(1) CREAF; (2) CREAF; (3) CIDE-CSIC; (4) Universitat de Lleida; (5) CREAF

Correspondence e-mail: [f.islam@creaf.uab.cat]

Climate change increases the frequency and severity of droughts, causing widespread forest die-offs. While drought impacts on tree growth and mortality are well-studied, research on post-drought regeneration and its effects on vegetation diversity and composition, particularly across climatic gradients, remains limited.

Here, we examine the effects of drought-induced die-off on woody plant diversity in twenty different Pinus sylvestris forest sites in Catalonia (NE Spain), comparing die-off-affected and unaffected plots across the temperature and precipitation gradients. Following a severe drought (2012), we surveyed trees in 2013, 2017, and 2022, with recruits and shrubs surveyed in 2022.

Die-off plots exhibited higher tree richness and diversity 5 and 10 years after the die-off event, particularly in arid sites, while evenness was higher in warmer ones. These changes in diversity encompassed a plant composition shift toward Mediterranean-type forests, where ingrowths of Quercus, Acer, Prunus, and other broadleaf trees persisted beneath the tree layer during the die-off event, potentially replacing dead P. sylvestris. Although overall recruit abundance did not differ, sapling richness and evenness were 36% and 42% higher in die-off plots, respectively. Shrub diversity and evenness were also higher in more arid, die-off-affected sites. Species similarity in tree layer and recruiting communities was 29% higher in die-off plots than unaffected ones, indicating advanced regeneration in die-off-affected plots got better chances to occupy the tree layer and promote subsequent seedling establishment. These findings suggest drought-induced die-off can drive a forest transition toward plant compositions that are more adapted to climate change and drier conditions.

[TSE.4-O-3]

Thursday 5, morning (first): 11:30
Room: Balconada

Enhanced resilience to drought and pest infestation through forest management in a Pinus pinaster plantation in Prades (NE Spain)

Nadal-Sala, Daniel[1]; Llasera, Laia[2]; Sabaté, Santi[3]

(1) Universitat de Barcelona; (2) Universitat de Barcelona; (3) Universitat de Barcelona

Correspondence e-mail: [d.sala@creaf.uab.cat]

Tree mortality can occur by interactions of biotic and abiotic stressors. For instance, pine trees weakened by drought stress are more vulnerable to pest infestation. Selective thinning modifies forest structure, improving individual tree health. In Prades (Catalunya, NE Spain) a 60-years-old Maritime pine [Pinus pinaster (Ait.)] plantation of 45 ha was infested by the bark beetle Tomicus destruens (Woll.). This was during year 2023, a particularly dry year, resulting in widespread tree mortality. Maritime pine is an allochthonous species there, outside its bioclimatic range. Several selective thinning interventions were implemented during the year 2009, resulting in a combination of managed and unmanaged patches within the same forest stand.

To address if forest management enhanced tree health and reduced tree vulnerability, we measured tree crown status for three unmanaged and three managed patches. Also, we took 46 stem circular sections from trees both alive and dead standing in the managed and unmanaged patches to evaluate stem growth patterns. We searched for stress legacies indicative of increased tree vulnerability to 2023's drought x infestation.

We found enhanced tree resilience in managed patches to 2023's drought x infestation. In managed stands we found 3- to 5-fold reduction in mortality risk. Also, we found that trees that ended up surviving were the ones most benefited from the selective thinning. Finally, we found strong drought legacies in tree growth spanning back to year 2000. Our results highlight the importance of selective thinning to enhance tree health and revert potential drought legacies, with implications for pest infestation spreading control.

[TSE.4-O-4]

Thursday 5, morning (first): 11:45
Room: Balconada

Identifying and monitoring drought induced forest decline in Scots Pine forest through Satellite Remote Sensing

Rodes Blanco, Marina[1]; García Alonso, Mariano[2]; Ruiz Benito, Paloma[3]; Zavala, Miguel Ángel[4]; Aguado, Inmaculada[5]

(1) Universidad de Alcalá; (2) Universidad de Alcalá; (3) Universidad de Alcalá; (4) Universidad de Alcalá; (5) Universidad de Alcalá

Correspondence e-mail: [marina.rodes@uah.es]

Introduction. Drought events are becoming more intense, prolonged and hotter in the Mediterranean region. Moreover, forest biomass is also increasing due to reductions in management intensity due to rural abandonment, increasing tree competition for limiting resources and the probability of drought-induced forest decline. Future climate change scenarios predict increased warming and drought intensity, highlighting the importance of developing spatio-temporal monitoring systems to identify drought-induced forest decay and promote adaptation measures.

Material and methods. Here, we use reference data derived from visual analysis of very high-resolution UAV imagery in Scots pine collected across a latitudinal gradient, to assess the potential of Landsat-8/OLI, Sentinel-2/MSI and PlanetScope/SD sensors to detect drought-induced forest decline in Mediterranean forests, quantifying the influence of spectral resolution, spatial resolution and forest structure. Subsequently, we apply models to predict the occurrence of forest decline of Pinus sylvestris analysing the differences in abiotic conditions and trends of Landsat spectral data.

Results and discussion. Sentinel-2/MSI at 20 m is the best sensor to detect forest decline, especially when using spectral indices that include SWIR or red edge bands conditioned to have enough forest cover to successfully detect forest decay (> 60%). Models of forest decline had a good performance (R2~0.7). We found abiotic conditions related to temperature and precipitation that strongly underlined drought-induced forest decline. Long time series of vegetation and humidity indices from Landsat provide crucial information to understand the decline process: the moment it began, the decline rate, triggering factors, recovery trends, and early detection signals.

[TSE.4-O-5]

Thursday 5, morning (first): 12:00
Room: Balconada

Advancing oak forest health monitoring: application of thermal imaging and CWSI in heterogeneous canopies

Hornero, Alberto[1]; Quero, José Luis[2]; Zarco-Tejada, Pablo J.[3]; Tomás Riera, Francisco[4]; Marcos Palacios, María José[5]; Gonzalez-Dugo, Victoria[6]; Hernandez-Clemente, Rocio[7]

(1) Consejo Superior de Investigaciones Científicas; (2) Universidad de Córdoba; (3) Consejo Superior de Investigaciones Científicas; (4) Universidad de Córdoba; (5) Universidad de Córdoba; (6) Consejo Superior de Investigaciones Científicas; (7) Universidad de Córdoba

Correspondence e-mail: [alberto.hornero@csic.es]

Introduction: Oak forest decline is a complex and growing global challenge caused by biotic and abiotic stressors such as pests, diseases, drought, pollution, and flooding. These stressors lead to physiological and functional changes that are often difficult to detect in their early stages. High-resolution thermal imaging (<1 m/px) offers a novel approach to identifying temperature variations in tree canopies. This study successfully utilised the Crop Water Stress Index (CWSI), a complex indicator previously limited in use due to the challenges of quantification in heterogeneous forest canopies, to detect early stress signals before visible symptoms become apparent.

Material and Methods: This study utilised high-resolution thermal imagery collected during the summer from airborne platforms across oak forests (Quercus ilex and Quercus suber) in southern and southwestern Spain. Over 3,000 trees were surveyed to assess temperature patterns. Field measurements were performed to validate the thermal data and establish correlations with observed stress indicators, including stem water potential and stomatal conductance.

Results and Discussion: Thermal indices such as the CWSI demonstrated their utility in identifying stress patterns within oak forests. Significant spatial differences were observed, influenced by climatic variability between different inland regions. Integrating thermal imaging data into forest monitoring enables targeted management strategies and early interventions. These results highlight the potential of thermal remote sensing as a scalable and proactive tool for forest health management in response to environmental stressors.

[TSE.4-O-6]

Thursday 5, morning (second): 12:45
Room: Balconada

Individual tree characteristics and plasticity to climate conditions modulate resistance to bark beetle attack in Pinus uncinata

Bellostes Garcia, Clara[1]; Batllori Presas, Enric[2]; Valor Ivars, Teresa[3]; Margalef Marrasé, Jordi[4]; Jaime González, Luciana[5]

(1) Universitat de Barcelona (UB); (2) Universitat de Barcelona (UB); (3) Centre de Ciència i Tecnologia Forestal de Catalunya (CTFC); (4) Centre d'Investigacions sobre Desertificació (CIDE-CSIC); (5) Universitat de Lleida (UdL)

Correspondence e-mail: [clarabellostes@gmail.com]

Forest infestation and mortality caused by bark beetles are increasing due to climate change. Tree resistance to bark beetle attack may depend on resource allocation to growth or defence, which controls the shift from endemic to epidemic beetle populations. This study assesses the tree individual characteristics and climatic factors influencing tree resistance to bark beetle infestation in Pinus uncinata populations in the Parc Natural de l'Alt Pirineu, Catalonia. Using dendrochronological methods in stands with bark beetle-induced mortality, the study evaluates (i) tree resistance in living and dead trees in relation to growth and resin ducts formation as indicators of tree vigour and defence investment, respectively; (ii) how these processes are modulated by competition for resources; and (iii) the influence of high temperatures and drought stress on tree resistance to bark beetle attack. The results indicate that trees forming larger resin ducts with greater total area of ducts exhibit higher resistance to infestation, likely due to increased resin flow. Larger trees can allocate more resources to resin duct formation, which may enhance their protection against bark beetle attack. Surviving trees show greater plasticity under environmental variations, reducing growth while increasing resin duct production and area under high temperatures and moderate drought conditions. Overall, investment in tree defence, rather than growth, emerges as a key determinant of resistance to bark beetle attack at the studied locations. Trees with larger resin ducts and the ability to adjust resource allocation in response to environmental changes are more likely to survive bark beetle infestation.

[TSE.4-O-7]

Thursday 5, morning (second): 13:00
Room: Balconada

The fate of Amazon rain forests under drought: collapse or stabilisation?

Sanchez Martinez, Pablo[1]; Martius, Lion R.[2]; Bittencourt, Paulo[3]; Silva, Mateus[4]; Binks, Oliver[5]; Coughlin, Ingrid[6]; Negrão-Rodrigues, Vanessa[7]; Silva Junior, João Athaydes[8]; Da Costa, Antonio Carlos[9]; Rowland, Lucy[10]; Mencuccini, Maurizio[11]; Meir, Patrick[12]

(1) University of Edinburgh; (2) University of Edinburgh; (3) Cardiff University; (4) University of Exeter; (5) CREAF; (6) Australian National University; (7) Universidade Federal do Pará; (8) Universidade Federal do Pará; (9) Universidade Federal do Pará; (10) University of Exeter; (11) CREAF; (12) University of Edinburgh

Correspondence e-mail: [Pablo.Sanchez@ed.ac.uk]

Drought-induced mortality is expected to cause substantial biomass loss in the Amazon Basin. However, responses by rain forest to prolonged drought remain largely unknown. Critically, how drought impacts individual trees over decades, whilst potential changes in forest structure alter competition for resources, remain unreported for any tropical forest globally. We demonstrate that an Amazonian rain forest subjected to more than two decades of drought at a throughfall-exclusion experiment reached long-term eco-hydrological stability. The stabilisation was largely driven by ecosystem-level structural changes that resulted in the remaining trees to no longer experiencing drought stress. The loss of the largest trees to drought-related mortality during the first 15 years of the experiment led to increasing water availability for the remaining trees, facilitating a stabilisation in biomass in the last seven years of the experiment. The elimination of water stress led to hydraulic variables commonly associated with physiological stress, such as leaf water potential, sap flow, and tissue water content to be equal to those in corresponding non-droughted control forest, indicating hydraulic homeostasis. This work reveals that significant resilience to persistent (multi-decadal) soil drought in tropical rain forest. The resilience emerges from structural feedbacks at ecosystem scale that prevent drought-induced collapse, whilst also resulting in a forest with reduced biomass and lower but positive net wood productivity.

[TSE.4-O-8]

Thursday 5, morning (second): 13:15
Room: Balconada

Evidencing drought-induced tree mortality and forest die-off in Mediterranean Chile after the 2019 extreme event

Paredes Berríos, Pablo Tomás[1]

(1) University of Stirling

Correspondence e-mail: [paredesberriospablo@gmail.com]

The Chilean Mediterranean bioregion has been facing severe and persistent drought conditions since 2010, culminating in extreme “Hyper-droughts” (Hd) in 2019 and 2021, an unprecedented event among all Mediterranean ecosystems. These events are linked to a tree mass mortality event, particularly within wet sclerophyllous forests dominated by Cryptocarya alba. To understand the impacts of these events, this research integrates remote sensing, field-based forest structure assessments, and tree-ring analyses across 15 sites in Mediterranean Chile. Remote sensing data reveal significant declines in vegetation productivity following the 2019 Hd. NDVI anomalies show a clear link with precipitation deficits and ecosystem stress, with 2019 and 2021 being the years with the lowest NDVI values. Local-scale remote sensing time series showed a decrease in productivity of up to 40% after 2019. Drone-based classifications corroborate these findings, indicating mortality rates of 28-38 percent in forest canopies. Field surveys data confirm extensive dieback in C. alba, with up to 60 percent of the individuals affected. Tree-ring and stable isotope analyses further illustrate reduced growth and changes in water-use efficiency among stressed trees, highlighting the physiological thresholds exceeded during prolonged and extreme droughts. This research provides the first evidence of drought-induced forest mortality in this Mediterranean ecosystem, as well as key insights on ecophysiological responses from C. alba populations to extreme drought events. By linking ecosystem-level remote sensing with field and tree-level analyses, this research offers critical insights into the cascading effects of climate change on forest structure, productivity, and resilience.

[TSE.4-O-9]

Thursday 5, morning (second): 13:30
Room: Balconada

Towards understanding the physiological and metabolic expressions in the sequence of pine decline under hotter-drought

Gea Izquierdo, Guillermo[1]

(1) ICIFOR-INIA, CSIC

Correspondence e-mail: [gea.guillermo@inia.csic.es]

Introduction. Decline syndromes leading to drought-induced mortality are expressed progressively along different plant and temporal scales, which makes necessary to understand how trees regulate their metabolism and physiology under increasing stress.

Material and methods. We analyzed physiological and metabolic adjustments of healthy and declining Pinus sylvestris and Pinus pinaster trees under hotter-drought during two contrasting drought years: one with an extreme long and one with unusually short summer drought. The two pine populations studied are at the respective species' rear-edges. Their high levels of defoliation and low regeneration rates prove that the species are in decline under synergistic climatic stress and mistletoe infestation.

Results and discussion. The physiological and metabolic responses were coherent with strong sensitivities to high abiotic stress, particularly heat and drought. Although gas exchange was downregulated in defoliated trees, the trees were far from being depleted in carbon. Healthy and declining trees remained above their hydraulic safety margins. However, the hydraulic function of declining trees was more severely impaired than that of healthy trees. Declining and healthy trees differed in their metabolic response to heat and water stress at the end of the summer. The metabolic response to stress integrated different pathways and distinct primary and secondary compounds sensitive to elevated water stress. The metabolic fingerprint under stress in trees with long-term constrained physiological performance characterized the decline sequence preceding pine mortality under increased abiotic stress.

[TSE.4-O-10]

Thursday 5, morning (first): 12:15
Room: Balconada

Can diversity improve forage production in the face of heatwaves?

Cera Rull, Andreu[1]; Brunel-Muguet, Sophie[2]; Lemauviel-Lavenant, Servane[3]

(1) Univeristé de Caen; (2) Université de Caen; (3) Université de Caen

Correspondence e-mail: [andreu.cera-rull@unicaen.fr]

Research in forage production with an ecological perspective is crucial in the face of the challenges posed by climate change. An important but understudied question is the impact of recurrent heatwaves. In the current context of agriculture intensification using monocultures, greater species diversity may improve grassland response to extreme climate events through complementarity or insurance hypothesis. A 36-week experiment was conducted on forage species subjected to repeated heatwaves (one spring and one summer heatwaves). The experiment included monocultures of four species (Lolium perenne, Lotus corniculatus, Plantago lanceolata, Festuca rubra), a legume-grass culture, and a mixture of the four species. We tested an (i) improvement in production in mixed cultures over monospecific ones; (ii) the ability of plants to acclimate to these recurrent events; (iii) and a better resistance, recovery and resilience of plants growing in mixed cultures over monospecific ones. We observed a cumulative negative effect of recurrent heatwaves rather than acclimation. But there was an improvement in production in mixed cultures in all treatments. Only L. perenne was involved in the better production in legume-grass cultures, although the complementary effects were relevant in the mixture. Some species were resistant, and most of them showed recovery activity. In conclusion, this study highlights the threat posed by recurrent heatwaves to grasslands. However, greater diversity could increase production in the face of heatwaves through the insurance hypothesis and complementarity.

[TSE.4-O-11]

Thursday 5, morning (second): 13:45
Room: Balconada

Biodiversity impact on productivity in crop systems with different cultivation histories

Tera Martínez, Raquel[1]; Schöb, Christian[2]; González Benítez, Natalia[3]; Hagos Berhe, Daniel[4]

(1) Universidad Rey Juan Carlos; (2) Universidad Rey Juan Carlos; (3) Universidad Rey Juan Carlos; (4) Universidad Rey Juan Carlos

Correspondence e-mail: [raquel.tera@urjc.es]

Mixed cropping systems can outperform monocultures in productivity, highlighting a notable net biodiversity benefit. Biodiversity benefits are greater for wild plants than domesticated crops, and crops with a history of growing in mixtures show greater biodiversity effects compared to those grown in monocultures. However, it is unknown whether the biodiversity effects achieved with domesticated crops that have a mixture selection history reach those achieved by their wild relatives, or whether domesticated crops are unable to reach the biodiversity benefits of wild plants due to loss of relevant traits for biodiversity benefits. To answer this question, in this study, the effects of biodiversity and underlying trait syndromes was compared among domesticated crops with either a history of monoculture or mixture selection over six years, and their wild relatives.

The common garden experiment was conducted with six annual crop species grown as individual plants, monocultures, and two-species mixtures: Triticum aestivum (wheat), Avena sativa (oat), Lens culinaris (lentil), Camelina sativa (camelina), Lupinus angustifolius (blue lupin), and Linum usitatissimum (linseed). The wild relatives are Aegilops geniculata, Avena sterilis, Lupinus angustifolius, Lens nigricans, Linum bienne, and Camelina microcarpa. We expected that mixed cropping systems would show higher productivity compared to monocultures. Additionally, plants with a history of growing in mixtures were anticipated to exhibit greater biodiversity effects than those cultivated in monocultures, and that the wild relatives would show the greatest biodiversity effects. This would demonstrate that although domesticated crops can adapt to growth in mixture, some relevant traits for maximal mixture yield performance seem to be lost during the domestication and breeding process. This could have important implications for crop improvement as traits from wild relatives would need to be introgressed into modern cultivars to maximize yield benefits of mixed cropping.

[TSE.4-O-12]

Thursday 5, morning (second): 14:00
Room: Balconada

The role of green covers in soil health for irrigated persimmon orchards in Valencia (Spain)

Orts, Carmen[1]

(1) Politechnic University of Valencia

Correspondence e-mail: [orts.mca@gmail.com]

Green covers are used as a tool to improve the soil health, its physicochemical properties, its edaphic biodiversity, and as a reservoir of useful fauna for the associated agricultural crops. The soil has the capacity to regenerate after a disturbance thanks to the species that live in it, also creating positive effects on its fertility and on the biological control of pests. It is the reason that soil fauna can be used as an indicator of the quality and health of an agroecosystem. The aim in this experimental work is to study the relationship of seeded green covers with edaphic biodiversity based on mesofauna, and with the management of soil moisture and temperature. For this purpose, different green covers of legumes, grasses, and a mixture of flowers from different botanical families were sown in an orchard. Soil samples were analyzed, arthropods were extracted for their study, soil moisture sensors were placed to measure soil moisture and soil temperature and vegetative biomass. As a result, all the covers were favorable for the soil, although the mixed flower green cover was the most suitable for this orchard, in addition to blooming throughout the year and therefore being a reserve of useful fauna, it increased the soil moisture and lowered the soil temperature, and there was also an increment of microarthropods in the soil, which enhances soil quality. This study shows to the growers the best options to avoid the use of phytosanitary products, accomplishing European regulations.

TSE.4. Posters

[TSE.4-P-1]

Thursday 5
Discussion corner: Room 6

Anatomical response of cork oak (Quercus suber L.) to cork stripping

Sánchez-Miranda Moreno, Ángela[1]; Borreguero Vázquez, Ismael J.[2]; Colangelo, Michele[3]; Matías Resina, Luis[4]

(1) Universidad de Sevilla; (2) Universidad de Sevilla; (3) Università della Basilicata, Potenza, Italia.; (4) Universidad de Sevilla

Correspondence e-mail: [asanchezmirandam@gmail.com]

The cork oak (Quercus suber L.) is a species of high ecological and economic value with high importance in the Iberian Peninsula. In managed areas, they are uncorked every 8-11 years as a source for the cork industry. Some studies have indicated a reduction in the vessel size following bark removal, which may potentially affect their hydraulic conductivity and ultimately their growth. Yet, little is known about the size effect of changes in vessel formation after bark removal and the resilience of cork oak trees in recovering their previous vessel formation patterns. Here, we quantify the immediate effect of bark removal on vessel size and number in a managed woodland in southern Spain. Anatomical traits were analysed using polished core samples and images obtained with a stereo microscope. Image analysis techniques were used to measure hydraulic diameter (Dh), area and vessel frequency in wood rings formed before and after stripping. We found evident differences in vessel formation between debarked and never debarked trees. Specifically, there was a notable reduction in vessel size following bark removal, while the number of vessels increased. Furthermore, these anatomical changes did not recover in the following years, suggesting important changes in wood development. These anatomical changes are likely to have consequences for the response capacity of these trees to the current increase in temperature and water scarcity. In this sense, our results provide a piece of the puzzle to the current problem of the viability of cork oak populations from the southern Iberian Peninsula.

[TSE.4-P-2]

Tuesday 3
Discussion corner: Room 6

Post-disturbance forest reorganization: a synthesis

Lecina-Diaz, Judit[1]; G. Turner, Monica[2]; Seidl, Rupert[3]

(1) Technical University of Munich; (2) Department of Integrative Biology, University of Wisconsin–Madison, Madison, WI 53706; (3) Technical University of Munich; Berchtesgaden National Park

Correspondence e-mail: [judit.lecina@tum.de]

Forest ecosystems are increasingly affected by climate change and disturbance activity, yet the outcomes of forest dynamics under these pressures remain uncertain. Traditional approaches often view forest change through resilience or regime shifts, a dichotomy that can obscure nuanced ecological transformations. Regime shifts occur when vegetation structure and composition are profoundly altered, leading to distinct ecosystem states. To better capture these dynamics, forest reorganization can be characterized along two dimensions: structure (e.g., tree number, size, and spatial arrangement) and composition (e.g., tree species identity and diversity). However, critical gaps remain in understanding the extent and prevalence of forest reorganization and the conditions driving structural or compositional changes. Here we synthesize knowledge of post-disturbance forest reorganization, focusing on disturbances as agents of change. We assess (i) the prevalence of structural and compositional changes following disturbance, and (ii) the frequency of specific reorganization patterns, including self-replacement, relay succession, novelty, and regeneration failure. A systematic review of studies examining post-disturbance forest structure and/or composition reveals structural changes dominate the literature (41%), followed by studies addressing both structure and composition (35%), and compositional changes (24%). Most studies, however, examine short-term effects (<10 years). Distinct patterns emerge across biomes: self-replacement dominates globally, except in boreal forests, where regeneration failure prevails. Novel ecosystems are most frequent in temperate forests, while relay succession occurs in temperate broadleaf, mixed, and boreal forests. The accelerating wave of global forest disturbances presents unique opportunities to advance research on forest reorganization, critical for informing ecosystem management under changing climates.

[TSE.4-P-3]

Wednesday 4
Discussion corner: Room 6

Drought-induced responses of Scots pine along continental Spain: a review of challenges and opportunities for building forest die-off monitoring networks

Ruiz Benito, Paloma[1]; Rodes-Banco, Marina[2]; Gazol, Antonio[3]; García, Mariano[4]; Fernández-Blas, Cristopher[5]; López-Caro, María J.[6]; Aguado, Inmaculada[7]; Astigarraga, Julen[8]; Camarero, J Julio[9]; Colangelo, Michelle[10]; Bravo-Hernández, Miriam[11]; Cruz-Alonso, Verónica[12]; Gallego, Francisco J.[13]; García-García, Isabel[14]; González, Esther[15]; Granda, Elena[16]; Herrero, Asier[17]; Linares, Juan C.[18]; Lines, Emily R.[19]; Morales-Molino, César[20]; Méndez-Cea, Belén[21]; Moreno-Fernández, Daniel[22]; Rebollo, Pedro[23]; Rodríguez-Rey, Marta[24]; Samblás, Eva[25]; Sánchez-Salguero, Raúl[26]; Serra-Maluquer, Xavier[27]; Tijerín-Triviño, Julián[28]; Triviño, María[29]; Valeriano, Cristina[30]; Zavala, Miguel A.[31]

(1) Universidad de Alcalá; (2) Universidad de Alcalá; (3) Instituto Pirenaico de Ecología (IPE-CSIC), Zaragoza, Spain; (4) Universidad de Alcalá; (5) Universidad de Alcalá; (6) Universidad de Alcalá; (7) Universidad de Alcalá; (8) Universidad de Alcalá; (9) Instituto Pirenaico de Ecología (IPE-CSIC); (10) Instituto Pirenaico de Ecología (IPE-CSIC); (11) Universidad de Alcalá; (12) Universidad Complutense de Madrid; (13) Universidad Complutense de Madrid; (14) Universidad Complutense de Madrid; (15) Instituto Pirenaico de Ecología (IPE-CSIC); (16) Universidad de Alcalá; (17) Universidad del País Vasco (UPV-EHU); (18) Universidad Pablo Olavide; (19) University of Cambridge; (20) Universidad de Alcalá; (21) Universidad Complutense de Madrid; (22) Instituto de Ciencias Forestales (INIA-CSIC); (23) Universidad Complutense de Madrid; (24) Universidad de Alcalá; (25) Universidad de Alcalá; (26) Universidad Pablo Olavide; (27) Universidad de Alcalá; (28) Universidad de Alcalá; (29) University of Jyväskylä; (30) Instituto Pirenaico de Ecología (IPE-CSIC),; (31) Universidad de Alcalá.

Correspondence e-mail: [paloma.ruizb@uah.es]

Introduction. Warming coupled with droughts is leading to die-off and tree mortality events worldwide. While existing large-scale monitoring networks provide valuable data to quantify and understand drought-induced forest responses, these events remain rare and scattered across the landscape. As a result, large-scale networks may fail to capture localised die-off and tree mortality processes accurately, highlighting the need for targeted fieldwork. Here, we compare the data provided by existing large-scale databases, existing records of die-off and tree mortality events in published studies and specifically targeted fieldwork in Scots pine (Pinus sylvestris) forests

Material and methods. We compared the differences between forest responses and characteristics in areas with drought-induced die-off and tree mortality events with the entire distribution of Scots pine from existing databases in continental Spain. Specifically, we characterised forest responses using greenness and wetness spectral indices using Sentinel-2, demographic and structural information using National Forest Inventories, and tree growth series from existing tree-ring datasets.

Results and discussion. Drought-induced die-off and tree mortality events covered a wide range of the current climatic distribution of Pinus sylvestris, with significant differences in their climatic conditions, greenness and wetness indices, demography and structural conditions between damaged and healthy sites. The climatic and spectral responses in published events covered a wider range of responses than targeted fieldwork, probably due to differences in spatial resolution. Notably, drought-induced events generally occurred at the extremes of the species' climatic distribution, highlighting the need to prioritise die-off monitoring networks.

[TSE.4-P-4]

Thursday 5
Discussion corner: Room 6

The Spanish Forest decline monitoring database: decaimiento.es

Pérez-Luque, Antonio J.[1]; Ruiz-Benito, Paloma[2]; Astigarraga, Julen[3]; LLoret, Francisco[4]; Acosta-Muñoz, Cristina[5]; Aguado, Inmaculada[6]; Aldea, Jorge[7]; Andivia, Enrique[8]; Aranda, Ismael[9]; Bravo-Hernández, Miriam[10]; Calama, Rafael[11]; Camarero, Jesús J.[12]; Carnicer, Jofre[13]; Carreira, José Antonio[14]; Curiel, Jorge[15]; de la Mata, Raúl[16]; del Río, Miren[17]; Díaz, Mario[18]; Esteban, Raquel[19]; Fernández de Blas, Cristopher[20]; Fernánez-López, Manuel[21]; Gallego Rodríguez, Francisco Javier[22]; García Alonso, Mariano[23]; Gazol, Antonio[24]; Gea-Izquierdo, Guillermo[25]; Gómez-Aparicio, Lorena[26]; González de Andrés, Ester[27]; Guzmán-Álvarez, José Ramón[28]; Hernández-Clemente, Rocío[29]; Herrero, Asier[30]; Hódar, José Antonio[31]; Hornero, Alberto[32]; Jaime González, Luciana[33]; Lasa, Ana V.[34]; Linares, Juan Carlos[35]; López, Rosana[36]; López-Caro, María José[37]; Marcos-Palacios, María José[38]; Margalef, Jordi[39]; Martín-Benito, Darío[40]; Martínez-Vilalta, Jordi[41]; Morcillo Julià, Luna[42]; Morales-Molino, César[43]; Navarro-Cerrillo, Rafel M.[44]; Pardos, Marta[45]; Quero, Jose Luis[45]; Rebollo, Pedro[46]; Rodríguez-Sánchez, Francisco[47]; Romeralo, Carmen[48]; Rubio Cuadrado, Álvaro; Samblas, Eva[49]; Sánchez-Salguero, Raul[50]; Tijerín-Triviño, Julian[51]; Vilagrosa, Alberto[52]; Zamora, Regino[53]; Zavala, Miguel Ángel[54]; REDEC (Red Española de Seguimiento del Decaimiento Forestal inducido por el Clima)[55]

(1) Instituto de Ciencias Forestales. INIA-CSIC; (2) Universidad de Alcalá de Henares; (3) Universidad de Alcalá de Henares; (4) CREAF; Universitat Autònoma de Barcelona; (5) Universidad de Córdoba; (6) Universidad de Alcalá de Henares; (7) Instituto de Ciencias Forestales. INIA-CSIC; (8) Universidad Complutense de Madrid; (9) Instituto de Ciencias Forestales. INIA-CSIC; (10) Universidad de Alcalá de Henares; (11) Instituto de Ciencias Forestales. INIA-CSIC; (12) Instituto Pirenaico de Ecología. IPE-CSIC; (13) CREAF; Universitat Autònoma de Barcelona; (14) Universidad de Jaen; (15) Basque Centre for Climate Change; (16) Universidad de Extremadura; (17) Instituto de Ciencias Forestales. INIA-CSIC; (18) Museo Nacional de Ciencias Naturales. CSIC; (19) Universidad del País Vasco; (20) Universidad de Alcalá de Henares; (21) Estación Experimental del Zaidín. CSIC; (22) Universidad Complutense de Madrid; (23) Universidad de Alcalá de Henares; (24) Instituto Pirenaico de Ecología. IPE-CSIC; (25) Instituto de Ciencias Forestales, INIA-CSIC; (26) Instituto de Recursos Naturales y Agrobiología de Sevilla. CSIC; (27) Instituto Pirenaico de Ecología. IPE-CSIC; (28) Consejería de Sostenibilidad y Medio Ambiente, Junta de Andalucía.; (29) Universidad de Córdoba; (30) Universidad del País Vasco; (31) Universidad de Granada; (32) Instituto de Recursos Naturales y Agrobiología de Sevilla. CSIC; (33) Universidad de Lleida; (34) Estación Experimental del Zaidín. CSIC; (35) Universidad Pablo de Olavide; (36) Universidad Politécnica de Madrid; (37) Universidad de Alcalá de Henares; (38) Universidad de Córdoba; (39) Centro de Investigaciones sobre Desertificación. Consejo Superior de Investigaciones Científicas; (40) Instituto de Ciencias Forestales, INIA-CSIC; (41) CREAF; Universitat Autònoma de Barcelona; (42) Centro de Estudios Ambientales del Mediterráneo; (43) Universidad de Alcalá de Henares; (44) Universidad de Córdoba; (45) Instituto de Ciencias Forestales, INIA-CSIC; (46) Universidad de Córdoba; (47) Universidad Complutense de Madrid; (48) Universidad de Alcalá de Henares; (49) Universidad de Sevilla; (50) Instituto de Ciencias Forestales, INIA-CSIC; (51) Universidad Politécnica de Madrid; (52) Universidad de Alcalá de Henares; (53) Universidad Pablo de Olavide; (54) Universidad de Alcalá de Henares; (55) Universidad de Córdoba; (56) Centro de Estudios Ambientales del Mediterráneo; (57) Universidad de Granada; (58) Universidad de Alcalá de Henares; (59) Grupo de Trabajo de la AEET.

Correspondence e-mail: [antonio.perez@inia.csic.es]

Introduction. Climate change is accelerating forest decline, primarily due to increasing drought and heat stress, leading to widespread tree die-off and rapid ecosystem disruption. In Spain, this phenomenon is particularly alarming, as future climate scenarios predict an increase of severity and frequency of drought events. The Spanish Network for Monitoring Climate-Induced Forest Decline (Red Española de Seguimiento del Decaimiento Forestal inducido por el Clima), is developing a national database to systematically investigate, monitor and document die-off events across the country.

Material and methods. The decaimiento.es database compiles detailed information on forest die-off sites, including location, affected species, environmental and biotic factors, defoliation rates, monitoring protocols, and the date of observed events. The database integrates metadata from field observations where climate-induced die-off is being recorded and monitoring. For its design, we considered the structure and methodology of leading international die-off databases and relevant bibliographic compilations on tree mortality (e.g., International Tree Mortality Network, ITMN) to make it directly compatible with other harmonizable international initiatives.

Results and discussion. In its initial version, the database including forest die-off sites distributed across Spain reveals wide spatial patterns. By aligning with international standards and fostering collaboration among researchers, decaimiento.es serves as a key tool for analyzing the impacts of climate change on forests. It will support forest management decisions by enabling the identification of particularly vulnerable areas. Furthermore, the database acts as a collaborative platform, connecting scientists working with different methodological approaches, and fostering joint efforts to address the shared challenge of forest die-off.

[TSE.4-P-5]

Tuesday 3
Discussion corner: Room 6

Drought and girdling effects on carbon dynamics and tree mortality in a tropical dipterocarp forest

Fernández de Uña, Laura[1]; Doughty, Christopher[2]; Cheesman, Alexander W.[3]; Riutta, Terhi[4]; Nottingham, Andrew[5]; Malhi, Yadvinder[6]; Zhang, Peipei[7]; Meir, Patrick[8]; McDowell, Nate[9]

(1) Universidade de Vigo; (2) Northern Arizona University; (3) James Cook University; (4) UK Centre for Ecology & Hydrology; (5) University of Edinburgh; (6) University of Oxford; (7) East China Normal University; (8) University of Edinburgh; (9) Pacific Northwest National Laboratory

Correspondence e-mail: [laura.fernandezdeuna@gmail.com]

In many tropical areas, El Niño events cause peak temperatures and severe drought, which are exacerbated by climate change. During drought, plants close stomata to regulate water loss, limiting photosynthesis and thus carbon availability to maintain plant function. It is however unclear whether carbon exhaustion can ultimately cause tree death. Stem girdling can contribute to a better understanding of the role of carbon starvation on tree mortality, as it hinders downward carbohydrate transport through the phloem. Here, we assessed how girdling affected tree non-structural carbohydrate (NSC) dynamics during the 2016 El Niño drought and whether NSC reserves influenced tree mortality.

The study was performed in Borneo (Malaysia). Leaf, twig, stem and root NSC content were monitored in six control and six girdled trees belonging to nine species along six campaigns between January and October 2016 (one before girdling, three during drought). Leaf gas exchange and stem respiration were also periodically measured.

All girdled trees died within a year of treatment application, three of them during the drought, whereas all control trees survived. Once drought receded, photosynthetic rates increased in control trees but not in girdled ones. In both treatments, twig and stem NSC concentrations were negatively related to water availability, indicating storage was prioritized during drought. Stem starch significantly decreased after girdling, while sugar concentrations remained similar between treatments, indicating a continuous starch-to-sugar conversion to maintain metabolism in girdled trees. Stem respiration increased and NSC concentrations decreased as girdled trees approached death; however, mortality occurred before NSC reserves were exhausted.

[TSE.4-P-6]

Wednesday 4
Discussion corner: Room 6

Venus satellite images to detect tree decline in Doñana Biological Reserve: patterns and effects

Díaz-Delgado, Ricardo[1]; Zang, Xu[2]

(1) Estación Biológica de Doñana-CSIC. Sevilla. Spain; (2) Universitat Autònoma de Barcelona Bellaterra, Spain

Correspondence e-mail: [rdiaz@ebd.csic.es]

An accelerated tree decline and dieback has been observed inside the Doñana National Park for the last 3 years. A remnant population of centuries-old Cork Oak trees has been decimated. These trees play a role as global change sentinels, with a steady mortality and ineffective recruitment, revealing the intensity of disturbances such as nesting birds, herbivores, diseases, extreme climatic events or groundwater depletion. This is even more conspicuous in the Doñana Biological Reserve (DBR). These trees, with monumental canopies, usually host bird colonies and nests, offer shade and food for wild and domestic herbivores and a habitat for an indeterminate number of insect species. Early observations in the 60's already report a steady decline of these remnant trees and stands in DBR. More recent studies have definitely confirmed an overall increase in Cork Oak mortality at DBR higher for trees used by nesting birds in addition to recent dieback observed in other tree species such as Junipers or Pinion Pine.

In this work, we test the images from the Israeli-French micro-satellite VENμS, with a higher spatial and temporal resolution than the available EO sensors, to detect tree decline and dieback at the DBR. Our main goal was to assess different analytical methods of time series of images to identify and locate isolated trees experiencing defoliation and die-off. We aim to quantify the effects of a recent extreme drought on the most widespread tree species in DBR together with the effects of underground water depletion.

[TSE.4-P-7]

Thursday 5
Discussion corner: Room 6

Application of thermal and hyperspectral imaging to anticipate forest decay in Quercus ilex

Tomás Riera, Francisco[1]; Hornero, Alberto[2]; Quero, Jose Luis[3]; Berdugo, Miguel[4]; Marcos, Maria José[5]; Hernández-Clemente, Rocío[6]

(1) Universidad de Córdoba; (2) Consejo superior de investigaciones científicas (CSIC); (3) Universidad de Córdoba; (4) Universidad Complutense de Madrid; (5) Universidad de Córdoba; (6) Universidad de Córdoba

Correspondence e-mail: [o22torif@uco.es]

Introduction. Forest decline is a reality, caused by various factors, we can classify in biotic and abiotic, both aggravated by climate change. These factors produce physiological changes in the plants, but by the time these changes are visible the health of the tree is already severely affected. In this study we want to use thermal images as a preview to the response that vegetation indices (ex. NDVI), derived from hyperspectral imaging) would give us in Quercus ilex. Testing different models to indicate the best distribution and whether there are changes within the range.

Material and Methods. This study uses thermal and hyperspectral images collected over several years in the summer season from aerial platforms across Quercus ilex dehesas in southern Spain. More than 1,000 trees were analysed in a single high-resolution time series. Field measurements were made to validate and establish correlations with thermal data.

Results and Discussion. With our results we can evaluate the decoupling between thermal and NDVI response, due to our models, providing more information when applying temporality than previous studies that only focused on one image. These decouplings are key to detect sudden forest dieback, as it is a dynamic event and not a one-off event.

TSE.5. The long-term recovery of post-agricultural land

Thursday, 5 (12:45-14:15)

Room: Seminario 6

Agriculture is the largest transformation of the Earthâ€™s surface. At this point in history, post-agricultural land has been dramatically increasing over the last decades and will only grow. However, the recovery of these lands is uncertain and will take centuries in optimistic scenarios. In this session, we will explore patterns and mechanisms of ecosystem recovery in post-agricultural lands over long periods of time (>100 years). For this, we will compare traditional functional and structural attributes (e. g. species diversity, carbon stocks) with emerging metrics integrating interactions and functions (e. g. the stability of interaction networks, abundance of meta-community hub species). These will allow us to propose potential future scenarios and tools to promote more diverse and functional recovering ecosystems. Attendees interested in succession, disturbance, long-term studies, species interactions, conservation or restoration might be interested.

Organizers:

• **David Moreno Mateos,** University of Oxford; Asun Rodriguez Uña, University of Cambridge

• **Daniel Montoya,** Basque Centre for Climate Change (BC3).

TSE.5. Orals

[TSE.5-O-1]

Thursday 5, morning (second): 12:45
Room: Seminario 6

Improving the long-term recovery of forest complexity after agriculture

Rodríguez-Uña, Asun[1]; Emilson, Erik[2]; Tanentzap, Andrew[3]

(1) University of Cambridge; (2) Great Lakes Forestry Centre; (3) Trent University

Correspondence e-mail: [ar2190@cam.ac.uk]

Introduction. Forests support Earth's health, but many are severely damaged by human activities like agriculture. Although ambitious restoration initiatives are creating an unprecedented opportunity to revert forest degradation, they rarely improve forest health to undisturbed levels. An explanation for this limited success is that restoration efforts usually concentrate on recovering simple attributes (e.g. tree species richness), and only for a few years after impact cessation. Far more important to forest health are more complex indicators, like biotic interactions, which are rarely measured, especially for the centennial timescales over which forests naturally develop. ChronoForNet is a collaborative network aiming to reconstruct long-term recovery trajectories of crucial species interactions and soil functionality in post-agricultural forests.

Material and methods. Root and leaf samples were collected in seventeen long-term (>50 years) recovery chronosequences of temperate and boreal post-agricultural forests, in twelve countries. They were used to characterize, through DNA sequencing, the interactions between trees and mycorrhizal fungi and between trees and the insects feeding on their leaves. Soil samples were also collected to assess how these interactions affect the recovery of soil microorganisms and key soil functions (e.g. related to carbon and nitrogen pathways).

Results and discussion. We are currently obtaining our first results which will allow us to identify which species interactions are more important for the recovery of forest ecosystem structure, biodiversity and functionality. The unprecedented large timescale and ecological complexity of our findings will help to better assist forest recovery, in the context of large-scale ambitious restoration initiatives, to deliver functional and resilient forests.

[TSE.5-O-2]

Thursday 5, morning (second): 13:00
Room: Seminario 6

Land transformation and climate change additively affect forest composition recovery worldwide

Cruz-Alonso, Verónica[1]; Andivia, Enrique[2]; Calatayud, Joaquín[3]; Rodríguez-Uña, Asun[4]; Curran, Michael[5]; Moreno-Mateos, David[6]

(1) Universidad de Alcalá; (2) Universidad Complutense de Madrid; (3) Universidad Rey Juan Carlos; (4) University of Cambridge; (5) Research Institute of Organic Agriculture; (6) University of Oxford

Correspondence e-mail: [veronica.cral@gmail.com]

Introduction. Despite significant investments in forest restoration, persistent gaps remain in understanding how to achieve successful restoration, particularly concerning the impacts of climate change and human land uses on forest recovery. Climate changes disrupt forest disturbance regimes and increase aridity, affecting species' demographic rates. Human activities, such as farming, leave lasting legacies that shape species recolonization, ultimately influencing community composition. This study aims to analyze the impacts of climate and land use changes on the recovery of forest species composition, measured as similarity to old-growth forests –hereafter, reference forests-.

Material and methods. We compiled a dataset of plant species communities in forests worldwide, capturing various stages after different disturbances. The dataset consisted of paired assemblages of recovering and reference forests. The dataset also included site locations to characterize conditions during recovery (i.e. average climate, soil features, landscape transformation and climatic deviations during the first years of recovery).

Results and discussion. Species composition in recovering forests tended to converge towards reference forests over time until reaching a threshold. Differences between recovering and reference forest communities primarily stemmed from taxon turnover (different taxa) rather than nestedness (lack of taxa from reference forests). Moreover, climate and land-use changes significantly influenced similarity to reference communities and nestedness. Landscape heterogeneity and lack of forest cover reduced similarity, and farming and posterior abandonment reduced similarity in contrast to other site impacts. Climate changes (higher warming and lower aridity) promoted differences by nestedness. The findings highlight the importance of preserving reference communities, as forests may not fully return to their pre-disturbance states due to global changes.

