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How the interaction network determines the herbivory effects on plant coexistence

Rodrigo R. Granjel, Oscar Godoy, Isabelle Badenhauer, Nicolas Gross

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Abstract book

**1st Meeting of the Iberian
Ecological Society &
XIV AEET Meeting**

Ecology: an integrative science
in the Anthropocene

February 4-7, 2019, Barcelona (Spain)



SIBECOL
Sociedad Ibérica Ecología

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WELCOME

We welcome everyone to Barcelona, the venue of the joint meeting of the Sociedad Ibérica de Ecología (1st SIBECOL) and the Asociación Española de Ecología Terrestre (XIV AEET) in 2019. The meeting is also supported by the Asociación Ibérica de Limnología (AIL), the Sociedad Española de Etología y Ecología Evolutiva (SEEEE), the Sociedade Portuguesa de Ecologia (SPECO), and the group of Iberian Marine Ecologists.

This conference is special since it will host scientists who study different types of ecological systems but who rarely meet together to share conceptual ecological frameworks. A new ecological society (SIBECOL) was established in July 2018 to bring together this scientific collective, while maintaining the identity of the existing societies that will progressively converge in their activities. This meeting will be the first action of the new society, its foundation conference. AEET is proud to contribute to the event, merging its regular meeting with 1st SIBECOL for this historic event.

The aim of the conference is to highlight crosscutting concepts shared by the different branches of ecology (limnology, marine ecology, terrestrial ecology, theoretical ecology), regardless of the system addressed. We seek to exchange ideas and approaches, and to provide a platform to discuss how ecological sciences, with a global perspective, can help to deal with the environmental transformations triggered by human activities.

The 1st SIBECOL meeting will also pay tribute to Professor Ramon Margalef, coinciding with the centenary of his birth. Margalef is a reference scientist for ecologists worldwide and particularly for ecologists in Iberia and Latin America. Based on numerous field observations, he developed powerful conceptual frameworks that keep inspiring scientists around the world. His legacy is very much alive.

The conference will be held at the Facultat de Biologia, Universitat de Barcelona, where Prof. Ramon Margalef worked during most of his career. We thank this institution, a reference for teaching and research, for hosting and facilitating the meeting. We also thank all institutions and corporations that support