[TSE.5-O-3]

Thursday 5, morning (second): 13:15
Room: Seminario 6

Reconfiguration of biodiversity and ecological processes along crop and livestock abandonment gradients

Gaspar, Mario[1]; Arroyo, Antonio I.[2]; Barrantes, Olivia[3]; Cruz-Amo, Lydia[4]; Guillera-Arroita, Gurutzeta[5]; Herrera-Russert, José[6]; Miñarro, Jesús[7]; Ramos, Javier[8]; Reiné, Ramón[9]; Saiz, Hugo[10]; Pueyo, Yolanda[11]; Anadón, José D.[12]

(1) Pyrenean Institute of Ecology (IPE-CSIC); (2) Pyrenean Institute of Ecology (IPE-CSIC); (3) University of Zaragoza; (4) Pyrenean Institute of Ecology (IPE-CSIC); (5) Pyrenean Institute of Ecology (IPE-CSIC); (6) Pyrenean Institute of Ecology (IPE-CSIC); (7) Pyrenean Institute of Ecology (IPE-CSIC); (8) Estación Experimental Aula Dei (EEAD-CSIC); (9) University of Zaragoza; (10) University of Zaragoza; (11) Pyrenean Institute of Ecology (IPE-CSIC); (12) Pyrenean Institute of Ecology (IPE-CSIC)

Correspondence e-mail: [mario@ipe.csic.es]

Land abandonment is a major driver of ecological change in developed countries, and also increasingly worldwide. A sound understanding of post-abandonment reconfiguration of ecosystems is key to predict the ongoing long-term evolution of our landscapes, and to inform restoration policies. Recovery trajectories of ecosystems are based on secondary succession; however, many aspects of this process are still not well understood. Among them: how recovery trajectories vary among different abandonment processes (e.g., crops and livestock abandonment), and how these trajectories vary along environmental gradients.

Here we present preliminary results of a study addressing the reconfiguration trajectories of ecosystems after crop abandonment and compare it to trajectories after livestock abandonment, considering two situations of markedly different climatic conditions: Mediterranean mid-mountain systems in the Iberian System and high-mountain temperate systems in the Pyrenees. We describe post-abandonment trajectories for different and related trophic components (i.e., soil, vegetation and invertebrate herbivores) considering both biodiversity (i.e., taxonomical composition of different components) and ecological processes (i.e., soil activity, productivity and herbivory).

Our results indicate that under the general framework of secondary succession, there are relevant differences between crop and livestock post-abandonment trajectories, and that these trajectories are strongly modulated by climate. Overall, our work contributes to the understanding of the long-term recovery of ecosystems after different human perturbations from a multitrophic approach and under a climatic gradient.

[TSE.5-O-4]

Thursday 5, morning (second): 13:30
Room: Seminario 6

Vikings in Greenland, how the ecosystem has evolved over the past 600 years after suffering agricultural impacts

Moreno Martin, Alvaro[1]; moreno mateos, David[2]; Sanz Sanchez, Maria Jose[3]

(1) Basque center for the climate change; (2) University of oxford; (3) Basque Center for the Climate Change

Correspondence e-mail: [alvaro.moreno@bc3research.org]

Introduction: The development of different human civilizations has meant a significant modification of the surrounding ecosystems, usually simplifying them through a loss of biodiversity. Restoration strategies are focused on reducing and reversing ecosystem degradation-biodiversity loss. Despite this, conventional actions are limited in recovering the levels of structure and functionality of non-degraded (reference) ecosystems. Our study focuses on understanding how ecosystems recover their complexity, after agricultural disturbances. We are particularly interested in the long-term (600 to 1,000 years) recovery of plant microbe interactions on post-agricultural areas abandoned by the Greenland Norse.

Material and methods: We selected 11 archaeological sites, Norse farms, where hay harvesting was confirmed. At each site, we sampled four states of the ecosystem, two alternative degraded states (one dominated by Poa glauca and another by Calamagrostis canadensis), one transitional state and a reference. There we surveyed the plant community and collected samples of the rizosphere (to find plant microbe interactions), soil (to assess the agricultural legacy), and charcoal (to date past land uses and abandonment).

Result and discussion: The results obtained from the analysis of plant communities indicate a directionality of change of the Calamagrostis-degraded state toward the transition and reference states, whereas the Poa-degraded state exhibits an alternative divergence less clearly oriented toward the reference. However, the progression of ecological recovery appears constrained, with both degraded states remaining anchored over time. From a soil nutrient perspective, elevated levels of phosphorus and sodium may act as limiting factors, potentially hampering recovery.

[TSE.5-O-5]

Thursday 5, morning (second): 13:45
Room: Seminario 6

Carbon accumulation over 70 years of old-field succession driven by live biomass in a Mediterranean continental environment

Velázquez, Eduardo[1]; Bravo, Felipe[2]; Turrión, María Belén[3]

(1) Universidad de Salamanca; (2) Instituto Universitario de Investigación en Gestión Forestal Sostenible (iuFOR); (3) Instituto Universitario de Investigación en Gestión Forestal Sostenible (iuFOR)

Correspondence e-mail: [eduardo.velazquez.martin@gmail.com]

We assessed the main patterns and drivers of C accumulation over spontaneous colonization of abandoned agricultural lands, considering the above- and below-ground biomass (AGB and BGB, respectively) and the surface soil (SS; 0–6 cm depth), in Castilla y León (Spain). To attain this objective, we established a chronosequence of 30 plots (0.0625 ha) located in agricultural lands abandoned in 1956–1977, 1977–2005 and 2005–2017, in four different forest types. We found that the AGB and the SS accounted for the major proportion of the total C stock, but the BGB was also relatively important. Carbon stocks in all these major compartments increased linearly with the age of tree colonization. But C in the SS showed decreasing rates of change from youngest to oldest stands (i.e. those in plots abandoned in 2005–2017 and in 1956–1977, respectively). Carbon accumulation was mainly driven by adult stem density and age of tree colonization in the AGB and the BGB, and by the total nitrogen content in the SS. Our findings indicate that, in these new forests, C accumulation in the live biomass is ongoing and proceeds relatively fast and at an increasing rate, which points toward a clear potential for atmospheric CO2 fixation over the next few decades. This process, however, is slower and shows an apparent deceleration in the SS. The C stock in the surface soil is, in fact, largely disconnected from that of live biomass and varies depending on pre-abandonment land-use differences among the study sites.

[TSE.5-O-6]

Thursday 5, morning (second): 14:00
Room: Seminario 6

Planted hedgerows and fenced perches speed up the slow recovery of woody vegetation in continental Mediterranean farmland

Rey Benayas, José María[1]; Cruz Alonso, Verónica[2]; Valencia Sanz, Alejandro[3]; Díez de la Macorra, Lucas[4]; Crespo Cepas, Guillem[5]

(1) Universidad de Alcalá; (2) Universidad Complutense de Madrid; (3) Universidad de Alcalá; (4) Fundación Internacional para la Restauración de Ecosistemas; (5) Fundación Internacional para la Restauración de Ecosistemas

Correspondence e-mail: [josem.rey@uah.es]

Introduction. Natural forest regeneration is slow in abandoned continental Mediterranean cropland due to several abiotic (e.g., summer water stress) and biotic (e.g., shortage of seed dispersion) factors. In this study, we aim at assessing the rates and limiting factors of woody plant recruitment and establishment following passive and assisted restoration of cropland in central Spain.

Material and methods. We quantified spontaneous recruitment at old fields and planted hedgerows and survival and growth of introduced plants by combining observational, quasi-experimental, experimental, and modeling approaches that included several biophysical and management variables.

Results and discussion. The recruitment rate at 46-yr-old plots was 2 Holm oaks ha-1 yr-1 only. Unplowed field strips with planted hedgerows favored the spontaneous recruitment of Holm oaks (rate was 22.72 ha-1 yr-1) compared to unplanted strips (7.8 ha-1 year-1) hinting the attraction of dispersers. Perches favored the recruitment of bird-dispersed species only in the long term provided they were fenced (71.44 individuals ha-1 yr-1). Protection of Q. ilex seedlings did not increase survival, pointing that herbivory was not a limiting factor of their early establishment, but increased growth in height (25.61 ± 12.5 cm vs 19.76 ± 9.5 cm), pointing to climate amelioration by tree shelters. We conclude that, if there are seed sources, (1) natural regeneration is a slow but effective nature-based solution to produce multifunctional and resilient landscapes, and (2) fenced perches and hedgerows speed up the recovery of woody vegetation in Mediterranean agricultural landscapes and enhance the biodiversity of agroecosystems.

TSE.5. Posters

[TSE.5-P-1]

Thursday 5
Discussion corner: Room 3

Drivers of multitrophic biodiversity change in abandoned rural landscapes in Aragón

Romero del Moral, Alba[1]; Roy Currás, Silvia[2]; Castellano Navarro, Clara[3]; Anadón, Jose Daniel[4]; Saiz Bustamante, Hugo[5]

(1) Universidad de Zaragoza; (2) Universidad de Zaragoza; (3) Instituto Pirenaico de Ecología (IPE-CSIC); (4) Instituto Pirenaico de Ecología (IPE-CSIC); (5) Universidad de Zaragoza

Correspondence e-mail: [albaromerobis@gmail.com]

Introduction. In the last century, strong socioeconomic changes in agrarian systems, particularly in the Mediterranean basin, has led to the abandonment of croplands in agricultural landscapes. These changes in land uses have a direct effect on biodiversity, where cropland communities follow the natural succession towards the natural communities in the area. However, the drivers of this succession are poorly understood, particularly for different taxonomic groups. The current work evaluates how local (soil), landscape (land uses) and regional (climate) variables contribute to multi-trophic biodiversity succession in abandoned agricultural lands in 40 municipalities in the middle Ebro valley and adjacent regions in Aragón.

Material and Methods. In each of these municipalities, we compared the biodiversity of plants, grasshoppers and spiders between abandoned agricultural fields (>30 years since cessation of activity) and sites where there is no record of agricultural activity (control).

Results and Discussion. Results showed that each group responded to different drivers, and the effect of those drivers was different on species richness (alpha) and composition (beta). These contrasting responses highlight the complexity of natural rewilding on abandoned agricultural landscapes and the need to consider multiple trophic groups to forecast the future of Mediterranean ecosystems.

[TSE.5-P-2]

Tuesday 3
Discussion corner: Room 3

The paradox of macrorewilding and microdefaunation in a post-agrarian world

Anadon, Jose Daniel[1]; Gaspar, Mario[2]; Sánchez-Zapata, José Antonio[3]

(1) Instituto Pirenaico de Ecología IPE-CSIC; (2) Instituto Pirenaico de Ecología IPE-CSIC; (3) Universidad Miguel Hernández

Correspondence e-mail: [jdanadon@ipe.csic.es]

Land abandonment has become one of the main drivers of biodiversity change worldwide. However, its consequences on higher levels of ecological complexity, as well as the interactions of abandonment processes with other drivers of global change remain poorly understood, particularly at large spatial scales.

Here, we describe and explore the causes and potential ecological consequences of an apparent paradox occurring in regions undergoing post-agrarian transition: while rewilding processes are enabling the refaunation of large-sized animals such as ungulates and carnivores (i.e., macrorewilding), smaller taxa like passerines and arthropods are simultaneously experiencing dramatic declines (i.e., microdefaunation). This contrasting pattern may have major implications for the post-agricultural recovery of ecosystem complexity.

This paradox likely arises because different drivers of global change are acting simultaneously on distinct layers of the community and at varying spatial scales. The recovery of large fauna occurs following shifts in direct persecution and forest expansion associated with the decline of traditional agrarian societies; microdefaunation results from the disappearance of mosaic landscapes and the outcomes of land use intensification. Furthermore, conservation policies have largely overlooked smaller taxa, thereby contributing to this imbalance. Although prior studies have separately identified these trends and their respective drivers, no research has integrated them and assessed the emerging implications. Among these: a) Under what environmental conditions and spatial scales do these opposing trends overlap and interact? b) Do these opposing trends drive significant changes in ecosystem functionality? and c) How does this imbalance impact the recovery trajectory following of land abandonment?

TSE.6. Greenhouse gas fluxes across natural and anthropized ecosystems

Thursday, 5 (15:30-17:00)

Room: Seminario 2

During the last century, the concentration of the main greenhouse gases (GHGs) like CO2, CH4, and N2O has increased substantially in the atmosphere, driving global climatic change. However, the knowledge about the sources and sinks of these GHGs in different types of ecosystems is still very limited, constraining global predictions and models. In this session, we want to explore the different processes involved in the GHG budgets (emissions and uptakes) in diverse natural (e.g., lakes, rivers, coastal wetlands, forests, grasslands, coastal vegetation) and anthropized (e.g., crops, aquaculture, reservoirs) ecosystems. This session invites scientists working on greenhouse gas fluxes at the ecosystem scale to present their results, enabling a comparison among different ecosystem types and produce a more holistic, global vision.

Organizers:

• **Isabel Reche,** Departamento de Ecología, Universidad de Granada; Iris Hendriks, Instituto Mediterráneo de Estudios Avanzados (CSIC-UIB)

• **Penélope Serrano-Ortiz,** Departamento de Ecología, Universidad de Granada.

TSE.6. Orals

[TSE.6-O-1]

Thursday 5, after lunch (third): 15:30
Room: Seminario 2

Seasonal and diurnal CO2 patterns in desiccated wetland sediments

Rodríguez Gómez, Sofía[1]; Ledesma Hernández, Guillermo[2]; Warren Jiménez, Paula[3]; Ruiz Nieto, Miriam[4]; Marcé Romero, Rafael[5]; Montes Pérez, Jorge Juan[6]; Moreno Ostos, Enrique[7]

(1) Universidad de Málaga; (2) Universidad de Málaga; (3) Universidad de Málaga; (4) Universidad de Málaga; (5) Centro de Estudios Avanzados de Blanes (CSIC); (6) Universitat de Barcelona; (7) Universidad de Málaga

Correspondence e-mail: [sofia.rg.gda@gmail.com]

Emerged sediments of inland aquatic ecosystems constitute a source of carbon dioxide (CO2) to the atmosphere. Wetlands are among the ecosystems with the highest carbon storage in sediments worldwide, making the quantification of its release and its relationship with environmental drivers particularly relevant in the context of global change.

In this study, CO2 fluxes were quantified in the exposed sediment of Fuente de Piedra Lagoon, a saline endorheic wetland located in Málaga (Spain). Monthly measurements were conducted over an entire year, spanning from sunrise to sunset. Additionally, four 24-hour sampling campaigns (one per season) were performed. CO2 fluxes were measured hourly at six stations: three near the shoreline (rewetted) and three along the incipient vegetation line (terrestrialized).

The desiccated sediment acted as a net CO2 source. No significant differences were observed between rewetted and terrestrialized zones. The magnitude and daily variation of the fluxes peaked in summer, showing a linear relationship with temperature. Likewise, a daily pattern was detected, with maximum emissions at midday and minimum at night. This behavior was also temperature-dependent but exhibited a hysteresis effect, where afternoon emissions were lower than morning emissions at the same temperature. Furthermore, nocturnal CO2 uptake was recorded throughout the year, a phenomenon reported in saline soils due to abiotic factors but rarely studied in exposed sediments. These findings highlight the importance of extending measurements both annually and daily to avoid over- or underestimating fluxes and to understand their complex relationship with environmental variables.

[TSE.6-O-2]

Thursday 5, after lunch (third): 15:45
Room: Seminario 2

The role of climate change in soil greenhouse gas fluxes from Mediterranean forests: A potential positive feedback with global warming

Villa-Sanabria, Elena[1]; Durán, Jorge[2]; Rodríguez, Alexandra[3]; Fangueiro, David[4]; Gallardo, Antonio[5]; Gómez-Aparicio, Lorena[6]

(1) IRNAS-CSIC (Seville, Spain); Universidad Pablo de Olavide (Seville, Spain); (2) MBG-CSIC (Pontevedra, Galicia, Spain); (3) MBG-CSIC (Pontevedra, Galicia, Spain); (4) LEAF, Instituto Superior de Agronomia, Universidade de Lisboa (Lisboa, Portugal); (5) Universidad Pablo de Olavide (Seville, Spain); (6) IRNAS-CSIC (Seville, Spain)

Correspondence e-mail: [elenavilla357@gmail.com]

Forest soils play a fundamental role in global climate regulation, generally acting as major sources of CO2 and N2O, while also acting as significant sinks for CH4. Climate change might alter these greenhouse gas (GHG) budgets, particularly in Mediterranean forests, which are highly susceptible to changes in precipitation and temperature. Despite this vulnerability, experimental evidence on the combined effects of reduced precipitation and warming on GHG fluxes in these ecosystems remains scarce.

To fill this gap, we analysed seasonal soil GHG fluxes during two years in a Mediterranean forest of Southern Spain under experimental conditions of reduced precipitation (ambient vs. ~30% rainfall reduction) and soil warming (ambient vs. ~ 0.5 °C increase), alone and combined. Throughout the study, approximately 3,600 soil gas samples were collected using static flux chambers and analysed by gas chromatography.

Soil net CO2 emission, CH4 uptake and a very low N2O flux were the prevailing trends. The climatic treatments affected flux magnitudes, but not their direction. Rainfall reduction and warming showed additive effects of opposite sign on GHGs. Rainfall reduction effects varied strongly among seasons and years, whereas warming effects were consistent across time. Overall, our results suggest a positive feedback to global warming from Mediterranean forest soils due to the positive and permanent effects of warming on soil CO2 fluxes across time, only temporally offset by the negative impact of rainfall reduction. Further, our study highlights the complexity of disentangling the simultaneous impacts of multiple climate change drivers on GHGs fluxes.

[TSE.6-O-3]

Thursday 5, after lunch (third): 16:00
Room: Seminario 2

Temporal Dynamics of Nitrous Oxide Hot Moments Across Ecosystems in Europe

Sabaté Gil, Maria Cinta[1]; Mattana, Stefania[2]; Peñuelas, Josep[3]; Fernández-Martínez, Marcos[4]; Tallec, Tiphaine[5]; Boland, François[6]; Heinesch, Bernard[7]; Freigenwinter, Iris[8]; Rautakoski, Helena[9]; Lohila, Annalea[10]; Magliulo, Enzo[11]; Janssens, Ivan[12]; Roland, Marilyn[13]; Poblador, Sílvia[14]; Ribas, Àngela[15]

(1) Global Ecology Unit CREAF-CSIC-UAB, Bellaterra, Catalonia, Spain; (2) Global Ecology Unit CREAF-CSIC-UAB, Bellaterra, Catalonia, Spain; (3) Global Ecology Unit CREAF-CSIC-UAB, Bellaterra, Catalonia, Spain; (4) Global Ecology Unit CREAF-CSIC-UAB, Bellaterra, Catalonia, Spain; (5) CNES/CNRS/INRAE/IRD/UPS, Toulouse, France; (6) University of Liège, Belgium; (7) University of Liège, Belgium; (8) Department of Environmental Systems Science, ETH Zurich, Switzerland; (9) Finnish Meteorological Institute, Climate System Research, Helsinki, Finland; (10) Finnish Meteorological Institute, Climate System Research, Helsinki, Finland; (11) CNR – ISAFOM Napoli, Italy; (12) PLECO (Plants and Ecosystems), Department of Biology, University of Antwerp; (13) PLECO (Plants and Ecosystems), Department of Biology, University of Antwerp; (14) BEECA, Universitat de Barcelona, Catalonia, Spain; (15) Global Ecology Unit CREAF-CSIC-UAB, Bellaterra, Catalonia, Spain

Correspondence e-mail: [c.sabate@creaf.uab.cat]

Nitrous oxide (N2O) is a critical greenhouse gas with notable global warming potential and ozone-depleting effects. Its emissions exhibit high spatiotemporal variability, often marked by brief periods of disproportionately high flux, hereafter called “hot moments.” These episodes contribute significantly to annual emissions in agricultural and forest ecosystems, yet their precise definition, triggers, and modelling remain ambiguous. This study examines N2O hot moments across five sites within the Integrated Carbon Observation System (ICOS) network, covering agricultural, sylvicultural, and unmanaged forest landscapes in Belgium, Switzerland, and Finland.

We analysed 81,749 hourly N2O flux observations collected between 2010 and 2020 using eddy covariance and automated chamber methods, along with soil water content (SWC) and temperature (TS) data. Hot moments were defined as fluxes exceeding four times the site-specific standard deviation. Temporal and environmental drivers were assessed using inferential statistics and machine learning, including Random Forest models incorporating lagged variables.

Although hot moments represented only 0.5–1.1% of observations, they accounted for 1–70% of annual N2O emissions, depending on the site. Fertilized parcels exhibited the highest overall emissions; however, it was unmanaged and unfertilized parcels that showed substantially greater contributions from hot moment emissions. Seasonal patterns differed across sites, with spring and summer being predominant for hot moment emissions. Random Forest analysis revealed site-specific differences in dominant drivers, with lagged TS and SWC variables further explaining flux variability.

This study underscores the importance of high-resolution temporal data in reducing uncertainties in N2O emissions and highlights the need for ecosystem-specific modelling approaches.

[TSE.6-O-4]

Thursday 5, after lunch (third): 16:15
Room: Seminario 2

Chaotic or periodic carbon fluxes? Estimating temporal complexity to understand ecosystem functioning

Fernández Martínez, Marcos[1]; Janssens, Ivan A.[2]; Obersteiner, Michael[3]; Manning, Peter[4]; Andrade, Filipe M.[5]; Rodríguez-Penedo, Eladio[6]; Peñuelas, Josep[7]

(1) CREAF; (2) Universiteit Antwerpen; (3) University of Oxford; (4) University of Bergen; (5) CREAF; (6) CREAF; (7) CREAF-CSIC

Correspondence e-mail: [m.fernandez@creaf.uab.cat]

Ever since the development of non-linear dynamics and chaos theory it has been known that simple processes can lead to high complexity in the functioning of nature. Recent studies have shown that non-linear dynamics are common across populations of very different taxa. However, whether the energy and matter fluxes of entire ecosystems follow non-linear dynamics, such as ecosystem carbon (C) fluxes, and how complex these dynamics are, is still unknown. We here take a novel approach to looking at C fluxes from 57 ecosystems around the world to investigate whether they display periodic, low- or high-dimensional chaotic, or a random temporal behaviour by means of the correlation dimension. Hence, we assessed the temporal complexity of ecosystem functioning, and investigated its drivers and trends over time. Ecosystems with higher temporal complexity exhibited lower interannual variability and seasonality. Causal analyses indicated that ecosystems with larger C fluxes generally cause higher temporal complexity, and larger and temporally complex C fluxes contribute to reducing interannual variability, potentially indicating higher resistance to perturbations. Our results showed a positive trend in the complexity of GPP over time, which correlates with increasing annual GPP. Although the increase in GPP temporal complexity is on average very small (<0.5 degrees of freedom over 20 years), this result may indicate that ecosystems are increasingly responsive to endogenous or exogenous stimuli. Our results indicate non-linear dynamics are present in C fluxes, and that the short-term temporal complexity of ecosystem functioning can be informative about ecosystem properties otherwise missed by longer timescales.

[TSE.6-O-5]

Thursday 5, after lunch (third): 16:30
Room: Seminario 2

Evaluating the Recovery of Ecosystem Services in a Restored Seagrass Meadow: Greenhouse Gas Fluxes and Climate Mitigation Potential

Máñez Crespo, Julia[1]

(1) Instituto Mediterráneo de Estudios Avanzados

Correspondence e-mail: [jmanez@imedea.uib-csic.es]

Introduction: Seagrass meadows are critical components of coastal ecosystems, playing a significant role in the global carbon cycle. These “Blue Carbon Ecosystems” (BCEs) are highly effective natural carbon sinks because they are highly productive, trap allochthonous carbon, and can store sequestered carbon for centuries to millennia in the sediment. Hence, they contribute to the long-term removal of atmospheric CO2 and prevent the remineralization of buried carbon via methanogenesis, thereby supporting climate regulation. This study evaluates the recovery of ecosystem services, specifically greenhouse gas (GHG) flux regulation, in a Zostera marina seagrass meadow that has undergone phased restoration since 2015.

Material & Methods: By assessing the fluxes of methane (CH4) and carbon dioxide (CO2) across different restoration stages using a LICOR 7810 and an incubator chamber, we explore how the meadow’s GHG emissions and carbon sequestration capacity change over time as the ecosystem recovers.

Results & Discussion: Our findings show that, after 9 years of restoration, CH4 emissions decreased by 1.11-fold and CO2 net sequestration increased by 1.23-fold compared to the eroded meadow. While CO2 fluxes in the older restored meadow are 1.33 times higher than those in the original meadow, CH4 fluxes are 3 times higher, indicating a greater challenge in restoring ecosystem services related to methane flux. Despite this, GHG fluxes, especially methane emissions, decrease over time, suggesting that restored meadows are gradually recovering their capacity as carbon sinks. This study highlights the potential of phased restoration to enhance carbon sequestration and support long-term climate mitigation efforts.

[TSE.6-O-6]

Thursday 5, after lunch (third): 16:45
Room: Seminario 2

Production profiles of methane and nitrous oxide in the sediments of a Mediterranean reservoir during mixing and stratification periods

García Alguacil, Miriam[1]; Ramón Casanas, Cintia Luz[2]; Rueda Valdivia, Francisco José[3]; McGinnis, Daniel[4]; Castellano Hinojosa, Antonio[5]; López Padilla, Sergio[6]; Martínez García, Andrés[7]; Picazo Mota, Félix[8]; Reche Cañabate, Isabel[9]

(1) Universidad de Granada. Facultad de Ciencias; (2) Universidad de Granada. E.T.S. de Ingeniería de Caminos, Canales y Puertos; (3) Universidad de Granada. E.T.S. de Ingeniería de Caminos, Canales y Puertos; (4) Université de Genève; (5) Universidad de Granada. Facultad de Farmacia; (6) Universidad de Granada. E.T.S. de Ingeniería de Caminos, Canales y Puertos; (7) Universidad de Granada. Facultad de Ciencias; (8) Universidad de Granada. Facultad de Ciencias; (9) Universidad de Granada. Facultad de Ciencias

Correspondence e-mail: [mga00043@ugr.es]

Reservoirs are relevant sources of greenhouse gases (GHGs). Most dissolved CH4 originates from the decomposition of organic matter under anoxic

conditions in the sediments, where it either diffuses into the water column or is released through ebullition. N2O is also produced in large quantities, particularly in eutrophic reservoirs, primarily via nitrification and denitrification under oxic and anoxic conditions, respectively. While many studies focus on gas exchanges through the water-air interface, less attention has been given to the sediment, where the majority of the production occurs. Here, we present CH4 and N2O potential production rates from a shallow, eutrophic Mediterranean reservoir over the course of one year. To quantify these production rates, sediment cores were collected monthly and sediment samples from different layers within each core were incubated in the laboratory at a constant temperature for one day. During the reservoir’s mixing period, when oxic conditions were present above the sediment, maximum CH4 production

occurred in the deeper layers (? 30 cm) where the sediment remained anoxic. In contrast, during the stratification period, when the water above the sediment was anoxic, CH4 production shows a more uniform distribution across sediment layers. Conversely, N2O production was predominantly observed in the upper sediment layers. This suggests that N2O production is enhanced under oxic conditions in the sediment, likely driven by nitrification or other microbial processes. These findings highlight the critical role of sediment redox conditions in GHG production, emphasizing the importance of oxygen availability in regulating CH4 and N2O dynamics in eutrophic reservoirs.

TSE.6. Posters

[TSE.6-P-1]

Tuesday 3
Discussion corner: Room 6

Effects of Forest Management on Soil CO2 Fluxes

Agea Plaza, Daniel[1]; Martínez López, Javier[2]; Alcaraz Segura, Domingo[3]; García Berro, Ignacio[4]; Aránega Cortés, María[5]; Postma, Thedmer[6]; Romero Freire, Ana[7]; Serrano Ortíz, Penélope[8]

(1) Facultad de Ciencias de la Universidad de Granada; (2) Facultad de Ciencias UGR; IISTA-CEAMA; (3) Facultad de Ciencias UGR; IISTA-CEAMA; CAESCG; (4) Facultad de Ciencias UGR; (5) Facultad de Ciencias UGR; (6) IISTA-CEAMA; Faculta de Ciencias UGR; (7) Facultad de Ciencias UGR; (8) Facultad de Ciencias UGR; IISTA-CEAMA

Correspondence e-mail: [danielageaplaza@gmail.com]

1) The implementation of adaptive management practices, such as thinning and clearing of pine and oak stands, promotes the protection and enhancement of the ecosystem services they provide. These management practices alter soil properties by contributing plant residues, affecting moisture and temperature, altering the activity of decomposing microorganisms, and modifying greenhouse gas (GHG) exchanges between the soil and the atmosphere. Knowing that two-thirds of the total amount of carbon in the biosphere is stored in the soil, it is of vital importance to analyze and understand the processes that contribute to its storage or release into the atmosphere and predict how these management practices modify its behavior.

2) In this study, CO2 fluxes were measured in oak forests, holm oak forests, and reforested pine stands in Sierra Nevada under two microhabitats: soil covered with thinning residues and bare soil. The measurements, conducted bimonthly between March 2022 and November 2024 using a gas analyzer and portable chamber, were complemented with satellite images (Landsat-8-9 and Sentinel-2), extracting information on various vegetation indices, moisture, albedo, and temperature to attempt to relate them to carbon fluxes along with other meteorological variables measured in the field.

3) As a general result, we highlight that the soil in these forest ecosystems acts as a CO2 emitter, with the flux varying according to the type of treatment. Environmental variables such as precipitation and temperature are key to predicting soil CO2 emissions, along with soil temperature values derived from the Thermal index.

[TSE.6-P-2]

Wednesday 4
Discussion corner: Room 6

The role of riparian soils as green nitrogen filters along a Mediterranean river network

Izquierdo, Aitana[1]; Poblador, Sílvia[2]; Sabater, Francesc[3]; Lupon, Anna[4]; Ledesma, José[5]; Peñarroya, Xavier[6]; Jativa, Carolina[7]; Bernal, Susana[8]

(1) Centre d'Estudis Avançats de Blanes, CEAB-CSIC; (2) Facultat de Biologia, Universitat de Barcelona; (3) Facultat de Biologia, Universitat de Barcelona; (4) Centre d'Estudis Avançats de Blanes, CEAB-CSIC; (5) Museo Nacional de Ciencias Naturales, MNCN-CSIC; (6) Centre d'Estudis Avançats de Blanes, CEAB-CSIC; (7) Centre d'Estudis Avançats de Blanes, CEAB-CSIC; (8) Centre d'Estudis Avançats de Blanes, CEAB-CSIC

Correspondence e-mail: [aitana.izquierdo@ceab.csic.es]

Riparian corridors can help to reduce nitrate pollution via denitrification, a microbial process that transforms nitrate into nitrogen (N) gas under anaerobic conditions. These ecosystems, considered powerful green N filters, are used as a mitigation strategy worldwide. However, their N buffering capacity is not warranted in Mediterranean regions where riparian soils show intermediate soil moisture conditions that enhance nitrification over denitrification, enhancing nitrate accumulation. Moreover, the two processes can produce N2O, a greenhouse gas 300 times more powerful than CO2.

The RIPAMED project aims to assess the role of Mediterranean riparian corridors as green N filters and to identify under which climatic conditions riparian soils act either as sources or sinks of nitrate and N2O. To do so, we have selected 10 riparian plots along La Tordera (Catalonia), a typical Mediterranean river draining 870 km2 of forested and agricultural landscapes. At each plot, we are measuring soil moisture and temperature at sub-daily time scales, and soil N cycling seasonally.

Our preliminary results suggest that altitude drives longitudinal changes in environmental variables, especially soil moisture, which tends to decrease from the headwaters to the river's mouth. We expect this spatial pattern to be accompanied by concomitant changes in net nitrification and denitrification, leading to an increase in nitrate accumulation in the lower parts of the riparian corridor. Our results will contribute to identify where and when Mediterranean riparian corridors emit more N2O and most effectively mitigate nitrate pollution, providing valuable insights that will help to prioritize management and conservation practices.

[TSE.6-P-3]

Thursday 5
Discussion corner: Room 6

Carbon fluxes in temperate rice fields; comparing organic and conventional farming under different management schemes

Alvarez, Nil[1]; Arias Ortiz, Ariane[2]; Estruch Puig, Carme[3]; Ibañez Martí, Carles[4]

(1) Eurecat; (2) UAB; (3) Eurecat; (4) Eurecat;

Correspondence e-mail: [nil.alvarez@eurecat.org]

Introduction: Rice paddies are significant methane (CH4) sources, contributing to around 9% of global anthropogenic CH4 emissions. These emissions arise from the anaerobic conditions in the flooded fields, with water management systems being key factors influencing CH4 emissions, but also one of the most promising approaches for CH4 emission mitigation. Periodic drainage and aeration of rice paddies not only help oxidize existing CH4 in the soil but also inhibit further methane production. In this study, we compared carbon fluxes in organic and conventional rice farming systems in the Ebro Delta, a major rice-growing region in Catalonia, Spain.

Materials and methods: We tested the effects of traditional management practices versus alternate wetting and drying (AWD) combined with late straw incorporation (LSI) in commercial rice fields. We designed a factorial experiment with 12 fields under 4 practices including both organic and conventional rice production. Together with environmental parameters, CH4 fluxes were monitored using static chambers coupled with an IRGA system (LI-COR 7810) once every two weeks over one year.

Results and discussion: Our findings demonstrate that AWD and LSI significantly reduce CH4 emissions in both organic and conventional systems, offering pathways to reduce the environmental footprint of rice farming. This research enhances understanding of carbon fluxes in temperate rice fields, providing insights to inform agricultural policy and carbon market strategies. The final goal of the study is to establish the basis for a voluntary carbon market in Spanish rice fields.

[TSE.6-P-4]

Tuesday 3
Discussion corner: Room 6

Labile lipids fuels methane ebullition

Martínez García, Andrés[1]; García Alguacil, Míriam[2]; Rodríguez Velasco, Eva[3]; Peralta Maraver, Ignacio[4]; Rodrigo Gámiz, Marta[5]; Naeher, Sebastian[6]; Reche Cañabate, Isabel[7]

(1) University of Granada; (2) University of Granada; (3) University of Granada; (4) University of Granada; (5) University of Granada; (6) GNS Science; (7) University of Granada

Correspondence e-mail: [andmargar@ugr.es]

The lability of sedimentary lipids affects both carbon sequestration and methane production in aquatic ecosystems. Refractory lipids, such as glycerol dialkyl glycerol tetraethers (GDGTs), can persist in sediments over long timescales and are commonly used as paleolimnological biomarkers. In contrast, phytoplankton-derived lipids tend to decompose faster, fueling a higher methane production, than those ones from terrestrial plants or animals (i.e., sterols). Here, we performed a round year weekly monitoring of lipid biomarkers, including GDGTs and fatty acids, from sediment traps deployed in a eutrophic reservoir to study their relationship to methane ebullition. We found a strong synchrony between methane ebullition and lipids associated with phytoplankton, such as phytol and specific short-chain fatty acids (C16:1?5, C16:1?7 and C18:2?7), collected during the previous week. We observed a week delay between the concentration maxima of short-chain alkanols (C14:0 to C20:0) and fatty acids (C14:0, C16:0, C18:0 and C20:0) and methane ebullition. In contrast, methane ebullition was not correlated to cyanobacterial lipids (e.g. C15 isomer fatty acids), sterols from phytoplankton (i.e., brassicasterol), animals (e.g., cholesterol) or terrestrial plants (e.g., sitosterol, amyrins), or microbial membrane components (e.g., GDGTs). This study highlights the large variability in lipids lability at the compound-specific level depending on its origin and structure with relevant consequences for methane ebullition and long-term storage.

[TSE.6-P-5]

Wednesday 4
Discussion corner: Room 6

A mechanistic description of methane emission fluxes during lake-overturn in a Mediterranean reservoir

López Padilla, Sergio[1]; Ramón Casañas, Cintia Luz[2]; García Alguacil, Miriam[3]; Martínez García, Andrés[4]; Navarro Campoy, Ana[5]; Serrano Ortiz, Penélope[6]; Pérez Sánchez-Cañete, Enrique[7]; Herrero Lantarón, Francisco Javier[8]; Reche Cañabate, Isabel[9]; Rueda Valdivia, Francisco José[10]

(1) Universidad de Granada; (2) Universidad de Granada; (3) Universidad de Granada; (4) Universidad de Granada; (5) Universidad de Granada; (6) Universidad de Granada; (7) Universidad de Granada; (8) Universidad de Granada; (9) Universidad de Granada; (10) Universidad de Granada

Correspondence e-mail: [sergiolp@ugr.es]

Reservoirs are significant sources of greenhouse gases (GHGs) to the atmosphere, with eutrophic reservoirs playing a critical role in global CH4 emissions from aquatic ecosystems. This study quantifies CH4 accumulation in the hypolimnion and its potential emission during the fall mixing period in the Iznájar Reservoir, one of Spain's largest, with a maximum volume of ~1000 hm³ and an average depth of 40 m. High concentrations of dissolved CH4, reaching up to 3000 µg CH4 l?¹, were measured in the hypolimnion during stratification, indicating substantial emissions during mixing. To estimate CH4 emissions, we applied a combined empirical-modeling approach, solving a methane mass balance in the surface mixed layer and considering processes like methane oxidation by bacteria, entrainment of CH4-rich hypolimnetic water, and gas exchange across the air-water interface. These processes, parameterized using empirical observations and modeled hourly, yielded time-varying emission estimates for 2024 consistent with eddy-covariance tower and flux chamber measurements.

[TSE.6-P-6]

Thursday 5
Discussion corner: Room 6

Leaf trait variation within and among species modulates the contribution of plant species richness to ecosystem production

Ortega, Miguel[1]; Peña García, Rocío[2]; Pérez Vallejo, María R.[3]; Vaca Benito, Celia[4]; Obeso Suárez, José R.[5]; Laiolo, Paola[6]

(1) Biodiversity Research Institute (CSIC, UO, PA); (2) Biodiversity Research Institute (CSIC, UO, PA); (3) Biodiversity Research Institute (CSIC, UO, PA); (4) Biodiversity Research Institute (CSIC, UO, PA); (5) Biodiversity Research Institute (CSIC, UO, PA); (6) Biodiversity Research Institute (CSIC, UO, PA)

Correspondence e-mail: [miguelortegus@gmail.com]

Stability in ecosystem services is of major concern in the context of global change impact. Previous studies linked ecosystem production to species richness within plant communities, finding both positive and negative associations but consistently identifying species richness as a stabilizing factor. Few studies considered other dimensions of biodiversity, such as those associated with functional trait and their interspecific and intraspecific variation.

Here, we assessed the relationship between ecosystem production and species richness in grasslands, incorporating the interaction with interspecific variation of leaf trait at the individual (within and among) and interspecific levels. Additionally, we tested the relationship between species richness and small scale spatial and short-term temporal stability. In total, 2,502 individuals from 123 plant species in 20 grassland stations were collected for leaf trait measurements, along with 526 quantifications of soil carbon flux used as a proxy for net ecosystem production.

Results showed that species richness increased net carbon flux, but under high levels of interspecific variation in specific leaf area. Interspecific variation was more important than intraspecific one in this context. Stability was spatially 146% higher and temporally 121% higher with high species richness . These findings suggest that species richness acts as both a stabilizing and production-enhancing mechanism, compensating for variability in communities with high niche differentiation. We also highlight the importance of including other levels of biological diversity to improve the understanding of ecosystem services and their resilience.

[TSE.6-P-7]

Tuesday 3
Discussion corner: Room 6

Cork Oak, a super-CH4 emitter tree species

Fíguls Calvelo, Roger[1]; Trullols, Josep Maria[2]; Bañeras, Lluís[3]; Gauci, Vincent[4]; Llorens, Laura[5]; Pacheco, Arturo[6]; Verdaguer, Dolors[7]; Barba, Josep[8]

(1) Universitat de Girona; (2) Universitat de Girona; (3) Universitat de Girona; (4) BIFoR; (5) Universitat de Girona; (6) University of Padua; (7) Universitat de Girona; (8) CREAF

Correspondence e-mail: [roger.estaron@gmail.com]

Methane (CH4) emissions from tree stems represent an important yet poorly understood process, potentially driven by microbial activity within the tree tissues or by transport from the soil. The extent to which environmental factors influence these emissions, particularly in water-limited ecosystems like the Mediterranean, remains uncertain. This study focuses on cork oak (Quercus suber), to investigate stem CH4 fluxes and the role of cork removal. Cork, which is periodically harvested for its insulating properties, may serve as a physical barrier to methane escape, so we expect an increase of stem emissions after the cork removal. We measured CH4 emissions from trees before and after the cork peeling, comparing emissions at two different stem heights: one in the cork peeled zone and one above it. Additionally, we conducted anaerobic incubations of wood to test CH4 production capacity and characterized microbial communities in the cork, sapwood, and hardwood tissues.

Our findings revealed significant CH4 emissions from cork oaks (mean 59.83 µmol m-2 h-1), with a positive correlation with tree diameter. Surprisingly, peeling the cork did not alter emission rates, even immediately after the bark was removed. A pronounced vertical gradient in emissions was noted, with higher fluxes at the base of the tree, traditionally linked to soil-originated methane. However, the detection of substantial CH4 production in tree cores and a correlation with methanogenic microbial genes point to a predominant internal source of methane, suggesting that tree-specific factors may have a greater influence on CH4 emissions than environmental conditions alone.

TSE.7. What works in forest management and restoration

Thursday, 5 (11:00-12:30); (12:45-14:15)

Room: Seminario 2

The increasing threats posed by forest destruction and extreme climate change mean that sustainable forest management and restoration are more urgent than ever. This importance is reflected in the ambitious commitments made by governments worldwide, such as restoring 3.6 million square kilometres of forests—around six times the size of the Iberian Peninsula. Despite the high political priority of forest management and restoration, many knowledge gaps remain. For example, we still know relatively little about the impacts of management and restoration practices on key aspects like soil health, water quality, and complex biodiversity outcomes, such as species interactions. In addition, the trade-offs between environmental and social priorities, the contexts in which different management and restoration strategies are most effective, and the social factors that determine success remain unclear. This session will explore these crucial themes, aiming to provide a comprehensive overview of what works—and what doesn't—when attempting to sustainably manage and restore forest ecosystems.

Organizers:

• **Philip Martin,** Basque Centre for climate change - Bc3

• **Isabel Donoso,** Basque Centre for climate change - Bc3.

TSE.7. Orals

[TSE.7-O-1]

Thursday 5, morning (first): 11:00
Room: Seminario 2

The forest within the forest: restoration of host plant-epiphyte networks following invasive plant control

Feldmann, Paula[1]; Heleno, Ruben[2]; Mieles, Alejandro E.[3]; Andrade, Miguel M.[4]; Traveset, Anna[5]; Jäger, Heinke[6]; Donoso, Isabel[7]

(1) University of Coimbra; (2) Community Ecology Lab, Universidade de Coimbra, Portugal; (3) Instituto Mediterráneo de Estudios Avanzados (IMEDEA-CSIC-UIB), Esporles, Islas Baleares, España; (4) Community Ecology Lab, Universidade de Coimbra, Portugal; (5) Instituto Mediterráneo de Estudios Avanzados (IMEDEA-CSIC-UIB), Esporles, Islas Baleares, España; (6) Charles Darwin Research Station, Charles Darwin Foundation, Santa Cruz, Galápagos, Ecuador; (7) Basque Centre for Climate Change (BC3) & IKERBASQUE, Basque Foundation for Science, Bilbao, Spain

Correspondence e-mail: [paulafeldmann82@gmail.com]

Introduction. Biotic invasions are a major driver of global biodiversity declines, particularly on islands. Epiphytes form an important fraction of tropical forest biodiversity, and although they are structurally dependent on host plants, their vulnerability to biotic invasions has been seldom evaluated. Here, we assess the impact of invasive plants (Rubus niveus and Cestrum auriculatum) on host-epiphyte interactions in the endemic and endangered Scalesia Forest on Santa Cruz Island (Galapagos). We evaluate structural differences in host-epiphyte interaction networks between invaded and restored plots and analyze the role of host plant status (invasive vs. native) in shaping epiphyte diversity.

Material and methods. Fieldwork was conducted in 20 paired 10 x 10 m plots (invaded vs. restored). Epiphyte sampling follow the grid-point intercept method to ensure randomized sampling. At 36 interception points per plot, we recorded the abundance of each epiphyte species on each host tree using ground-level binocular observation. Tree characteristics, including height, perimeter and moss cover, were also measured to assess their influence on epiphyte diversity and network structure.

Results and discussion. We recorded 1102 interactions between 37 host and 34 epiphyte species. Bipartite networks have been constructed to evaluate the impact of plant invasion on network robustness. Results suggest structural differences, with restored plots showing greater epiphyte diversity and abundance, as well as higher network robustness. Our findings reveal a still underappreciated impact of invasive plants on host-epiphyte interactions and highlight the importance of monitoring plant-plant interactions when monitoring restoration effectiveness.

[TSE.7-O-2]

Thursday 5, morning (first): 11:15
Room: Seminario 2

Key structural attributes of reforestations for the conservation of avian biodiversity: a comparison with natural forests

Lopez-Angulo, Jesús[1]

(1) Universidad Rey Juan Carlos

Correspondence e-mail: [jesus_loan@hotmail.com]

Reforestation has been widely promoted as a key strategy for restoring forests worldwide. However, it remains unclear whether these practices have been successful to recover biodiversity, particularly concerning bird communities, which play an essential role in forest ecosystems as seed dispersers and regulators of insect populations. This study aims to assess the impact of reforestation on bird communities by comparing species diversity and composition between natural and planted forests, and to identify the key structural characteristics of forests that promote avian biodiversity recovery.

We conducted passive acoustic surveys with to monitor bird communities in 28 planted forests and 24 mature reference forests in Castilla-La Mancha and Madrid, for one hour per day over 7 days. We evaluated how bird diversity and composition were affected by structural forest attributes (e.g., tree density, average DBH, forest structural heterogeneity) and management practices (e.g., time since planting, planted species, density-reduction thinning).

Preliminary results show that natural stands exhibit higher species diversity than planted forests, with a higher representation of specialized forest species. In contrast, bird community in planted forests is dominated by more generalist species. Our data reveal that reducing tree density in plantations to levels similar to those found in mature forests can increase bird community diversity. This study highlights how forest management can significantly contribute to the recovery and conservation of more diverse bird communities.

[TSE.7-O-3]

Thursday 5, morning (first): 11:30
Room: Seminario 2

Why does Portuguese oak regenerate less successfully than holm oak? Is it a matter of taste?

Morato Sánchez, María Noelia[1]; Pérez Camacho, Lorenzo[2]; Martínez de Baroja Villalón, Loreto[3]; Rebollo de la Torre, Salvador[4]; Villar Salvador, Pedro[5]; Cuevas Moreno, Jesús Ángel[6]

(1) Universidad de Alcalá; (2) Universidad de Alcalá; (3) Universidad de Alcalá; (4) Universidad de Alcalá; (5) Universidad de Alcalá; (6) Universidad de Alcalá

Correspondence e-mail: [noelia.morato@edu.uah.es]

Trees of the Quercus genus dominate much of the forests in the Iberian Peninsula and Europe, providing key ecosystem services and resources for human well-being. Evergreen and deciduous species coexist in transitional zones, but there is evidence of declining vigour in oaks stands and reduced sexual regeneration, with notable differences among species. Acorn dispersers are crucial for the regeneration and expansion of oak forests. Eurasian jays (Garrulus glandarius) in forested areas and Eurasian magpies (Pica pica) in open agroforestry landscapes are the most efficient acorn dispersers, while wood mice (Apodemus sylvaticus) act across both environments. However, it remains unclear whether dispersers' preferences for acorn species contribute to the differences in regeneration among species.

Using camera traps and acorn radio-tracking, we assessed the preferences of these three dispersers for holm oak (Q. ilex, evergreen) and Portuguese oak (Q. faginea, deciduous) acorns across the different stages of dispersal: removal from trees, caching, recaching, recovery, and abandonment.

All three dispersers showed a high preference for removing holm oak acorns, with magpies and wood mice storing a higher proportion of holm oak acorns on the ground compared to Portuguese oak acorns. No differences were observed between the two oak species in terms of dispersal distances, microsites, recaching, or recovery rates for any of the dispersers. We conclude that all disperser species studied prefer to remove and cache holm oak acorns, likely due to their superior nutritional, organoleptic, and durability traits. Consequently, acorn dispersal may represent a bottleneck for Portuguese oak compared to holm oak.

[TSE.7-O-4]

Thursday 5, morning (first): 11:45
Room: Seminario 2

Resprouting response of two oak species to repeated biomass loss: effects of warming and revegetation method

Medina, María[1]; Reyes-Martín, Marino Pedro[2]; Castro, Jorge[3]; Leverkus, Alexandro B.[4]

(1) University of Granada; (2) University of Granada; (3) University of Granada; (4) University of Granada; Inter-University Institute for Earth System Research in Andalusia (IISTA)

Correspondence e-mail: [mariasm@go.ugr.es]

The UN Decade on Ecosystem Restoration calls for climate-adapted revegetation. By affecting taproot development, the choice between seeding and planting may modulate resource acquisition capacity and plant ability to resprout. We studied the resprouting capacity of 3 year-old seedlings of two oak species of contrasting drought sensitivity (Quercus rotundifolia and Q. faginea) under two revegetation methods (seeding and planting) and two climatic scenarios (current conditions and a ~2°C increase using open-top chambers) after two biomass-removing events.

In late 2020, a field experiment was established in Granada, Spain, with acorns directly seeded and grown in a nursery. In 2021, 522 one-year-old seedlings were planted intermingled with 562 emerged seedlings. Aboveground biomass was harvested from 294 seedlings in late 2023, and a second harvest was done in late 2024. Monthly survival assessments will be conducted from December 2024 to May 2025. The resprouting capacity will be analysed by comparing the number of stems and their initial diameter with those of the resprouts. Data were analysed using linear mixed models to test fixed effects of revegetation method, species and temperature increment and treatment interactions.

After the first harvest, 94.6% of the seedlings resprouted. Ongoing monitoring following the second harvest shows that 63,1% of the seedlings have resprouted again as of Jan 2025. Experimentally induced air warming accelerated resprouting within 1 week on average and reduced first resprout survival rates by 11,5%. We will present the data on the probability of the second resprout. The results help understand the resilience of these species after multiple disturbances and facilitate decision-making in present and future restoration efforts.

[TSE.7-O-5]

Thursday 5, morning (first): 12:00
Room: Seminario 2

Evaluating reforestation success: plant diversity and structural characteristics in central Iberian forests

Conde-Raposo, Estrella[1]; García-Cervigón, Ana I.[2]; López-Angulo, Jesús[3]; Pescador, David S.[4]; Jiménez-López, F. Javier[5]; de la Cruz, Marcelino[6]; Calvo-Donate, Victoria[7]; Rojo-Valencia, Manuel[8]; Escudero, Adrián[9]

(1) Rey Juan Carlos University; Global Change Research Institute IICG-URJC; (2) Rey Juan Carlos University; Global Change Research Institute IICG-URJC; (3) Rey Juan Carlos University; Global Change Research Institute IICG-URJC; (4) Complutense University of Madrid; (5) Rey Juan Carlos University; Global Change Research Institute IICG-URJC; (6) Rey Juan Carlos University; Global Change Research Institute IICG-URJC; (7) Rey Juan Carlos University; (8) Rey Juan Carlos University; (9) Rey Juan Carlos University; Global Change Research Institute IICG-URJC

Correspondence e-mail: [estrella.conde@urjc.es]

Forest restoration is a powerful tool to mitigate biodiversity loss and enhance ecosystem resilience under Global Change. In Spain, reforestation has been a widespread practice for decades, and in recent years a growing number of laws and initiatives promoting it as a central strategy for ecosystem restoration have emerged. However, it remains unclear whether reforestations effectively conserve biodiversity and replicate the ecological functions of mature forests. Plants are fundamental components of forest ecosystems, as they sustain trophic chains and shape the structure, functionality, and stability of these systems. This study investigates the diversity and composition of perennial plants as indicators of restoration success in Mediterranean forests.

We sampled 62 reference forests and 71 reforestations across Madrid and Castilla-La Mancha, covering a wide range of ecological conditions and reforestation types. Plant diversity and composition were assessed in relation to structural forest attributes (e.g., tree density, tree height, DBH, forest structural heterogeneity) and reforestation characteristics (e.g., time since planting, patch size, planted species, management practices).

We hypothesize that plant richness may not differ significantly between reforestations and reference forests. However, plant composition will be influenced by structural forest characteristics, with mature forests supporting a higher abundance of specialized forest species. Young, dense, and structurally more homogeneous reforestations are expected to differ most from their reference forests. The results will provide insights into how reforestation strategies affect plant communities and will inform future restoration efforts to enhance their ecological effectiveness.

[TSE.7-O-6]

Thursday 5, morning (first): 12:15
Room: Seminario 2

Promoting adaptive post-fire forest restoration practices and socio-ecological resilience through a participatory process (Maials, Lleida, Northeastern Spain)

Duguy Pedra, Beatriz[1]; Vila Plandiura, Joana[2]; Gil Ortega, Víctor[3]; Albó Timor, Dalmau[4]

(1) Universidad de Barcelona; (2) Universidad de Barcelona; (3) Fundació Pau Costa; (4) Universitat de Lleida

Correspondence e-mail: [bduguy@ub.edu]

Over the last decades, in most Mediterranean landscapes, land use changes combined with global warming have enhanced the risk of large intense forest fires. As highlighted by the EU Nature Restoration Law, forests provide key ecosystem services and are essential to climate change mitigation. We need participatory approaches for promoting adaptive forest management practices (including post-fire restoration) that will increase ecosystems' capacity to cope with climate change, while integrating science with other stakeholders' perceptions and knowledge to develop more sustainable policies.

The study area (Maials, Lleida) was affected by a large fire in 2019. The study of fire impacts showed the loss of Juniperus phoenicea (with no adaptation to fire) and a small abundance of woody resprouters (that is a low resilience to fire).

We intended to design, implement and assess, in a participatory manner, post-fire restoration treatments aiming to recover biodiversity and promote resilience to fire.

Several knowledge-sharing and outreach events fed the decision-making process in relation to post-fire restoration. Plantations of J. phoenicea, Rhamnus alaternus and Pistacia lentiscus were carried out in January 2024, following an innovative clusters-based design.

Preliminary results show high survival rates after the first summer (ranging between 77% and 88%, for plants without or with tree shelter, respectively). Survival is dependent on the species (higher for J. phoenicea) and the environmental conditions (soil, aspect). Structural and functional vegetation parameters are also sampled. All results are discussed with stakeholders, facilitating long-lasting interaction mechanisms for guiding adaptive and sustainable post-fire restoration practices and promoting socio-ecological resilience.

[TSE.7-O-7]

Thursday 5, morning (second): 12:45
Room: Seminario 2

Effects of harvesting regimes on forest biodiversity indicators across Iberian forests

Rebollo, Pedro[1]; Ruiz-Benito, Paloma[2]; Andivia, Enrique[3]; Cruz-Alonso, Verónica[4]

(1) Universidad Complutense de Madrid; (2) Universidad de Alcalá; (3) Universidad Complutense de Madrid; (4) Universidad de Alcalá

Correspondence e-mail: [prebollo@ucm.es]

Introduction. Forest ecosystems have been shaped by human activities for centuries, with harvesting playing a key role in their functioning and dynamics. The EU Nature Restoration Law has established some indicators aimed at improving biodiversity of forest ecosystems. However, the ways in which forest management can enhance these indicators remain largely unexplored. To address this gap, we investigated the spatio-temporal patterns of tree harvesting regimes across the Iberian Peninsula and evaluated their effects on forest biodiversity indicators.

Material and methods. Using permanent plot data of the Spanish Forest Inventory from the 80s to present, we calculated five forest biodiversity indicators: deadwood, structural diversity, Shannon index, carbon storage and percentage of non-native species. In addition, we characterised harvesting regimes in studied plots as the percentage of removed basal area between consecutive inventories.

Results and discussion. Out of the 33,126 plots analysed across the two periods, 9,795 were classified as managed. In these plots, forest biodiversity indicators diminished regardless of the intensity of the harvesting and the forest type (i. e., monospecific/mixed, temperate/mediterranean, protected/unprotected), except for carbon storage, which was higher in plots with moderate levels of harvesting. Our results indicate that common tree harvesting is not an effective tool for promoting forest biodiversity according to the EU Nature Restoration Law, and although forest management might have different objectives (e.g. timer production, fire risk reduction), it can contribute to climate change mitigation through increasing carbon sequestration potential.

[TSE.7-O-8]

Thursday 5, morning (second): 13:00
Room: Seminario 2

Disentangling the effects of resin-tapping to ensure the resilience and sustainable provision of ecosystem services by maritime pine forests

Lema, Margarita[1]

(1) Misión Biológica de Galicia - CSIC

Correspondence e-mail: [mlema@mbg.csic.es]

Atlantic maritime pine forests provide timber and non-timber goods, besides valuable ecosystem services essential for the mitigation of global change. In particular, resin extraction is currently gaining attention as a renewable and sustainable way to produce bio-products that can substitute petroleum derivatives in many industrial processes. Resin is the main resistance mechanism of pine trees against biotic aggressions. Produced on huge amounts along every tissue, resin production is highly costly causing physiological trade-offs with other tree functions. Whether these physiological changes in the trees scale up and alters ecosystem functioning and the long-term resilience of Maritime pine forests is, however, still unknown. To fill this gap, this project aims to i) establish a robust long-term ecological network of field trials to ii) explore the effects of resin tapping on multiple components of forest functioning, including tree physiology (i.e. growth, defenses and reserves), ecological interactions with other elements of the ecosystem (i.e. insects, bats, birds, ectomycorrhizal fungi and soil microbiota) and forest regeneration (reproductive allocation, seed provisioning and transgenerational effects on the offspring). After two years of resin tapping in this network, we found that tapping operations lead to differences in the attraction of some species of herbivore insects, and alters bat and bird abundance, affecting ecosystem biodiversity. Changes in tree growth and defensive investment were pronounced. Response to resin tapping had also consequences on seedling performance through transgenerational plasticity effects. Alterations in pine-associated soil fungal communities, needle microbiome and emission of volatile compounds due to tapping are under study.

[TSE.7-O-9]

Thursday 5, morning (second): 13:15
Room: Seminario 2

Post-disturbance management shapes regeneration dynamics in an Iberian beech forest: Insights from six years after a tornado

Albeniz Arana, Lide[1]; Laskurain, Nere Amaia[2]; Astigarraga, Julen[3]; Jiménez-Martínez, Clara[4]; Medina-Villar, Silvia[5]; Cruz-Alonso, Verónica[6]; Herrero, Asier[7]

(1) Faculty of Pharmacy, University of the Basque Country, UPV-EHU, Vitoria-Gasteiz, Spain; (2) University of the Basque Country, UPV-EHU; (3) University of Alcalá; (4) University of Lleida; (5) National Institute of Agroalimentary Research and Technology, INIA-CSIC; (6) University of Alcalá; (7) University of the Basque Country, UPV-EHU

Correspondence e-mail: [lidealbeniz@gmail.com]

Introduction. Extreme winds are a major disturbance in forest ecosystems, highlighting the need for effective restoration strategies to facilitate recovery. The effects of common management options after disturbances on forest biodiversity such as salvage logging (harvesting of damaged trees) are controversial and might not be alienated with the obligations imposed by the Nature Restoration Law. This study evaluates the effect of post-disturbance management on the regeneration capacity of a beech (Fagus sylvatica) forest in northern Spain after a tornado in 2018 comparing contrasting management alternatives: salvage logging and retention forestry (dead wood retention).

Material and Methods. The tornado-impacted area was divided into east and west sections, each containing two plots: one with salvage logging (extraction) and the other with dead wood preservation (retention). Regeneration was assessed annually from 2019 to 2024 using 10 permanent transects of 40 m × 2 m per plot, documenting tree and large shrub species, height, seedling/sapling microhabitat, and herbivory damage by ungulates.

Results and Discussion. After six years, regeneration in retention plots was dominated mainly by pre-disturbance beech saplings, in part due to the absence of machinery damage. This advanced regeneration, with large sized saplings, could lead to an accelerated recovery of the beech forest canopy. In contrast, in the extraction plots, pioneer Salix spp. dominated and suffered higher browsing damage than beech. Our results suggest that the establishment of “wood retention islands” in areas with pre-existing regeneration can accelerate forest recovery while promoting species diversity by supporting the coexistence of various secondary succession pathways.

[TSE.7-O-10]

Thursday 5, morning (second): 13:30
Room: Seminario 2

Biomass and isotopes as indicators of post-fire management impact on natural regeneration in British Columbia

Barbeito, Ignacio[1]; Querejeta Mercader, Jose Ignacio[2]

(1) Faculty of Forestry, University of British Columbia; (2) Cebas-CSIC

Correspondence e-mail: [ignacio.barbeito@ubc.ca]

In British Columbia (Canada), the area affected by high-intensity crown fires has significantly increased in recent years, driven by climate change, the accumulation of dense understory due to fire suppression, and the rise in dead trees caused by mountain pine beetle infestations. In this context, understanding the factors controlling natural post-fire regeneration is crucial. Our study focused on post-fire regeneration of Douglas-fir, a species of great economic and ecological importance, following the 2017 wildfires. Sampling considered the interaction between fire severity (high, medium, and low) and the logging and removal of burned wood. In 2023, we collected samples from 228 seedlings for isotopic and biomass growth analyses. In areas with moderate severity, logging and removal of burned wood enhanced access to light, which is the main limiting factor for growth. Conversely, in high-severity areas, where sunlight was already abundant, salvage logging caused additional water stress without improving seedling growth. Therefore, seedlings on high severity not salvaged sites may regenerate well naturally without need for post-fire silvicultural intervention. Lower seedling densities in high severity sites indicate that limited seed sources, due to fewer surviving trees, combined with extreme heatwaves and droughts could hinder recovery.

[TSE.7-O-11]

Thursday 5, morning (second): 13:45
Room: Seminario 2

Applying the ecosystem service co-production concept to assess the sustainability of forest management

Antelo Barral, Alejandro[1]; Buendía García, Lucía[2]; Felipe-Lucia, María[3]

(1) Instituto Pirenaico de Ecología; (2) Instituto Pirenaico de Ecología; (3) Instituto Pirenaico de Ecología

Correspondence e-mail: [alejandroanba.2001@protonmail.com]

Forests support human wellbeing by providing multiple ecosystem services. These services are derived from an interplay of both natural and anthropogenic (i.e. human, social, financial and technological) assets, known as co-production. Understanding the relative importance of natural and anthropogenic capitals in the supply of ecosystem services is critical to provide guidelines for the sustainable management of ecosystem services, particularly in forests.

Using Geographic Information Systems (GIS), secondary data and key interviews, we classified forests in three study areas in Spain (Huesca, Navarra and Guadalajara) along a gradient of forest management intensity, ranging from natural protected forests to forestry plantations. For each forest type, we gathered information of both natural and anthropogenic capitals using fieldwork and social surveys. The results were statiscally analyzed to provide an index of the sustainability of forest management based on the relative proportion of each anthropic capital involved in the co-production of key ecosystem services (timber production, recreation, pest control, climate regulation).

Our results will show differences depending on the targeted ecosystem service and the type of forest management. This information will be useful for implementating more sustainable forest management policies that take into account an interdisciplinary approach of the landscape.

[TSE.7-O-12]

Thursday 5, morning (second): 14:00
Room: Seminario 2

Human Ecosystems Rewilding Experimental System (HERES): a research network to understand natural rewilding of abandoned agricultural areas in Mediterrranean Basin

Roy Currás, Silvia[1]; Romero del Moral, Alba[2]; Castellano, Clara[3]; Anadón, Jose Daniel[4]; Saiz, Hugo[5]

(1) Escuela Politécnica Superior, Universidad de Zaragoza; (2) Escuela Politécnica Superior, Universidad de Zaragoza; (3) Instituto Pirenaico de Ecología; (4) Instituto Pireinaico de Ecología; (5) Escuela Politécnica Superior, Universidad de Zaragoza

Correspondence e-mail: [roycurras96@gmail.com]

Introduction. In ecology, individual and specific studies are essential for hypotheses development, experimental design, and advancing knowledge at local scales. However, the results of such methodologies, while valid and necessary, are challenging to extrapolate to broader scales. This can limit our ability to detect and understand the processes and relationships within ecological communities across climatic and temporal gradients, factors that are crucial for facing current challenges associated to global change.

Material and Methods. Here we try to address this limitation through a regionally coordinated network designed to evaluate the dynamic of Mediterranean ecosystems following agricultural abandonment. To achieve this, we have created a network of sites across Aragón, a key region of depopulation and rural abandonment in Europe, spanning a diverse set of ecosystems (scrublands, shrublands and forests). In each site, we established a pair of plots, a) an abandoned agricultural field (>30 years since cessation of activity) and a site with no record of agricultural activity (control). For these plots, we have measured key environmental variables, such as climate, landscape land use, soil properties, multitrophic taxonomic diversity and biomass. In the future we aim to open this network to any researcher to further the knowledge on the rewilding of abandoned rural landscapes.

Results and Discussion. This approach allows us to evaluate hypotheses about the natural rewilding process in a more general manner, providing a research network to further our understanding in the face of global change.

TSE.7. Posters

[TSE.7-P-1]

Thursday 5
Discussion corner: Room 3

Identifying and quantifying biases in forest restoration

Martin, Philip[1]; Barreiro Chaves, Rafael[2]; Brancalion, Pedro[3]; Cruz, Veronica[4]; Downey, Harriet[5]; Hua, Fangyuan[6]; Kwarteng, David[7]; Lemma, Yigremachew[8]; Meli, Paula[9]; Wauchope, Hannah[10]

(1) Basque Centre for Climate Change; (2) University of Sao Paulo; (3) University of Sao Paulo; (4) Universidad Complutense de Madrid; (5) Woodland Trust; (6) Peking University; (7) Institute of Nature and Environmental Conservation, Ghana; (8) World Resources Institute; (9) Universidad de Concepción; (10) Edinburgh University

Correspondence e-mail: [phil.martin.research@gmail.com]

The use of different forest restoration practices varies across regions. This has important impacts on which practices are considered to be effective. For example, in Latin America natural regeneration has often been used, while more intensive restoration, such as tree planting, are more common in North America and Europe. In our global-scale study we quantify this geographic disparity to determine how it could impact apparent restoration effectiveness. Using evidence synthesis we show that natural regeneration typically occurs in areas with (i) greater forest cover, (ii) lower risks of invasive species, and (iii) lower income levels than areas where planting takes place. This means that global meta-analyses which have suggested that natural regeneration is more effective for biodiversity restoration than planting are likely to have been misleading. As such, we call for more robust studies to address which forest restoration methods are most effective and under which contexts.

[TSE.7-P-2]

Tuesday 3
Discussion corner: Room 3

Beyond LIFE TECMINE Project: Innovative techniques for mine restoration in Mediterranean environments. Results, impact and lessons learned

Morcillo, Luna[1]; Aparicio, Ana Isabel[2]; Gil, Cristina[3]; Martín Duque, José Francisco[4]; Nicolau, José Manuel[5]; Santiago, Juan Carlos[6]; olmo, Beatriz[7]; Uriol, Juan[8]; Vilagrosa, Alberto[9]

(1) Mediterranean Center for Environmental Studies (CEAM Foundation); (2) Vaersa; (3) Generalitat Valenciana; (4) Universidad Complutense de Madrid; (5) Universidad de Zaragoza; (6) SIBELCO; (7) Red de Restauración de minas y Canteras; (8) Generalitat Valenciana; (9) Mediterranean Center for Environmental Studies (CEAM Foundation)

Correspondence e-mail: [luna@ua.es]

Moving from remediation and rehabilitation to ecological restoration may contribute to recovering essential ecological losses along with promoting positive impacts on society, even beyond the area directly affected by mining. In dry climates, such as in the Mediterranean Basin, successful actions may depend on features related to proper species selection and restoration techniques, which may substantially contribute to provide substrate stability and facilitate the regeneration of the main ecological processes. In this context, we developed the LIFE TECMINE project.

The restoration strategy planned in TECMINE was designed at the landscape level with two main goals: the recovery of the natural geomorphology and the ecological restoration, including vegetation recovery and soil quality, based on suitable reference ecosystems. The implemented actions included: (i) surface remodelling to improve substrate stabilization and minimize the visual impact; (ii) an accurate species selection according to the habitat characteristics; (iii) high-quality plant production; and (iv) the implementation of low-cost techniques to enhance resources availability, soil fertility and the amelioration of abiotic conditions for the introduced seedlings. Within TECMINE, we developed a monitoring program to assess the success of the implemented restoration techniques over time and a powerful dissemination program to ensure knowledge transfer to a wide variety of actors. In fact, TECMINE has been replicated several times, was awarded at the LIFE 2023 Awards and participated at UNCCD COP16. The LIFE TECMINE project has demonstrated the economic feasibility of restoring mining-affected landscapes from an ecological approach, if there is good planning within a sustainable transfer mining.

[TSE.7-P-3]

Wednesday 4
Discussion corner: Room 3

Forest management practices shape ecosystem service provision and multifunctionality in a protected area

Ortega Barrueta, Unai[1]; Sertutxa Irazola, Unai[2]; Ametzaga Arregi, Ibone[3]; Curiel Yuste, Jorge[4]; Esteban Terradillos, Raquel[5]; Ruiz de Larrinaga, Lorena[6]; San Miguel Oti, Francisco[7]; Peña López, Lorena[8]

(1) Universidad del País Vasco; (2) Universidad el País Vasco; (3) Universidad del País Vasco; (4) BC3-Basque Centre for Climate Change; (5) Universidad del País Vasco; (6) Universidad del País Vasco; (7) BC3-Basque Centre for Climate Change; (8) Universidad del País Vasco

Correspondence e-mail: [unai.ortegab@ehu.eus]

Introduction. Forest ecosystems provide a wide range of ecosystem services (ES) essential for human well-being. However, traditional forest management practices have prioritized timber production, reducing the capacity of forests to deliver multiple ES. This study aims to evaluate the impact of different forest management types on multifunctionality, associated with thirteen ES (two provisioning, nine regulating, and two cultural). Additionally, it investigates the influence of forest attributes (location, structure, maturity, soil properties) on the supply of ES. The research is conducted within the Urdaibai Biosphere Reserve, a significant protected area in the Basque Country, Spain.

Methodology. Four forest management types were analysed in the study: i) unmanaged native forests, ii) abandoned pine plantations, iii) managed pine plantations, and iv) managed eucalyptus plantations. For each management type, 10 forest stands were sampled to evaluate 13 ES. Generalized linear mixed models were applied to assess the relations between forest attributes (e.g., forest location, structural complexity, soil properties) and multifunctionality, as well as individual ES.

Results and Discussion. Results showed that unmanaged native forests and abandoned pine plantations showed higher multifunctionality than managed plantations, which prioritized timber provision but performed poorly in other ES. Soil pH and vertical heterogeneity positively influenced several ES, while slope negatively affected certain regulating ES. Abandoned pine plantations demonstrated strong potential for ecological restoration, enhancing natural regeneration and the supply of regulating and cultural ES. These findings highlight the need for management practices that preserve structural complexity and optimize soil conditions to support multifunctionality.

[TSE.7-P-4]

Thursday 5
Discussion corner: Room 3

The impact of forest plantations on soil microbial communities in Biscay (Basque Country)

Sertutxa, Unai[1]; Ortega-Barrueta, Unai[2]; Ametzaga-Arregi, Ibone[3]; Peña, Lorena[4]

(1) University of the Basque Country; (2) University of the Basque Country (UPV/EHU); (3) University of the Basque Country (UPV/EHU); (4) University of the Basque Country (UPV/EHU)

Correspondence e-mail: [unai.sertutxa@ehu.eus]

Introduction. The issue of forest plantations and their management is of critical concern in the Iberian Peninsula due to the threats for biodiversity, events of fire and climate change. In the Basque Country, pine plantations are widely established, and in recent decades, the area of eucalypt plantations has increased notably, largely due to the replacement of pine plantations affected by band diseases. The impact of these two forestry systems has been the subject of some research in the region, for instance, it has been shown that they impoverish the soil and they increase soil erosion. However, there is still a lack of information regarding eucalypt plantations, particularly with respect to soil microbial communities, which are indispensable. It is therefore essential to gain an understanding of the potential impacts of these plantations in the Basque Country in order to ensure effective management.

Material and Methods. This study compares three types of forest systems in Biscay (Basque Country) in terms of soil microbial diversity: native forests, eucalyptus plantations and pine plantations. In order to characterise soil microbial diversity and composition, 16S rRNA gene sequencing from bacteria and ITS2 from fungi were used. Other soil variables, including pH and soil organic matter, were also analysed.

Results. The results obtained revealed significant differences in soil microbial composition among the three forest systems, which suggest that plantations have a significant impact on the structure of soil microbial communities, which can affect their functions and soil health.

[TSE.7-P-5]

Tuesday 3
Discussion corner: Room 3

Evaluation of the structure, functions, and ecosystem services of abandoned Eucalyptus plantations for their ecological restoration

Granda, Elena[1]; Bravo-Oviedo, Andrés[2]; Merino-Martín, Luis[3]; Fernández-Blas, Cristopher[4]; Romero, Alberto[5]; Viniegra, Pablo[6]; Castro-Díez, Pilar[7]

(1) University of Alcalá; (2) Museo Nacional de Ciencias Naturales (MNCN-CSIC); (3) Universidad Rey Juan Carlo; (4) Universidad de Alcalá; (5) Universidad de Alcalá; (6) Universidad de Alcalá; (7) Universidad de Alcalá

Correspondence e-mail: [elena.granda@uah.es]

Introduction. Climate change poses serious threats to human well-being. To mitigate it, European policies aim for a green transition by promoting natural carbon sinks, such as forests. However, large-scale plantations often fail to meet expectations due to several factors: 1) climate change increases droughts, potentially turning forests into sources of CO2; 2) the abandonment of management leads to greater competition and forest stress; 3) non-native trees, such as Eucalyptus, may store more carbon aboveground but less belowground; 4) forests provide other functions related to biodiversity and resource provision, which are often neglected.

Materials and Methods. The PROGRESA project aims to evaluate the structure, functioning and ecosystem services at different stages of abandoned Eucalyptus plantations to create management strategies for a successful and climate-resilient conversion. The impact of Eucalyptus plantation abandonment will be assessed in relation to carbon accumulation, water resources, soil quality and functional plant and microbial diversity, comparing them with native cork oak (Quercus suber) forests. Specifically, we will study: 1) carbon storage above and below ground; 2) soil moisture and water uptake depth of coexisting species and their relationship with growth; 3) recovery of the functional diversity of woody plants and soil microorganisms.

Results and Discussion. Effective forest policies must consider these studies to maintain forests as carbon sinks with high diversity, providing better ecosystem services in the context of climate change. The PROGRESA project aims to propose forest management policies that promote more diverse and climate change-resilient forests, improving ecosystem services such as climate regulation and water resources.

[TSE.7-P-6]

Wednesday 4
Discussion corner: Room 3

Evaluating tree planting in Mediterranean drylands: insights from three initiatives in a Europe-wide project

Allasia-Grau, Samuel[1]; Nadal-Sala, Daniel[2]; Sauras-Yera, Teresa[3]; Sabaté-Jorba, Santiago[4]

(1) University of Barcelona; (2) Centre for Ecological Research and Forestry Applications (CREAF); (3) University of Barcelona; (4) University of Barcelona

Correspondence e-mail: [samuelallasia@ub.edu]

Introduction. Large-scale tree planting initiatives are expanding across Europe to support the EU's goal of planting 3 billion trees by 2030. In Mediterranean drylands, these efforts aim to combat desertification, enhance ecosystem services, and promote biodiversity. However, the lack of systematic monitoring limits understanding of their effectiveness. In this study, we report on the initial results from three planting sites under the Life Terra project, a Europe-wide initiative, in lower-dry to semiarid eastern Spain.

Methods. Survival status and environmental and management variables were recorded at each site—some common (e.g., vegetation cover, species identity) and others tailored to site-specific features. A random forest analysis was performed to evaluate survival predictors. Daily P-PET and SPEI values were estimated to contextualize site-level differences.

Results and discussion. Survival rates after one year varied between sites (35–87%), reflecting differences in meteorological conditions, topography, soils, and planting procedures. At the site with the lowest survival rates, microsite characteristics and tree shelter type were the strongest predictors of survival. Sensitivity analysis revealed 46% lower mean predicted survival rates for holeless plastic shelters compared to holey shelters. Outplanting size was a confounding factor, with smaller sizes negatively affecting survival across species. At two sites, species selection was biased toward water-demanding species. While the influence of autecology on survival was moderate after one year, it is expected to increase over time. Research funded by the Life Terra project (LIFE19 CCM/NL/001200), the FORESTREAM consolidated research group (2021 SGR 00530), and the FPU pre-doctoral grant (FPU22/04377).

[TSE.7-P-7]

Thursday 5
Discussion corner: Room 3

Spatio-temporal comparative of plant diversity and forest structure of reforestations and reference pine forests in the central Iberian Peninsula

Sánchez Pescador, David[1]; García-Cervigón, Ana I.[2]; Conde-Raposo, Estrella[3]; López-Angulo, Jesús[4]; García-Valdés, Raúl[5]; Escudero Alcántara, Adrián[6]

(1) Facultad de Farmacia, Universidad Complutense de Madrid; (2) Universidad Rey Juan Carlos; (3) Universidad Rey Juan Carlos; (4) Universidad Rey Juan Carlos; (5) Universidad Rey Juan Carlos; (6) Universidad Rey Juan Carlos

Correspondence e-mail: [david.sanchez@urjc.es]

Introduction. Reforestation has been a key strategy in Spain for at least the last 100 years. However, there is a lack of knowledge about its effect and dynamic compared to reference forests, especially regarding diversity and ecosystem functioning. This study aims to evaluate, in space and time, the success of reforestations, focusing on diversity and structure of Mediterranean forests.

Material and methods. We used information from the Third and Fourth National Forest Inventories (NFI) of Spain for 3266 pine-dominated plots (976 reforestations versus 2290 reference forests) distributed in Castilla-La Mancha and Madrid. We evaluated the changes that have occurred in plant diversity, multiple dasometric variables and vegetation index (NDVI) derived from satellite imagery (Landsat) in both forest types across the last 20 years (2001-2021).

Results and discussion. Preliminary results suggest similar plant diversity in both forest types, but more complex structure (i.e. greater diversity in the class structure) and regeneration of natural forests, in the two NFI used. By contrast, reforestations showed more tree density, above ground tree biomass and annual tree growth. Vegetation index over the 20-year period showed similar patterns in both forest types, with higher NDVI values for reforestation plots. These results allow us to identify the weaknesses and strengths of reforestation, and to propose management policy that guarantees a healthier national green infrastructure.

[TSE.7-P-8]

Tuesday 3
Discussion corner: Room 3

Diversification of monospecific stands can enhance the multifunctionality and resilience of forest ecosystems in the Mediterranean mountains

Andivia, Enrique[1]; Ureña, Carmen[2]; Pérez-Corona, M. Esther[3]; Aponte, Cristina[4]; Cruz-Alonso, Verónica[5]; Delgado, Juan Antonio[6]; Gutiérrez, Mónica[7]; de las Heras, Paloma[8]; Jiménez, María Dolores[9]; Rebollo, Pedro[10]; Rolo, Víctor[11]

(1) Universidad Complutense de Madrid; (2) Universidad Complutense de Madrid; (3) Universidad Complutense de Madrid; (4) INIA-CSIC; (5) Universidad Complutense de Madrid; (6) Universidad Complutense de Madrid; (7) Universidad Complutense de Madrid; (8) Universidad Complutense de Madrid; (9) Universidad Complutense de Madrid; (10) Universidad Complutense de Madrid; (11) Universidad de Extremadura

Correspondence e-mail: [eandivia@ucm.es]

Introduction. The promotion of mixed forests is a key strategy for adapting forest ecosystems to climate change. However, most studies evaluating their success focus on a few aspects of ecosystem functioning, limiting our ability to understand the impact of adaptation strategies on the provision of multiple ecosystem services.

Material and methods. In this study, we compared the multifunctionality of mixed and monospecific stands of Pinus sylvestris L. and Quercus pyrenaica Willd. in the Sierra de Guadarrama National Park. We characterized a total of 22 indicators related to forest productivity and carbon sequestration, drought resistance and resilience, wood and habitat provision, soil functionality, and soil biodiversity.

Results and discussion. Our results suggest that diversifying monospecific stands is an effective strategy to enhance forest ecosystem resilience and increase multifunctionality. Mixed stands showed higher values of indicators related to carbon sequestration, habitat provision, nutrient cycle regulation and soil biodiversity compared to monospecific pine stands. This suggests that diversifying pine stands can contribute to forest adaptation to climate change while keeping high levels of multiple ecosystem services. However, our findings also indicate that mixed stands do not maximize all evaluated indicators, especially when compared to oak stands. Therefore, their implementation should align with the specific management objectives of each forest.

[TSE.7-P-9]

Wednesday 4
Discussion corner: Room 3

Innovative Agroforestry with AF4EU: Weaving Networks for a Sustainable Future

Couso-Viana, Ana[1]; Rodríguez-Rigueiro, Francisco Javier[2]; Ferreiro-Domínguez, Nuria[3]; Santiago-Freijanes, José Javier[4]; Mosquera-Losada, María Rosa[5]

(1) Higher Polytechnic Engineering School; (2) Higher Polytechnic Engineering School; (3) Higher Polytechnic Engineering School; (4) Higher Polytechnic Engineering School; (5) Higher Polytechnic Engineering School

Correspondence e-mail: [ana.couso.viana@usc.es]

Agroforestry systems integrate woody perennials (trees or shrubs) with crops and/or livestock on the same land area to benefit from the resulting ecological and economic interactions. AF4EU is a European project funded under Horizon Europe, aimed at promoting agroforestry systems through the development of a multi-actor agroforestry innovation network. This network builds on the one created in the AFINET project, which involved over 1,300 stakeholders, and will be expanded in AF4EU to extend agroforestry knowledge to other areas of Europe. The project will create business models focused on European agroforestry policy and strengthen agroforestry extension services. AF4EU will also contribute to the implementation and adoption of agroforestry systems across Europe by providing cost-effective business models and techniques. This will be supported by a successful communication, dissemination, and exploitation strategy that will reach a wide European audience. The project will develop an agroforestry knowledge platform, including decision support tools for agroforestry businesses and an online course (MOOC) targeted at farmers and advisors. AF4EU will foster the adoption of agroforestry systems throughout Europe by offering sustainable and profitable business models and promoting their integration across different regions. Additionally, the project will strengthen cooperation among farmers, researchers, policymakers, and other key stakeholders, driving the adoption of agroforestry systems in diverse regions.

TSE.8. Biological invasions, knowledge to manage in a context of global change

Wednesday, 4 (11:00-12:30)

Room: Seminario 7

Scientific and public interest in invasive species is driven by their ecological, economic and social impacts. Invasive species are responsible for many of the extinctions of species for which the cause is known, and are considered to be one of the main drivers of biodiversity loss. They are considered an important part of global change, as they can significantly alter ecosystem processes and functions, leading to significant environmental damage that can sometimes be irreversible.

Factors such as climate change, habitat degradation or overexploitation pose an additional challenge for the effective management of invasive species, as they allow their appearance in other areas, favour the increase of their distribution area, hinder their management and magnify the problem. This problem has caused great general interest, with special emphasis on the role of Spain and Portugal, including different points of view and scientific fields.

This thematic session may constitute a necessary forum for the presentation of systematic reviews, methodological studies and experiences that provide answers to scientific research questions that would otherwise appear scattered in the 'corpus' of the congress. On the other hand, it is intended to be a backbone session of the new AEET working group, ecology of invasions.

Organizers:

- **González Rodríguez,** Universidade de Vigo
- **Jonatan Rodríguez Parra,** Unversidade de Santiago
- **Ana Novoa Pérez,** EEZA-CSIC.

TSE.8. Orals

[TSE.8-O-1]

Wednesday 4, morning (first): 11:00
Room: Seminario 7

Incorporating local insights through interviews and a participatory workshop for invesive plant species management in southeastern iberian arid ecosystems

González-Moreno, Pablo[1]; Bernal-Borrego, Jessica[2]; Navarro-López, Sara[3]

(1) Universidad de Córdoba; (2) Universidad de Córdoba; (3) Universidad de Córdoba

Correspondence e-mail: [pablo.gonzalez@uco.es]

Invasive Alien Species (IAS) are a significant driver of desertification in arid and semiarid ecosystems. Yet, we have limited understanding of the management priorities and impacts. We tackled this using the South-eastern Iberian Peninsula as a study case. We conducted over 35 semi-structured interviews across the region and a participatory workshop in the Guadalfeo watershed, gathering insights from diverse stakeholders including land managers, and public officers. Through Framework Analysis we structured the interview data into thematic categories, reflecting stakeholders' concerns and priorities. Key species identified through interviews include Cenchrus setaseus, Cortaderia selloana, Nicotiana glauca, Ricinus communis, Arundo donax and Ailanthus altissima but their relevance varied according to geographical and management context. The latter two were also highlighted for their marked socio-economic and environmental impacts. The interviews underscored urgent challenges as prioritized non-chemical control, collaborative strategies, and greater legislative enforcement to address IAS spread effectively. During the workshop, stakeholders shared their experiences and perceptions reaching a consensus across common challenges. Specifically, they emphasized the importance of socio-ecological approaches in resource management and the need for a coordinated long-term plan across sectors for IAS management. Finally, 17 actions were identified to tackle the challenges. By leveraging local knowledge through participatory methods, the study enhances our understanding of the dynamics at play in invasive species management and underscores the necessity for strategies that are both scientifically informed and culturally attuned. This approach can potentially ensure that management interventions and IAS plans are responsive to local needs, facilitating more effective and sustainable outcomes.

[TSE.8-O-2]

Wednesday 4, morning (first): 11:15
Room: Seminario 7

Evaluating invasion risk through hierarchical species distribution models and greenhouse experiments

Lázaro-Lobo, Adrián[1]; Jiménez-Alfaro, Borja[2]

(1) University of Oviedo; (2) University of Oviedo

Correspondence e-mail: [adrianlalobo@gmail.com]

Predicting the potential distribution of invasive species is important to reduce uncertainty of future spread and to support management programs. In this study we combine Species Distribution Models (SDMs) with greenhouse experiments to evaluate the susceptibility to invasion (i.e., invasion risk) by the ecoregional invasive plant species pool. The central hypothesis is that plant niche, both realized (i.e., current distribution) and potential (i.e., based on dispersal and regeneration), is highly influenced by ecosystem characteristics and plant traits. As the study system, we use the Atlantic region of Iberian Peninsula, an ecoregion with optimal conditions for the spread of invasive plants. We first created a complete list of invasive plant species in the ecoregion (~170 species). Then, we used a hierarchical SDM approach to analyze how environmental predictors affected habitat suitability. We found that climatic and soil variables were good predictors of habitat suitability. To evaluate the potential invasion risk, we combined the habitat suitability estimates for each species with extensions of SDMs implementing dispersal constraints into species projections. Dispersal limitation was approached by estimating geographical barriers, dispersal kernel, and frequency of long-distance dispersal events. We found that dispersal rates across the study ecoregion were species-specific and dependent on species ecological requirements and dispersal potential. Lastly, we conducted greenhouse experiments with the most successful invasive species to evaluate the effect of temperature, water availability, and plant traits on plant regeneration. We found the ecological thresholds for germination and early growth, as well as positive maternal effects on offspring performance.

[TSE.8-O-3]

Wednesday 4, morning (first): 11:30
Room: Seminario 7

European Honey Buzzards as Natural Predators of the Invasive Yellow-Legged Hornet in Agroforestry Landscapes

Martín Ávila, Jorge Ángel[1]; Díaz Aranda, Luisa M.[2]; Fernández Pereira, José Manuel[3]; Rebollo de la Torre, Salvador[4]

(1) Universidad de Alcalá; (2) Universidad de Alcalá; (3) Asistente de campo independiente; (4) Universidad de Alcalá

Correspondence e-mail: [jorgeangel.martin@uah.es]

Introduction. Avian predators have often been overlooked in Integrated Pest Management (IPM) until the recognition of their role as providers of ecosystem services. Birds, as highly mobile regulators of pest populations, offer potential solutions for managing invasive species in agroforestry systems. The yellow-legged hornet (Vespa velutina), introduced into Europe in 2004, poses a severe threat to agriculture, beekeeping, and native pollinators. This study explores whether European honey buzzards (Pernis apivorus) can mitigate hornet populations by preying on their nests.

Methods. Foraging patterns of 11 honey buzzards during the breeding season were analyzed using GPS trackers and trail cameras to identify attacked hornet nests. The effects of buzzard predation were assessed by comparing the abundance of hornet workers and the density of full-grown hornet nests near 17 buzzard nests and 10 control points.

Results. Buzzards attacked nests at an average distance of 1234.7 m, destroying 89.3% of targeted nests. Worker abundance declined significantly within 1000 m of buzzard nests (-0.000116 workers/h/m), with impacts intensifying later in the breeding season. However, there was no significant reduction in full-grown nest density.

Conclusion. European honey buzzards contribute to reducing hornet worker populations at a local scale, making them valuable allies in managing this invasive species. Including these raptors in IPM strategies could enhance pest control while promoting native biodiversity conservation.

[TSE.8-O-4]

Wednesday 4, morning (first): 11:45
Room: Seminario 7

Evaluating the invader complex between the giant resin bee (Megachile sculpturalis) and the Japanese pagoda tree (Styphnolobium japonicum) in a non-native range

Echeandía, Daniel[1]; Hernández-Castellano, Carlos[2]; Margalef-Marrasé, Jordi[3]; Riera, Marc[4]

(1) UAB - Universitat Autònoma de Barcelona; (2) UAB - Universitat Autònoma de Barcelona; (3) CIDE - Centro de Investigaciones sobre Desertificación; (4) CREAF - Centro de Investigación Ecológica y Aplicaciones Forestales

Correspondence e-mail: [decheandiagomez@gmail.com]

Introduction: The interaction between non-native pollinators and plants, originally from the same region, can lead to mutual facilitation of their spread in invaded area, known as an invasion complex. “Megachile sculpturalis” is a solitary bee native to East Asia that has been introduced to most of Europe. Its main pollen source is the non-native species “Styphnolobium japonicum”. Here, we aim to determine whether an invasion complex exists between these two species.

Material and methods: The study area was Catalonia (NE Spain), where we collected 151 “M. sculpturalis” occurrences and 21,384 “S. japonicum” occurrences. We studied the effects of climatic suitability and “S. japonicum” presence on “M. sculpturalis” occurrence through ecological niche characterisation and generalised linear models. We used “M. sculpturalis” native occurrences to characterise climatic suitability, through a Principal Component Analysis with bioclimatic variables.

Results and discussion: Our results show that the presence of “S. japonicum” near “M. sculpturalis” increases the fit of the models and is the primary factor affecting bee occurrence. Thus, the distribution and spread of “M. sculpturalis” are primarily determined by the proximity of “S. japonicum” trees, corroborating trophic specialisation, and secondarily by the climatic suitability of the bee. The introduction route also plays a crucial role, leading to a higher probability of presence in the eastern study area, where it was first introduced. Based on our findings, we advocate for discontinuing the use of “S. japonicum” as an ornamental tree in urban areas, and instead, recommend planting native species to mitigate further invasions.

[TSE.8-O-5]

Wednesday 4, morning (first): 12:00
Room: Seminario 7

Review of the invasion of exotic crab Percnon gibbesi in the Mediterranean Sea

Puentes, Daniel[1]; Hinz, Hilmar[2]; Antón, Andrea[3]

(1) IMEDEA (CSIC-UIB), Mediterranean Institute for Advanced Studies, Espor; (2) IMEDEA (CSIC-UIB), Mediterranean Institute for Advanced Studies, Esporles, Illes Balears, Spain; (3) IMEDEA (CSIC-UIB), Mediterranean Institute for Advanced Studies, Esporles, Illes Balears, Spain

Correspondence e-mail: [dbohorquez@imedea.uib-csic.es]

Marine biological invasions pose a significant threat to biodiversity and the stability of ecosystems worldwide. The Mediterranean Basin, in particular, has become the most invaded marine area on Earth, with over a thousand introduced species. Among these is the invasive crab Percnon gibbesi, which has spread through the region at an unprecedented rate, and its ecological impacts are expected to be large. In this review, we compile the accumulated literature on this invasion, detailing its geographic extent and chronology, exploring the factors that may contribute to its rapid spread and establishment, and summarizing both its current and potential future ecological consequences.

The invasion has unfolded rapidly, with Percnon gibbesi establishing stable populations across the Mediterranean Sea in just 25 years, from the western to the easternmost regions, aimed by its reproductive strategies. In terms of ecological impact, a total of 38 species of algae were identified as food sources for the crab, including nine green algae, six brown algae, and 22 red algae. Through this review, we have gained a deeper understanding of the invasion of Percnon gibbesi in the Mediterranean, underscoring the urgent need for a management response. Its growing presence threatens to cause irreversible changes in the structure of marine ecosystems.

[TSE.8-O-6]

Wednesday 4, morning (first): 12:15
Room: Seminario 7

From waste to resource: advantages of using Acacia longifolia biomass

Guedes de Jesus, Joana[1]

(1) Center for Ecology, Evolution and Environmental Changes (CE3C)

Correspondence e-mail: [jgjesus@fc.ul.pt]

Ecological restoration is a priority considering land use changes, unpredictable consequences of climate change and higher frequency of forest fires. Sustainable strategies are determinant for targeting ecosystems' rehabilitation and biodiversity conservation. Portugal is one the countries very affected by forest fires every year and is also widely occupied by exotic invasive species. Acacia longifolia is one of the species characterized by its fast growth and ease on adaptation through symbiotic associations with microbes that increase its dispersal capacity. Due to its abundant aboveground biomass, A. longifolia can be a resource to produce a green waste compost (Gwc) that could improve soil nutrition and water retention. In this sense, under the scope of R3forest project, we aimed to investigate how native species respond to the incorporation of this Gwc in soils. This study was established through the comparison of rhizospheric soils collected from Arbutus unedo, Pinus pinea and Quercus suber saplings planted with and without the addition of compost. Microbial communities along with plant ecophysiological parameters were studied to integrate both above- and belowground environments. We found that plants survived and grew more with Gwc, and soils were more hydrated and enriched in nitrogen and phosphorus, leading to a higher microbial activity and diversity. With this study, we highlight the advantages of applying this Gwc from an invasive species, serving a dual purpose of reducing the area occupied by A. longifolia by using the waste from Acacia and converting it to compost that will regenerate soils ultimately improving vegetation recovery.

TSE.8. Posters

[TSE.8-P-1]

Wednesday 4
Discussion corner: Room 5

Warming-induced spread of emerging crop pests in the Mediterranean Basin and Europe

San-Segundo Molina, Darío[1]; Villén-Pérez, Sara[2]; Morales-Castilla, Ignacio[3]

(1) Universidad de Alcalá; (2) Universidad de Alcalá; (3) Universidad de Alcalá

Correspondence e-mail: [dario.ssm2@gmail.com]

Introduction. Emerging crop pests from tropical and subtropical regions are increasingly intercepted in Europe and the Mediterranean Basin. Despite their inclusion into alert lists to guide policies, pest risk assessments often lack ecological rigor or are absent. Addressing this gap requires integrating (1) fundamental physiological and ecological mechanisms driving pest potential distributions and (2) robust modelling frameworks that enable ecologically informed forecasts across species for practical applications.

Methods. Temperature is a major determinant of insect pest performance and distribution. To approximate the fundamental thermal niches of major emerging pests, we fitted nonlinear thermal performance curves leveraging published ecophysiological experimental data on development rates across temperatures. Then, their optimal thermal curve zones were projected onto air temperatures that each species will likely encounter across growing regions of their host crops in the Mediterranean Basin and Europe. Projections were conducted for both historical and future (2050, RCP 8.5) climatic scenarios.

Results & Discussion. Projections for current conditions indicate that optimal thermal conditions for most invasive pests are confined to the Mediterranean Basin. More so in the warmest regions, where pests would occur for up to 7 months annually. Under warmer conditions, pest distributions are projected to spread geographically —polewards— and seasonally —to spring and autumn. Mediterranean provinces cultivating fruit trees (e.g., pome, stone, citrus, subtropical fruits, olives and vineyards) and fruiting vegetables (e.g., tomato, melons, eggplant, peppers) are particularly vulnerable to multiple pest occurrences under current conditions, with increased risks under future warming scenarios.

[TSE.8-P-2]

Thursday 5
Discussion corner: Room 5

Effects of soil silica availability and adaptation to silica uptake in the invasive grass Cortaderia selloana

Rodríguez-Coronado, Carmen[1]; Canle, Moisés[2]; Carrillo-Barral, Néstor[3]; Servia, María J.[4]; Pomar, Federico[5]; Fagúndez, Jaime[6]

(1) Faculty of Science, University of A Coruña; (2) Faculty of Science, University of A Coruña; (3) University of Santiago de Compostela; (4) Faculty of Science, University of A Coruña; (5) Faculty of Science, University of A Coruña; (6) Faculty of Science, University of A Coruña

Correspondence e-mail: [carmen.rodriguez.coronado@udc.es]

Some invasive species are early colonizers of shallow soils of perturbed areas. In such conditions, plant-soil interactions may be a strong driver of invasiveness. Cortaderia selloana is an invasive plant species from South America with massive seed production and pioneer colonizing ability. The species colonizes perturbed areas with no vegetation indifferently of soil types, from acid to highly basic soils. We performed an experiment with seeds from two populations growing on the soil acidity gradient ends, one from a highly acid and another from a basic soil type. This gradient of acidity in soil is linked to silica availability for the plant. We found higher silica concentrations in leaves from plants grown with added silica, but these did not have a positive effect in plant performance. The effect of silica addition on photosynthetic efficiency and growth was mainly explained by a different mother plant rather than population soil type. Thus, we did not find evidence of local adaptation to a range of acidity and silica concentration. These results may aid in the design of species-specific measures to counteract C. selloana invasive potential and promote competition by native species.

[TSE.8-P-3]

Tuesday 3
Discussion corner: Room 5

Evaluation of water hyacinth biomass use as a potential agricultural enhancer under two water regimes

León Pinheiro, Ignacio[1]; Patinha, Carla[2]; Costa, Sara[3]; Lopes, Isabel[4]; Venâncio, Cátia[5]

(1) CESAM – Centre for Environmental and Marine Studies; (2) GEOBIOTEC; (3) CESAM – Centre for Environmental and Marine Studies; (4) CESAM – Centre for Environmental and Marine Studies; (5) CESAM – Centre for Environmental and Marine Studies

Correspondence e-mail: [ignacioleon@ua.pt]

Water hyacinth (WH, Eichhornia crassipes) is an invasive aquatic species. Attempting to explore its biomass as an agricultural amendment, this study aimed to evaluate, in a 120- day long experiment, two rates of application of WH biomass (as a surrogate of organic matter, 2.5% and 5%) in a standard OECD soil under two water regimes [45% and 22.5% of the water holding capacity of the soil (WHC)]. OECD soil contained 5% turf (5%T). Soil pH, electrical conductivity (EC), and relative humidity (RH) were measured twice weekly. To check for soil productivity under these conditions, on days 0, 30, 60, and 120-d of the test, Solanum lycopersicum was seeded and fresh and dry weights were evaluated.

The pH values showed a one-unit change between the treatments in both water regimes. Regarding EC at 45%WHC, 5%WH increased EC up to day 30 of the assay (3000 µS/cm), decreasing to 2360 µS/cm, compared with an average value of 769 and 349 µS/cm for 5%T and 2.5%WH, respectively. The same tendency was observed for 22.5%WHC. The 2.5% and 5%WH biomass increased the RH of the soil over time in both water regimes. Regarding tomato plants, there was an overall tendency for plant root fresh and dry weights to be lower in 5%WH than in the other treatments under both water regimes, but with heavier aerial weights in plants growing in 2.5% and 5%WH. The results showed that WH incorporation may change soil parameters, although there are no long-term pernicious effects on soil productivity.

[TSE.8-P-4]

Wednesday 4
Discussion corner: Room 5

Physiological integration in Carpobrotus spp.: key to invasive success?

González Rodríguez, Luís[1]; Pérez Diz, Marta[2]; Skalova, Hanka[3]; Borges Silva, Lurdes[4]; Canavan, Susan[5]; Brundu, Giuseppe[6]; D'Antonio, Carla M.[7]; Dudley, Tom[8]; Gutiérrez, Jorge L.[9]; Hulme, Philip[10]; Le Roux, Johannes J.[11]; Levine, Sam C.[12]; Pyšek, Petr[13]; Rodríguez, Jonatan[14]; Silva, Luís[15]; Novoa, Ana[16]

(1) Faculty of Biology, Universidade de Vigo; (2) Faculty of Biology, Universidade de Vigo; (3) Institute of Botany of the Czech Academy of Sciences, Pruhonice, Czech Republic.; (4) French National Institute for Agriculture, Food, and Environment, Paris, France; (5) School of Natural Sciences, Ollscoil na Gaillimhe, University of Galway, Ireland; (6) Università degli Studi di Sassari, Sardegna, Italy; (7) University of California, Santa Barbara, USA; (8) University of California, Santa Barbara, USA; (9) IGCyC, UNMdP-CIC, IIMyC, UNMdP-CONICET; (10) Lincoln University, Canterbury, New Zealand; (11) Faculty of Science and Engineering,Macquarie University, Australia; (12) Martin Luther University Halle-Wittenberg, Institute of Geobotany, Germany; (13) Institute of Botany of the Czech Academy of Sciences, Pruhonice, Czech Republic.; (14) Faculty of Biology, Universidade de Santiago de Compostela, Spain; (15) Faculdade de Ciências e Tecnologia, Universidade dos Açores,Ponta Delgada, Portugal; (16) Estación Experimental de Zonas Áridas del CSIC (EEZA-CSIC), Almería, Spain

Correspondence e-mail: [iyrcis.conference@gmail.com]

Clonal plants like Carpobrotus spp. use physiological integration to transfer resources between connected ramets, improving survival in stressful environments. This trait is thought to contribute to their invasive success. While it has been previously suggested that clonal integration benefits non-native and admixed populations more than native ones, evidence remains inconclusive. We hypothesized that physiological integration would favor non-native and admixed populations, enhancing their invasiveness.

We studied 11 populations of Carpobrotus spp. from native and non-native ranges. Twenty clonal fragments with four connected ramets from each population were grown in a greenhouse under controlled conditions. Plants were divided into two portions and subjected to two treatments: half of the plant remained intact as connected ramets while the other half were severed forming disconnected ramets. The first and second pair of ramets from the apices were considered recipient ramets, and the two basal ramets (three and four) were considered donor ramets. Donor ramets were placed in nutrient-rich soil, while recipients were in nutrient-poor soil. Growth, ramet production, and biochemical markers, such as protein content and antioxidant activity, were measured.

Results showed that physiological integration significantly improved recipient ramet growth and biomass allocation in connected plants compared to severed ones. Biochemical analyses indicated higher defense protein levels in donor ramets from native populations. These findings emphasize that integration supports Carpobrotus spp. by enabling resource sharing and adaptation to diverse conditions, making it a key factor in their invasiveness. Targeting this trait could inform strategies to limit Carpobrotus spp. invasions.

[TSE.8-P-5]

Thursday 5
Discussion corner: Room 5

Dendroecological and genetic evaluation of Pinus pinaster plantations affected by Matsucoccus feytaudi in eastern Catalonia

Fontova Musté, Anna[1]; Shestakova, Tatiana[2]; Valor, Teresa[3]; Vilà-Vilardell, Lena[4]; Segarra, Miquel[5]; Ros, Laura[6]; Torell, Antoni[7]; Alía, Ricardo[8]; Grivet, Delphine[9]; Voltas, Jordi[10]

(1) Universitat de Lleida; (2) Universitat de Lleida; (3) Universitat Politècnica de Catalunya; (4) Centre de Ciència i Tecnología Forestal de Catalunya (CTFC); (5) Forestal Catalana, SA; (6) Forestal Catalana, SA; (7) Forestal Catalana, SA; (8) CIFOR-CSIC; (9) CIFOR-CSIC; (10) Universitat de Lleida

Correspondence e-mail: [anna.fontova@udl.cat]

The maritime pine (Pinus pinaster) covers more than 4 million hectares in the Mediterranean basin. Its remarkable genetic diversity is manifested in an extraordinary phenotypic variability in the Iberian Peninsula, probably modified as a result of reforestation carried out without adequate control of the genetic material of origin. Since 2009, the infestation of the scale bast insect Matsucoccus feytaudi in Catalonia has led to severe attacks on planted pine forests, causing the death of entire stands. The main objective of this study is to determine whether the recent susceptibility to Matsucoccus is related to different radial growth patterns in affected and healthy stands, indicating different sensitivities to environmental factors, and in turn related to the genetic origin of the materials used in the plantations. To this end, wood cores and needle samples were taken from ten commercial stands on the north coast of Catalonia, seven of which have had presence of Matsucoccus since 2022 and are severely affected, two of which have presence but are asymptomatic, and one of which is asymptomatic and free of the insect. The results will allow the identification of factors associated with resistance or susceptibility to the pest and will provide information to improve forest management strategies for planted stands of the species. We hypothesise that differences in the genetic origin of the stands will be an underlying factor determining the severity of the outbreaks, which can be traced back in time in relation to contrasting patterns of secondary growth of healthy and infested trees.

[TSE.8-P-6]

Tuesday 3
Discussion corner: Room 5

How does Carpobrotus taxa removal affect vegetation and soil recovery?

Núñez-González, Noa[1]; Piñeiro-Juncal, Nerea[2]; Rodríguez, Jonatan[3]

(1) Universidade de Vigo; (2) Universidade de Vigo; (3) Universidade de Santiago de Compostela

Correspondence e-mail: [noa.nunez@uvigo.gal]

Clonal succulent invasive plants of the genus Carpobrotus are causing severe impacts in coastal regions worldwide. Given the considerable negative consequences, eradication programs have been launched in various locations across southern Europe. Manual removal of Carpobrotus spp. is known to promote vegetation recovery. However, it remains unclear whether the soil alterations caused by the invasion will persist or shift in a way that further supports restoration. Here, we aimed to investigate whether areas of manual removal (uprooting) of the invasive plant would eventually resemble uninvaded vegetation and native soils (where the plant was not present) or whether soil legacies caused by the invasion would persist as in invaded areas. To this end, we collected soil samples and evaluated vegetation at six sites on the Atlantic coast of Galicia, Spain (three dunes and three shrublands) in the spring of 2024. In each site, samples collected were taken from four plots: the invaded, the native and two removal plots (one where the plant was removed five years ago and the other where it was removed one year ago). Our results on plant diversity show a reduction in the invaded plots compared to the native plots, while the removed plots are more habitat dependent. We also found differences in plant biomass productivity, where we found differences both between habitats and within the plots studied. Moreover, our results indicated soil physicochemical alterations due to Carpobrotus spp. invasion, affecting soil microbial metabolism (AWCD) and the Shannon-Wiener diversity index.

TSE.9. Brown Urban Ecology: The interlink between nature and humanity

Wednesday, 4 (12:45-14:15)

Room: Seminario 6

General background: Urbanization produces some of the most significant impacts on biodiversity and ecosystem functioning. As cities rapidly expand, they exert pressure on natural habitats, leading to biodiversity loss, ecosystem degradation, and disruptions in essential ecosystem services such as air and water purification, temperature regulation, and disease control. Abiotic and biotic conditions are highly modified in cities including higher levels of pollution, small-sized, fragmented habitat and modified ecological interactions. Thus, urban areas represent a thrilling environment for ecological studies, and ecological knowledge should be integrated in urban planning to maximize the ecosystem services provided by the urban biota.

- *Scope:* Animal ecology, biotic interactions, ecology and evolution, ecosystem services, human health, socio-ecology, pest regulation.
- *Objective:* Bring together researchers from different urban disciplines to discuss methodologies and approaches to understand the drivers of biodiversity and ecological and evolutionary processes happening in urban habitats, highlight the benefits provided to people (ecosystem services), and discuss their contribution to mitigating the biodiversity crisis.
- *Relevance:* Currently, most of the human population lives in cities and this percentage will continue to increase. Understanding the social-ecological processes driving urban biodiversity, ecology and evolution is critical for finding solutions to reconcile people and nature while tackling any socio-ecological challenges arising from this interaction.

Organizers:

• **Juan Antonio Hernández Agüero,** Departament of Environmental Studies, Vrije Universiteit Amsterdam

• **Jéssica Jiménez-Peñuela,** IREC-CSIC-UCLM

• **Joan Casanelles-Abella,** Technische Universität München (TUM).

TSE.9. Orals

[TSE.9-O-1]

Wednesday 4, morning (second): 12:45
Room: Seminario 6

Bottom-up and top-down drivers of urbanization effects on insect herbivory on oaks

Quiroga, Gabriela[1]; Vázquez-González, Carla[2]; Rodríguez, Víctor M.[3]; Lago-Núñez, Beatriz[4]; Van den Bossche, Astrid[5]; de Frenne, Pieter[6]; Gossner, Martin M.[7]; Stenberg, Johan A.[8]; Tack, Ayco J.M.[9]; Chor Bjørn, Mona[10]; Sam, Katerina[11]; Milanovic, Slobodan[12]; Bonnard, Olivier[13]; Castagneyrol, Bastien[14]; Covelo, Felisa[15]; Abdala-Roberts, Luis[16]; Moreira, Xoaquín[17]

(1) Centro de Investigaciones Agrarias de Mabegondo; (2) MBG-CSIC; (3) MBG-CSIC; (4) MBG-CSIC; (5) Ghent University; (6) Ghent University; (7) ETH Zürich; (8) Swedish University of Agricultural Sciences; (9) Stockholm University; (10) University of Copenhagen; (11) Biology Centre of Czech Academy of Sciences; (12) University of Belgrade; (13) BIOGECO, INRAE, Univ. Bordeaux; (14) BIOGECO, INRAE, Univ. Bordeaux; (15) Universidad Pablo de Olavide; (16) Universidad Autónoma de Yucatán; (17) MBG-CSIC

Correspondence e-mail: [gaquirogagar@gmail.com]

Urban forests provide essential ecosystem services, such as pest control, biodiversity support, recreation, and health benefits. Understanding the ecological mechanisms that sustain these services, particularly how species interactions like herbivory affect forest functions, is critical for promoting urban forest resilience. Herbivory plays a key role in processes such as primary productivity and nutrient cycling, which are foundational for carbon sequestration and soil fertility. However, urbanization can alter herbivory by changing both bottom-up factors (e.g., plant traits) and top-down control (e.g., herbivore natural enemies).

In this study, we examined insect leaf herbivory on Quercus robur trees across urban and rural forests in 13 European cities. We excluded vertebrate (e.g., birds, bats) and invertebrate (e.g. ants) predators to measure insect damage on both control and predator-excluded branches. We also analyzed microclimatic factors (e.g., temperature) and leaf traits (e.g. nutrients, phenolic compounds) to explore bottom-up influences. The aim was to understand urban-rural differences in herbivory and the relative contributions of top-down and bottom-up factors in explaining these differences.

Our findings revealed that urbanization generally reduced oak leaf herbivory. This reduction is likely due to factors such as increased predation and warmer temperatures, although the exact causes remain unclear. These results underscore the complexity of urban ecosystems and highlight the need for further research to understand urban ecological dynamics and improve urban forest management for greater resilience.

[TSE.9-O-2]

Wednesday 4, morning (second): 13:00
Room: Seminario 6

Morphological adaptations of butterfly populations in response to urbanization

Tejeda Meneses, Ashley[1]; Colom Montojo, Pau[2]; Melero Cavero, Yolanda[3]

(1) Faculty of Biology, University of Barcelona; (2) Faculty of Biology, University of Barcelona; (3) Faculty of Biology, University of Barcelona. CREAF (Center for Ecological Research and Forestry App)

Correspondence e-mail: [atejeda@ub.edu]

Urbanization threatens biodiversity through land use changes, habitat degradation, and fragmentation, which may reduce population fitness often leading to declines and species extirpations. Whether a species persists in these drastic environments highly depends on their phenotypic adaptation. Previous studies have shown that only a series of traits thrive in the city; however phenotypic change, either by plasticity or genetic adaptation, is still understudied, partly due to the difficulty of gathering enough quality data. Understanding phenotypic changes in response to urbanization may help mitigate its distinct impacts on population dynamics and improve predictions about which species can or cannot adapt to these environments. Here, we investigated if and how species phenotypes can change as an adaptative response to urbanization, using butterflies as the study system. We focused on wing size, a proxy of dispersal ability known to increase species persistence, across ca. 150 years (1851-2006) for over 50 species in the UK. Results showed a decrease in wing size over time for most species, due to mixed effects between urbanization and temperature, with stronger reductions in dominant species, indicating some species showed pre-adaptations while others showed phenotypic change. A minor subset did not show modifications or were not present in the cities. Our findings are key to improve future predictions on species viability in urban areas.

[TSE.9-O-3]

Wednesday 4, morning (second): 13:15
Room: Seminario 6

Bee diversity patterns in urban vs adjacent natural ecosystems: species turnover makes urban parks biodiversity refuges

Hernández-Castellano, Carlos[1]; Aguilar, Marina[2]; Batlle-Benaiges, Júlia[3]; Carbonell, Rafael[4]; Coromina, Júlia[5]; Lucena, Joan Ramon[6]; Peguero, Guillermo[7]; Romero, José Luís[8]

(1) Universitat Autònoma de Barcelona; (2) Universitat de Barcelona; (3) Universitat Autònoma de Barcelona; (4) Institució Catalana d'Història Natural; (5) Universitat Autònoma de Barcelona; (6) Ajuntament de Viladecans; (7) Universitat de Barcelona; (8) Institut Català d'Ornitologia

Correspondence e-mail: [carlos.hernandezcastellano@gmail.com]

Bees are experiencing pressures such as habitat loss or invasive species, negatively affecting their populations and risking pollination. Transforming urban ecosystems into biodiversity refuges is an initiative to reverse these patterns, but often its effectiveness is limited because their communities are simply a nested subset of those found in the surrounding habitats. In this study we evaluated the effectiveness and the mechanisms of an urban ecosystem to act as a refuge for bees.

To do so, we conducted plant-pollinator surveys between March-October (2021) in 10 urban parks and natural areas in Viladecans (Barcelona, NE Spain). We combined high taxonomic resolution of bees with analyses of community nestedness and betadiversity, to determine whether communities from urban parks are nested subsets of those present in adjacent natural areas or on the contrary host more and/or different species.

We found a total of 167 species of bees (~15% Iberian Peninsula diversity). Bee communities showed antinestedness, because 39% species were idiosyncratic to specific sites. Accordingly, communities of urban parks are not nested subsets of those in natural areas, and contained similar richness. All these patterns are driven by the turnover component of betadiversity, representing the 84% of differences between the communities of urban parks and natural areas.

Our results suggest that urban ecosystems may be biodiversity refuges hosting different species than adjacent natural ecosystems. Thus, city managers should 1) establish conservation measures to protect idiosyncratic fauna and 2) foster betadiversity as a measure to increase regional diversity of bees.

[TSE.9-O-4]

Wednesday 4, morning (second): 13:30
Room: Seminario 6

Complementing urban agriculture and green spaces is important for ecosystem functions and biodiversity in cities: A systematic review and meta-analysis

Pagani-Núñez, Emilio[1]; Li, Zeyu[2]; Chen, Sihao[3]; Priyadarshana, Tharaka S[4]; Lee, Myung-Bok[5]; Xiao, Lingyun[6]; Fischer, Thomas B.[7]; He, Xueqing[8]; Woodcock, Ben A[9]

(1) Edinburgh Napier University; (2) Royal Melbourne Institute of Technology; (3) Xi'an Jiaotong-Liverpool University; (4) Nanyang Technological University; (5) Chonnam National University; (6) Xi'an Jiaotong-Liverpool University; (7) University of Liverpool; (8) Xi'an Jiaotong-Liverpool University; (9) UK Centre for Ecology and Hydrology

Correspondence e-mail: [e.pagani-nunez@napier.ac.uk]

As cities expand, they encroach on agricultural land impacting food production and natural habitats. While urban agriculture could help address these issues, the impact that increasing food production in cities will have on urban ecosystems remains poorly understood. To fill this knowledge gap, we conducted a meta-analysis to quantify the effects of urban agriculture on ecosystem functions (i.e., soil quality and climate regulation) and biodiversity (i.e., plants, birds, mammals, and invertebrates and invertebrate pollinators). We estimated ecosystem functions and biodiversity in urban agriculture by comparing them with other urban green spaces (e.g., parks, residential gardens, green roofs) and conventional rural farms. Urban agriculture had a positive effect on the studied ecosystem functions relative to conventional rural farms (+25%, CI95: +12% to +39%) but was equivalent in its provision of these functions to other green spaces. Urban agriculture also had a positive effect on biodiversity compared to conventional rural farms (+38%, CI95: -10 to +111%) but a negative effect compared to green spaces (-12%, CI95: -29 to +8%). Specifically, urban agriculture had 39% (CI95: -59 to -10%) lower plant diversity and abundance than that seen in other green spaces. Our results overall showed that urban agriculture is in an intermediate state between the other urban green spaces and conventional rural farms in terms of its environmental impacts. This indicates that urban agriculture contribution to urban sustainability requires complementarity with other green spaces to effectively support ecosystem functions and biodiversity in cities.

[TSE.9-O-5]

Wednesday 4, morning (second): 13:45
Room: Seminario 6

Contrasting levels of contaminants in different urban land uses depending on the identity

Sala Navarro, Andrea del Carmen[1]; Casado-Coy, Nuria[2]; Campos Castro, Axel[3]; L. Martos-Maestre, Alba[4]; Algora, Camelia[5]; Aguilar Santana, Elena[6]; G. Alday, Josu[7]; Armas, Cristina[8]; Bueno, Guillermo[9]; Calvo, Leonor[10]; Carmona Yáñez, María Dolores[11]; Centenaro, Giada[12]; Dashevskaya, Svetlana[13]; Durán Humia, Jorge[14]; Rodríguez Pereias, Alexandra[15]; Ladrón de Guevara, Mónica[16]; R. Felipe-Lucia, María[17]; Sánchez García, María José[18]; Fernández Alonso, María José[19]; García Palacios, Pablo[20]; Chamizo, Sonia[21]; G. de la Riva, Enrique[22]; Jiménez Prieto, Beatriz[23]; Jiménez, Juan José[24]; Leo, María[25]; López Velasco, Ana[26]; Lorenzo, Carmen[27]; Lucas Borja, Manuel Esteban[28]; Pérez López, Jesús[29]; Plaza Alvárez, Pedro Antonio[30]; Prieto Aguilar, Iván[31]; Terrones, Alejandro[32]; Torres, Aurora[33]; Herrera Melián, José Alberto[34]; Álvarez Ferraz, Ulises[35]; de Nascimiento, Lea[36]; Rocafull, Elena[37]; Sierra Coprnejo, Natalia[38]; Costa, Joana[39]; García, Eva[40]; Figueira, Daniela[41]; Bastidas, Felipe[42]; Delgado Vaquerizo, Manuel[43]; Soliveres, Santiago[44]; Beltrán Sanahuja, Ana[45]; Sanz Lázaro, Carlos[46];

(1) Universidad de Alicante; (2) Universidad de Alicante; (3) Universidad de Alicante; (4) Universidad de Alicante; (5) Instituto de Recursos Naturales y Agrobiología de Sevilla (IRNAS-CSIC; (6) Instituto de Recursos Naturales y Agrobiología de Sevilla (IRNAS-CSIC).; (7) Centre for Research in Agrotechnology (AGROTECNIO – CERCA),; (8) Estación Experimental de Zonas Áridas EEZA-CSIC; (9) Instituto Pirenaico de Ecología (IPE- CSIC); (10) Universidad de León; (11) Universidad de Castilla-La Mancha; (12) Universidad de LLeida; (13) Universidad de LLeida; (14) Misión Biológica de Galicia (MBG-CSIC); (15) Misión Biológica de Galicia (MBG-CSIC); (16) Misión Biológica de Galicia (MBG-CSIC); (17) Instituto Pirenaico de Ecología (IPE- CSIC); (18) Universidad de las Palmas de Gran Canaria (ULPGC); (19) Universidad Autónoma de Madrid; (20) Instituto de Ciencias Agrarias (ICA-CSIC; (21) Estación Experimental de Zonas Áridas (EEZA), CSIC,; (22) Universidad de León; (23) Instituto de Ciencias Agrarias (ICA-CSIC); (24) Instituto Pirenaico de Ecología (IPE- CSIC); (25) Instituto de Ciencias Agrarias (ICA-CSIC),; (26) Western Sydney University; (27) Instituto de Ciencias Agrarias (ICA-CSIC),; (28) Universidad de Castilla-La Mancha; (29) Instituto de Recursos Naturales y Agrobiología de Sevilla (IRNAS-CSIC); (30) Universidad de Castilla-La Mancha; (31) Universidad de León; (32) Estación Experimental de Zonas Áridas (EEZA), CSIC; (33) Universidad de Alicante; (34) Universidad de las Palmas de Gran Canaria (ULPGC); (35) Universidad de las Palmas de Gran Canaria (ULPGC); (36) Universidad de La Laguna; (37) Universidad de La Laguna; (38) Universidad de La Laguna; (39) Centre for Functional Ecology - Universidade de Coimbra; (40) Instituto Pedro Nunes; (41) Instituto Pedro Nunes; (42) Centro de Edafología y Biología Aplicada del Segura (CEBAS-CSIC); (43) Instituto de Recursos Naturales y Agrobiología de Sevilla (IRNAS-CSIC); (44) Universidad de Alicante; (45) Universidad de Alicante; (46) Universidad de Alicante.

Correspondence e-mail: [andrea.sala@ua.es]

Introduction. Cities host the majority of the world's population and many human activities, which result in pollution that affects ecosystem functions and citizens. Pollution levels may depend on many potential drivers, including its size, population density, climate conditions or type of urban greenspace. Yet, we do not know neither the relative importance of these drivers, nor how different pollutants distribute in our cities.

Material and Methods. We examined contamination in 50 cities across the Iberian Peninsula and the Balearic Islands, covering a gradient of weather conditions. Four urban areas (Urban Parks, Urban Crops, Golf Courses, and Roundabouts) were compared with nearby natural areas. We analyzed metals, pesticides, microplastics, and macrolitter. Correlation of soil properties (pH, texture, nitrogen, organic matter), environmental factors (temperature, precipitation, tree cover), and human-related variables (population, urban sprawl) was tested with contaminant levels.

Results and discussion. Pesticide levels were higher in urban areas than natural areas, but the opposite pattern was found for microplastics. In addition, within urban areas, urban crops were the most contaminated with heavy metals and roundabouts in macrolitter, while golf courses showed lower heavy metal and litter contamination than natural areas. Microplastics, pesticides, and macrolitter levels correlated with pH and redox potential: positively with pH and negatively with redox for pesticides and macrolitter, but inversely for microplastics. Metals levels correlated positively with carbon, nitrogen, and phosphorus. These findings reveal that distinct urban land uses shape contamination levels, underscoring the need for targeted management strategies that guide policymakers toward sustainable interventions to preserve ecosystems.

[TSE.9-O-6]

Wednesday 4, morning (second): 14:00
Room: Seminario 6

The role of reproductive mode on the phenotypic divergence between urban and forest populations: salamanders as a study case

Alarcón-Ríos, Lucía[1]; Álvarez, David[2]; Marques, Adam D.[3]; Velo-Antón, Guillermo[4]

(1) CIBIO – Centro de Investigação em Biodiversidade e Recursos Genéticos (Associação BIOPOLIS); (2) Universidad de Oviedo; (3) CIBIO – Centro de Investigação em Biodiversidade e Recursos Genéticos (Associação BIOPOLIS); (4) Universidad de Vigo

Correspondence e-mail: [alarconrioslucia@gmail.com]

Urbanization-driven environmental transformations impact biodiversity and provide valuable systems for addressing eco-evolutionary questions. The magnitude and direction of urban effects on species depend on their life-history traits, which determine their ability to cope with urban stressors. Amphibians are particularly sensitive to urbanization due to reduced mobility, ectothermic physiology, high environmental sensitivity, and a typically biphasic life-cycle involving both aquatic and terrestrial phases, which expose them to conditions in both environments. Variations from this ancestral reproductive mode, such as reproductive independence from water, have repeatedly evolved in all amphibian orders, and may influence their persistence in urban environments. The common salamander (Salamandra salamandra) exhibits both aquatic-dependent and fully-terrestrial reproductive modes, each with differing developmental requirements. This makes it an exceptional system for investigating how the effects of urbanization vary with reproductive traits at the intraspecific level. This study examines whether patterns of differentiation in phenotypic traits (head shape, body size, and body condition) between urban and forest habitats differ according to reproductive mode. We used six urban salamander populations in northwestern Iberia: three with aquatic (S. s. gallaica) and three with terrestrial (S. s. bernardezi) reproduction. Each city included at least one urban and one forest population, with additional populations sampled in one city of each reproductive mode to capture urban heterogeneity. Preliminary findings reveal reproductive different patterns in head shape, but not in body size or condition, with urban heterogeneity likely influencing these patterns, suggesting distinct drivers for each trait and a potential role of reproductive mode in urbanization responses.

TSE.10. Green Urban Ecology: nature and the city

Thursday, 5 (11:00-12:30)

Room: Seminario 6

General background: Urbanization produces some of the most significant impacts on biodiversity and ecosystem functioning. As cities rapidly expand, they exert pressure on natural habitats, leading to biodiversity loss, ecosystem degradation, and disruptions in essential ecosystem services such as air and water purification, temperature regulation, and disease control. Abiotic and biotic conditions are highly modified in cities including higher levels of pollution, small-sized, fragmented habitat and modified ecological interactions. Thus, urban areas represent a thrilling environment for ecological studies, and ecological knowledge should be integrated in urban planning to maximize the ecosystem services provided by the urban biota.

- *Scope:* Green infrastructure in urban design, the ecological role of green spaces, habitats and ecological niches in cities.
- *Objective:* Ecologists working on urban environments are invited to present their research at this symposium, considering the application of their outcomes to urban design to promote better ecosystem functioning. We seek to share knowledge and integrate ecological studies with the design of sustainable urban planning, developing practical ideas considering the challenges of more resilient and diverse urban ecosystems.
- *Relevance:* The concept of green infrastructure, that incorporates ecological connectivity into urban design, provides a tool for improving the city's green spaces and human well being. Green infrastructure in urban planning seeks an integrative approach linking environmental, social and architectural views, representing a challenge for interdisciplinary approaches to global issues such as climate change.

Organizers:

• **Jaime Fagúndez,** Universidade da Coruña

• **María José Servia García,** Universidade da Coruña

• **Yaiza Rodríguez Lueje,** Universidade da Coruña.

TSE.10. Orals

[TSE.10-O-1]

Thursday 5, morning (first): 11:00
Room: Seminario 6

Mapping Barcelona's Urban Smellscape: A Multi-layered Analysis of Scented Vegetation Distribution and Accessibility

Ma, Shichun[1]; Basnou, Corina[2]

(1) CREAF; (2) CREAF

Correspondence e-mail: [Shichun.Ma@autonoma.cat]

Urban green design and planning often overlook the sensory dimension of smell, despite its significant impact on biodiversity, human health and well-being. Smell influences emotions, memories, behaviour and communication, but little is known about how urban green fragrances planning underpin a positive impact in relation to biodiversity and Planetary Health. This study pioneers a comprehensive analysis of Barcelona's urban green "smellscape" through an innovative and inclusive multi-layered approach.

The methodology integrated data from Barcelona's Biodiversity Atlas, to assess a GIS-based spatial assessment of scented tree distribution across districts. We developed a classification scent framework, and then integrated data from Smell Walks, seasonal patterns and green areas' accessibility. We built 20-m walking buffers around schools and hospitals (areas with high demand from vulnerable groups), using the Open Street Map of Barcelona, to measure the percentage of scented trees.

Results revealed that out of 476 planted trees in Barcelona, most trees exhibit confirmed (29.7%) or potential (67.9%) scent characteristics, with distinct seasonal variations. The spatial analysis exposed clear disparities in scented tree distribution, accessibility and equity. Sants-Montjuïc district has the highest number of fragrant flowering trees, while Ciutat Vella has the lowest number of scented trees. The results showed that 37% of hospitals and 24% of schools lack fragrant trees in their proximity.

This pioneering study provides essential insights for urban green planning, public health, and environmental justice. This research suggests a paradigm shift from purely visual to multi-sensory urban landscape planning, developing scent-conscious design guidelines, particularly around healthcare and educational facilities.

[TSE.10-O-2]

Thursday 5, morning (first): 11:15
Room: Seminario 6

Strengthening urban green infrastructure networks through multi-scale and interdisciplinary frameworks

Concepción Cuevas, Elena Daniela[1]; Vilanova Caicoya, Covadonga[2]; Pérez López, Fermín[3]; Rescia Perazzo, Alejandro[4]; Herrero - Jáuregui, Cristina[5]

(1) BIOPOLIS - CIBIO, Campus de Vairão, Universidade do Porto. Portugal.; (2) Ingenia, Soluciones para la Ingeniería. Madrid, España.; (3) Tecnigral. Madrid, España; (4) Facultad de Ciencias Biológicas, Universidad Complutense de Madrid, España.; (5) Facultad de Ciencias Biológicas, Universidad Complutense de Madrid, España.

Correspondence e-mail: [elenadconcepcion@gmail.com]

Significant efforts are being made to integrate nature into urban environments through green infrastructure plans, aiming to create more sustainable and livable cities. Traditionally, the planning of urban green infrastructure has been conducted from a single-, whole-city perspective. This limited approach has resulted in fragmented green networks ineffective to penetrate within city centers and consolidated urban zones. If green spaces are not connected and evenly distributed throughout the whole city, they will not help to solve these problems of fragmentation. Addressing this challenge demands innovative spatial planning that integrates ecological knowledge and expertise.

We propose an interdisciplinary and multi-scale approach to urban green infrastructure planning. In particular, we advocate the integration of landscape ecology concepts and methods into urban spatial planning. By considering the city as a complex interconnected system, this perspective allows for the development of a cohesive and functional network of green spaces bridging the entire urban area, from the dense urban centre to the suburban periphery.

We illustrate this approach by applying it to the cities of Madrid and Valladolid (Spain) as case studies. These examples showcase distinct practical strategies for improving urban green infrastructure by linking ecology and urban design. Based on the comparison of scenarios, the results highlight the importance of using a multi-level framework guided by various criteria to establish a truly interconnected and functional green infrastructure network. This is not only to foster ecological connectivity, but also to improve urban sustainability and resilience, as well as the quality of life of residents.

[TSE.10-O-3]

Thursday 5, morning (first): 11:30
Room: Seminario 6

Growth variability and drought resilience in urban trees

Pérez Andrés, Nerea[1]; Madrigal González, Jaime[2]; García Hidalgo, Miguel[3]; Olano Mendoza, Jose Miguel[4]; Águeda Hernández, Beatriz[5]; Houdas, Hermine[6]; Barreiro Verea, Olga[7]; Lechuga Ordóñez, Víctor[8]; Linares Calderón, Juan Carlos[9]; Hernández Alonso, Héctor[10]; Sangüesa Barreda, Gabriel[11]

(1) Universidad de Valladolid; (2) Universidad de Valladolid; (3) Universidad de Valladolid; (4) Universidad de Valladolid; (5) Universidad de Valladolid; (6) Universidad de Valladolid; (7) Universidad de Valladolid; (8) Universidad de Jaén; (9) Universidad de Pablo Olavide; (10) CEFE/CNRS; (11) Universidad de Valladolid

Correspondence e-mail: [nerea.perez.andres23@uva.es]

Urban areas hold more than half of the world's population, a figure that increases to 80% in Spain. Urban vegetation is vital for public health, offering shade, regulating temperatures, and improving air quality. However, global warming and the intensified heat island effect of cities might pose a threat to urban trees. In this context, tree-ring dating could help assess species-specific drought resilience across different management contexts.

We selected six cities across a broad dry-wet gradient in Spain, including northern (Bilbao and Avilés), center (Soria and Madrid) and southern (Jaén and Córdoba) locations. The study focused on five commonly planted species: Platanus x hispanica, Aesculus hippocastanum, Cedrus sp., Cupressus arizonica and Celtis australis. In each city, we took increment core samples of 160 trees, 80 watered and 80 unwatered. High-resolution digital images of the cores were obtained using a CaptuRING device to conduct tree-ring analyses. Linear-mixed effect models will be used to analyze growth variations between watering groups, species × latitude, climatic drivers, and drought resilience.

Tree age varied significantly across cities and species, with Platanus x hispanica and Cedrus sp. in Bilbao reaching up to 150 years, while averages in other cities ranged from 40 to 70 years. Remarkably, Cedrus sp. showed declining growth in southern Spain, suggesting that microclimatic drivers of growth vary significantly across cities and species. Watered trees exhibited a weaker response to climate variations, which could potentially reduce their resilience to drought and increase their vulnerability to projected climate change scenarios.

[TSE.10-O-4]

Thursday 5, morning (first): 11:45
Room: Seminario 6

Exploring structural and functional attributes in urban parks to optimize ecosystem services in the climate-vulnerable city of Cordoba, Spain

Bastias, Cristina C.[1]; Rodríguez, Ginés[2]; Gómez, Emma[3]; Roldán, Francisco José[4]; Hernández Clemente, Rocío[5]; Salazar Zarsoza, Pablo[6]; Quero Pérez, José Luis[7]; Villar Montero, Rafael[8]

(1) Universidad de Córdoba; (2) Universidad de Córdoba; (3) Universidad de Córdoba; (4) Universidad de Córdoba; (5) Universidad de Córdoba; (6) Universidad de Córdoba; (7) Universidad de Córdoba; (8) Universidad de Córdoba

Correspondence e-mail: [crbasc@gmail.com]

Urban green spaces represent essential nature-based solutions to address the challenges posed by the global climate emergency, which exacerbates the "urban heat island" effect, especially in cities with high climate vulnerability. However, the planning and design of urban green infrastructure are generally guided by aesthetic and economic criteria rather than ecological ones, resulting in potential significant deficiencies in the multifunctionality and balance of ecosystem services that urban green spaces should provide to humans. This study, conducted in 18 urban parks in Cordoba (Spain) as an example of a highly climate-vulnerable city, evaluates the functional balance (trade-offs and synergies) between various ecosystem services (temperature regulation, shading, CO2 storage, allergy regulation) and how they vary depending on the green spaces' structural and functional attributes (size, species diversity, abundance, etc.). The results show that green spaces with higher NDVI (a proxy for biomass) and tree species diversity better regulate the air's surface temperature within the urban green space and its surroundings up to 500 meters. However, park size did not affect temperature reduction. Parks with species such as Cedrus deodara, Melia azedarach, Platanus x hybrida, Casuarina equisetifolia, and Eucalyptus camaldulensis store more carbon per hectare. Across parks, we found the general pattern of trade-offs between climate regulation services (temperature and carbon storage) and allergy and noise regulation. This study highlights the importance of selecting vegetation thoughtfully, emphasizing that species identity, diversity, and abundance should serve as key criteria in urban park design to optimize the multifunctional role of green spaces.

[TSE.10-O-5]

Thursday 5, morning (first): 12:00
Room: Seminario 6

Quantifying the factors influencing ecosystems services provision by urban green & blue infrastructure

Pinho, Pedro[1]; Rocha, Bernardo[2]; Matos, Paula[3]; Dekan-Carreira, Vladimíra[4]; Beça, Ana[5]; Grilo, Filipa[6]; Branquinho, Cristina[7]

(1) cE3c - Center for Ecology, Evolution and Environmental Changes & CHANGE; (2) cE3c - Center for Ecology, Evolution and Environmental Changes & CHANGE; (3) CEG - Centro de Estudos Geográficos do Instituto de Geografia e Ordenamento do Território UL; (4) cE3c - Center for Ecology, Evolution and Environmental Changes & CHANGE; (5) cE3c - Center for Ecology, Evolution and Environmental Changes & CHANGE; (6) cE3c - Center for Ecology, Evolution and Environmental Changes & CHANGE; (7) cE3c - Center for Ecology, Evolution and Environmental Changes & CHANGE

Correspondence e-mail: [ppinho@fc.ul.pt]

Cities green & blue infrastructure provide ecosystem services which can help future proof the long-term sustainability of cities. These include climate, air quality and flood regulation, and biodiversity support, and are provided by cities terrestrial and aquatic ecosystems. For planning, it's important to quantify how environmental drivers influence such services provision. This can be done using direct measures or ecological indicators, i.e. measures of biodiversity related to the amount of service provided. Overall, and using studies done locally and over Europe, air quality regulation was influenced by the amount and density of green areas. Habitat connectivity, which supports long-term animal biodiversity, was provided by the remnants of semi-natural habitats in the urban matrix, prompting for their conservation, even under urbanization expansion plans. Climate regulation was shown to be consistently influenced by multiple drivers working at multiple spatial scales, although the amount of vegetation was critical at all scales. Importantly, thresholds for effects were observed, suggesting the prevalence of non-linear relationships between the amount of vegetation and climate regulation. Urban aquatic habitats biodiversity and water residence time were strongly influenced by climate, but also by local conditions, such as the type of habitats and amount of surround green. Overall, while ecosystem services were influenced by hard-to-manage drivers such as climate, they were also influenced by factors working at city and site scale, an information which can be used to optimize the provision of ecosystem services by planning and management options.

[TSE.10-O-6]

Thursday 5, morning (first): 12:15
Room: Seminario 6

How biodiversity of private gardens is shaped by management practices and garden composition? A review and meta-analysis

Muriel, Deparis[1]; Quentin, Duterte[2]; Mathieu, Lachaise[3]; Emmanuelle, Baudry[4]

(1) ESE, Ecology Society and Evolution; (2) ESE, Ecology Society and Evolution; (3) ESE, Ecology Society and Evolution; (4) ESE, Ecology Society and Evolution

Correspondence e-mail: [deparismuriel@gmail.com]

Private domestic gardens are important elements of urban areas, representing 16% (Stockholm, Sweden) to 36% (Dunedin, New Zealand) of urban green spaces. They provide habitats for different taxa (Gaston et al., 2005), exhibit more plant species than natural areas (Padulles Cubino et al., 2019) and have a positive impact for pollinators (Levé et al., 2019). Different parameters constrain biodiversity in private gardens, as the garden size (Majewska & Altizer, 2020), the vegetation coverage and abundance (Morpurgo et al., 2024), the frequency of mowing (Lerman et al., 2018) and the use of pesticides (Bertoncini et al., 2012). However, the knowledge about these questions is dispersed and somewhat inconsistent.

Here, we present a review about the effects of the composition and management practices on the richness and abundance of non-domestic species in private gardens. We collected 3,872 peer-reviewed articles interested in all taxonomic groups, management practices and garden compositions. After a three-stage screening and a critical appraisal, we retained 53 articles.

For composition, index of garden heterogeneity, the richness and surface of vegetation in relation to ground fauna and predatory insects are the most documented, whereas for management, it's the use of pesticides, the index of management intensity and the frequency of mowing, in relation to plant and pollinators. We also present the results of the meta-analysis of those studies, the first at our knowledge focusing exclusively to private gardens. Those results provide useful advices about planning and management for owners willing to increase the diversity of their garden.

TSE.10. Posters

[TSE.10-P-1]

Wednesday 4
Discussion corner: Room 4

Pollinator visits to ornamental plants in urban parks

Vilà, Montserrat[1]; Trillo, Alejandro[2]; Ragel, David[3]; Molina, Francisco P[4]

(1) EBD-CSIC; (2) EBD-CSIC; (3) EBD-CSIC; (4) EBD-CSIC

Correspondence e-mail: [montse.vila@ebd.csic.es]

Understanding the importance of ornamental plants for pollinators is key to reconcile urban planning and nature conservation. We explored pollinator dynamics and their floral visits to ornamental plants over 12 consecutive months in 15 parks in Seville (Spain). We observed 8422 floral visitors from 155 morphospecies in 62 plant taxa (74% non-native). Pollinators were mostly hymenopterans (79%), of which nearly half were honeybees, and dipterans (18%). Pollinators were present all year round and peaked twice: first, between late winter and early spring; and second, in early summer for hymenopterans or early autumn for dipterans and lepidopterans. Floral availability per plant taxa increased Hymenoptera visits, but not Diptera or Lepidoptera visits. Floral visits and species richness of each pollinator order did not differ between native and non-native plants. Overall, 37 plant taxa were visited by at least one pollinator order more often than their floral abundance would predict. Despite there were substantial differences in plant visits among pollinator orders throughout the year, the native species Salvia rosmarinus and Vitex agnus-captus, and the non-native species Parkinsonia aculeata and Koelreuteria paniculata were highly visited by most pollinators. Our results indicate that about half of the plants in the parks are highly attractive to at least one pollinator order. When designing parks, we suggest planting a combination of these plants to provide flowers all year round for pollinators to thrive. It is key to integrate information on pollinator foraging preferences when managing green spaces to support biodiversity in cities.

[TSE.10-P-2]

Thursday 5
Discussion corner: Room 4

Unveiling the conservation importance of natural habitats in a renaturing city context

Corominas Godori, Fiona[1]; Vilar Sais, Lluís[2]; Bou Manobens, Jordi[3]

(1) University of Girona; (2) University of Girona; (3) University of Girona

Correspondence e-mail: [fiona.corominas@udg.edu]

Green infrastructure is relevant in urban systems for biodiversity and ecosystem services but also for its contribution to human's health and good quality of life. To achieve the potential nature's contributions to people of urban ecosystems its health is very relevant. The conservation status of urban and peri-urban habitat is in the centre of this framework, as a relevant indicator of the green infrastructure's quality. Renaturing cities must consider habitats conservation in order to have a real effect on citizens. The study's main objective is to reveal how habitats evaluation can give new insights about green urban systems and its conservation, in a renaturing context.

This work has been developed in the municipality of Girona (NE Iberian Peninsula), where a renaturing project to transform the city (GiroNat) is being carried out. A habitats cartography of the study case has been developed using CORINE and HIC classification systems. The conservation status of natural habitats is being evaluated by three criteria: structure and function, species composition and other external impacts. To obtain the data a sampling campaign has been carried out with floristic inventories, measuring stand structure and in-situ and ex-situ evaluation of the impacts.

The results unveil the urban and peri-urban effect on the conservation of habitats. Diverse types of vegetation show different conservation status therefore nature's health must be considered in the management and local policies of urban areas. Renaturing actions have to improve the quality of green infrastructure to really contribute to good quality of life and ecosystem services.

[TSE.10-P-3]

Tuesday 3
Discussion corner: Room 4

Exploring urban nature perceptions in urban semi-arid spaces to inform sustainable urban planning

Garau, Enrica[1]; Quintas-Soriano, Cristina[2]; Requena-Mullor, Juan Miguel[3]; Otamendi-Urroz, Irene[4]; Alba-Patiño, Daniela[5]; El Ghafraoui, Youssra[6]; Castro, Antonio J.[7]

(1) University of Almería; (2) University of Almería; (3) University of Almería; (4) University of Almería; (5) University of Almería; (6) University of Almería; (7) University of Almería

Correspondence e-mail: [egarau@ual.es]

Introduction. Semi-arid cities, characterized by their harsher environmental conditions and less visibly green urban nature, face unique challenges in maintaining human-nature connections. Disconnection from nature is increasingly recognized as a key driver of landscape degradation. This increasing disconnection impacts not only human well-being but also weakens emotional affinity for nature, fostering a gradual increase in tolerance for its degradation. Addressing this issue requires cultural and social shifts tailored to semi-arid urban areas, where nature's appearance often struggles to compete with societal expectations of green, lush landscapes.

Materials and Methods. As a case study, we conducted 206 face-to-face surveys in Almería, Spain, to explore perceptions of urban nature and the connection between people and nature in diverse urban settings. The surveys focused on three main topics: (1) perceptions of urban nature, (2) human-nature connectedness within urban spaces, and (3) preferences and values associated with different types of urban nature spaces.

Results and Discussion. The findings reveal diverse perceptions of urban nature in semi-arid environments. Participants associated urban nature with various elements, both biotic and abiotic, as well as colors and personal experiences. Respondents expressed a preference for urban nature spaces featuring non-native plants, large trees, water, and greenery over spaces with native, yellow-brownish vegetation. We also found varying levels of human-nature connectedness and perceived ecosystem services across different types of urban nature spaces. The results provide actionable insights for sustainable urban planning, emphasizing the need to reframe and enhance human interactions with nature in cities to create more sustainable urban spaces.

[TSE.10-P-4]

Wednesday 4
Discussion corner: Room 4

Urban gradient effects on the invasive hornet Vespa velutina in the coastal city of A Coruña

Fagúndez, Jaime[1]; R. Sánchez, Sara[2]; R. Lueje, Yaiza[3]; Servia, María J.[4]

(1) Universidade da Coruña; (2) Universidade da Coruña; (3) Universidade da Coruña; (4) Universidade da Coruña

Correspondence e-mail: [jaime.fagundez@udc.es]

Urban areas show unique environmental conditions for biodiversity. The heat island effect, high air pollution levels, artificial light and noise, or lack of vegetation cover are some of the factors that define urban environments. Such conditions may facilitate the colonization by opportunists, including many invasive alien species. In this study, we explore how an urban gradient affects the Asian hornet Vespa velutina Lepeletier, 1836, an invasive alien species that has expanded over large areas of East Asia and Europe. We measured the abundance of hornets captured by trapping at four different moments from March to June covering one whole season. Captures from 199 traps were analysed using the Getis-Ord statistic to identify clustered areas with higher values. Then, we compared the data with spatially explicit data of air pollutants (CO, CO2, COV, NOx, NH3, SO2, PM2.5, PM10), artificial light and acoustics from the municipality monitoring program of the city of A Coruña in Galicia, NW Spain, and vegetation cover from NDVI values extracted from Sentinel-2 satellite images. A weakly positive correlation to the urban gradient could be observed, supporting a generalist behaviour of V. velutina.

[TSE.10-P-5]

Thursday 5
Discussion corner: Room 4

Assessment of the urban tree at municipal scale in the Basque Country (Spain)

Peña, Lorena[1]
(1) Universidad del País Vasco (UPV/EHU)
Correspondence e-mail: [lorena.pena@ehu.eus]

Introduction. In recent years, a new land management model has emerged, called Green Infrastructure (GI), to be implemented at different scales, including the urban areas. Among the potential elements that can form part of GI, urban trees stand out, which despite supplying relevant Ecosystem Services (ES) are often not considered in the sustainable management of GI. For this reason, a tool has been developed so that technicians at the municipal level can assess the urban trees, based on four criteria (quantity, quality, connectivity and multifunctionality), and the pressures on the municipality, in order to improve the UGI.

Methodology. A series of indicators based on abundance, ES (Provisioning ES: food production; Regulating ES: habitat maintenance, climate regulation, air quality regulation, water regulation, pollination; and cultural ES: aesthetic enjoyment of the landscape) and disservices (Volatile Organic Compounds emission and allergy) have been used to carry out the urban tree assessment. While the pressures on the municipality (Urbanisation, Climate Change, Water demand, Air pollution, Flood risk, Sea level rise, Flood risk, Noise pollution, and Heat wave health risk) were also assessed using indicators. The information has been obtained from both, cartography and bibliography.

Results and discussion. Finally, the most suitable tree species and restoration measures were proposed for each municipality based on species multifunctionality and pressures, respectively. This tool has been developed for the Basque Country; however, its conceptual and methodological framework can be developed in other territories, as it can be very useful for making decisions regarding the improvement and increase of the UGI.

TSE.11. Blue Urban Ecology: Aquatic ecosystems for Healthy and Sustainable Cities

Thursday, 5 (15:30-17:00)

Room: Seminario 6

General background: Urbanization produces some of the most significant impacts on biodiversity and ecosystem functioning. As cities rapidly expand, they exert pressure on natural habitats, leading to biodiversity loss, ecosystem degradation, and disruptions in essential ecosystem services such as air and water purification, temperature regulation, and disease control. Abiotic and biotic conditions are highly modified in cities including higher levels of pollution, small-sized, fragmented habitat and modified ecological interactions. Thus, urban areas represent a thrilling environment for ecological studies, and ecological knowledge should be integrated in urban planning to maximize the ecosystem services provided by the urban biota.

- *Scope:* This session explores the intersection of urban aquatic ecology and human health, focusing on how urbanization impacts freshwater and coastal ecosystems, living organisms, and ultimately, human well-being.
- *Objective:* Gather studies that: i) investigate the effects of urbanization in the health of freshwater and coastal ecosystems (including rivers, streams, lakes, estuaries and coastal areas) and their associated organisms, ii) link aquatic ecosystems' degradation to human health risks; and iii) demonstrate/relate the critical value of services of aquatic ecosystems in urban settings for human health.
- *Relevance:* By bridging aquatic ecology, public health, and ecosystem services, this session offers valuable insights for researchers interested in fostering healthy, resilient, and sustainable cities.

Organizers:

- **Maria João Feio,** Department of Life Sciences, University of Coimbra, Coimbra, MARE - Marine and Environmental Sciences Centre, ARNET - Aquatic Research Network
- **Ana Raquel Calapez,** Department of Life Sciences, University of Coimbra, Coimbra, MARE - Marine and Environmental Sciences Centre, ARNET - Aquatic Research Network
- **João M. Neto,** Department of Life Sciences, University of Coimbra, Coimbra, MARE - Marine and Environmental Sciences Centre, ARNET - Aquatic Research Network.

TSE.11. Orals

[TSE.11-O-1]

Thursday 5, after lunch (third): 15:30
Room: Auditorio

Blue connectivity in urban ecosystems: simulating future scenarios as a management tool

Bou, Jordi[1]; Corominas, Fiona[2]; Martín, Luis[3]; Boix, Dani[4]; Cunillera-Montcusí, David[5]

(1) University of Girona; (2) University of Girona; (3) University of Girona; (4) University of Girona; (5) HUN-REN Centre for Ecological Research

Correspondence e-mail: [jordi.bou@udg.edu]

Urban ecosystems have grown together with human societies development that nowadays have become key for both nature contributions to people and nature conservation. In this regard, freshwater ecosystems can be an important part of these urban ecosystems, configuring major corridors for connectivity within the city but also through it (i.e. rivers and streams). While the relevance of these blue infrastructure has been largely acknowledged, major threats such as climate change or land-use pressures threaten its sustainability, especially in Mediterranean regions.

In this work we simulate different relevant future scenarios for urban management: drought and renaturing (restoration and creation of new ponds). The city of Girona was selected as a study case due to its rich and complex waterscape. We mapped this waterscape and then transformed it into a grid with 100x100m cells. Then, we calculated three centrality metrics to identify areas playing a major role as regional dispersal source, sink and/or stepping-stone (out-degree, in-degree, betweenness).

Overall, permanent rivers have a major role at the network scale due to their major coverage of municipality's network structure. With the simulated scenarios we could identify permanent water bodies as key nodes for network under drought scenarios. Renaturing urban channels and ponds modified waterscape structure and fostered connectivity in focal areas. Moreover, the creation of new ponds promoted connectivity when they were created next to rivers. Through this approximation we provided novel insights for the management of blue urban structure and the impact of future threats, which may challenge blue connectivity contributions to people.

[TSE.11-O-2]

Thursday 5, after lunch (third): 15:45
Room: Auditorio

Urban Streams as Biodiversity Hotspots within cities: assessing ecological communities and environmental influences

Calapez, Ana Raquel[1]; Teixeira, Zara Fani[2]; Silva, Janine P[3]; Ramos, Jaime A[4]; Santos, Jorge[5]; Almeida, Salomé FP[6]; Schmitt, Rafael[7]; Chen, António[8]; Alexandre, Carlos M[9]; Pedro, Sílvia[10]; Marques, João Pedro[11]; Feio, Maria João[12]

(1) MARE/ARNET & University of Coimbra; (2) MARE/ARNET & University of Coimbra; (3) MARE/ARNET & University of Coimbra; (4) MARE/ARNET & University of Coimbra; (5) MARE/ARNET & University of Coimbra; (6) Biology Department and GeoBioTec, University of Aveiro; (7) Department and GeoBioTec, University of Aveiro; (8) Department and GeoBioTec, University of Aveiro; (9) MARE/ARNET & University of Évora; (10) MARE/ARNET & University of Évora; (11) MARE/ARNET & Faculdade de Ciências da Universidade de Lisboa; (12) MARE/ARNET & University of Coimbra

Correspondence e-mail: [anacalapez@uc.pt]

Urbanization and human activities have significantly affected freshwater ecosystems, often leading to critical ecological changes and biodiversity loss. However, rivers and streams within urban environments can provide vital green and blue areas, as well as ecological corridors, supporting diverse biological communities. This research investigates the role of urban stream ecosystems in sustaining biodiversity by examining 15 streams in Coimbra, Portugal.

Biological communities, including diatoms, macroinvertebrates, fish, and birds, were analysed alongside environmental and land-use factors (n=27). The streams harboured approximately 300 taxa, including sensitive macroinvertebrates such as Leutridae (Plecoptera), Leptophlebiidae (Ephemeroptera) and Calomoceratidae (Trichoptera), fish species classified as Endangered on Portugal's Red List (Anguilla anguilla, Gasterosteus aculeatus), and iconic bird species like the kingfisher (Alcedo atthis) and the green woodpecker (Picus viridis). Diatoms exhibited the highest average richness and diversity, while fish displayed the lowest. Fish biodiversity indices were negatively associated with nutrient levels (e.g., phosphates and ammonia) but positively linked to water depth (Spearman $p<0.05$). Birds had the highest mean evenness, which correlated positively with Habitat Quality Assessments derived from the River Habitat Survey (Spearman $p<0.05$). The composition and structure of biological communities varied in relation to environmental factors and land-use characteristics (BIOENV and dbRDA analyses). These findings highlight that different biological groups respond distinctively to environmental impacts. Also, urban stream ecosystems exhibit high biological diversity and can sustain sensitive, endemic, and endangered species, highlighting their ecological significance in conserving biodiversity within urban environments.

[TSE.11-O-3]

Thursday 5, after lunch (third): 16:00
Room: Auditorio

Satellite remote sensing for assessing urban stream health

Pereira da Silva, Janine[1]; Calapez, Ana Raquel[2]; Serra, Sónia[3]; Karagiannis, Xenofon[4]; Symeonidis, Symeon[5]; Koutalieris, Georgios[6]; Feio, Maria João[7]

(1) MARE - Marine and Environmental Sciences Centre & ARNET; (2) MARE - Marine and Environmental Sciences Centre & ARNET; (3) MARE - Marine and Environmental Sciences Centre & ARNET; (4) ENORA Innovation, Greece; (5) ENORA Innovation, Greece; (6) ENORA Innovation, Greece; (7) MARE - Marine and Environmental Sciences Centre & ARNET

Correspondence e-mail: [janinepdasilva@gmail.com]

Monitoring the health of urban streams using remote sensing is challenging due to their narrow size and the complexity of urban landscapes. However, advances in satellite technology offer new opportunities for improving monitoring and providing early warnings for ecological and human health risks. Within the Horizon Europe project OneAquaHealth, we aimed to explore the potential of PlanetScope and Sentinel-2 spectral bands and indices to complement or substitute the WFD-based ecological assessment of streams, particularly in urbanised areas. Correlation analyses were performed to evaluate relationships between satellite data and ecological quality ratios derived from the Portuguese Index for Invertebrates, alongside hydromorphological quality, water pollution, and land use metrics. In addition, LASSO models were used to identify potential satellite predictors of biological quality and in situ conditions. Spectral bands Red (from Planetscope) and Coastal (from Sentinel-2) provided the most comprehensive assessments of urban streams, showing a high frequency of selection in the models and significant correlations with several biological quality indices, hydromorphological quality, and land use. Direct use of spectral bands proved more effective than complex indices for urban stream assessments. These findings highlight the potential to complement ground ecological assessments with satellite data to enhance the extent and frequency of monitoring programs. Moreover, a custom spectral index tailored for urban streams could further improve monitoring capabilities. Key spectral bands and indices are currently being embedded in the OneAquaHealth Geospatial and Satellite Information Platform (GEOSSIP) to support decision-making and mitigate risks to both ecosystem and human health.

[TSE.11-O-4]

Thursday 5, after lunch (third): 16:15
Room: Auditorio

Pharmaceuticals in urban streams: an evaluation in European cities across urbanisation and climatic gradients

Rodrigues, Fernanda[1]; R. Calapez, Ana[2]; M.P.T. Pereira, André[3]; J.G. Silva, Liliana[4]; Freitas, Andreia[5]; P. da Silva, Janine[6]; Piscopo, Nadia[7]; A.E. Forio, Marie[8]; De Cock, Andree[9]; Goethals, Peter[10]; S. Schmeller, Dirk[11]; Moen, Anne[12]; H. Henni, Silje[13]; Durães, Luisa[14]; E.C. Simões, Nuno[15]; J. Feio, Maria[16]

(1) University of Coimbra, MARE/ARNET, CERES, INESC Coimbra, FCTUC, Coimbra, Portugal.; (2) University of Coimbra, MARE/ARNET, CERES, INESC Coimbra, FCTUC, Coimbra, Portugal.; (3) University of Coimbra, MARE/ARNET, Department of Life Sciences/FCTUC, Coimbra, Portugal.; (4) University of Coimbra, LAQV/REQUIMTE, Faculty of Pharmacy, Coimbra, Portugal.; (5) University of Coimbra, LAQV/REQUIMTE, Faculty of Pharmacy, Coimbra, Portugal.; (6) LAQV/REQUIMTE, Porto, Portugal; INIAV, I.P., Vairão, Vila do Conde, Portugal.; (7) University of Coimbra, MARE/ARNET, Department of Life Sciences/FCTUC, Coimbra, Portugal.; (8) University of Naples Federico II, Dep. of Veterinary Medicine and Animal Production, Naples, Italy.; (9) Ghent University, Aquatic Ecology Research Unit, Ghent, Belgium.; (10) Ghent University, Aquatic Ecology Research Unit, Ghent, Belgium.; (11) Ghent University, Aquatic Ecology Research Unit, Ghent, Belgium.; (12) Université de Toulouse, CRBE, CNRS, IRD, Toulouse INP, Toulouse, France.; (13) University of Oslo, Institute of Health and Society, Dep. of Public Health Science, Oslo, Norway.; (14) University of Oslo, Institute of Health and Society, Dep. of Public Health Science, Oslo, Norway.; (15) University of Coimbra, CERES, Department of Chemical Engineering/FCTUC, Coimbra, Portugal.; (16) University of Coimbra, INESC Coimbra, Department of Civil Engineering/FCTUC, Coimbra, Portugal.; (17) University of Coimbra, MARE/ARNET, Department of Life Sciences/FCTUC, Coimbra, Portugal.

Correspondence e-mail: [fernanda.rodrigues@student.uc.pt]

Pharmaceuticals are Contaminants of Emerging Concern present in wastewater and their fate is associated with freshwaters, especially in urban areas. The effects on aquatic organisms include reproduction inhibition, increased mortality and hatching disorders. This study evaluated the presence of pharmaceuticals in 102 urban streams collected in 2022/2023 from 5 European cities, across urbanisation and climatic gradients. Solid phase extraction followed by UHPLC-ToF-MS was used for pharmaceuticals analysis. The results showed that 16 pharmaceuticals from all therapeutic groups were present in the streams. The antihypertensives irbesartan and bisoprolol and the anticonvulsant carbamazepine were found in >50% of the sites (maximum concentration up to 31,659 ng/L, 966 ng/L and 1,218 ng/L, respectively). From the pharmaceuticals in the Watch-List, the antibiotic ofloxacin was only detected in Coimbra and Ghent, while the antibiotic trimethoprim and the antidepressant venlafaxine were detected in all cities. Climate does not influence the pharmaceuticals distribution patterns, as the most distant cities and climates (Coimbra and Oslo) had no statistical differences (PERMANOVA, p=0.416). MDS analyses showed that pharmaceuticals concentrations were lower in Coimbra and Oslo, where a higher tree cover density surrounds the streams. In Toulouse and Ghent there were higher concentrations of several pharmaceuticals which were associated with a higher stream degradation (morphological condition, water pollution and loss of connectivity). This study highlights the urgency to prevent the entrance of pharmaceuticals in freshwater ecosystems in cities, and simultaneously that a better ecosystem condition could contribute as a solution to improve water quality.

[TSE.11-O-5]

Thursday 5, after lunch (third): 16:30
Room: Auditorio

Risks for human health from the loss urban stream ecosystems services

Chaves de Sousa, Maria Carolina[1]; Zerega, Andreína[2]; Calapez, Ana Raquel[3]; R. Q. Serra, Sónia[4]; E. C. Simões, Nuno[5]; Feio, Maria João[6]

(1) MARE e INESCC; (2) MARE; (3) MARE; (4) MARE; (5) INESCC; (6) MARE

Correspondence e-mail: [mary.carolina@gmail.com]

River ecosystems provide essential services that benefit human society, however their degradation in urban areas can lead to significant adverse effects on human health. We proposed and applied an innovative approach to obtain the potential risks for the health of the population of a city based on the loss of specific ecosystem services provided by urban streams. The Urban Stream Assessment System - UsAs was used to obtain the quality of regulating (n=6; 14 indicators) and cultural ecosystem services (n=6; 22 indicators) provided by 16 urban streams of Coimbra city, Portugal. We further selected the services and respective indicators that were better linked to human health including climate regulation, air quality, water quality, education and cognitive development, and therapeutic services. At the city level, we estimated a risk of physical and mental disorders of 55.5% due to low air quality service and 32.8% due to absence of climate regulation; a risk for enteric and vector-borne diseases due to a poor water quality of 24.7%. We also identified potential risks related to educational and cognitive development (55.9%) and therapeutic services (34.4%), which are frequently and predominantly associated with mental illnesses. We concluded that the monitoring of ecosystem services could be a useful approach to assess the potential risks of freshwaters degradation and support preventive measures for a better human health in cities, and simultaneously design the most appropriated and cost-effective restoration measures of urban stream ecosystems.

[TSE.11-O-6]

Thursday 5, after lunch (third): 16:45
Room: Auditorio

Seasonal patterns of diatom communities and water quality of urban streams

Schmitt, Rafael[1]; Feio, Maria João[2]; FP Almeida, Salomé[3]

(1) GeoBioSciences, GeoTechnologies and GeoEngineering Research Centre; (2) Marine and Environmental Sciences Centre; (3) GeoBioSciences, GeoTechnologies and GeoEngineering Research Centre

Correspondence e-mail: [rafaelschmitt@ua.pt]

Urbanization is one of the most transformative anthropogenic activities. In stream ecosystems it promotes changes in riparian zones, hydrological changes, and alterations in water quality through multiple pollutants. In addition, climatic changes, namely lower precipitation and higher temperatures in summer, and the increase in population density and anthropogenic activities from tourism may exert stronger effects on these fragile freshwater ecosystems. These changes can collectively affect the biodiversity of streams, including the taxonomic composition of diatom assemblages. We assessed the seasonal dynamics of diatom communities of 16 urban streams in the Aveiro region, Portugal alongside an urbanization gradient. Our results showed a clear distinction between winter and summer. There were higher concentrations of nitrogen compounds during the winter, while metal concentrations were higher during summertime, and in sites with a greater proportion of built-up areas. The diatom communities differed significantly between seasons (PERMANOVA: Pseudo-F = 2.4250, p = 0.0001). These variations were also reflected in the Indice de Polluosensibilité Spécifique (IPS), accompanied by a higher occurrence of abnormal forms, highlighting the poor ecological status of streams during winter. Overall, our findings demonstrate a substantial impact of the combined effects of seasonality and urbanization on the ecological quality of urban streams.

TSE.11. Posters

[TSE.11-P-1]

Tuesday 3
Discussion corner: Room 4

The blue city: multicriteria ecological evaluation of freshwater ecosystems

Martín, Luis[1]; Corominas, Fiona[2]; Tornero, Irene[3]; Sala, Jordi[4]; Rodrigo, María A.[5]; Bou, Jordi[6]; Boix, Dani[7]

(1) University of Girona; (2) University of Girona; (3) University of Girona; (4) University of Girona; (5) Cavanilles Institute for Biodiversity and Evolutionary Biology; (6) University of Girona; (7) University of Girona

Correspondence e-mail: [luis.martin@udg.edu]

Blue infrastructure supports biodiversity, provides ecosystem services, and improves human health and quality of life. Maintaining healthy urban ecosystems is key to fully harnessing nature's benefits. Freshwater ecosystems are very threatened by global change, particularly in cities where human activities are more intense. Due to their complexity, evaluating aquatic ecosystems requires a multi-criteria approach that combines chemical and biological indices. This study aims to identify relevant indicators for blue urban ecosystems and to perform a comparison between urban and peri-urban freshwater ecosystems.

The blue city of Girona has been taken as study case as it has a complex waterscape which includes lentic and lotic water bodies both temporary and permanent. A sampling campaign has been carried out in 20 lotic and 20 lentic water bodies. For each sampling site it has been evaluated biodiversity variables (including invertebrate and plant communities) and various water quality indicators (based on water characteristics, i.e., TRIX and nutrients concentration; or in organisms' composition, i.e., QAELS, IBWMP and IF) and habitat indices (i.e., ECELS, QBR, IHF and HCS).

The results show the importance of multi-criteria approaches for evaluating to evaluate the health of blue ecosystems. The effect of urban areas significantly impacts on the abundance of invasive species. Peri-urban ponds show better ecological states than urban ones as traditional management often degrades habitat quality. This poor health of blue urban nature shows the importance of renaturing cities to enhance the contributions of blue ecosystems to people, ultimately improving urban biodiversity and citizens' quality of life.

TSE.12. Effectiveness of anthropogenic actions in reducing biodiversity loss

Monday, 2 (18:00-19:30) • Tuesday, 3 (11:00-12:30)

Room: Seminario 2

Anthropogenic actions are one of the main causes of the current biodiversity crisis and pose a significant threat to ecosystems. Measures to conserve species, maintain evolutionary potential and adaptation to in situ conditions, together with improving habitat restoration are becoming increasingly urgent.

In response, several conservation actions are being developed to protect threatened species, improve ecosystem services, and reduce human impacts on biodiversity. This session aims to explore the effectiveness of conservation measures, such as species translocations, ecosystem restoration, and mitigation efforts in endangered habitats or species, including meta-analysis and database compilations. By sharing up-to-date knowledge, this session will contribute to assessing how well these actions have succeeded in reversing biodiversity loss and promoting ecological integrity.

Attendees will gain insights into the efforts and challenges being faced in this field, with discussions relevant to scientists, policymakers and conservation practitioners . Engaging in this debate is crucial for shaping future conservation strategies and enhancing the global response to biodiversity decline.

Organizers:

• **Sara Carona,** CE3C - Center for Ecology, Evolution and Environmental Change, Universidade de Lisboa

• **Alfredo García Fernández,** Universidad Rey Juan Carlos, Instituto de Investigación en Cambio Global

• **Carmen Bessa-Gomes,** Université Paris-Saclay, CNRS, AgroParisTech, Ecologie Systématique et Evolution.

TSE.12. Orals

[TSE.12-O-1]

Monday 2, evening: 18:00
Room: Seminario 2

Conservation of the Pyrenean Desman (Galemys pyrenaicus): recommendations for practitioners from a systematic review

Santos, Mário[1]; Sendral, Matthieu[2]

(1) CITAB - Centre for the Research and Technology of Agro-Environmental and Biological Sciences, (UTAD); (2) Ecole Polytechnique Palaiseau, Ile-de-France FRANCE

Correspondence e-mail: [mgsantos@utad.pt]

A systematic review on the existing information on the Pyrenean desman (Galemys pyrenaicus) was implemented under the 2020 Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. The current state-of-the-art on the species' bioecology was integrated, including the interactions between genetics, diet, habitat and behaviour with conservation. Recommendations for future research and potential conservation actions to restore and protect its habitat are presented and discussed.

[TSE.12-O-2]

Monday 2, evening: 18:15
Room: Seminario 2

Ecological restoration of transhumance drove roads: Insights from the LIFE CAÑADAS project

Azcárate, Francisco M.[1]; Hevia, Violeta[2]; Alcorlo, Paloma[3]; Castro, Juan[4]; González, José A.[5]; López, César A.[6]; Malo, Juan E.[7]; Mata, Cristina[8]; Solascasas, Paula[9]

(1) Science Faculty; (2) Science Faculty - UAM; (3) Science Faculty - UAM; (4) Science Faculty - UAM; (5) Science Faculty - UAM; (6) Science Faculty - UAM; (7) Science Faculty - UAM; (8) Science Faculty - UAM; (9) Science Faculty - UAM

Correspondence e-mail: [fm.azcarate@uam.es]

Introduction: The Spanish network of drove roads (DRs) covers over 125,000 km and 421,000 ha, representing nearly 1% of the country's area. Historically, these corridors served as vital reserves of natural pastures in agricultural and forested regions. However, the decline of transhumant livestock farming has led to significant degradation of DRs, now threatened by urban, agricultural, and forest encroachment, as well as rapid soil and vegetation loss. The LIFE CAÑADAS project has implemented ecological restoration actions centered on extensive transhumant livestock farming, engaging both local authorities and herders to leverage the potential of human activities in achieving ecological restoration across spatial scales.

Materials and Methods: Restoration efforts focused on Madrid's DR network, targeting 62 intervention sites. Actions included hedge and dry-stone wall reconstruction, soil decompaction, seasonal grazing, among other practices. These were designed under a BACI (Before-After-Control-Impact) framework to ensure effective monitoring. Concurrently, conservation measures were carried out along the Cañada Real Conquense (CRC) in Castilla–La Mancha to safeguard traditional transhumant movements.

Results and Discussion: Four years after initial interventions, clear ecological improvements have been documented. Soils show a measurable enhancement, and vegetation recovery has been significant. Reinforced edges, achieved through dry-stone wall rebuilding and seeding, have effectively deterred encroachment, increased spatial heterogeneity, and boosted populations of reptiles and wild bees. In the CRC, the interventions have supported transhumant livestock movements. These successful outcomes provide a replicable model for administrations and stakeholders to collaboratively enhance the ecological condition of DRs, improve landscape connectivity, and promote sustainable extensive livestock farming.

[TSE.12-O-3]

Monday 2, evening: 18:30
Room: Seminario 2

The eel market extinction vortex

Clavero, Miguel[1]; Blanco-Garrido, Francisco[2]; Díaz, Estíbaliz[3]; Hermoso, Virgilio[4]

(1) Estación Biológica de Doñana - CSIC; (2) Profesional autónomo; (3) AZTI; (4) Estación Biológica de Doñana - CSIC

Correspondence e-mail: [miguelclavero@ebd.csic.es]

Declines of overexploited species can trigger a market extinction vortex, a self-fueled process by which the intensity of exploitation increases as species become rarer, because humans value rare items as indicators of social status. Empirical and theoretical works have shown that market extinction vortices can drive species extinctions. Here, we use Spanish long-term data on glass eel catches and prices to show that a market extinction vortex is currently operating, and leading the European eel (Anguilla anguilla), an already critically endangered species, to extinction.

Glass eel catch in Spain increased from the mid-20th until the late 1970s, to then decline sharply, while glass eel deflated price augmented exponentially along a century (1925-2024). While in the first period catches rose in parallel with prices, the subsequent collapse in glass eel catches was linked to acceleration in the increase of prices. As a result, the overall value of glass eel catch remained relatively constant (ie, with no temporal trends) independently of eel availability. Selling 1 kg of glass eels in 2024 equals to selling 36 kg in 1950. Thus, there exists a constant market incentive to maintain eel exploitation until its very extinction.

There is an urgent need to implement regulations to avoid perverse market processes related to rarity, ideally acting upon demand by establishing restrictions or bans on eel commercialization.

[TSE.12-O-4]

Monday 2, evening: 18:45
Room: Seminario 2

De-coupling of the social and ecological subsystems in Spanish Protected Areas

Mustin, Karen[1]; Villodre, María[2]; Arnaíz-Schmitz, Cecilia[3]; Acosta-Gallo, Belén[4]; Valeri, Simone[5]; Schmitz, María Fe[6]; Perretta, Miriam[7]

(1) Universidad Complutense de Madrid; (2) Universidad Complutense de Madrid; (3) Universidad Complutense de Madrid; (4) Universidad Complutense de Madrid; (5) Sapienza University of Rome; (6) Universidad Complutense de Madrid; (7) University of Naples Federico II / NBFC, National Biodiversity Future Center

Correspondence e-mail: [kmustin@ucm.es]

1) Introduction: Rural landscapes are changing rapidly worldwide, with resulting threats to their natural and cultural values. The protection of rural landscapes through the establishment of protected areas remains a key policy instrument governing land management. However, the extent to which such areas effectively protect natural, cultural and socio-economic values of traditional farming systems of very high conservation value remains unclear.

2) Material and methods: Here, we used a social-ecological approach in the network of Natural and Regional Parks of Spain to quantify spatial-temporal changes in landuse/land-cover and identify the main socio-economic drivers of social-ecological change both inside and outwith the protected areas.

3) Results and discussion: The results reveal the degradation and loss of resilience of the rural landscape, subjected to an evident process of land abandonment and rewilding, which has implied the decline of agricultural land uses, the reduction of the agricultural area and significant scrub and forest expansion. The dynamics of landscape change have been similar within and outside the boundaries of the protected area network, suggesting that designation has not helped to prevent the loss of cultural landscapes across Spain. We conclude that the lack of adequate conservation objectives aimed at the maintenance and promotion of valuable farming systems and a notable duality “naturalness - culturalness” (or “cultural severance”) in protected areas represent a serious problem for the protection of the natural and cultural heritage of Spain’s rural landscapes.

[TSE.12-O-5]

Monday 2, evening: 19:00
Room: Seminario 2

Are conservation translocation efforts biased in the Iberian Peninsula? A functional analysis of translocated species across taxa

Carona, Sara[1]; Coutinho Soares, Filipa[2]; Bessa-Gomes, Carmen[3]; García Fernández, Alfredo[4]; Mouchet, Maud[5]; Ascensão, Fernando[6]

(1) CE3C - Centre for Ecology, Evolution and Environmental Change; (2) Centre d'Ecologie et des Sciences de la Conservation (CESCO); (3) CNRS, AgroParisTech, Ecologie Systématique et Evolution; (4) Instituto de Investigación en Cambio Global de la Universidad Rey Juan Carlos; (5) Centre d'Ecologie et des Sciences de la Conservation (CESCO); (6) CE3C - Centre for Ecology, Evolution and Environmental Change

Correspondence e-mail: [sccarona@fc.ul.pt]

Biodiversity is severely threatened by anthropogenic activities, prompting the implementation of conservation measures like species translocations to establish viable populations and improve conservation status. However, these efforts are often taxonomically biased, favouring mammals and birds, especially larger, charismatic species that attract public attention and funding. These translocations tend to address regional extinctions over broader conservation priorities. The functional roles of species within ecosystems are often overlooked, potentially neglecting key species for ecosystem resilience. Therefore, understanding the impact of taxonomic bias on the functional representativeness of translocated species is critical for biodiversity conservation and ecosystem services.

The Iberian Peninsula, acknowledged biodiversity hotspot, lacks a systematic overview of conservation translocations. Using a comprehensive database compiled under the Biodiversa 'Transloc' project, we evaluate taxonomic and functional biases in the Iberian Peninsula translocations across mammals, birds, fish, and plants by calculating functional diversity metrics (e.g. functional richness and evenness).

We found a bias towards Carnivora and Artiodactyla among translocated mammals, with Rodentia underrepresented. In birds, translocations predominantly targeted Accipitriformes, whereas Passeriformes accounted for less than 1%. A preference for high body mass species was evident, with many translocated mammals and birds feeding on fish, vertebrates, or scavenging. Fish translocations primarily involved endemic species. Globally threatened species were more frequently translocated, though non-threatened species remained highly represented, suggesting a focus on local conservation priorities. Overall, taxonomic biases, driven by conservation status and endemism, result in poor representation of functional roles within ecosystems. Addressing these biases will help minimize their impact, enhancing ecosystem integrity.

[TSE.12-O-6]

Monday 2, evening: 19:15
Room: Seminario 2

Ecological restoration of the coastal dune system in S. João da Caparica: scientific assistance and lessons learned in the REDUNA project

Nunes, Alice[1]

(1) CE3C - Centre for Ecology, Evolution and Environmental Changes & CHANGE

Correspondence e-mail: [amanunes@fc.ul.pt]

Coastal dune habitats are globally under great anthropogenic pressure, disrupting their ecological and physical integrity. The destruction of its protective effect against coastal erosion and ocean inundations endangers many human structures and activities and is expected to worsen with more frequent storms and rising sea levels. Portugal has an extensive coastline, facing severe degradation. Frequent efforts to artificially replenish sand levels are a costly solution with short-lived results, while dune ecological restoration with long-lasting goals is rarer and poorly documented. The project REDUNA in S. João da Caparica aimed at associating artificial sand nourishment with dune ecological restoration, to strengthen dune resilience. It was promoted by Almada Municipality and started in 2014, to combat the effects of increasingly frequent storms, which caused the disruption of the frontal dune and inundation of urban areas. Restoration actions included the installation of sand traps, plantation of 10 native species from local origin, trampling conditioning, and strong communication and community involvement. The scientific ongoing monitoring to assess restoration success over time, is essential for the project to adapt and evolve and showed that the establishment of vegetation and faunal communities, and the geomorphology evolution of the dune system were highly successful. Dune ecological restoration is an effective lower-cost and easy-to-maintain solution for the protection of costal ecosystems.

[TSE.12-O-7]

Tuesday 3, morning (first): 11:00
Room: Seminario 2

Multi-Action Conservation Planning across realms: A Mixed Integer Programming Model approach

Salgado, Jose[1]; Hermoso, Virgilio[2]; Álvarez-Miranda, Eduardo[3]

(1) Forest Science and Technology Centre of Catalonia; (2) Estación Biológica de Doñana; (3) Universidad de Talca

Correspondence e-mail: [jose.salgroj@gmail.com]

Spatial connectivity is essential when planning effective conservation, especially for species that depend on different realms during their life cycle. Traditionally, most of efforts have focused on working on different realms independently, overlooking the propagation of threats across realms, the cumulative impacts of threats or tackled the problem using heuristic optimization models.

We present a mathematical programming model that identifies priority areas for the implementation of management actions for multiple threats across four realms (terrestrial, freshwater, estuary, and marine) to benefit multiple species simultaneously. We use the Tagus River (Iberian Peninsula) as a case study, where we integrate three different types of connectivity: longitudinal along rivers, and multidimensional in the estuary and marine realms. We simulate the propagation of threats across the study area using four types decay functions: two exponential decays (medium and high), one linear, and no decay. We then compare the allocation of management actions under two alternative scenarios: multi-realm planning vs single-realm planning. The results show that the multi-realm planning outperforms the single-realm, especially for species that depend on multiple realms and that the greater the propagation of threats, the larger the differences between scenarios. This model could help better address complex conservation management problems elsewhere.

[TSE.12-O-8]

Tuesday 3, morning (first): 11:15
Room: Seminario 2

The role of two constructed wetlands for wastewater treatment in Odonata conservation in the agricultural landscape of the Ebro Delta

Pinilla Rosa, Manuel[1]; Menéndez, Margarita[2]

(1) University of Barcelona; (2) University of Barcelona

Correspondence e-mail: [manu.pinilla@ub.edu]

Wetlands are widely recognized biodiversity hotspots and suppliers of valuable ecosystem services. The Ebro Delta (NE Spain) is considered one of the most important wetlands of the Mediterranean and is included in Natura 2000 network and Ramsar Convention. However, 60-70% of its extension is occupied by rice fields, which affects water regimes and generate inputs of organic nutrients and pesticides to natural ecosystems. We studied the conservation role for Odonata of two constructed wetlands created to treat the water effluents from rice fields. Adult Odonata were monitored during the whole flying period and we compared their diversity and community dynamics to that of a rice field and a natural coastal lagoon. Our results showed that agriculture impacted all the studied water bodies, which presented homogeneous and low diverse Odonata communities dominated by few generalist species. However, the artificial wetlands presented equal and even higher species richness than that of the natural lagoon, and harbor the only specialist species detected in the study. Moreover, constructed wetlands may be acting as refuges for Odonata during winter, when rice fields are dried, thus contributing to the maintenance of populations and ecosystem services in the whole area. In addition, we present data of species phenology for the Ebro Delta and possible patterns of competence between the most abundant taxa.

[TSE.12-O-9]

Tuesday 3, morning (first): 11:30
Room: Seminario 2

Does the Natura 2000 Network ensure the conservation of threatened species? A demographic study of spur-thighed tortoises (Testudo graeca) in southeastern Spain

Ramos Benito, Andrés[1]; Rodríguez Caro, Roberto Carlos[2]; Bruno, Daniel[3]; Mira Jover, Andrea[4]; Pujante Expósito, Nuria[5]; Graciá, Eva[6]; Giménez, Andrés[7]

(1) University Institute for Agro-food and Agro-environmental Research and Innovation (CIAGRO); (2) Miguel Hernández University of Elche; (3) University Institute for Agro-food and Agro-environmental Research and Innovation (CIAGRO); (4) University Institute for Agro-food and Agro-environmental Research and Innovation (CIAGRO); (5) University Institute for Agro-food and Agro-environmental Research and Innovation (CIAGRO); (6) Miguel Hernández University of Elche; (7) Miguel Hernández University of Elche

Correspondence e-mail: [andres.ramos@umh.es]

Introduction. The Natura 2000 Network is the European Union's main instrument for the protection and conservation of species and habitats threatened by the biodiversity loss. One of the main threats to biodiversity is the loss and fragmentation of habitats, and the spur-thighed tortoise (Testudo graeca) is a species threatened mainly for these reasons. The aim of this study was to evaluate the role of the Natura 2000 Network in the conservation of this species.

Material and methods. We compared the population density of 125 localities sampled between 2005 and 2024 inside and outside protected areas throughout the distribution area of the species in southeastern Spain. Density was estimated using distance sampling models, and then subjected to analysis of variance (ANOVA) to test differences between localities depending on whether they belonged to a protection status.

Results and discussion. Density ranged from 0.068 to 7.657 tortoises/hectare, a range consistent with the distribution and abundance patterns in patches observed in previous studies. However, no significant differences were obtained between the densities of populations located inside and outside protected areas. In addition, population nuclei with high densities were observed outside these protected areas. This study suggests that the Natura 2000 Network may not ensure the conservation of high-density populations of conservation interest, and discusses measures to better protect T. graeca populations.

[TSE.12-O-10]

Tuesday 3, morning (first): 11:45
Room: Seminario 2

Spatial prioritization for the restoration of terrestrial ecosystems in Chile

Moreno-Faguett, Matías[1]; Castillo-Mandujano, Jessica[2]; Salgado-Rojas, José[3]; Larraín-Barrios, Bárbara[4]; Álvarez-Miranda, Eduardo[5]; Martínez-Harms, María José[6]

(1) University of Seville, Spain; (2) Institute of Ecology and Biodiversity, Chile; (3) Forest Science and Technology Center of Catalonia, Spain; (4) Institute of Ecology and Biodiversity, Chile; (5) University of Talca, Chile; (6) Institute of Ecology and Biodiversity, Chile

Correspondence e-mail: [matiasmorenofaguett@gmail.com]

Introduction: Chile faces significant challenges in ecosystem restoration, with most of its terrestrial ecosystems are under some degree of threat due to anthropogenic pressures and climate change effects. Addressing this issue requires a spatial prioritization framework to identify restoration areas that maximize ecological benefits while ensuring the achievement of restoration goals. This study aligns with global restoration initiatives, such as the Kunming-Montreal Global Biodiversity Framework, which aims to restore 30% of degraded terrestrial ecosystems by 2030.

Material and methods: We developed an optimization framework integrating three objectives: enhancing biodiversity conservation, improving water provision and mitigating climate change effects. The analysis incorporated geospatial data from 125 terrestrial ecosystems and 154 threatened species across Chile, as well as information from proximity to watercourses and carbon storage in soil and above-ground biomass. Restoration targets were set at 30% of the surface area of degraded terrestrial ecosystems, also considering resource constraints such as suitability for restoration and the current protection status of the land to ensure feasibility.

Results and discussion: The proposed framework identified priority areas that optimize biodiversity conservation by reducing extinction risks, enhance water provision in terms of flow and quality in watercourses, and mitigate climate change effects through increased carbon storage. The findings highlight key trade-offs among objectives, demonstrating how cost-effective solutions can balance ecological benefits with resource constraints. These results offer actionable insights for policymakers, supporting the alignment of restoration efforts with Chile's national and international commitments.

[TSE.12-O-11]

Tuesday 3, morning (first): 12:00
Room: Seminario 2

Animal GPS-tracking as a tool to assess compliance with regulations that affect biodiversity conservation

Mateo Tomás, Patricia[1]; Rodríguez-Pérez, Jorge[2]; Fernández-García, María[3]; Bravo-Chaparro, Elena[4]; Santos, João[5]; Gutiérrez, Iván[6]; López-Bao, José Vicente[7]

(1) Biodiversity Research Institute; (2) Biodiversity Research Institute; (3) Biodiversity Research Institute; (4) Biodiversity Research Institute; (5) Palombar; (6) Palombar; (7) Biodiversity Research Institute

Correspondence e-mail: [patricia.mateo@csic.es]

Monitoring compliance with environmental laws is essential to overcome possible implementation shortfalls jeopardizing their effectiveness for biodiversity conservation. Remote tracking technologies not only enhance our ecological knowledge of wildlife, but also allow us to use such information to assess the level of compliance with laws. To illustrate this potential, we used GPS-tracked large scavengers (i.e., 21 vultures and 13 wolves) as sentinels of compliance of with EU sanitary regulations allowing livestock carcass disposal in the field. The GPS-tracked animals allowed the systematic evaluation of 489 livestock carcasses left in the field in three Spanish regions and Portugal, revealing an important mismatch between on-paper and in-reality implementation of these regulations. Less than half of the carcasses were placed in authorized areas, but compliance with all the criteria required by the regulations (e.g., carcass characteristics such as species, age, or production system and its location away from water, buildings or roads) was much lower, i.e., < 5% in all the study areas. By feeding on livestock carcasses abandoned in the field, GPS-tagged scavengers allow the quantitative assessment of compliance with the law, as well as the addressing of potential risks for wildlife, livestock and human health. These results will be further discussed together with other examples that illustrate the huge potential of GPS-tagged wildlife as sentinels for monitoring compliance to enhance the environmental rule of law.

[TSE.12-O-12]

Tuesday 3, morning (first): 12:15
Room: Seminario 2

Integrating detection and motivation to enhance mapping predictions of wildlife poisoning risk and inform on-ground actions

Fernández-García, María[1]; Rodríguez-Pérez, Jorge[2]; Mateo-Tomás, Patricia[3]; López-Bao, José Vicente[4]

(1) Biodiversity Research Institute (CSIC – University of Oviedo – Principality of Asturias), 33600 Mier; (2) Biodiversity Research Institute (CSIC – University of Oviedo – Principality of Asturias), 33600 Mier; (3) Biodiversity Research Institute (CSIC – University of Oviedo – Principality of Asturias), 33600 Mier; (4) Biodiversity Research Institute (CSIC – University of Oviedo – Principality of Asturias), 33600 Mier

Correspondence e-mail: [maria.f.garcia@csic.es]

The cryptic nature of wildlife crimes, such as poaching, poses challenges to effectively combat to these important threats to biodiversity and human wellbeing. Official wildlife crime records suffer from biases associated with low and imperfect detection, hampering resource allocation against these illicit activities. Spatially explicit risk mapping may enhance this process, particularly in improving on ground actions. Herein, it is crucial to consider the dual nature of wildlife crimes, assessing the differential influence of factors affecting cases' detection and those related to the underlying wildlife poisoning motivations.

The utility of this approach is illustrated using an extensive database of >1,300 animals registered as poisoned in 2010-2022 in an area of 101,706 km2 in northwestern Spain as a case study, combined with an Integrated Species Distribution Model accounting for imperfect detection and heterogeneous information.

The spatially-explicit predictions of poisoning risk were largely influenced by factors affecting detection (e.g., human density, canine units). Motivation-related factors included agriculture and small livestock. Five poisoning hotspots were identified where patrolling efforts should increase, either preventive to discourage this illegal activity or to search for poisoning cases. This approach can be applied to risk mapping of different wildlife crimes where presence-only data are usually available.

TSE.12. Posters

[TSE.12-P-1]

Wednesday 4
Discussion corner: Room 5

Insights for restoration of rupicolous endemic plants: evaluating reinforcement techniques for Petrocoptis sp. in fragile rocky habitats in northwestern Iberia

Saiz Campomar, Lena[1]; Tejero Ibarra, Pablo[2]; Agut Escrig, Agustí[3]; Hermosilla, Brais[4]; Núñez Santalla, Roberto[5]

(1) Pyrenean Institute of Ecology IPE-CSIC; (2) Pyrenean Institute of Ecology. CSIC and Society of Science Aranzadi.; (3) Olarizu Botanical Garden. Vitoria-Gasteiz Council; (4) Olarizu Botanical Garden. Vitoria-Gasteiz Council; (5) Castilla y León County Council

Correspondence e-mail: [lenasz_31@hotmail.com]

Rocky cliffs represent extreme environments characterized by limited soil, high exposure, and unique ecological pressures, making them hotspots for endemic biodiversity and priority targets for conservation. However, these ecosystems face growing threats from human activities, including recreational activities such as outdoor climbing. In El Bierzo region (León, Spain) two endemic rupicolous species, Petrocoptis grandiflora Rothm. and Petrocoptis pyrenaica ssp. viscosa Rothm., have experienced significant population declines due to climbing activities, leading to the implementation of a restoration plan. This study evaluates three reinforcement methodologies in affected populations: direct seed sowing, seed encapsulation in cotton balls, and the transplantation of lab-germinated seedlings (applied only to P. pyrenaica ssp. viscosa).

Preliminary results indicate that direct seed sowing achieved the highest germination rates for both species, whereas transplantation resulted in high survival rates for P. pyren.

[TSE.12-P-2]

Thursday 5
Discussion corner: Room 5

IberArthro: A free online database compiling taxonomic and distributional data on Ibero-Balearic arthropods

Mañas-Jordá, Saray[1]; Acosta, Raúl[2]; Ariño, Arturo[3]; Baquero, Enrique[4]; Bartomeus, Ignasi[5]; Bonada, Núria[6]; Galicia, David[7]; García-Barros, Enrique[8]; García-Meseguer, Antonio José[9]; García-Roselló, Emilio[10]; González, Marcos[11]; M. Lobo, Jorge[12]; L. Munguira, Miguel[13]; López-Rodríguez, Manuel Jesús[14]; Martínez, Jesús[15]; Millán, Andrés[16]; J. Monserrat, Víctor[17]; Prieto, Carlos[18]; Romo, Helena[19]; Sánchez-Campaña, Carlota[20]; Tierno de Figueroa, José Manuel[21]; Yela, José Luis[22]; Sánchez-Fernández, David[23]

(1) Universidad de Murcia; (2) University of Barcelona (UB); (3) University of Navarra; (4) University of Navarra; (5) CSIC; (6) Universitat de Barcelona; (7) University of Navarra; (8) Autonomous University of Madrid (UAM); (9) University of Murcia; (10) University of Vigo; (11) University of Santiago de Compostela; (12) National Museum of Natural Sciences (MNCN-CSIC); (13) Autonomous University of Madrid (UAM); (14) University of Granada; (15) University of Santiago de Compostela; (16) University of Murcia; (17) Complutense University of Madrid; (18) University of País Vasco (UPV/EHU); (19) Autonomous University of Madrid (UAM); (20) Universitat de Barcelona (UB); (21) University of Granada; (22) University of Castilla-La Mancha; (23) University of Murcia

Correspondence e-mail: [saraymanas@um.es]

Introduction. Arthropods constitute the bulk of global biodiversity, being the most diverse metazoan phylum on the planet. The Iberian Peninsula is part of one of the global biodiversity hotspots, the Mediterranean Basin. However, very little is known on the ecology and spatial distribution of many Iberian arthropod species. To address these knowledge gaps and guide effective conservation actions, it is essential to compile taxonomic and distributional data for the different groups of organisms that comprise the arthropods. Thus, our aim is to systematize accurate information on the occurrences of Iberian arthropods facilitating therefore future conservation actions.

Material and methods. The data were sourced from a variety of origins, including literature, museum and private collections, PhD theses, fieldwork data, validated citizen contributions, and other unpublished research sources.

Results and discussion. We present here a database on the distribution of Ibero-Balearic arthropods (the IberArthro database) belonging to 10 taxonomic groups: Coleoptera (Aquatic), Coleoptera (Scarabaeoidea), Collembola, Hymenoptera (Apoidea), Lepidoptera (Noctuoidea), Lepidoptera (Papilionoidea), Neuropterida, Opiliones, Plecoptera and Trichoptera. The database contains 1,006,768 records with associated geographic data (at 10 × 10 km grid squares), compiled from various sources and validated by specialists in each group. These records cover 4,620 species and subspecies, spanning from the 18th century to February 2024. The complete dataset is provided in Darwin Core Archive format and is available through the Global Biodiversity Information Facility (GBIF). This database represents an unprecedented advance in understanding the distribution of Iberian arthropod biodiversity and its conservation.

[TSE.12-P-3]

Tuesday 3
Discussion corner: Room 5

Advances in the Knowledge of Apifauna in the Doñana Natural Area

Molina Fuentes, Francisco de Paula[1]

(1) Estación Biológica de Doñana (EBD-CSIC)

Correspondence e-mail: [fpaula.molina@gmail.com]

The Iberian Peninsula faces a significant lack of information regarding the diversity and distribution of its Apifauna. Understanding biodiversity is critical for effective conservation, especially in protected areas like the Doñana Natural Space. This study presents the first bee inventory conducted in this region over the past 40 years, documenting more than 200 species from 32 genera. These results highlight the rich fauna of Doñana and emphasize the need for further research to document bee diversity in southern Europe. Additionally, we have included data on the floral preferences of bees, as understanding this complex plant-pollinator network can reveal key plant species involved in pollination. This information is vital for supporting conservation management decisions in the natural space, particularly in the context of climate change. Factors such as land-use changes, reduced water availability for plants, and their impacts on bee populations are central to understanding observed trends. To assess these dynamics, we compare current surveys from 2020 and 2021 with data from the 1980s (1984 and 1985), aiming to identify trends in plant and pollinator populations under the influence of climate change and ongoing endemic drought.

[TSE.12-P-4]

Wednesday 4
Discussion corner: Room 5

Biodiversity patterns and conservation gaps for continental molluscs in southeastern Iberia

García-Meseguer, Antonio J.[1]; Guillard, Mathéo[2]; Sánchez-Fernández, David[3]

(1) University of Murcia; (2) Observatoire des Sciences de l'Environnement de Rennes (OSERen), Université de Rennes (France); (3) University of Murcia

Correspondence e-mail: [aj.garciameseguer@um.es]

Introduction. Human-driven biodiversity loss poses a significant challenge in the 21st century, as it profoundly impacts ecosystem functioning and essential services. This study focuses on the biogeography and conservation of continental molluscs in a semi-arid Mediterranean region in the southeastern Iberian Peninsula. We aim i) to create a database on molluscs occurrences in the Region of Murcia and to assess its completeness; ii) to explore the congruence between spatial biodiversity patterns of aquatic and terrestrial molluscs, iii) to identity areas of high conservation interest (hotspots) for both groups and, iv) to assess the effectiveness of protected areas in protecting these areas.

Material and Methods. A comprehensive database was compiled including all georeferenced occurrences of molluscs in the Region of Murcia (including data from bibliography, public and private collections and own data field). Spatial distribution patterns were explored using species richness, rarity, endemicity, and a combined conservation index.

Results and Discussion. The database encompasses 2,971 records of 110 species (both aquatic and terrestrial) from 38 families. The evaluation of the completeness of this database revealed a general lack of complete inventories. We found congruence in species richness and combined conservation index between terrestrial and aquatic molluscs, but patterns of rarity and endemicity were less consistent. Hotspots of mollusc biodiversity exhibited up to 30% overlap between the two groups, and only partial protection within the Natura 2000 network. This study highlights the need for targeted conservation strategies to safeguard mollusc habitats and informs decision-making processes for more effective biodiversity conservation policies.

[TSE.12-P-5]

Thursday 5
Discussion corner: Room 5

Integrated assessment framework to estimate the effectiveness of coastal restoration actions in Spain

Cortés Sánchez, Francisco Miguel[1]

(1) Centre for Studies and Experimentation of Public Works (CEDEX)

Correspondence e-mail: [Francisco.m.cortes@cedex.es]

Introduction. The General Directorate of the Coast and the Sea allocates a significant budget each year to draft technical reports and to implement projects for the protection and conservation of the maritime-terrestrial public domain. We present here a methodological approach to evaluate restoration actions in coastal ecosystems with the double objective of highlighting the efforts that Public Administrations carry out for the restoration of ecosystems, and for achieving an adaptive management to identify aspects to improve and to reinforce, but also to enhance strengths.

Material and methods. A standardized protocol for the evaluation of restoration actions in coastal ecosystems has been proposed. It follows a multi-criteria approach where the indicators have been grouped into the following blocks: i) General descriptors of the restoration project; ii) Water quality elements according to the classification of the water body; iii) Ecosystem naturalness, and iv) Socioeconomic impact. To address the applicability of the proposal, a project from each coastal zone (six zones in total) has been assessed.

Results and discussion. Given the diversity of the Spanish coast, and the dissimilarity of the restoration projects evaluated, this proposal must be taken as a first step in the search for an integrated assessment method to estimate the effectiveness of coastal restoration works. One of the most remarkable results has been the relationship between the investment costs and the number of benefited inhabitants. Among future challenges, it is needed to develop an index to allow comparisons between evaluated projects and hence facilitate the decision-making process to managers.

[TSE.12-P-6]

Tuesday 3
Discussion corner: Room 5

Assessment of the effect on environmental quality of a Natural Reserve expansion in coastal scrub

Suárez, Isabel[1]; Pestano, Miguel[2]; Piquet, Julien[3]; Rocafull, Elena[4]; Rodríguez, Felipe[5]; Sierra Cornejo, Natalia[6]; Otto, Rüdiger[7]; de Nascimento, Lea[8]

(1) Universidad de La Laguna; (2) Universidad de La Laguna; (3) Instituto de Productos Naturales y Agrobiología (IPNA-CSIC); (4) Universidad de La Laguna; (5) Universidad de La Laguna; (6) Universidad de La Laguna; (7) Universidad de La Laguna; (8) Universidad de La Laguna

Correspondence e-mail: [isabel.suaher@gmail.com]

Protected natural areas are key figures in the conservation of biodiversity. In the Canary Islands, 40 % of the territory is covered by protection networks, including natural reserves that are ideally restricted to management and research activities with minimal human activities. Many natural reserves aim to preserve the coastal scrubland, a fragmented ecosystem that maintains around 14 % of its original area. We used the Special Natural Reserve of Malpaís de la Rasca and an adjacent unprotected area proposed for expansion to evaluate the consequences of this protection. We first compared plant cover, richness and biomass in six plots of 400 m2 in the protected and the unprotected areas respectively, representing mature and secondary communities. Six of these were long-term plots, which allowed us to characterize vegetation succession in the protected area over 30 years. We additionally studied the effect on the entire vertebrate community by comparing 11 protected sites and 10 unprotected sites where we respectively surveyed reptiles and birds by means of distance sampling and observation points, respectively. Although we found no differences in vegetation regarding protection status, time since protection favoured mature vegetation, with a significant increase in plant cover. Endemic lizards were the only vertebrates affected by protection, being more abundant in the reserve. The results indicate that, despite the current state of the coastal scrubland, the patches are relatively well-preserved. This makes them worth protecting, which would allow for the development of mature communities and the maintenance of populations of endemic reptiles.

GENERAL SESSION

GSF. New Technologies, New Discoveries: Big Data, Remote Sensing, and AI

Tuesday, 3 (11:00-12:30) • Wednesday, 4 (11:00-12:30) • Thursday, 5 (11:00-12:30)

Room: Restaurante

The advent of new technologies has revolutionized the field of biodiversity research. Specifically, the integration of big data analtics, remote sensing, and artificial intelligence (AI) has markedly enhanced our ability to monitor, analyze, and understand biological diversity on a global scale. The exponential growth of open-access databases on biodiversity has facilitated unprecedented data availability. These extensive datasets enable researchers to perform large-scale analyses, uncover patterns, and make informed predictions about biodiversity trends. Remote sensing technology has become an invaluable asset in biodiversity research, allowing for the monitoring of habitat changes, assessment of ecosystem health, and detection of environmental disturbances with high temporal and spatial resolution. AI-driven tools, such as automated image recognition algorithms, facilitate the rapid processing of large datasets, enabling more efficient and accurate biodiversity assessments.

Key Questions:

• How will new technologies allow us to explore novel and more detailed aspects of how life interacts with our planet?

• What are the benefits and challenges of integrating big data, remote sensing, and AI in biodiversity research?

Coordinators:

• **Laura Hernández Mateo,** ICIFOR-INIA, CSIC

• **Jose Manuel Álvarez-Martínez,** Univ. Oviedo-CSIC-Princ. Asturias

• **Salvador Arenas-Castro,** Universidad de Córdoba

• **Adrián Regos,** Misión Biolóxica de Galicia (MBG-CSIC)

• **David S. Pescador,** Universidad Complutense de Madrid (UCM).

GSF. Orals

[GSF-O-1]

Tuesday 3, morning (first): 11:00
Room: Balconada

Passive Acoustic Monitoring combined with deep learning for assessing the health status of Doñana: challenges and perspectives

Mendoza Sagrera, Irene[1]; Galeano, Javier[2]; Mohedano-Muñoz, Miguel A.[3]; Novalbos, Marcos[4]; Bastianelli, Giulia[5]; Santamaría-García, Eduardo[6]; Márquez-Rodríguez, Alba[7]; García-Algarra, Javier[8]

(1) Universidad de Sevilla; (2) Universidad Politécnica de Madrid; (3) Universidad Politécnica de Madrid; (4) U-Tad; (5) Estación Biológica de Doñana; (6) Estación Biológica de Doñana; (7) Universidad de Cádiz; (8) U-Tad; (9)

Correspondence e-mail: [imendoza1@us.es]

Passive acoustic monitoring (PAM) enables large-scale and continuous sound recording, which offers valuable insights to ecosystem health. Combined with artificial intelligence (AI), it automates species detection, reducing dependence on faunistic expertise. However, there are many challenges associated with the use of PAM for biodiversity monitoring, mainly related to the need to efficiently store and manage Tb of audio data. Additionally, the annotation of audio by humans is a complex and costly process that requires expertise. These annotations are critical for interpreting PAM data in the context of ecosystem health and biodiversity trends. The integration of AI to automate PAM introduces new challenges, such as extensive training data and specialized computer science skills to refine models like BirdNET, which fails in local soundscapes. In this communication, we will discuss these challenges using the BIRDeep project as an example. In it, we developed a cyberinfrastructure to automatically monitor birdsong diversity in Doñana. Across the four main habitats of Doñana National Park, we deployed automatic recording stations equipped with AudioMoth recorders and Raspberry Pi processors. These stations transmit recorded audio via the Internet to a database hosted on a server, enabling real-time access to Doñana recordings. Using deep-learning techniques, bird species identification was automated, and validated later by ornithological experts. BIRDeep's advancements serve a dual purpose: detecting shifts in birdsong fauna as indicators of Doñana's ecosystem health and establishing a framework for scalable, international acoustic monitoring. This innovative approach underscores PAM's potential to transform biodiversity monitoring through automated, data-driven methodologies.

[GSF-O-2]

Tuesday 3, morning (first): 11:15
Room: Balconada

Not So Intelligent: Evaluating Traditional Methods Against AI-Based Approaches for Estimating Dark Diversity

Gracia Mas, Clara[1]; Hirn, Johannes[2]; Verdú, Miguel[3]; Pärtel, Meelis[4]; Carmona, Carlos P.[5]; de Bello, Francesco[6]

(1) Centro de Investigaciones sobre Desertificación (CIDE-CSIC-UV-GVA); (2) Centro de Investigaciones sobre Desertificación (CIDE-CSIC-UV-GVA); (3) Centro de Investigaciones sobre Desertificación (CIDE-CSIC-UV-GVA); (4) University of Tartu; (5) University of Tartu; (6) Centro de Investigaciones sobre Desertificación (CIDE-CSIC-UV-GVA)

Correspondence e-mail: [claragraciamas@gmail.com]

Introduction. Dark diversity, the set of species absent from a site but capable of dispersing to and establishing there (i.e., the missing portion of a habitat-specific species pool), provides crucial insights for linking biodiversity to ecological processes and guiding effective conservation and restoration strategies. Since dark diversity cannot be directly measured, a variety of methods have been developed in recent years with consecutive uncertainty on their success.

Methods. In this study, we introduce an artificial intelligence approach — the Variational Autoencoder (VAE) — and compare it to established methods for predicting probabilities of species' occurrence and suitability for given communities. Using a previously published virtual landscape built with flexible simulations, featuring diverse habitats and species, we modeled community development over time based on simple ecological assembly rules, generating scenarios with varying degrees of complexity and sampling efforts.

Results and discussion. Our results show that conventional methods, such as Beals' smoothing and the Hypergeometric approach, consistently perform robustly and efficiently across different scenarios: the former more suited to estimate probabilities of occurrence even with smaller sampling sizes and the latter species suitability for given ecological conditions. While the VAE approach outperforms these traditional methods, it requires significantly more data, particularly under more complex community assembly rules. Nevertheless, when sufficient data is available, the VAE generates latent variables that effectively characterize species' ecological niches, effectively improving ecological extrapolations. This study underscores the reliability of established methods for estimating probabilistic dark diversity and species pool composition while highlighting the potential of a novel AI-based approach to yield valuable ecological predictions.

[GSF-O-3]

Tuesday 3, morning (first): 11:30
Room: Balconada

Identifying limiting factors of tree species performance across Northern Hemisphere forests: An approach through the Law of the Minimum

Grajera-Antolín, Cristina[1]; Astigarraga, Julen[2]; Cruz-Alonso, Verónica[3]; Bravo-Hernández, Miriam[4]; Serra-Maluquer, Xavier[5]; Ruiz-Benito, Paloma[6]; Esquivel-Muelbert, Adriane[7]; Pugh, Thomas A.M.[8]; Barrere, Julien[9]; Cienciala, Emil[10]; Fridman, Jonas[11]; Govaere, Leen[12]; Kunstler, Georges[13]; Leyman, Anja[14]; Redmond, John J.[15]; Schelhaas, Mart-Jan[16]; Suvanto, Susanne[17]; Talarczyk, Andrzej[18]; Thibaut, André[19]; Villén-Pérez, Sara[20]

(1) University of Alcalá; (2) Universidad de Alcalá, Madrid, Spain; (3) Universidad Complutense de Madrid, Madrid, Spain; (4) Universidad de Alcalá, Madrid, Spain; (5) Universidad de Alcalá, Madrid, Spain; (6) Universidad de Alcalá, Madrid, Spain; (7) University of Birminghan, Birmingham, UK; (8) University of Birminghan, Birmingham, UK; Lund University, Lund, Sweden; (9) Wageningen Environmental Research (WENR), Wageningen, Netherlands; (10) IFER - Institute of Forest Ecosystem Research, Jilove u Prahy, Czech Republic; (11) Swedish University of Agricultural Sciences, Umeå, Sweden; (12) Nature and Forest Agency (ANB), Brussel, Belgium; (13) Université Grenoble Alpes (INRAE), UR LESSEM, Saint-Martin-d`Hères, France; (14) Nature and Forest Agency, Belgium; Research Institute for Nature and Forest, Belgium; (15) Department of Agriculture, Food and the Marine, Johnstown Castle Estate, Wexford, Y35 PN52; (16) Wageningen Environmental Research (WENR), Wageningen, Netherlands; (17) Natural Resources Institute Finland (Luke), Helsinki, Finland; (18) Forest and Natural Resources Research Centre Foundation, Warsaw, Poland; (19) Service Public de Wallonie, Jambes, Belgium; (20) Universidad de Alcalá, Global Change Ecology and Evolution Research Group, Madrid, Spain

Correspondence e-mail: [cristinagrajeraantolin@gmail.com]

Introduction. Understanding which environmental factors limit the distribution and abundance of species is a key question in ecology. Darwin's classical hypothesis suggests that biotic variables are more restrictive at lower latitudes, whereas abiotic variables predominate at higher latitudes. Although different approaches have been proposed to assess this hypothesis, none has considered the perspective of Liebig's Law of the Minimum, which posits that a single variable limits species' performance at any given time and location.

Material and methods. In this study, we use this law to test Darwin's hypothesis by analysing more than 270 species in c. 247,500 forest inventory plots across Europe, USA, and Mexico. Specifically, we modeled tree species performance, represented by basal area, along the latitudinal gradient of Northern Hemisphere forests (15º–70º latitude) using 0.95 quantile regressions. We estimated the limiting effects of biotic (competition) and abiotic (winter temperature, aridity index, soil pH and soil nitrogen) factors on tree species performance. The variable predicting the lowest potential performance in each plot was identified as the limiting factor.

Results and discussion. Preliminary results in North America indicate that all variables are limiting factors in at least one location. Combining Liebig's Law of the Minimum with quantile regressions offers a novel framework for better understanding the factors driving species distributions and anticipating the risks of species range shifts under climate change.

[GSF-O-4]

Tuesday 3, morning (first): 11:45
Room: Balconada

Unravelling the daily activity rhythms of urban mosquitoes through the use of smart-traps

González-Pérez, María I[1]; Cerecedo, Catuxa[2]; Richter-Boix, Alex[3]; Bartumeus, Frederic[4]
(1) CEAB-CSIC; (2) CEAB-CSIC; (3) CEAB-CSIC; (4) CEAB-CSIC
Correspondence e-mail: [maria.gonzalez@ceab.csic.es]

Introduction. Novel approaches in the field of entomological surveillance include the use of smart-traps trained with machine learning techniques for the automated remote identification of targeted species in real-time. These next-gen tools can provide high-quality data with an unprecedented time resolution, which is of great interest for ecological research and chronobiology studies on insects.

Material and methods. In this contribution, four smart-traps composed by optoacoustic sensors coupled to conventional mosquito suction traps, were used to monitor the daily activity rhythms of two of the most important urban vector mosquitoes (Aedes albopictus and Culex pipiens), for four consecutive years (2021-2024) in the city of Barcelona (NE Spain). Species- and sex-specific differences in the peaks of daily activity are assessed for a sub-daily and seasonal scales; and the role of the two main drivers of mosquito activity (light and temperature) is discussed.

Results and discussion. The activity patterns observed using the smart-traps revealed a distinct bimodal behaviour in both mosquito species, with two daily peaks occurring in the morning around sunrise and in the afternoon near sunset. Culex pipiens exhibited more crepuscular activity, aligning with its twilight-focused biting behaviour, while Ae. albopictus displayed a more diurnal pattern, consistent with its preference for daytime biting. Sex-specific differences were noted, with males initiating activity earlier in the afternoon compared to females. Mosquito activity was influenced by critical thresholds of temperature and daylight hours, which varied seasonally. This study represents a groundbreaking assessment of mosquito activity across an unprecedented range of temporal scales, ranging from hourly fluctuations to annual trends.

[GSF-O-5]

Tuesday 3, morning (first): 12:00
Room: Balconada

The spatial scaling of evolutionary uniqueness to inform biodiversity conservation priorities

Baselga, Andrés[1]; Martín-Devasa, Ramiro[2]; Gómez-Rodríguez, Carola[3]

(1) CRETUS- University of Santiago de Compostela; (2) University of Helsinki; (3) CRETUS-University of Santiago de Compostela

Correspondence e-mail: [andres.baselga@usc.es]

Introduction. Identifying regions where spatially restricted clades are concentrated and understanding how phylogenetic uniqueness scales with spatial distance are two key steps for preserving global phylogenetic diversity. The spatial scaling of phylogenetic uniqueness is particularly crucial because the irreplaceability of biological communities depends on whether phylogenetic dissimilarity between a focal site and others arises at small or large spatial scales. Addressing this knowledge gap is essential for informing conservation priorities.

Methods. We developed a scale-independent framework to assess conservation relevance by integrating phylogenetic endemism with the spatial structure of phylogenetic uniqueness across terrestrial vertebrates (amphibians, reptiles, mammals, and birds). Our approach models the increase of phylogenetic uniqueness with spatial scale to identify regions of high conservation value globally.

Results and Discussion. Phylogenetic endemism emerged as the most efficient criterion for maximizing protected global phylogenetic diversity within any given land area. Regions of high phylogenetic endemism and uniqueness for all four vertebrate groups were concentrated in Central and South America, tropical Africa, Southeast Asia, and Australia. Among these, “evolutionary islands”—regions exhibiting high phylogenetic uniqueness at the smallest spatial scales—were identified in Mexico and Central America, the Andes, Equatorial Africa, Madagascar, southern India, Southeast Asia, and eastern Australia. Conversely, some sites were globally distinct but regionally less unique, termed “evolutionary hills.” Our results demonstrate that distance-increase models of uniqueness reveal macroecological biodiversity patterns that are undetectable at smaller scales. This framework provides a robust tool for prioritizing conservation efforts, enabling the effective safeguarding of evolutionary heritage.

[GSF-O-6]

Tuesday 3, morning (first): 12:15
Room: Balconada

From Empirical Data to Ecological Dynamics: Modelling Tetrapod Communities Across the Iberian Peninsula

Merino Robert, Nicolas[1]; Galiana Ibáñez, Núria[2]; Araújo, Miguel Bastos[3]

(1) Museo Nacional de Ciencias Naturales; (2) Museo Nacional de Ciencias Naturales; (3) Museo Nacional de Ciencias Naturales

Correspondence e-mail: [nicolasmerino41@gmail.com]

Animal communities are shaped by the climatic niches of species, biotic interactions, and resource availability. Understanding how these factors influence the stability of complex animal communities remains a key challenge. So far, stability assessments of empirical communities have often been limited to describing structural properties and limited to local scales. We present a hybrid modelling framework that integrates empirically collected data into a population-level generalized Lotka-Volterra model. This approach enables us to build realistic communities and evaluate their dynamics, allowing for a more comprehensive understanding of community stability across broader spatial extents.

We constructed 5000 tetrapod communities at a 100 km² resolution across the Iberian Peninsula, using species distributions, climatic data, and interaction networks. Additionally, we linked net primary production to resource availability, ensuring that animal biomass is constrained by underlying productivity and distributed among species through predation and competition. Parametrisation was restricted to ensure the initial survival of all species. Once assembled, these communities were subjected to a series of perturbations: species removals, shifts in productivity, climate change, and species invasions.

Model explorations suggest that certain community attributes —such as species richness and network connectivity— strongly influence stability. Mapping these properties across the Iberian Peninsula reveals spatial patterns in community robustness, guiding the identification of particularly sensitive regions. By bridging ecological theory with empirical data, this work lays the groundwork for evaluating community properties that best predict how real communities will respond to various perturbations, ultimately leading to more effective conservation and management strategies.

[GSF-O-7]

Wednesday 4, morning (first): 11:00
Room: Balconada

Dynamic habitat-based conservation indicators of flagship species for priority areas in southern Europe

Arenas-Castro, Salvador[1]; Velasco-Rodríguez, Antonio[2]; Regos, Adrián[3]; Castillejo González, Isabel[4]; Sillero, Neftalí[5]

(1) Faculty of Sciences (University of Córdoba, Spain); (2) Faculty of Sciences (University of Córdoba, Spain); (3) Misión Biológica de Galicia (MBG-CSIC), Santiago de Compostela (Spain); (4) ETSIAM (University of Cordoba, Spain); (5) Centro de Investigação em Ciências Geo-Espaciais (CICGE - Universidade do Porto, Portugal)

Correspondence e-mail: [b62arcas@uco.es]

Biodiversity loss is accelerating due to human activities, highlighting the urgent need for more efficient conservation strategies. Using ex-situ biodiversity modeling and satellite time series data offers a cost-efficient way to prioritize conservation areas. We present several indicators for conservation prioritization by applying a habitat suitability index (HSI) trend analysis of six flagship species over 19 years (2001 – 2019) derived from ecological niche models (MaxEnt) and time series of the MODIS satellite sensor in Andalucía (southern Spain). Annual HSI models for all species were integrated into the spatial conservation planning tool Marxan to generate indicators such as cost-effectiveness, adequacy, stability, and conservation legacy. Overall, species models performed well (AUCmean = 0.92±0.07), predicting 31% of negative and 19% of positive trends for the habitat availability across all species, showing a generalized habitat regression. Key predictors were related to vegetation composition and structure (land cover), climate (land surface temperature), and energy balance (evapotranspiration), matching with the species ecology. Marxan identified interannual dynamics for the priority areas. Our results suggested that (1) additional areas than those currently protected need to be prioritized, and (2) areas recently degraded could be restored based on their historical importance for the conservation of the target species. In summary, this model-based system supported by a well-established conservation planning software provides a new set of dynamic priority-area indicators informing about the adequacy and effectiveness of conservation areas to meet long-term conservation goals at a regional scale, and being applicable to other species, ecosystems and socio-economic contexts across scales.

[GSF-O-8]

Wednesday 4, morning (first): 11:15
Room: Balconada

AI-Enhanced LULC and Biodiversity Mapping for Protected Areas Monitoring

Álvarez-Martínez, Jose Manuel[1]; Becerra Corral, Javier[2]; Jiménez-Alfaro, Borja[3]; Hugé, Justine[4]; Dewaissage, Carlos[5]; Marsico, Noemi[6]; Papadakis, Dimitri[7]; Martín, Alberto[8]; Sujar, Adrián[9]; Valdés, María Alicia[10]; Hernández, Gonzalo[11]; Sousa, Ana[12]

(1) Biodiversity Research Institute (IMIB), University of Oviedo-CSIC-Principality of Asturias; (2) Centro de Observación y Teledetección Espacial, COTESA; (3) Biodiversity Research Institute (IMIB), University of Oviedo-CSIC-Principality of Asturias; (4) Collecte Localisation Satellites, CLS; (5) Collecte Localisation Satellites, CLS; (6) EVENFLOW; (7) EVENFLOW; (8) Centro de Observación y Teledetección Espacial, COTESA; (9) Centro de Observación y Teledetección Espacial, COTESA; (10) Biodiversity Research Institute (IMIB), University of Oviedo-CSIC-Principality of Asturias; (11) Biodiversity Research Institute (IMIB), University of Oviedo-CSIC-Principality of Asturias; (12) European Environment Agency, EEA

Correspondence e-mail: [jm.alvarez@uniovi.es]

Accurate monitoring of land use and land cover (LULC) is a fundamental tool for addressing global challenges such as biodiversity loss and climate change. Protected Areas (PAs), as cornerstone elements for conservation, require up-to-date LULC information for defining multipurpose and effective management strategies. While Copernicus Land Monitoring Service (CLMS) already offers valuable LULC datasets, translating maps into European Nature Information System (EUNIS) habitat types—aligned with Annex I typologies of the Habitats Directive—remains a complex, pressing and still unresolved challenge.

This study proposes an integrated methodological framework that combines high-resolution LULC mapping with predictive modeling of EUNIS habitat types across the entire Natura 2000 network. Using CLMS PA product as a foundation, we constructed hierarchical habitat models across biogeographical regions defined by the European Environment Agency (EEA), reducing bias and maximizing efficiency in data collection. The approach employs Sentinel-2 time-series imagery enhanced by cutting-edge Artificial Intelligence (AI) algorithms and super-resolution techniques to achieve unprecedented spatial and temporal detail in habitat predictions, accounting for regional ecological variability. Modeling outputs are also subjected to locally adapted post-processing procedures to align with CLMS portfolio while delivering high-quality, operationally relevant products for pan-European biodiversity assessment.

Preliminary results indicate over 90% classification accuracy for Level 1 LULC categories, with promising outcomes for finer-scale LULC and EUNIS habitat mapping. By integrating super-resolved Sentinel-2 imagery into scalable AI workflows, the framework offers a transformative pathway for monitoring and reporting obligations of Article 17 of the Habitats Directive, the EU Biodiversity Strategy and the European Green Deal

[GSF-O-9]

Wednesday 4, morning (first): 11:30
Room: Balconada

Mapping coastal habitats at state-level: integrating GIS, remote sensing, and fieldwork

Genua Olmedo, Ana[1]; Aranda García, María[2]; Martínez Sánchez, Antonio[3]; Montero Montero, Ana[4]; González Burguillo, Sergio[5]; Gracia Prieto, Francisco Javier[6]; Velázquez Melero, Juan Carlos[7]; Aguirre Sierra, María Aranzazu[8]; Barberán Molina, Diego[9]; Moreno Gutiérrez, Cristina[10]; Ruiz Franco, Blanca[11]

(1) Tragsatec, Madrid, Spain; (2) Tragsatec, Madrid, Spain; (3) Tragsatec, Madrid, Spain; (4) Tragsatec, Madrid, Spain; (5) Tragsatec, Madrid, Spain; (6) Faculty of Marine and Environmental Sciences, CASEM, University of Cádiz, Spain; (7) Tragsatec, Madrid, Spain; (8) Tragsatec, Madrid, Spain; (9) Tragsatec, Madrid, Spain; (10) Ministry for the Ecological Transition and the Demographic Challenge (MITECO), Madrid, Spain; (11) Ministry for the Ecological Transition and the Demographic Challenge (MITECO), Madrid, Spain

Correspondence e-mail: [agenuaolmedo@gmail.com]

There is no updated cartography of natural and semi-natural habitats in Spain at state-level. Harmonizing existing maps from the Autonomous Communities is a complex task due to variations in scale, habitat classifications, and interpretation criteria. The project "Mapping of terrestrial habitats: improvement of territorial information at a national scale" funded by the Ministry for the Ecological Transition and the Demographic Challenge aims to create a consistent national habitat cartography applying two legends: the Spanish Habitats Checklist (EUNIS based) and the Habitats of Community Interest (EU Habitats Directive). The project is organized by habitat groups, with coastal habitats posing particular challenges for accurate mapping due to dynamic natural processes such as tides and sea level changes. Challenges are further complicated by the diverse characteristics of Spain's coastlines, including both the Atlantic and Mediterranean regions. Digitization tasks and fieldwork are completed using up-to-date auxiliary data like LiDAR, digital terrain models, orthophotos, and slope maps. GIS tools and R software are used for the cartography process and quality control, with a high spatial resolution (typically ~500 to 1000 m). By June 2025, the national coastline, with approximately 8.000 km, will be digitized including the habitat assignation that will be partially based on fieldwork with ground control points covering 47% of the coastline. This is the first homogeneous cartography of coastal habitats that can serve as starting point to support habitat conservation management plans.

[GSF-O-10]

Wednesday 4, morning (first): 11:45
Room: Balconada

Diversity in drought-tolerance traits promotes temporal stability in forest productivity

García-Valdés, Raúl[1]; Roces-Díaz, José V.[2]; de Cáceres, Miquel[3]; Descals, Adrià[4]; Hurtado, Pilar[5]; Lloret, Francisco[6]; Espelta, Josep Maria[7]; Álvarez-Martínez, José Manuel[8]; Batllori Presas, Enric[9]; Martínez-Vilalta, Jordi[10]

(1) Instituto de Investigación en Cambio Global (IICG-URJC); (2) Biodiversity Research Institute IMIB, CSIC – University of Oviedo – Principado de Asturias; (3) CREAF; (4) CREAF; (5) CREAF; (6) CREAF; (7) CREAF; (8) Biodiversity Research Institute IMIB, CSIC – University of Oviedo – Principado de Asturias; (9) Universitat de Barcelona (UB); (10) CREAF

Correspondence e-mail: [raul.garcia.valdes@urjc.es]

Introduction. Forest productivity is key in climate change mitigation, but fluctuates between years due to environmental variability. This variability is rising because of climate change, increasing forest vulnerability to drought, and compromising the future provision of forest ecosystem services. Temporal stability is the property of ecosystems to remain in the same state over time in response to environmental fluctuations. It is related to climate conditions, the dominant species, vegetation structure, and community maturity. Importantly, many studies found a positive effect of species diversity across different ecosystems. However, the role of tree functional (trait) diversity on forest stability is still poorly understood. In this study, we explored how different variables (climate, vegetation structure, and tree community mean and diversity of drought-related traits) affected the forest temporal stability in ~40,000 forest plots across Spain.

Material and methods. We used satellite vegetation indexes (NDVI and EVI) from the year 2000 to 2018 to measure stability, and plot-level (~40,000 plots) from the Third Spanish Forest Inventory for characterising tree communities, including the weighted mean and functional richness of hydraulic traits related to embolism vulnerability (P50 and HSM).

Results and discussion. We found solid evidence that those forest stands showing higher richness in drought-tolerance traits also showed higher levels of stability. Our results explain recent findings linking drought-tolerance diversity and long-term forest productivity, and indicate that drought-related functional diversification would be a good management strategy to secure a stable provision of forest ecosystem services, especially under the current increase in climate variability and drought frequency.

[GSF-O-11]

Wednesday 4, morning (first): 12:00
Room: Balconada

Hierarchical ecosystem mapping for large-scale biodiversity assessment

Jiménez-Alfaro, Borja[1]; Alvarez Martinez, Jose Manuel[2]

(1) Biodiversity Research Institute (IMIB), University of Oviedo-CSCI-Principado de Asturias; (2) Biodiversity Research Institute (IMIB), University of Oviedo-CSCI-Principado de Asturias

Correspondence e-mail: [jimenezalfaro@uniovi.es]

Ecosystem mapping is globally needed to accomplish international biodiversity initiatives like the IUCN red list of ecosystems or the UN standards on ecosystem accounting. The use of big data, remote sensing, and spatial modeling is crucial for producing high-resolution maps more efficiently than traditional mapping methods. However, we still need to develop up-to-date methodologies for ecosystem mapping at high spatial and thematic resolution. Here we present a comprehensive modeling framework for mapping ecosystem types at large spatial scales using high-quality ground truth data and remote sensing. Our framework uses a hierarchical spatial approach to model (a) the distribution of functional ecosystems (formations), and (b) nested ecological ecosystems at high thematic resolution (habitat types). We test our framework in Central Anatolia (Turkey), a large biogeographic region covering 180,000 km2 with high biodiversity value but without previous ecosystem or habitat mapping attempts. We designed a 2-year sampling campaign conducted by 20 field ecologists, resulting in 130.000 data points covering a pre-defined list of habitat types for the study area. The models performed high-quality maps at 30 m resolution, predicting the distribution of ecosystem types at both hierarchical levels, with remote sensing variables being more explicative for formations than for habitat types. The results provided individual maps for the dominant ecosystems in the study area, offering information about their environmental drivers, and estimates of ecosystem extents. The maps can be easily improved and updated when new data or predictors are available, offering a dynamic tool for large-scale biodiversity assessment.

[GSF-O-12]

Wednesday 4, morning (first): 12:15
Room: Balconada

Parakeet invasion: Novel noise creates a shift in urban soundscapes

Boisseau, Loréna[1]; Mendoza, Irene[2]; Vilà, Montserrat[3]

(1) Estación Biológica de Doñana - CSIC; (2) University of Sevilla; (3) Estación Biológica de Doñana - CSIC

Correspondence e-mail: [lorena.boisseau@ebd.csic.es]

Noise pollution, defined as environmental sound with harmful effects on wildlife and humans, disrupts animal acoustic communication. For instance, anthropogenic noise has been widely shown to mask the propagation and reception of vocal signals, acting as polluting agent of soundscapes. Vocalising invasive species have been proposed as sources of novel noises, but their acoustic impact on local native species has received little attention. Monk parakeets (Myiopsitta monachus) and rose-ringed parakeets (Psittacula krameri) are the two most successful invasive parrots, and they are known for their loud and persistent calling. Here, we aim to describe the acoustic presence of both parakeets in the soundscape of an invaded city, as well as to evaluate their role as acoustic pollutants. To do so, we conducted a sampling campaign by recording 15-minutes soundscape in 11 gardens and parks of the city of Seville, Spain, during three different seasons. The vocal activity of invasive parakeets and local birds, as well as the levels of anthropogenic noise, will be used to describe the dominant acoustic features of each park. We will create soundmaps to visually represent the spatial and seasonal variation of the city's soundscape, as well as the contribution of the parakeets to the different acoustic features of soundscapes. This approach allows us to tackle the contribution of invasive parakeets as sources of noise and their impact on native bird signal transmission.

GSF. Posters

[GSF-P-1]

Tuesday 3
Discussion corner: Room 12

Discrimination of intertidal goose barnacle from in situ hyperspectral signatures

Román Geada, Marta[1]; Simon, Oiry[2]; Davies, Bede F. R.[3]; Rosa, Philippe[4]; Gernez, Pierre[5]; Olabarria, Celia[6]; Barillé, Laurent[7]

(1) Centro de Investigación Mariña- Universidade de Vigo; (2) Institut des Substances et Organismes de la Mer-Nantes Université; (3) Institut des Substances et Organismes de la Mer-Nantes Université; (4) Institut des Substances et Organismes de la Mer-Nantes Université; (5) Institut des Substances et Organismes de la Mer-Nantes Université; (6) Centro de Investigación Mariña- Universidade de Vigo; (7) Institut des Substances et Organismes de la Mer-Nantes Université

Correspondence e-mail: [marroman@uvigo.es]

Using drone imagery for mapping intertidal species offers advantages with respect to traditional surveys. However, the effect of spectral resolution of the sensors, hyper- or multi-spectral, for detection of intertidal sessile invertebrates has not been assessed yet. We tested if reflectance spectra of goose barnacle Pollicipes pollicipes (Gmelin, 1789) could be discriminated from those of neighboring mussels Mytilus galloprovincialis (Lamarck, 1819), barnacles of subclass Cirripedia and macroalgae. For that, we measured and analyzed hyperspectral signatures of these sessile invertebrates and macroalgae in a rocky intertidal shore of NW Spain in September 2023 and June 2024, and in the laboratory in March 2024 with an ASD handheld Spectroradiometer. From these hyperspectral signatures composed of 491 narrow bands, we tested the ability of a lower resolution multispectral Micasense Dual Camera to capture key spectral features for classification in spite of the 10 bands of this sensor. Dissimilarity between classes was assessed through non-metric MultiDimensional Scaling (nMDS) based on Spectral angles Mapping distances. The nMDS revealed three groups: 1) macroalgae, 2) adults and spat of M. galloprovincialis and 3) P. pollicipes and Cirripedia. To test if P. pollicipes could be distinguished from Cirripedia, a machine learning classification based on hyper and multispectral resolutions was performed through Random Forest analysis. Forest classifications showed a high overall accuracy for hyperspectral and multispectral resolutions. Results indicated satisfactory discrimination between P. pollicipes and Cirripedia and evidence a good potential of using multispectral reflectance for mapping goose barnacle populations.

[GSF-P-2]

Wednesday 4
Discussion corner: Room 12

OCCUR app: an interactive guide for curating species occurrence records

Ronquillo Ferrero, Cristina[1]; Stropp, Juliana[2]; Hortal, Joaquín[3]

(1) Museo Nacional de Ciencias Naturales (MNCN-CSIC); (2) Trier University; (3) Museo Nacional de Ciencias Naturales (MNCN-CSIC)

Correspondence e-mail: [cristinaronquillo@mncn.csic.es]

Introdution. The massive volume of biodiversity occurrence records available nowadays can help us understand many large-scale biogeographical, ecological, and evolutionary phenomena. However, without clearly documenting how such data are collected, filtered and standardised, the comparability and reproducibility between studies cannot be assured, which undermines the robustness of any ecological result.

Material and methods. We reviewed the literature on data curation and organised all available tools and strategies in a complete guide in the form of an interactive app. OCCUR is a Shiny application developed with R code and available at https://ecoinformatic.shinyapps.io/OCCUR. It aims to provide a user-friendly platform to the biodiversity informatics community, incorporating the data curation into analytical workflows. OCCUR can also be used as a resource for teaching best practices to ecologists.

Results and discussion.OCCUR guides researchers through five modules (Basis of Record, Taxonomy, Geography, Time, and Identification of duplicates) offering detailed information on the pros and cons of each curation option. OCCUR also includes guesstimates of the trade-off between the certainty and coverage of data generated in each selected step. Finally, it produces a custom-made final report with all the steps marked to apply. The Shiny app offered multiple combinations of methods and this stresses the importance of documenting and justifying any criteria used to handle occurrence records from biodiversity databases.

[GSF-P-3]

Thursday 5
Discussion corner: Room 12

Co-designing agroforest resilient landscapes: participatory processes and multi-objective planning

Aquilué Junyent, Núria[1]; Salgado, José[2]; Zaldo, Quim[3]; Capizzi, Giuseppe[4]; Camps, Joana[5]; Moreno, Jan[6]; Trasobares, Antoni[7]

(1) Forest Science and Technology Centre of Catalonia; (2) Forest Science and Technology Centre of Catalonia; (3) Forest Science and Technology Centre of Catalonia; (4) Forest Science and Technology Centre of Catalonia; (5) Forest Science and Technology Centre of Catalonia; (6) Forest Science and Technology Centre of Catalonia; (7) Forest Science and Technology Centre of Catalonia

Correspondence e-mail: [nuria.aquilue@ctfc.cat]

In a global context marked by climate change, increasing natural disturbances, growing demands on natural resources, and growing environmental and social challenges, sustainable agroforestry landscape planning must address multiple objectives that balance ecosystem conservation, productivity, and ecosystem resilience to multiple drivers of change.

The FORMES projection system for multi-objective landscape planning is designed to address the challenges of landscape management in the context of global change. FORMES integrates critical stages for planning resilient landscapes: (1) characterization of current land cover and forest stand composition and structure; (2) modeling forest dynamics under various silvicultural prescriptions and land-use change processes; (3) estimation of multiple ecosystem services (e.g., blue water, carbon sequestration, and fuel loads); (4) engagement of local stakeholders to prioritize objectives and integrate technical expertise into strategic plans; (5) multi-criteria spatial optimization; and (6) visualization of forest evolution under different management alternatives and the comparative provision of ecosystem services.

This study showcases FORMES' practical application across four pilot agroforestry landscapes in Catalonia, aligning with one of the strategic goals of the Catalonia Bioeconomy Strategy 2030. By facilitating participatory co-design processes with technicians and local stakeholders, FORMES promotes the development of sustainable and resilient landscapes. The tool provides an integrated approach to optimize agro-pastoral production, biodiversity conservation, and fire resistance while advancing circular bioeconomy goals.

The results emphasize the critical role of combining robust datasets, climate-sensitive models, and community engagement with decision-support tools to address the complexities of ecosystem service provision and landscape management under changing environmental conditions.

[GSF-P-4]

Tuesday 3
Discussion corner: Room 12

A.I. for Biodiversity: Bringing Biodiversity Collections to the Digital Age

Jiménez-Lalana, Diego E.[1]; Rodríguez Pertierra, Luis[2]; De los Ríos, Asunción[3]

(1) MNCN-CSIC; (2) MNCN-CSIC; (3) MNCN-CSIC

Correspondence e-mail: [diego.jimenez@mncn.csic.es]

The availability of diverse datasets and machine learning tools is transforming biodiversity research, but their complexity often creates a barrier for researchers. Our LIA-MNCN project (MOMENTUM) looks to address these questions by developing A.I.-driven solutions to support digitalization, annotation, and analysis of biodiversity collections. We specially focus on computer-based technologies to enhance ecological studies, including computer vision, the processing of soundscapes, video frames, and traditional datasets. This poster highlights our first iterations of A.I. training in the recognition of microscopic (e.g. soil fauna) and macroscopic organisms (e.g. larger arthropods). Taxonomic identifications are often challenging due to the sheer number of specimens, often cryptic in nature with subtle differences. Using high-resolution imaging, 3D scanning, and convolutional neural networks (CNNs), we here showcase a computer vision pipeline for automated identification and curation of these specimens. Additionally, we also take advantage of A.I. techniques to construct 3D models of the organisms and study their morphometrics beyond baseline taxonomic description. Here we showcase some examples of 3D mapping. These advancements open the door to more efficient biodiversity surveys, enabling large-scale monitoring of soil ecosystems and species patterns. This project not only streamlines traditional research workflows but also makes biodiversity data more accessible, fostering collaboration and democratizing A.I. tools for researchers across disciplines. Operational challenges and solutions are presented last. We aim to bridge the technological gap, empowering the scientific community to leverage cutting-edge AI for ecological discovery. Therefore, we present our latest advances in the matter and the arising perspectives for the field.

TECHNICAL SESSIONS

TSF.1. Ecoacoustic monitoring of biodiversity: challenges and applications

Wednesday, 4 (11:00-12:30)

Room: Seminario 2

There is a current need to develop biodiversity monitoring schemes that are automatic, fast, reliable, and scalable over broad spatial and temporal scales. Sounds from nature are one of the best proxies of the health status of ecosystems and they serve as indicators of global-change impacts. Traditional techniques of acoustic survey are labour-intensive, expensive, and logistically impracticable in remote areas. Passive Acoustic Monitoring (PAM) is an alternative to monitor biodiversity that can cover broad and spatial temporal scales, including simultaneous and long-term monitoring, while reducing biases among observers. However, vast amounts of data is often generated, which requires the use of machine learning algorithms to automatize the identification of animal species. Nonetheless, the development of machine learning algorithms is not friendly for many researchers and practitioners, so multidisciplinary approaches are required. In this session, we aim at presenting the most advanced research on terrestrial ecoacoustic monitoring, focusing on challenges including methods, applications, and standardisation of acoustic data. We will favour the diversity of speakers, including different backgrounds, genders and career stages. As ecoacoustics is getting increased interest, we believe that this session will be informative for attendees already working on the topic and others that could start doing so promptly.

Organizers:

- **Irene Mendoza Sagrera,** Estación Biológica de Doñana (CSIC)
- **Esther Sebastián González,** Department of Ecology. University of Alicante
- **Cristian Pérez Granados,** Forest Science and Technology Centre of Catalonia.

TSF.1. Orals

[TSF.1-O-1]

Wednesday 4, morning (first): 11:00
Room: Seminario 2

Monitoring biodiversity and ecosystems with sounds: review and perspectives[o]

Llusia Genique, Diego[1]

(1) Universidad Autónoma de Madrid

Correspondence e-mail: [diego.llusia@uam.es]

Monitoring methods in ecology have undergone a remarkable transformation in the last two decades. Among other emerging methods, passive acoustic monitoring (PAM) is revolutionizing traditional survey techniques and expanding our capacity to assess biodiversity and ecosystems. With the combined use of sensor networks and artificial intelligence, we are now able to automatically record acoustic activity of animal communities at large temporal and spatial scales. In this talk, I will offer a short review on the past, present and future of this technique for a broad audience (practitioners and researchers, beginners and experts). The aim of the presentation is to give an historical overview and introduce pros and cons of such a cutting-edge method. Specifically, I will focused on three main components: (i) data collection; (ii) analysis; and (iii) applications. With a series of examples and studies, I will show current projects for a variety of taxa in terrestrial environments. To promote debate and orient future research, I will outline main current challenges in the field. The development of this technology has greatly expand the possibilities for biodiversity assessment and ecological research, but we still need to push its future.

[TSF.1-O-2]

Wednesday 4, morning (first): 11:15
Room: Seminario 2

Listening to the mountains: towards a large-scale passive acoustic observatory for Ordesa & Monte Perdido National Park

Lahoz Monfort, Jose Joaquin[1]; Greenhalgh, Jack Allan[2]; García González, Begoña[3]

(1) Instituto Pirenaico de Ecologia - CSIC; (2) Instituto Pirenaico de Ecología - CSIC; (3) Instituto Pirenaico de Ecología - CSIC

Correspondence e-mail: [jlahoz@ipe.csic.es]

Recent developments in passive acoustic technology are facilitating acoustic monitoring programmes across increasingly larger spatial and temporal scales, providing novel insights into the function and condition of soundscapes around the world, as well as promising powerful methods for large-scale surveillance monitoring of ecosystem health.

Here, we present the establishment of a large scale “acoustic observatory” for the Ordesa and Monte Perdido national park (Aragón, Spain), an iconic protected area in the Spanish Pyrenees. Established in 2022, it consists of a network of ~40 low-cost open-source acoustic sensors (AudioMoths), covering five major terrestrial habitats along the elevation gradient (Mediterranean bushland, Scots pine forest, mixed beech-fir forest, mountain pine forest, and subalpine grassland). We do not target specific aspects of soundscapes (e.g., proxy of bird species richness) but instead investigate a broad representation of their properties across a large mountain area.

Through the calculation of multiple acoustic indices, we describe the temporal and spatial diversity within the park and create the first reference library of mountain soundscapes for the region. We use compact representations to easily visualise > 1 year of acoustic data in a single plot, to aid rapidly scanning and comparing the complete set of soundscapes; these revealed distinct diel and seasonal cycles in bird and insect acoustic activity, with notable variations between habitat types and elevations. We aim to characterise typical acoustic heterogeneity within each habitat, which will serve as baseline for an experimental early warning system for ecosystem change via automated detection of deviations in soundscape metrics.

[TSF.1-O-3]

Wednesday 4, morning (first): 11:30
Room: Seminario 2

Evaluating acoustic and distance sampling for monitoring bird communities in a One Health context

Cerecedo-Iglesias, Catuxa[1]; Bogdanovic, Nina[2]; San Sebastian, Olatz[3]; Richter-Boix, Alex[4]; Ollé, Alex[5]; Bartumeus, Frederic[6]

(1) Centre d'Estudis Avançats de Blanes (CEAB-CSIC); (2) Centre d'Estudis Avançats de Blanes (CEAB-CSIC); (3) Centre d'Estudis Avançats de Blanes (CEAB-CSIC); (4) Centre d'Estudis Avançats de Blanes (CEAB-CSIC); (5) Servei de Control de Mosquits de la Badia de Roses i el Baix Ter; (6) Centre d'Estudis Avançats de Blanes (CEAB-CSIC), CREAF, ICREA

Correspondence e-mail: [catuxa.cerecedo@ceab.csic.es]

In the One Health context, effective methodologies are needed to monitor wildlife communities and early detect emerging infections, as well as to identify potential changes in disease dynamics. Acoustic monitoring is becoming increasingly popular due to its cost-effectiveness and the ability to cover larger areas compared to traditional methods. However, a key challenge lies in determining how accurately acoustic activity metrics reflect species richness and abundance, an issue that remains under debate. This study addresses this gap by comparing two different methodologies —acoustic monitoring and distance sampling— to evaluate their effectiveness in estimating the abundance and richness of potential host bird species. Data collection took place in Aiguamolls de l'Empordà Natural Park in Catalonia, an ecologically rich area where interactions among mosquitoes, birds, and humans present a risk for pathogen spillover. Bird data were gathered using AudioMoth autonomous audio recorders and linear transect censuses. Bird call records were classified using the BirdNet algorithm, and vocal activity rate and other richness metrics were calculated to compare them with the density and richness estimates obtained through distance sampling models. This research contributes to a broader understanding of the strengths and limitations of using acoustic devices to monitor bird populations and obtain metrics on abundance and richness. Additionally, it assesses the potential applications of these technologies for monitoring host communities in hypothetical epidemiological scenarios.

[TSF.1-O-4]

Wednesday 4, morning (first): 11:45
Room: Seminario 2

Ecoacoustic Camera Trap: A Unified, AI-Driven Solution for Multimodal Biodiversity Monitoring

Velasco-Montero, Delia[1]; Fernández-Berni, Jorge[2]; Bustamante-Díaz, Javier[3]; Bastianelli, Giulia[4]; Palomares, Francisco[5]

(1) Estación Biológica de Doñana; (2) Instituto de Microelectrónica de Sevilla; (3) Estación Biológica de Doñana; (4) Estación Biológica de Doñana; (5) Estación Biológica de Doñana

Correspondence e-mail: [delia@imse-cnm.csic.es]

This study introduces an ecoacoustic monitoring device that unifies the functionalities of Autonomous Recording Units (ARUs) and camera traps into a single platform, termed as bioacoustic camera trap. Equipped with integrated audio-visual sensing and on-device AI processing, the system offers a novel approach to biodiversity monitoring, addressing key limitations of traditional methods. By enabling real-time analysis of audio and visual data, the device significantly reduces human intervention and eliminates the need to manually analyse irrelevant data such as audio without species calls or images devoid of animals. This also minimizes reliance on cloud-based systems, conserving bandwidth and lowering data transfer demands.

A key innovation of the system, which is based on the Raspberry Pi platform, is a custom synchronism protocol that ensures optimal utilization of hardware resources, enabling the seamless integration of dual sensing modalities on a resource-constrained device. Another critical advancement is the adaptability of the integrated AI to dynamic environmental conditions, which enhances the device's versatility across diverse ecological settings. Extensive field testing under varying operational conditions has been conducted to refine the system performance and validate its capability for robust data collection and processing.

Applications of this integrated system are wide-ranging, including real-time species detection, colony size estimation for birds, and habitat monitoring. By combining ARU and camera trap functionalities with advanced AI, we aim to provide the community with a transformative tool for ecological research, enabling efficient, scalable, and cost-effective biodiversity assessments.

[TSF.1-O-5]

Wednesday 4, morning (first): 12:00
Room: Seminario 2

Low-cost recorders and ready-to-use machine learning tools: An effective combination for monitoring nocturnal and cryptic aquatic birds

Pérez-Granados, Cristian[1]; Manzano-Rubio, Robert[2]; Ramilo-Henry, Maguiña[3]; Burgas, Albert[4]; Soto-Largo, Eduardo[5]; Bota, Gerard[6]

(1) Centre de Ciència i Tecnologia Forestal de Catalunya; (2) Centre de Ciència i Tecnologia Forestal de Catalunya; (3) Centre de Ciència i Tecnologia Forestal de Catalunya; (4) Parc Natural dels Aiguamolls de l'Empordà; (5) OIKOS Consultores & Medio Ambiente S.L; (6) Centre de Ciència i Tecnologia Forestal de Catalunya

Correspondence e-mail: [cristian.perez@ctfc.cat]

Passive acoustic monitoring (PAM) is a powerful tool to monitor nocturnal and scarce species living in sites difficult to access. The development of affordable autonomous recorders and user-friendly tools for automated identification, like BirdNET have extended the use of this tool to the public. Here, we evaluated the use of low-cost recorders to monitor two nocturnal aquatic threatened species, the Eurasian bittern (Botaurus stellaris) and the Baillon's Crake (Zapornia pusilla) in Spain. The Eurasian bittern was monitored across 17 wetlands and BirdNET detected its presence in 59 of the 63 (93.7%) recordings with known presence and up to 76% of the vocalizations within the recordings (recall rate), including its presence on a wetland with unknown breeding records. The Baillon's Crake was monitored in 12 sites and BirdNET detected its presence in 64.7% of the recordings with known presence. This study highlights the difference in detection performance of BirdNET between these species and provides new insights regarding the potential of PAM for monitoring cryptic aquatic bird species at large temporal and spatial scales. We also discuss the challenges found during the projects to guide further research, such as evaluate the impact of the sound environment in relation to BirdNET's detection ability (most false positives for the Baillon's Crake were sounds of species with similar vocalizations). In any case, the use of low-cost recorders coupled to ready-to-use machine learning tools has a big potential for bird acoustic monitoring by a non-scientific community (e.g. rangers), which are usually responsible for species monitoring.

[TSF.1-O-6]

Wednesday 4, morning (first): 12:15
Room: Seminario 2

Optimizing BirdNET for local ecosystems, fine-tuning for ecoacoustic monitoring

Márquez-Rodríguez, Alba[1]; Mora Quintana, Miguel Ángel[2]; Rollán, Laura[3]; Muñoz, Gonzalo[4]; Barrionuevo Moreno, Ignacio[5]; de la Cruz, Andrés[6]

(1) University of Cádiz; (2) University of Cádiz; (3) University of Cádiz; (4) University of Cádiz; (5) Birding The Strait; (6) University of Cádiz

Correspondence e-mail: [alba.marquez@uca.es]

Passive Acoustic Monitoring (PAM) has become an invaluable tool for biodiversity assessment, providing scalable and long-term monitoring solutions. However, the reliability of automatic species identification tools like BirdNET [1] is influenced by environmental contexts, requiring prior validation and fine-tuning tailored to specific cases [2]. This study evaluates BirdNET's performance in detecting Actitis hypoleucos in the Bahía de Cádiz, with an emphasis on understanding the impact of fine-tuning.

Recordings from two locations (INM and TAR) were collected using autonomous devices over nine months. INM, in the INMAR building in Bahía de Cádiz, and TAR, on Tarifa Island in the Strait of Gibraltar, represent distinct ecological contexts. A custom tool was created to facilitate manual validation [3]. BirdNET predictions for Actitis hypoleucos at INM were validated by analyzing 300 segments, which were then used for fine-tuning and evaluation. Evaluation metrics were computed pre- and post-fine-tuning using a subset of validations. Preliminary evaluations involved a small subset, with plans to scale up training and testing data, incorporating additional validations from both locations. Future improvements include analyzing full audio files to identify undetected Actitis hypoleucos vocalizations and reclassifying segments initially predicted as other species but validated as Actitis hypoleucos.

Initial validation at INM revealed limited performance (accuracy and precision: 6.8%; recall: 100%), reflecting high sensitivity but poor specificity. Fine-tuning improved accuracy and precision to 66.7%, highlighting the value of local training in reducing false positives. Planned analyses will assess the model's generalization and expand datasets enhancing robustness and applicability for ecoacoustic monitoring.

TSF.1. Posters

[TSF.1-P-1]

Wednesday 4
Discussion corner: Room 12

Mapping Ecoacoustics Projects in Spain: Progress, Biases, and Challenges

López Gallego, Zeltia[1]; Pérez-Granados, Cristian[2]; Sebastián González, Esther[3]; Mendoza Sagrera, Irene[4]; Bastianelli, Giulia[5]; Puig-Gironès., Roger[6]; Brotons, Lluis[7]; Douglas Carvalho, William[8]; Fandos, Guillermo[9]; Bota Cabau, Gerard[10]; Traba Díaz, Juan[11]

(1) Biodiversity Node S.L.; (2) Centre de Ciència i Tecnologia Forestal de Catalunya; (3) Universidad de Alicante, Alicante; (4) Universidad de Sevilla; (5) ICTS, Estación Biológica de Doñana, Sevilla; (6) Universitat de Girona. Universitat de Barcelona; (7) CREAF & CSIC, CTFC; (8) Autonomous University of Madrid; (9) Universidad Complutense de Madrid; (10) CTFC; (11) Universidad Autónoma de Madrid

Correspondence e-mail: [zeltia.lopez@biodiversitynode.com]

Passive Acoustic Monitoring (PAM) has experienced remarkable growth in recent years as a tool for studying biodiversity and soundscapes. However, there is still limited knowledge of its specific applications in ecoacoustics, particularly regarding the taxonomic groups studied, the habitats analyzed, the types of recorders used, and the analytical methodologies employed.

In this context, the Spanish Research Network on Ecoacoustics (REIE) has mapped research projects carried out in Spain that employ PAM, compiling data based on the experiences and contributions of its members. This study presents a preliminary analysis of the current state of ecoacoustics in Spain, identifying the most studied habitats, key taxonomic groups, and the technological approaches used.

The results reveal spatial and thematic distribution patterns across the projects, as well as potential biases concerning geographic coverage, represented ecosystems, and methodological strategies. Additionally, the study highlights existing knowledge gaps and underscores the need for greater standardization in recorder usage, data analysis techniques, and protocols for sensor deployment and data handling to ensure consistency and reproducibility in ecoacoustic research. We anticipate that this work will contribute to a comprehensive understanding of ecoacoustics in Spain, promoting the effective use of PAM as a critical tool for studying acoustic biodiversity, which will support more effective measures for nature conservation.

Our aim is to expand this mapping by incorporating additional projects, fostering collaboration within Spain's ecoacoustics research community, and encouraging data sharing. We also aim to advance the standardization of sampling protocols, acoustic data storage and processing practices, tagging processes, and metadata documentation.

TSF.2. Perspectives and Challenges in Biodiversity Forecasting

Tuesday, 3 (12:45-14:15)

Room: Restaurante

The global decline in biodiversity over recent decades, primarily due to key anthropogenic stressors, is a pressing issue. Predicting near-term changes in biodiversity is essential for adaptive management, that is, anticipating and mitigating biodiversity loss instead of just reacting to loss. However, many challenges persist in developing such forecasts, and our predictive capacity needs improvement. This session will address data constraints, information gaps, and modeling challenges – but also opportunities – in biodiversity forecasting. We will discuss theoretical and conceptual tools that synthesize incoming data, create and validate predictive models, estimate uncertainties, improve data collection, detect trends, and ensure scalability across various spatial and temporal levels.
The aim is to outline current incentives and recommendations for the broader use of biodiversity models for decision support. Additionally, we hope to generate synergies and debate among researchers interested in predicting biodiversity, discussing limitations, and addressing new challenges in biodiversity forecasting and conservation. Attendees will benefit from expert perspectives on innovative solutions and the latest advancements, fostering a collaborative approach to biodiversity forecasting and its practical implementation.

Organizers:

• **Guillermo Fandos,** Department of Biodiversity, Ecology, and Evolution\; Faculty of Biological Sciences, Universidad Complutense de Madrid

• **Maria Paniw,** Department of Conservation Biology and Global Change, Estación Biológica de Doñana (EBD-CSIC).

TSF.2. Orals

[TSF.2-O-1]

Tuesday 3, morning (second): 12:45
Room: Restaurante

Predicting organismal responses to climate change through biophysical modeling

Gallego Rubalcaba, Juan Vicente[1]

(1) Fac Biological Sciences, UCM

Correspondence e-mail: [jg.rubalcaba@gmail.com]

A core challenge of our time is to predict how organisms will respond to global environmental change. Yet most of our current predictive tools are correlative (statistical) methods that largely overlook the mechanisms underlying organism-environment interactions and thus have a limited capacity to extrapolate responses to unprecedented environmental scenarios. An emerging area of research is committed to developing mechanistic models to capture these interactions – a multidisciplinary endeavor integrating disparate fields such as thermodynamics, physiology, and evolutionary biology. A starting point towards achieving this integration has been to develop biophysical models describing the balances of heat, water and other aspects of energy and mass exchange between organisms and their environment and translate these into metrics of physiological performance and fitness. I will show that biophysical models can scale individual-microenvironment interactions up into broad-scale responses to environmental and climate change. Hence, they provide a means to model species' range shifts while integrating the individual-level mechanisms underlying these responses. I will illustrate that biophysical models are contributing to the transformation of ecology into a predictive science even though they face methodological and conceptual barriers that need to be overcome with further theoretical and empirical development.

[TSF.2-O-2]

Tuesday 3, morning (second): 13:00
Room: Restaurante

Modeling population dynamics of mediterranean shrubs: Integrating climatic complexity

Sánchez-Mejía, Teresa[1]; Paniw, Maria[2]; Lloret Maya, Francisco[3]

(1) Centre de Recerca Ecològica i Aplicacions Forestals (CREAF), Universitat Autònoma de Barcelona (UAB); (2) Estación Biológica de Doñana (EBD-CSIC); (3) Centre de Recerca Ecològica i Aplicacions Forestals (CREAF), Universitat Autònoma de Barcelona (UAB)

Correspondence e-mail: [teresaschezmejia@gmail.com]

Understanding how climatic variability influences population dynamics is key to predicting species' responses to climate change. Demographic responses to climate often involve multiple, correlated drivers, making model parametrization challenging due to data limitation, multicollinearity, and interpretative difficulties. Climatic niche variables, reflecting species' optimal conditions or tolerance limits, offer an ecologically meaningful framework to address these challenges. By relying on species distribution data, they synthesize climatic drivers impacts by building a two-dimensional space that links populations to their niche.

We used Integrated Population Models (IPMs) to model the population trends in response to changes in temperature and rainfall for two Mediterranean shrub species, Halimum halimifolium and Lavandula stoechas. We parameterized survival, growth, and reproduction from four years of individual monitoring data across 18 plots. Demographic rates were integrated into population models to compare forecast accuracy between models incorporating climatic niche variables and those using raw climatic variables.

Overall, both modeling approaches captured observed population trends with similar accuracy, with no overall differences between the two studied species. However, seedling survival and recruitment - the most climate-sensitive vital rates - showed somewhat different responses between the two approaches. Adult and juvenile survival, flowering, and growth exhibited minimal influence of climate in either model.

Our results suggest that demographic models using climatic niche variables offer a useful tool for demographic forecasting by accounting for climatic complexity and species-specific responses. This study highlights the importance of selecting ecologically meaningful climatic predictors to improve the accuracy and interpretability of species dynamics forecasts under changing climates.

[TSF.2-O-3]

Tuesday 3, morning (second): 13:15
Room: Restaurante

A comprehensive probabilistic metaweb of plant-pollinator interactions across EU

Montes-Pérez, Nerea[1]; Bartomeus Roig, Ignasi[2]; Poisot, Timothée[3]

(1) Estación Biológica de Doñana; (2) Estación Biológica de Doñana; (3) Université de Montréal

Correspondence e-mail: [montesperez.nerea@gmail.com]

As global change progresses, improving the ability to predict shifts of species and their interactions is essential. However, relying solely on local interaction network data might not be sufficient to predict future shifts caused by climate change or anthropogenic factors. This is particularly alarming for key organisms like plants and their pollinators, where we might be able to create species distribution models, but predicting shifts in local interaction networks remains challenging. This study aims to provide the first probabilistic metaweb for plant-pollinator interactions at the European level, enabling the study of potential shifts in local networks using only species lists. We employed an imputation model to create a probability matrix for plant-pollinator interactions at the European level, using 1.376 plants and 2.096 pollinators from the EuPPollNet dataset. The model integrates linear filtering (LF) and singular value decomposition (SVD) to detect false negatives and capture the network's low-rank structure. Additionally, biotic data such as phylogeny, traits, phenology, and distribution were incorporated to predict interactions for species with no prior records, covering 95% of all European pollinators. The model's predictions can be adjusted based on network characteristics like connectance, degree, or a hybrid approach. Preliminary results from data-rich countries like Germany, France, and Spain show strong model performance, with models tuned to connectance outperforming others. This study provides the first probabilistic metaweb for European plant-pollinator interaction networks, offering a valuable tool for exploring how local networks may change under future scenarios.

[TSF.2-O-4]

Tuesday 3, morning (second): 13:30
Room: Restaurante

Modelling birds' annual cycle using Euro Bird Portal data

Gallego Zamorano, Juan[1]; Sierdsema, Henk[2]; Kampichler, Christian[3]; Davies, Jacob G.[4]; Faverjon, Celine[5]; Robinson, Rob[6]; Gargallo, Gabriel[7]; Stahl, Julia[8]

(1) Sovon-Dutch Centre for Field Ornithology; (2) Sovon-Dutch Centre for Field Ornithology; (3) Sovon-Dutch Centre for Field Ornithology; (4) BTO-British Trust for Ornithology; (5) Epimundi; (6) BTO-British Trust for Ornithology; (7) ICO-Catalan Ornithological Institute; (8) Sovon-Dutch Centre for Field Ornithology

Correspondence e-mail: [juan.gallego-zamorano@sovon.nl]

The Euro Bird Portal (EBP) aims to create a comprehensive European data repository by aggregating bird observation data from various online portals across Europe at a 10x10 km scale. With our study we seek to describe broad spatiotemporal patterns in bird distributions, including seasonal shifts, migratory routes, and phenology, while tracking changes over time. We used all data collected by the EBP during the period 2015 to 2021 to model annual cycles of birds across Europe. To address data imbalances between countries and to capture non-stationary relationships between species and their environments, we applied a modelling framework called Adaptive Spatio-Temporal Exploratory Model (AdaSTEM). AdaSTEM is designed to analyse large-scale patterns using an ensemble of several local regression models, accounting for the variability among different models while reducing overfitting. In this talk, we will present this modelling framework and its application to 26 bird species for which we predicted their weekly abundances across Europe. Funded by the European Food Safety Authority these models were applied within a spatio-temporal risk assessment project aimed at forecasting the risk of Avian Influenza introductions into poultry populations, the so-called Bird Flu Radar.

[TSF.2-O-5]

Tuesday 3, morning (second): 13:45
Room: Restaurante

geoSABINA: A unified ecological geoportal for Spain to support biodiversity research and conservation planning

García Mateo, Rubén[1]; Goicolea, Teresa[2]; Morales-Barberocom, Jennifer[3]; García-Viñas, Juan Ignacio[4]; Gastón, Aitor[5]; Calleja, Juan Antonio[6]; Ramos-Gutiérrez, Ignacio[7]; Moreno, Juan Carlos[8]; Rodríguez, Miguel Ángel[9]; Aroca-Fernández, María José[10]; Broennimann, Olivier[11]; Guisan, Antoine[12]; Adde, Antoine[13]

(1) Universidad Autónoma de Madrid; (2) Universidad Autónoma de Madrid; (3) Universidad Autónoma de Madrid; (4) Universidad Politécnica de Madrid; (5) Universidad Politécnica de Madrid; (6) Universidad Autónoma de Madrid; (7) Universidad Autónoma de Madrid; (8) Universidad Autónoma de Madrid; (9) Universidad de Alcalá de Henares; (10) Universidad Politécnica de Madrid; (11) Universidad de Lausana; (12) Universidad de Lausana; (13) Swiss Federal Institute of Aquatic Science and Technology

Correspondence e-mail: [rubeng.mateo@uam.es]

Introduction: The geoSABINA geoportal is a comprehensive platform designed to support biodiversity research, conservation planning, and ecological restoration in Spain. By integrating high-resolution spatial datasets, the platform addresses key needs in biodiversity conservation and ecological data accessibility.

Materials and methods: The geoportal organizes its datasets into four key collections: 1) Species occurrence records: High-resolution spatial data for 250 native tree and shrub species, complemented by an atlas of vascular plant and bryophyte distributions at a 10 km resolution. 2) Environmental and climatic variables: Layers of bioclimatic, edaphic, hydrological, and solar radiation data at 250 m resolution. 3) Species distribution models (SDMs) were developed using a spatially nested hierarchical modeling approach with the sabinaNSDM R package, providing robust predictions of species distributions. 4) Thematic conservation maps: Including biodiversity estimates, forest connectivity networks, and vegetation type distributions under current and future climate scenarios (2070–2100). The geoportal also provides interactive tools for data exploration and downloading, enabling standardized and reproducible use of ecological data.

Results and discussion: The geoSABINA geoportal provides access to high-quality, openly accessible datasets hosted on Zenodo, ensuring stability and scalability for future updates. By integrating diverse data layers into a user-friendly platform, the geoportal addresses critical gaps in ecological research and management tools. It enables users to seamlessly analyze biodiversity patterns, model species distributions, and plan restoration and conservation initiatives. The standardized datasets improve reproducibility and interoperability, promoting effective decision-making in biodiversity conservation and forest management under current and future climate scenarios.

[TSF.2-O-6]

Tuesday 3, morning (second): 14:00
Room: Restaurante

Comparative assessment of freshwater biodiversity in the Los Morales reservoir (Madrid) using eDNA collected from sponges and water filtration

Corral Lou, Andrea[1]; Gallego, Ramon[2]; Alcaraz, Lourdes[3]; Bergamo, Gilberto[4]; Conejero, Maria[5]; Diez-Vives, Cristina[6]; Lorente-Sorolla, Jose[7]; Hill, April[8]; Mathias, Avery[9]; Ramón-Laca, Ana[10]; Taboada, Sergio[11]; Riesgo, Ana[12]

(1) Museo Nacional de Ciencias Naturales, CSIC, Madrid; (2) Universidad Autónoma de Madrid; (3) MNCN-CSIC; (4) MNCN-CSIC; (5) MNCN-CSIC; (6) MNCN-CSIC; (7) MNCN-CSIC; (8) Bates College, United States; (9) Bates College, United States; (10) MNCN-CSIC; (11) MNCN-CSIC; (12) MNCN-CSIC

Correspondence e-mail: [ancoralou@gmail.com]

Biodiversity loss is occurring at a faster rate in freshwater ecosystems than in marine or terrestrial ones. Developing tools for biodiversity monitoring in freshwater ecosystems is crucial to addressing conservation policies. Environmental DNA (eDNA) can serve as a key tool for environmental management by providing valuable information about ecosystem biodiversity. The use of sponges as natural eDNA collectors has emerged as an innovative approach, showing promising results. Although this method was initially developed for marine ecosystems, it is expected to be applicable to freshwater environments. The main goal of this study was to evaluate the effectiveness of the freshwater sponge Ephydatia muelleri as a natural eDNA collector in freshwater ecosystems. To achieve this, we used metabarcoding techniques targeting a mitochondrial cytochrome c oxidase region on tissue samples from E. muelleri (with and without host-specific blocking primers) and water filter samples from the Morales Reservoir in Madrid, Spain. Preliminary results indicate congruence among methods (filter and tissue), though some differences were observed in the recovered phyla in tissue samples, with a greater number of taxonomic groups identified when host blocking primers were used. A more detailed analysis is expected to clarify the factors contributing to these differences, enabling future improvements in the development of such studies.

TSF.2. Posters

[TSF.2-P-1]

Thursday 5
Discussion corner: Room 12

Terrestrial habitats mapping: improvement of lotic habitat cartography at the state level

Martínez-Megías, Claudia[1]; Mariscal-García, Bárbara[2]; Nieto-Mira, Andrea[3]; Velázquez, Juan Carlos[4]; Aguirre-Sierra, Arantxa[5]; Barberán, Diego[6]; Moreno, Cristina[7]; Ruiz, Blanca[8]

(1) Tragsatec; (2) Tragsatec; (3) Tragsatec; (4) Tragsatec; (5) Tragsatec; (6) Tragsatec; (7) MITECO; (8) MITECO

Correspondence e-mail: [clauecomm@gmail.com]

Lotic ecosystems provide a wide range of habitats and ecosystem services. However, their biodiversity is in a continuous decline. To date there is a lack of unified and homogeneous cartography of lotic habitats. This work aims to develop a homogeneous, consistent and harmonized framework to support the monitoring of conservation status in alignment with European and national guidelines. The specific objectives are to apply two thematic legends: the EUNIS-based Spanish Habitat Checklist and Habitats of Community Interest from EU Habitats Directive. These tasks are part of the project "Terrestrial habitats mapping: improvement of territorial information at a national scale", funded by the Ministry for Ecological Transition and Demographic Challenge (MITECO). The project is coordinated in different terrestrial habitat groups, with this work focusing on mapping lotic habitats in Spain. The methodology started from an initial cartographic source provided by the Directorate General of Water. The assignment of legends included the use of regional and national mapping as references, in addition to hydrological databases to serve as decision tree base such as the Water Quality and Status Information Systems. A key limitation lies in the use of linear rather than polygonal mapping which, results in an initial lack of surface data in the baseline cartography. The final product aims to include a national map with the location and occupied surface data of both Habitat of Community Interest and Habitat Checklist at a national scale.

[TSF.2-P-2]

Tuesday 3
Discussion corner: Room 12

Analysis of the Mediterranean oak forests resilience to extreme climate change events in Andalucía (Spain)

Velasco Rodríguez, Antonio[1]; Arenas Castro, Salvador[2]; Benítez Humanes, Juan[3]; Salazar Zarzosa, Pablo[4]; Villar Montero, Rafael[53]

(1) University of Córdoba; (2) Universidad de Córdoba; (3) Universidad de Córdoba; (4) Universidad de Córdoba; (5) Universidad de Córdoba

Correspondence e-mail: [a62veroa@uco.es]

Mediterranean oak forests (MOFs) are a critical ecosystem in southern Europe, particularly in Andalusia (Spain), where they occupy nearly half the region. Over recent decades, climate change has significantly impacted MOF health and productivity. This study evaluates the drought response and resilience of holm oak (Quercus ilex) MOFs—categorized as open woodlands, intermediate, and dense forests across Andalusia during extreme drought events from 2001 to 2023. Using satellite data processed in Google Earth Engine, interannual spectral indices (EVI, NDVI, NDWI, and VHI) were analyzed for 1180 MOF plots from the National Forest Inventory to calculate resilience indicators: resistance (Res) and recovery (Rec). Results demonstrate a trade-off between drought resistance and recovery, with distinct adaptive strategies observed across the climatic gradient in this region. These findings underline the elevated vulnerability of MOFs to droughts over the last two decades and highlight the importance of further research into long-term resilience mechanisms.

TSF.3. Quantitative ecology: modelling of populations and species distributions

Thursday, 5 (11:00-12:30)

Room: Seminario 3

In the era of global change and big data, there is a growing demand among practicing ecologists and managers to interpret ever larger and more complex data sets to study and predict responses of wildlife populations and species distributions. The development, testing and application of advanced statistical tools for analysing ecological data is an active area of work and a wide range of ecological models are currently available. Modern developments include, among other things, methods to account for the observation process, the inclusion of different ecological mechanisms and the integration of disparate types of data.

The objective of this session is to share advances in population and species distribution modelling. The session aims to cover interesting applications of modern modelling tools, as well as possible methodological developments. Contributions for this session may cover a variety of methodologies (such as hierarchical occupancy models, capture-recapture models, individual-based models, etc). Both junior and senior researchers are encouraged to contribute with studies where ecological modelling is applied to infer and/or predict effects of environmental (climate change, habitat changes, anthropogenic disturbances, etc.) or intrinsic factors (species interactions, functional traits, etc.) on populations or distributions.

Organizers:

• **María Victoria Jiménez Franco,** Departamento de Biología Aplicada. Centro de Investigación e Innovación Agroalimentaria y Agroambiental (CIAGRO-UMH). Universidad Miguel Hernández de Elche

• **Gurutzeta Guillera Arroita,** Instituto Pirenaico de Ecología (CSIC), Jaca

TSF.3. Orals

[TSF.3-O-1]

Thursday 5, morning (first): 11:00
Room: Seminario 3

Is biodiversity declining? Or fluctuations reflect natural variability? A decade of monitoring pollinator dynamics

de Aledo, Julia G.[1]; Bartomeus, Ignasi[2]

(1) Estación Biológica de Doñana; (2) Estación Biológica de Doñana

Correspondence e-mail: [juliagdealedo@gmail.com]

Introduction: Biodiversity is changing as a result of anthropogenic influences including climate change, habitat loss, and agricultural intensification. How these changes manifest remains complex. Time-series analyses reveal not only biodiversity loss but also species homogenization and fluctuating population dynamics. However, existing models often focus on decade-scale responses of vertebrates, leaving a gap in understanding fast-lived insect population dynamics, with often shorter time series available. While pollinators are key in providing ecosystem services, supporting ~85% of wild flowering plant species, detecting and interpreting biodiversity changes remains a challenge. We aim to analyze temporal changes in pollinator alpha and beta diversity, abundance trends, and shifts in community structure and propose a framework to disentangle when the observed decline trends are compatible with stable populations.

Material and methods: In this context, we present preliminary results from a 10-year monitoring project in the Parque Nacional de Doñana (Spain), where pollinator-plant interactions have been recorded. From 2015 to 2024 we documented 12 sites, 322 pollinator species (bees, syrphids, beetles, butterflies) from 48 families, interacting with 92 plant species. A total of 41,500 visits were recorded, providing a unique temporal dataset. Based on species abundance trends, we developed a null model to compare when the observed trend are compatible with r stable species populations.

Results and discussion: Species richness shows no directional pattern over the 10 years period. In contrast, species -specific responses are more nuanced. However, we show that species-specific short-term negative biodiversity trends are often compatible with the natural fluctuations of a stable population. We provide a framework that allows to get insights into short-term monitoring of pollinator population dynamics, which are characterized by exhibiting rapid, context-dependent fluctuations, and highlight the importance of long-term data for predicting declines and guiding biodiversity conservation strategies.

[TSF.3-O-2]

Thursday 5, morning (first): 11:15
Room: Seminario 3

Ecological Drivers of Mosquito-Borne Disease Risk in Human-Impacted Wetlands

Rodríguez Grabalosa, Júlia[1]; Mariani, Simone[2]; Cerecedo Iglesias, Catuxa[3]; Richter Boix, Alex[4]; Bartumeus Ferré, Frederic[5]

(1) CEAB-CSIC; (2) CEAB-CSIC; (3) CEAB-CSIC; (4) CEAB-CSIC; (5) CEAB-CSIC

Correspondence e-mail: [julia.rodriguez@ceab.csic.es]

Introduction. The rising incidence and spread of mosquito-borne diseases poses an increasing public health challenge worldwide. However, local-scale interactions among vectors, hosts, and the environment remain poorly understood. Here, we assess mosquito-borne disease transmission risk in Mediterranean humanized wetlands, examining mosquito vectors, avian hosts for West Nile Virus (WNV), and human hosts for dengue, Zika, and chikungunya.

Materials and Methods. The study was conducted in the Parc Natural dels Aiguamolls de l'Empordà, leveraging 20 years of mosquito trapping data, avian species distribution data from regional atlases, and meteorological records. Predictive models for mosquito populations incorporated climatic and land cover variables. Avian host competence for WNV was estimated using experimental infection data and integrated with species abundance to assess potential transmission risk. A combined WNV risk index was developed by overlaying mosquito abundance predictions and avian reservoir species distributions.

Results and Discussion. Mosquito activity peaked between June and October. Aedes albopictus was predominant in urban areas, while Culex species were more prevalent in rural and natural environments. The spatial patterns of avian host communities influenced the potential amplification and dilution of the WNV enzootic cycle. High-risk areas for WNV circulation were identified near urban edges, particularly adjacent to rice fields and wetlands where mosquitoes and reservoir hosts overlapped. These findings emphasize the importance of targeted mosquito surveillance and mitigation strategies in both urban centers and surrounding rural landscapes to effectively reduce the risk of mosquito-borne diseases.

[TSF.3-O-3]

Thursday 5, morning (first): 11:30
Room: Seminario 3

Polygonal-shaped patterns in ecological data are common and significant

Villén-Pérez, Sara[1]; Alves-Martins, Fernanda[2]; Morales-Barbero, Jennifer[3]; Palomino, David[4]; Grajera-Antolín, Cristina[5]; De Marco, Paulo[6]; Andivia, Enrique[7]; Astigarraga, Julen[8]; Cruz-Alonso, Verónica[9]; Ruiz-Benito, Paloma[10]; Morales-Castilla, Ignacio[11]

(1) Universidad de Alcalá; (2) University of Porto; (3) Universidad Autónoma de Madrid; (4) Universidad de Alcalá; (5) Universidad de Alcalá; (6) Universidade Federal de Goiás; (7) Universidad Complutense de Madrid; (8) Universidad de Alcalá; (9) Universidad Complutense de Madrid; (10) Universidad de Alcalá; (11) Universidad de Alcalá

Correspondence e-mail: [sara.villen@uah.es]

Introduction: Understanding which ecological factors limit performance and therefore species distributions is a fundamental goal of ecology and biogeography. However, most efforts fail to answer this essential question: while nearly all studies assess whether species abundance relates to the environment, the key point is whether the environment imposes a limitation on species abundance. This fundamental debate relates to the Law of the Minimum, which establishes that species performance is limited by a single environmental factor at each location and time. A prediction of this Law is that the relationship between species abundance and a single environmental factor will show a polygonal-shaped pattern, with points scattered from zero to an upper boundary.

Material and methods: We assess the incidence of polygonal-shaped patterns in different taxa and regions and explore several applications of their analysis using quantile regressions.

Results and discussion: Our team demonstrated that polygonal-shaped patterns are pervasive across ca. 400 species of plants, trees and birds in Europe and US. However, we also found that they have been consistently understudied. We will show their utility in modelling environmental constraints on species performance, predicting the potential abundance of species under changing conditions, identifying limiting factors acting at specific locations, or estimating the fundamental niche of species. In addition, we will present an opportunity for collaboration supported by a novel function that identifies polygon-shaped patterns in ecological data and aimed to further map the commonness of polygonal patterns in biodiversity worldwide.

[TSF.3-O-4]

Thursday 5, morning (first): 11:45
Room: Seminario 3

Rethinking the role of spatially structured random effects in species distribution models

Fernández-López, Javier[1]; Acevedo, Pelayo[2]; Tellería, José Luis[3]; Guillera-Arroita, Gurutzeta[4]

(1) IREC Institute for Game and Wildlife Research; (2) IREC Institute for Game and Wildlife Research; (3) Universidad Complutense de Madrid; (4) Pyrenean Institute of Ecology / University of Melbourne

Correspondence e-mail: [Javier.FLopez@uclm.es]

Correlative species distribution models (SDMs) are widely used by ecologists to explain and predict species distributions by combining species occurrence or abundance data with environmental predictors. Recently, the inclusion of spatially structured random effects is becoming increasingly common due to advances in statistical software and computational methods. This approach addresses unmodeled heterogeneity but shifts the classical SDM paradigm, as species distribution is not only characterized as a function of environmental predictors but also through a purely spatial component.

In this research, we assessed the role of spatially structured random effects in SDMs and their impact on ecological inferences. We conducted a simulation study where species distribution was modeled using a known predictor, while spatially structured random effects were incorporated to address unmodeled heterogeneity via INLA R package and SPDE approach. Additionally, we presented a case study modeling the relative abundance of two Passerine species in the Iberian Peninsula.

Our simulations showed that spatial random effects effectively accounted for unmodeled heterogeneity, improving model fit and yielding more reliable spatial predictions. However, this approach also increased uncertainty in parameter estimates for the known predictor, diluting its effect. Similarly, in the case study, fixed effects of predictors were partially masked by spatial random effects for both species.

These findings suggest that while this powerful methodology enhances predictive accuracy in some contexts, it may limit the ecological understanding that can be derived from the models, highlighting the need to carefully consider its application depending on the study's objectives.

[TSF.3-O-5]

Thursday 5, morning (first): 12:00
Room: Seminario 3

Comparison of occupancy predictions from dynamic vs static multi-season occupancy models

Cervantes Peralta, Francisco[1]; Guillera Arroita, Gurutzeta[2]

(1) Institudo Pirenaico de Ecología; (2) Instituto Pirenaico de Ecología

Correspondence e-mail: [pcervantes@ipe.csic.es]

Introduction: Monitoring changes in species distributions helps us understand changes in the environment and how these affect biodiversity. Occupancy models are used to analyse detection/nodetection data and estimate the probability of a species being present at a number of sites, while accounting for the detectability of the species. Multi-season models are a convenient extension that allow the simultaneous analysis of multiple periods with different occurrence probabilities. Different formulations for these models have been proposed and it is not always clear what are the implications of choosing one model over another.

Methods: To test whether different model formulations result in equivalent results, we fitted two types of multi-season models to detection/no-detection data of four Spanish bird species with low detection rates spanning 25 years. We fitted 1) dynamic occupancy models that mechanistically estimate occupancy through persistence and colonization processes, and 2) static multi-season occupancy models that estimate occupancy directly without process-based transitions. We fitted these models with and without temporal random effects. We also used simulations where the true occupancy is known, to complement our findings from the real data.

Results and discussion: We found that although both types of models sometimes separated the occupancy and the observation processes differently, the results were more sensitive to the temporal structure of the random effects than they were to the choice of static vs dynamic models. We provide some model design considerations to use multi-season models when interested in occupancy predictions, and not in colonization and extinction processes.

[TSF.3-O-6]

Thursday 5, morning (first): 12:15
Room: Seminario 3

Occupancy modeling for wild ungulates from camera traps at National scale

Illanas, Sonia[1]; Fernández-López, Javier[2]; Vicente, Joaquín[3]; Acevedo, Pelayo[4]; Zipkin, Elise[5]

(1) Institute for Game and Wildlife Species, IREC (CSIC-UCLM.JCCM); (2) Institute for Game and Wildlife Species, IREC (CSIC-UCLM.JCCM); (3) Institute for Game and Wildlife Species, IREC (CSIC-UCLM.JCCM); (4) Institute for Game and Wildlife Species, IREC (CSIC-UCLM.JCCM); (5) Department of IBIO; Ecology, Evolution, and Behavior Program, Michigan State University, USA

Correspondence e-mail: [sonia.illanas@uclm.es]

The lack of national and European monitoring programs hinders reliable species tracking, despite its importance for assessing sustainability and biodiversity changes. Hunting yields are the only data source available at large scales and often used as a proxy of abundance. To improve population monitoring in Spain, a network of 30 observatories were established in 2023, each equipped with an average of 27 camera traps.

The aim of this work is to model occupancy of wild ungulates at national level using a camera trap network and compare if the spatial predictions are equivalent to the patterns shown by hunting yields statistics.

Camera traps (714 sites) recorded 8 big game species which were classified as detected (1) or non-detected (0) and grouped into weeks (sampling occasions) to avoid temporal correlation. The total number of detections across all species were 5613. Sampling occasions varied between camera sites and observatories, and only the weeks during which a camera was active were considered as sampling occasions. We modeled species occupancy considering imperfect detection under a Bayesian framework with nimble package in R.

The predictive occupancy patterns of some study species revealed similar spatial patterns as hunting yields models. This study represents an initial approach to use of camera traps for modeling wild ungulates occupancy at national level in Spain. Moreover, it serves as a first step towards integrating both data sources (camera traps and hunting yields) in the future, which will enhance the understanding of latent processes behind of species abundance patterns.

TSF.3. Posters

[TSF.3-P-1]

Wednesday 4
Discussion corner: Room 12

Congruence between species abundance and genetic diversity across epiphytic coleoptera families in the NW of the Iberian Peninsula

Gómez-Rodríguez, Carola[1]; Baselga, Andrés[2]

(1) Universidade De Santiago de Compostela; (2) Universidade De Santiago de Compostela

Correspondence e-mail: [carola.gomez@usc.es]

The fundamental processes structuring biological diversity can be inferred from the analysis of communities at multiple levels of organization, from the genetic to species level. Such Unified Models of Biological Diversity have been used to evidence that the stability of biological communities can be inferred from the congruence between the Species Abundance Distribution (SADs) and the Genetic Diversity Distribution (SGDs). This observation aligns with the theoretical framework proposed by Overcast et al. (2023), which predicts high congruence (i.e. the most abundant species are also the most genetically diverse) when communities are older. In this study, we tested this prediction using the community of epiphytic beetles in the Dunes of Corrubedo Natural Park (Galicia, Spain). The relative abundance and nucleotide diversity (based on the cox1-5' marker) was estimated for each beetle species using intensively collected data (ca. 8000 specimens) over three years (2015, 2016 and 2017). The congruence between SADs and SGDs accounted for the position of each species in each of the statistical distributions. In these distributions, species are ordered from highest to lowest abundance or genetic diversity as appropriate (ranked abundance distribution, RAD) and therefore inform whether are relatively frequent/diverse or not in the community. Analyses were conducted independently for each beetle family (e.g. Chrysomelidae, Coccinellidae, Curculionidae, Oedemeridae). Marked differences were observed among beetle families, suggesting that the stability of the community largely depended on the traits of the particular beetle family.

Reference: Overcast I et al. (2023). Global Ecology and Biogeography 32, 4-23 https://doi.org/10.1111/geb.13604

[TSF.3-P-2]

Thursday 5
Discussion corner: Room 12

Identifying practical model selection strategies for dynamic occupancy models

Guillera Arroita, Gurutzeta[1]; Kelleher, Saoirse[2]; Briscoe, Natalie[3]; Elith, Jane[4]

(1) Instituto Pirenaico de Ecología - CSIC; (2) University of Melbourne; (3) University of Melbourne; (4) University of Melbourne

Correspondence e-mail: [gguillera@ipe.csic.es]

Dynamic occupancy models (DOMs) are an important tool for analysing patterns of species occupancy across space and time. By explicitly describing occupancy change as a function of local extinction and colonization processes, DOMs can overcome limitations of static models that focus on modelling patterns. However, despite their potential, DOMs are not yet widely used to support conservation and management decisions. This is partly due to methodological aspects that require development. For instance, identifying efficient model selection approaches will help increase DOMs practical utility. As DOMs involve several processes all potentially related to predictors, the pool of candidate models can be large and previous research suggests that some strategies for model selection simplification can limit DOMs performance.

Here we explore in detail how differences in model selection strategy may change DOMs performance. As a case study, we use a long-term Swiss breeding bird survey. We apply a suite of covariate selection workflows to a set of focal species, recording their computational demands, and examine how the models selected vary in their estimates of covariate importance, their temporal predictive performance and their predictions of occupancy at new sites.

Our findings reflect previous research on covariate selection in hierarchical models: while model fit and predictive performance between alternative approaches can often be similar, the covariates selected and the magnitude of estimated relationships can vary between methods. Some strategies are much more computationally demanding that others, and reducing the pool of covariates can be a key limitation in model performance.

[TSF.3-P-3]

Tuesday 3
Discussion corner: Room 12

Novel regimes of extreme climatic events trigger negative population rates in a common insect

Vives-Ingla, Maria[1]; Capdevila, Pol[2]; Clements, Christopher F.[3]; Stefanescu, Constantí[4]; Carnicer, Jofre[5]

(1) CREAF; (2) Universitat de Barcelona; (3) University of Bristol; (4) Museu de Ciències Naturals de Granollers; (5) Universitat de Barcelona)

Correspondence e-mail: [m.vives@creaf.uab.cat]

The IPCC predicts that events at the extreme tail of the probability distribution will increase at a higher rate relative to less severe but still abnormal events. Such outlier events are called low-likelihood high-impact events (LLHI) and are of particular concern due to the nonlinear physiological and population responses they might trigger over the next decades. Because such events are historically rare, forecasting how biodiversity will respond requires mechanistic models that integrate the fundamental processes driving biological responses to our changing climate.

Here we built a matrix population model (MPM) from long-term monitored Mediterranean populations of a well-known insect. The model simultaneously integrates the effects of extreme microclimatic heat exposure and drought-induced host-plant scarcity on early life stages, a key methodological step forward because these understudied stages are usually very susceptible to climatic events.

This model for the first time allowed us to forecast the demographic impacts that LLHI events will have on a currently abundant species considering their whole life cycle. We found that juveniles were the life stage with the largest relative contribution to population dynamics. Simulated population rates in current climatic regimes were importantly determined by drought impacts, producing a regional mosaic of non-declining and declining populations. The simulations also indicated that, in future climate scenarios, LLHI heat extremes will trigger regionally-widespread and severe declines in this model species. Our results suggest that LLHI events could emerge as a critical new — but overlooked — driver of the declines in insect populations, risking the crucial ecosystem functions they perform.

[TSF.3-P-4]

Wednesday 4
Discussion corner: Room 12

Catch dynamics and hyperstability in an exploited stalked barnacle stock with the use of depletion models

Gómez-del Campo, Víctor[1]; González-Gil, Ricardo[2]; Gutiérrez-Basterrechea, Carmen[3]; Guardado, Carlos[4]; Roa-Ureta, Rubén[5]; Acuña, José Luis[6]

(1) Universidad de Oviedo; (2) Observatorio Marino de Asturias; (3) Rula de Avilés; (4) Observatorio Marino de Asturias; (5) Independent consultant; (6) Observatorio Marino de Asturias

Correspondence e-mail: [gomezvictor@uniovi.es]

Stalked barnacles support a high value, small-scale fishery along the Western Asturian Coast (N Spain). It is divided into eight contiguous coastal zones, each co-managed independently according to Territorial Use Rights for Fishers (TURF). Despite its importance, the stock has never been formally assessed, although precautionary closures have been implemented in two TURFS due to symptoms of stock decline.

We have built a database of weekly catch, effort, and weight data using fish auction records and biological sampling to apply intra-annual generalized depletion models to a single fishing season (2021/2022) for each of the eight TURFs.

Our analysis identified two immigration pulses: one in early autumn, consistent with the recruitment of harvestable individuals settled during the previous year, and another during the Christmas period, associated with the opening of the highest-quality fishing grounds. Mortality estimates had a median of 0.0049 week-1 among TURFs, in accordance with the life history of a long-lived species. Results showed that catches for all TURFs were proportional to effort but hyperstable to barnacle abundance (i.e., catch remains stable even as abundance declines). This hyperstability can be explained by fishers adjusting their fishing trips to the perceived state of the resource, leading to nearly stationary Catch Per Unit Effort (CPUE). Under such conditions, management based on CPUE trends is unreliable, as stable CPUE may mask a declining population trend. This research demonstrates that elementary fisheries data from a single season can provide valuable insights into populations dynamics and status definition.

[TSF.3-P-5]

Thursday 5
Discussion corner: Room 12

Modelling the area of occupancy of habitat types at different successional stages

González Le Barbier, Jorge[1]; Roces-Díaz, Jose V.[2]; Jimenez-Alfaro, Borja[3]

(1) IMIB (University of Oviedo - CSIC - Principality of Asturias); (2) IMIB (University of Oviedo - CSIC - Principality of Asturias); (3) IMIB (University of Oviedo - CSIC - Principality of Asturias)

Correspondence e-mail: [j.gonzalez.leb@gmail.com]

Understanding the distribution of ecosystem types in large and meaningful geographical areas is necessary for addressing global targets of biodiversity conservation. Using occurrence data for modelling the potential Area of Occupancy (pAOO) could be a useful method to produce high resolution maps of ecosystem extents, which can have different applications on management and conservation. However, the performance of ecosystem-based models of the pAOO across habitats has not been evaluated yet.

In this study, we use a vegetation database containing vegetation inventories related to the EUNIS habitat classification to model the pAOO of sixty-three habitat types (including forests, shrublands and grasslands) in the Ibero-Atlantic biogeographic region of SW Europe. Our main aims were to evaluate (1) model performance across habitat types and modelling techniques, (2) the role of climatic and edaphic drivers in the distribution of habitat types, and (3) how pAOO models can indicate the relationships between early- and late-successional habitats.

Model performance was in general good, with machine-learning methods (RF and GBM) outperforming regression-based ones (GLM and GAM). Minimum temperature of the coldest month was in general the most important driver. We also found meaningful correlations of pAOO between habitat types which are linked in successional stages.

Our results indicate that modelling the pAOO of habitat types in entire regions is useful to understand their spatial patterns and to test hypotheses about their drivers. These models may differ when applied to early- or late-successional habitats. The resulting maps are useful for ecosystem red listing and for setting biogeographical borders.

TSF.4. Do-it-yourself (DIY) open source tools and projects in ecology

Thursday, 5 (12:45-14:15)

Room: Seminario 3

Developing novel technologies and custom-made equipment, often referred to as “do-it-yourself,” (DIY) has a long history in science. However, inadequate communication among researchers leads to fragmented efforts hindering the widespread adoption of these valuable innovations. Our goal is to present successful open-source DIY projects and tools developed by the Iberian Ecology community, as they contribute to democratize science and enable research that might otherwise be limited by trade secret and budget constraints.

Our objectives include i) demonstrating the benefits of DIY and open-source tools in terms of adaptability, creativity, and cost saving, ii) assessing the needs of Iberian ecologists to advance these technologies and ideally create a network dedicated to this field, and iii) challenging the misconception that using these tools requires advanced technological expertise, promoting accessibility and inclusivity.

To do so, we propose a combination of a poster session and a workshop.

- The theoretical session will consist on a poster session of relevant open-source or DIY tools (hardware and software) developed by Iberian ecologists, followed by a roundtable with specialized researchers on this topic.
- The workshop-like session will be a hands-on tests of several of these tools, enabling researchers to test potential useful tools for their projects.

Organizers:

- **María Leo,** Instituto de Ciencias Agrarias (ICA-CSIC)
- **Ángel Lareo,** Universidad Autónoma de Madrid (UAM)
- **Lluis Gómez Gener,** Centre de Recerca Ecològica i Aplicacions Forestals (CREAF).

TSF.4. Orals

[TSF.4-O-1]

Thursday 5, morning (second): 12:45
Room: Seminario 3

Specifind: Extracting Occurrences from Scientific Literature Using NLP Techniques

Golomb Durán, Tomás[1]; Díaz Lorca, Anna[2]; Barroso Lucena, María del Puerto[3]; Far, Antoni Josep[4]; Roldán Pérez, Alejandro[5]; Cancellario, Tommaso[6]

(1) Centre Balear de Biodiversitat - Universitat de les Illes Balears; (2) Centre Balear de Biodiversitat - Universitat de les Illes Balears; (3) Centre Balear de Biodiversitat - Universitat de les Illes Balears; (4) Centre Balear de Biodiversitat - Universitat de les Illes Balears; (5) Centre Balear de Biodiversitat - Universitat de les Illes Balears; (6) Centre Balear de Biodiversitat - Universitat de les Illes Balears

Correspondence e-mail: [tomas.golomb@uib.cat]

In scientific literature, a vast amount of valuable information about species occurrences remains scattered throughout the vast and continually growing corpus of unstructured ecological texts written in natural language. This information is crucial for gaining deeper insights into the distribution and ecology of species. By harnessing this knowledge, we can implement more effective conservation measures and enhance our understanding of biodiversity. Specifind is a new Python package specifically designed to identify scientific species nomenclature and geographic locations while simultaneously searching for relationships between these two types of entities that could result in effective occurrences. The package utilizes two named entity recognition (NER) models trained with a newly generated and annotated dataset comprising over a thousand open-access abstracts spanning five distinct categories to maximize coverage and diversity: biogeography, botany, entomology, mycology, and zoology. The annotations were performed manually by qualified biology experts ensuring both domain-specific relevance and high-quality training data. With the rising of Large Language Models and the new transformers architecture, we opted to use these techniques, which incorporates dynamic attention mechanisms and contextual embeddings within SpaCy's pipeline, enabling robust performance in identifying species names and geographic entities. While we employed a coreference resolution model to identify cross-sentence relationships, enabling the linking of species and locations even when mentioned in separate sentences. Specifind serves as a valuable resource for bridging the distribution knowledge gap and so advancing biodiversity research, informing conservation strategies, and facilitating a deeper understanding of species distribution and ecology.

[TSF.4-O-2]

Thursday 5, morning (second): 13:00
Room: Seminario 3

A new Comprehensive Platform for Biodiversity Data Integration and Research

Roldán Pérez, Alejandro[1]; Golomb Durán, Tomás[2]; Cancellario, Tommaso[3]; Far, Antoni Josep[4]; Arboleda, Enrique[5]; Capa Corrales, María[6]

(1) Baleric Biodiversity Center - Universitat de les Illes Balears; (2) Baleric Biodiversity Center - Universitat de les Illes Balears; (3) Baleric Biodiversity Center - Universitat de les Illes Balears; (4) Baleric Biodiversity Center - Universitat de les Illes Balears; (5) Baleric Biodiversity Center - Universitat de les Illes Balears; (6) Baleric Biodiversity Center - Universitat de les Illes Balears

Correspondence e-mail: [alejandro.roldan@uib.cat]

Developed by the Balearic Biodiversity Center – Universitat de les Illes Balears, the platform is an advanced public database designed to host diverse types of biological data, streamlining their search and promoting efficient sharing. By integrating data from various public repositories—including field observations, museum records, genetic data, and records retrieved from scientific and grey literature—this platform provides a comprehensive view of the biodiversity in the Balearic Islands. This integrated approach helps in identifying knowledge gaps in taxonomic, genetic, and species distribution, which is crucial for prioritizing research efforts, preserving ecosystem dynamics and biological community. Furthermore, the system incorporates ecological and legislative information labelling to aid public administrations in developing management plans. The platform utilizes a relational database and follows the Darwin-Core standardization protocol, ensuring interoperability. A user-friendly interface and API system facilitate data exploration and download for both the general public and researchers. This platform provides access to standardized curated taxonomic data, being able to navigate through the taxonomic tree with agility, as well as to download it. Additionally, it features an advanced map view for displaying species occurrences, with options to filter them by specific geographic levels. The platform also includes a genetic section, allowing users to view and download genetic markers for species of the Balearic Islands, whether the samples were collected locally or globally. Finally, it is worth mentioning that, although the platform was developed for the Balearic Islands, it can be adapted to other geographic scales, making it a valuable tool for biodiversity research worldwide.

[TSF.4-O-3]

Thursday 5, morning (second): 13:15
Room: Seminario 3

Biodumpy: A new Python package to download comprehensive biological data

Cancellario, Tommaso[1]; Golomb Durán, Tomás[2]; Far, Antoni[3]; Roldán Pérez, Alejandro[4]; Capa Corrales, María[5]

(1) Balearic Biodiversity Centre - Universitat de les Illes Balears; (2) Balearic Biodiversity Centre - Universitat de les Illes Balears; (3) Balearic Biodiversity Centre - Universitat de les Illes Balears; (4) Balearic Biodiversity Centre - Universitat de les Illes Balears; (5) Balearic Biodiversity Centre - Universitat de les Illes Balears

Correspondence e-mail: [t.cancellario@uib.eu]

In recent years, the scientific community has witnessed a significant expansion of public biodiversity platforms and associated datasets. Advances in research, institutional initiatives, increasing data storage capacities and powerful computational resources have greatly enhanced access to ecological and biological data, spanning vast geographic areas, extended time frames, and diverse taxonomic groups. These resources are now indispensable for ecological studies, enabling scientists to conduct more comprehensive analyses and test new hypotheses previously unattainable due to limited data availability, along with multiple issues such as data quality, time consumption, and source heterogeneity. Alongside this growth, there has been a rise in programming packages that simplify data access and interaction, streamlining data retrieval. However, most of these tools are restricted to individual databases, creating challenges for researchers who need to integrate data seamlessly from multiple sources. To address this limitation, we introduce biodumpy, a new Python package designed to streamline the retrieval, management, and integration of biological data from multiple public databases. biodumpy provides access to up-to-date and comprehensive datasets spanning genetic (e.g., NCBI and BOLD), distributional (e.g., GBIF and OBIS), taxonomic (e.g., Catalogue of life), and bibliographic sources (e.g., Crossref). The package features specialized modules for efficient data retrieval for specified taxa, with the capability to process multiple modules simultaneously. We believe that biodumpy will significantly enhance data acquisition by combining diverse datasets, providing researchers with a robust foundation for comprehensive analyses and supporting ecological research to address complex environmental challenges.

[TSF.4-O-4]

Thursday 5, morning (second): 13:30
Room: Seminario 3

Unravelling the temporal variability of diazotrophy in dynamic upwelling bays

Ferández Román, Daniel[1]; Fontela, Marcos[2]; Broullón, Esperanza[3]; Varela, Marta M.[4]; Farnelid, Hanna[5]; Fernández Carrera, Ana[6]; Fernández Castro, Bieito[7]; Martínez, Sandra[8]; Rodríguez Ramos, Tamara[9]; Mouriño-Carballido, Beatriz[10]

(1) Centro de Investigación Mariña, Universidade de Vigo (CIM-UVIGO); (2) Instituto de Investigacións Mariñas (IIM), Vigo, SPAIN.; (3) Ocean and Earth Science, National Oceanography Centre, University of Southampton, Southampton, UK.; (4) Centro Nacional Instituto Español de Oceanografía, (IEO-CSIC); (5) Centre for Ecology and Evolution in Microbial model Systems, Linnaeus University, Kalmar, SWEDEN; (6) Instituto de Oceanografía y Cambio Global, Universidad de Las Palmas de Gran Canaria (ULPGC); (7) Ocean and Earth Science, National Oceanography Centre, University of Southampton, Southampton, UK.; (8) Centro de Investigación Mariña, Universidade de Vigo (CIM-UVIGO); (9) Centro Nacional Instituto Español de Oceanografía, (IEO-CSIC); (10) Centro de Investigación Mariña, Universidade de Vigo (CIM-UVIGO)

Correspondence e-mail: [daniel.fernandez.roman@uvigo.gal]

Diazotrophs—microbes capable of fertilizing the ocean through biological dinitrogen fixation (BNF)—are enigmatically active in eutrophic regions, where they are known to respond to seasonal hydrodynamic forcing. However, their ability to respond to short-term variability remains largely underexplored. To assess diazotrophy across temporal scales, we used multidisciplinary observations collected in two dynamic upwelling bays of NW Iberia. Upwelling in these bays is seasonally-modulated but occurs as brief pulses driven by synoptic weather conditions typically lasting about three days. Diazotrophs showed significant seasonal variability, with higher BNF during summer and early autumn attributed to small cyanobacteria UCYN-A2, now considered as a nitroplast inside Braarudosphaera bigelowii. Wavelet spectral analysis revealed significant sub-seasonal variability (15-60 days) in abundance of the UCYN-A2 between June and August. During summer, variability in BNF rates and the abundance of UCYN-A2 were coupled in the short-term (days), responding to changes in upwelling fertilization. Notably, BNF rates peaked during relaxation-downwelling events, representing the main input of new nitrogen into the euphotic zone. In contrast, during fertilizing upwelling pulses, BNF and the abundance of UCYN-A2 sharply decreased. Periods of enhanced BNF rates co-occurred with high abundances of Hemialus haukii and Rhizosolenia sp., potential hosts of diatom diazotroph associations, suggesting that such symbiosis may play a crucial ecological role in the system. Our findings highlight that diazotrophs can respond rapidly to changes in the environment occurring over a few days. This short-term variability should be considered to fully understand the role of diazotrophs in the marine nitrogen cycle.

[TSF.4-O-5]

Thursday 5, morning (second): 13:45
Room: Seminario 3

Low-cost time-lapse camera system combined with automated image analysis to study the shallow-water Mediterranean sponge Aplysina aerophoba

Burgues Martinez, Itziar[1]; Stratmann, Tanja[2]; Jolles, Jolle[3]

(1) Universidad de Barcelona; (2) NIOZ; (3) CEAB-CSIC

Correspondence e-mail: [itziarburgues@gmail.com]

Sponges are key components of benthic marine ecosystems, driving nutrient cycling by transforming dissolved organic matter into particulate forms through the sponge-loop and detritus production. Although sponges are known to contract and actively move particles, the periodicity, drivers, and ecological consequences of these behaviours - particularly their role in detritus production - are not well understood. Studying sponge behavior in natural conditions entails the utilization of imaging technologies which are often costly and require high expertise. Despite the advances in marine video imaging, shallow-water environments have received little attention.

This work introduces a novel, low-cost time-lapse imaging system designed to observe slow biological processes such as sponge contractions under natural conditions. The system comprises a Raspberry Pi single-board computer, a Pi Camera Module, and a power source ensembled in an underwater housing easily deployable and custom recording scripts to enable image recording for extended periods. The open-source interactive machine learning tool, RootPainter, for rapid and automated image analysis is applied and tested on the images.

Combining time-lapse and automated image analysis, we provide new insights into contraction behaviour and detritus movement of the shallow water sponges and its potential ecological implications.

This work bridges technological innovation and ecological research questions, emphasizing the utility of open-source tools in marine ecology when budgets are limited. The methodology developed is affordable, adaptable, and easily replicable, offering significant opportunities to democratize marine and freshwater ecological research.

[TSF.4-O-6]

Thursday 5, morning (second): 14:00
Room: Seminario 3

Applications of the BtM, a Customizable Open-Source Datalogger, for Monitoring Long-Term water dynamics in Cryptogam Dynamics

Leo, María[1]; Lareo, Ángel[2]; Medina, Nagore G.[3]

(1) CSIC; (2) UAM; (3) UAM

Correspondence e-mail: [maria.leomontes@gmail.com]

The availability of open-source tools is key to replication, dissemination and advancement of scientific research. They have more affordable costs than commercial alternatives, which is particularly relevant in non-thriving areas. They also enable flexibility to align the tool to the research objectives. Finally, they provide more autonomy and independence in setting research agendas, free from external pressures.

We present here the the BtM, a low-cost open-source datalogger capable of monitoring ambient temperature, humidity, and conductance as a proxy of water status from up to eight samples simultaneously with minimal power consumption. The open-source nature of this device, with its accessible and well-described electronics and source code, makes it modifiable to satisfy the specific needs of different research groups.

Since its disclosure, the BtM has been successfully applied in diverse studies across several scales. These include laboratory set-ups, common garden experiments, and observational long-term monitorization studies in remote locations across Europe and the Antarctic. These studies had different approaches, from addressing the water content and the desiccation dynamics of nonvascular cryptogams, to microclimate studies across Europe and the Antarctic. The results provided here show the BtM's versatility and its potential to expand our knowledge in multiple ecological disciplines.

TSF.4. Posters

[TSF.4-P-1]

Tuesday 3
Discussion corner: Room 12

sabinaHSBM: An R package for link prediction and network reconstruction using Hierarchical Stochastic Block Models

Lima, Herlander[1]; Morales-Barbero, Jennifer[2]; Morales-Castilla, Ignacio[3]; G. Mateo, Rubén[4]; Rodríguez Fernández, Miguel Ángel[5]

(1) Universidad de Alcalá; (2) Universidad Autónoma de Madrid; (3) Universidad de Alcalá; (4) Universidad Autónoma de Madrid; (5) Universidad de Alcalá

Correspondence e-mail: [limaherlander@gmail.com]

Network analysis provides a powerful framework to understand complex ecological systems, such as predator-prey, host-parasite, or plant-pollinator relationships. However, ecological datasets often suffer from incompleteness and errors due to sampling limitations or taxonomic uncertainties, leading to missing and spurious links that hinder our understanding of these systems. The Hierarchical Stochastic Block Model (HSBM), offers a robust yet underexplored approach in ecology, for reconstructing networks from incomplete data. While HSBM is implemented in the Python graph-tool module, its use is not directly available to R users.

To address this gap, we present the sabinaHSBM R package, which integrates HSBM into a user-friendly workflow. The package simplifies network reconstruction into three steps: (1) preparing input data, (2) predicting link probabilities, and (3) reconstructing networks. It enables the reconstruction of bipartite species interaction networks, estimation of missing and spurious link probabilities, and inference of hierarchical community structures. Key features include built-in cross-validation for robust predictions, flexible thresholding methods, advanced evaluation metrics, and uncertainty quantification to assess link reliability.

By linking theoretical advancements with practical applications, sabinaHSBM empowers researchers to improve the accuracy of network analyses, supporting a deeper understanding of ecological systems, and addresses persistent gaps in biodiversity data quality.

[TSF.4-P-2]

Wednesday 4
Discussion corner: Room 12

How to measure CO2 fluxes in very shallow water sheets?

Warren Jiménez, Paula[1]; Ruiz Nieto, Miriam[2]; Moreno Ostos, Enrique[3]

(1) Universidad de Málaga; (2) Universidad de Málaga; (3) Universidad de Málaga

Correspondence e-mail: [paulawarren@uma.es]

Introduction. Very shallow wetlands, with a water sheet of only a few centimeters in depth (0.5-5 cm), could suppose a challenge to measure CO2 fluxes in the water-atmosphere interface with conventional soil or floating chambers. In our experience, soil chambers enclose water on their inside hindering the water exchange, while floating chambers get stranded in soil and the flux measurements are very turbulent. In this context, we designed a very simple and cost-effective chamber that solve this.

Material and methods. The cylindrical chamber is made of acrylic, supported by 4 stainless steel legs. The chamber is equipped with two fast fitting connectors for polyurethane tubing which connects to the IRGA, a vent, and a temperature sensor (HOBOMX2202) to continuously register air temperature on its inside.

Our recommendation on this chamber usage is, with the vent open, to insert the metallic legs in soil enough so the chamber sits 0.5 cm under the water surface, close the vent and start the CO2 flux measure.

Result and discussion. To test the reliability of the chamber we performed 3 measuring tests in a wetland with a water sheet depth of 0.5-5.5 cm, and we compared it with measures made with a floating chamber. Measurements made with the floating chamber were less reliable (R2 0.66-0.85) than the ones made with our designed chamber (R2 > 0.97).

[TSF.4-P-3]

Thursday 5
Discussion corner: Room 12

Estimating and mapping stand age distributions across 10 European countries

Astigarraga, Julen[1]; Pugh, Thomas A. M.[2]; Suvanto, Susanne[3]; Cruz-Alonso, Verónica[4]; Miguel-Romero, Sofía[5]; Bravo-Hernández, Miriam[6]; Schelhaas, Mart-Jan[7]; Esquivel-Muelbert, Adriane[8]; Grajera-Antolín, Cristina[9]; Zavala, Miguel A.[10]; Astrup, Rasmus[11]; Barrere, Julien[12]; Cienciala, Emil[13]; Fridman, Jonas[14]; Kunstler, Georges[15]; Redmond, John J.[16]; Starcevic, Ajdin[17]; Talarczyk, Andrzej[18]; Vayreda, Jordi[19]; Viana-Soto, Alba[20]; Ruiz-Benito, Paloma[21]

(1) Lund University; (2) Lund University, Lund, Sweden; University of Birmingham, Birmingham, UK; (3) Natural Resources Institute Finland (Luke), Helsinki, Finland; (4) Universidad de Alcalá, Madrid, Spain; Universidad Complutense, Madrid, Spain de Madrid; (5) Universidad de Alcalá, Madrid, Spain; (6) Universidad de Alcalá, Madrid, Spain; (7) Wageningen Environmental Research (WENR), Wageningen, Netherlands; (8) University of Birmingham, Birmingham, UK; (9) Universidad de Alcalá, Madrid, Spain; (10) Universidad de Alcalá, Madrid, Spain; (11) Norwegian Institute for Bioeconomy Research, Ås, Norway; (12) Université Grenoble Alpes (INRAE), UR LESSEM, Saint-Martin-d`Hères, France; (13) IFER - Institute of Forest Ecosystem Research, Jilove u Prahy, Czech Republic; (14) Swedish University of Agricultural Sciences, Umeå, Sweden; (15) Université Grenoble Alpes (INRAE), UR LESSEM, Saint-Martin-d`Hères, France; (16) Department of Agriculture, Food and the Marine, Wexford, Ireland; (17) Wageningen Environmental Research (WENR), Wageningen, Netherlands; (18) Forest and Natural Resources Research Centre Foundation, Warsaw, Poland; (19) CREAF, Cerdanyola del Vallès, Spain; (20) Technical University of Munich, Freising, Germany; (21) Universidad de Alcalá, Madrid, Spain

Correspondence e-mail: [julenastigarraga@gmail.com]

Introduction. Forest stand age is crucial for modeling multiple ecosystem services like carbon sequestration and wood provision. However, estimating stand age across multiple countries is challenging due to labor-intensive data collection and variations in estimation methods between countries. We quantified forest stand age distributions across 10 European countries for 2010 at 0.5º resolution by assembling forest inventory data from those countries and merging it with openly available disturbance and tree height data.

Material and Methods. Stand age distributions were estimated by integrating millions of high-resolution Landsat disturbance pixels with over 190,000 national forest inventory plots containing stand age data across 10 European countries, using time since disturbance and ground-based measurements as proxies for stand age. A spatially weighted quantile mapping approach was used to quantify the relationship between stand age and tree height, enabling stand age estimation at 30 m resolution. This data was subsequently aggregated to 0.5º resolution, with uncertainty accounted for through bootstrapping.

Results and discussion. We provide three datasets for each country: stand age distributions at 0.5º resolution, uncertainty metrics for each 0.5º grid cell, and aggregated country-level age distributions. Validation of the 2010 stand age distributions, using cross-validation and comparisons between pre-processed and post-processed datasets, showed high confidence in the results across the 10 European countries. Future work will focus on estimating stand age for the rest of Europe and adapting the open-source code used to generate these datasets into an R package to improve accessibility and facilitate broader use.

[TSF.4-P-4]

Tuesday 3
Discussion corner: Room 12

BOGAR: An Integrated DIY oceanographic solution observing Galicia surface waters

Fontela, Marcos[1]; Giráldez, Andrés[2]; Padin, Xosé Antonio[3]

(1) IIM-CSIC; (2) UTM-CSIC; (3) IIM-CSIC

Correspondence e-mail: [mfontela@iim.csic.es]

BOGAR represents a transformative initiative for ocean observation in Galicia, utilizing a mobile infrastructure equipped with advanced biogeochemical sensors to establish an integrated ocean observation network. This innovative project develops portable, cost-effective equipment easily deployable across diverse platforms, including research vessels, professional ships, and recreational boats. The self-assembled devices currently measure sea surface temperature and salinity (SBE45), dissolved oxygen (Aandera optode 4330), fluorometry (Seapoint SCF), pH (Honeywell Durafet), and partial pressure of carbon dioxide (HydroC CO2 FT). Time and position are obtained via a GPS module, and everything is connected to an Arduino Mega microcontroller. BOGAR's modular design, housed within a lightweight suitcase and assembled with 3D digitally designed and printed components eases replacement or upgrades. The project's DIY tools and open-source approach, combined with their ease of use, enhance accessibility while fostering inclusivity in marine research, enabling a broader spectrum of participants to engage in democratizing sustainable ocean observation. The information gathered through BOGAR is invaluable not only for the biogeochemical oceanography community but also for ecologists and the general public. Aligned with FAIR principles, BOGAR contributes significantly to international and regional databases, increasing the accessibility of oceanographic data while strengthening evidence-based policymaking for climate resilience and marine conservation. By focusing on the observation of the biogeochemical and ecological impact of climate change in surface waters, BOGAR addresses critical knowledge gaps and supports global efforts to achieve climate neutrality by 2050. Endorsed by the UN Decade of Ocean Science, BOGAR exemplifies how innovative, inclusive, and sustainable approaches can redefine oceanographic research in the coming decades.

AUTHORS INDEX

C

D

F

M

Q

S

T

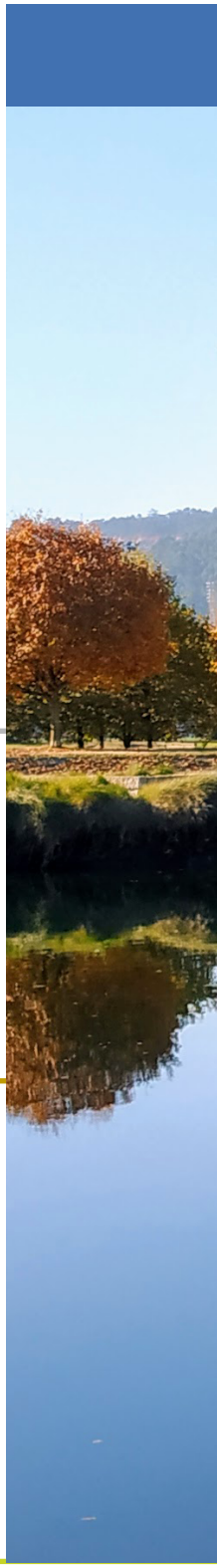
U

ACKNOWLEDGEMENTS

PARTNERS

We would like to thank all our scientific partners the University of Vigo (UVigo), the University of Santiago de Compostela (USC) and the Biological Mission of Galicia (MBG-CSIC) for supporting this project formulated with the aim to provide a platform for the exchange of the latest knowledge on ecology and to inspire debates and collaborations that will drive positive change in the field of ecology, promoting a more inclusive and sustainable future for scientific research.

We are especially grateful for their support to the Council of Pontevedra, which has lent us the “Pazo de Cultura de Pontevedra”, whose facilities are hosting the III SIBECOL & XVII AEET congress.



Silver SPONSORS

Bronze SPONSORS

Collaborators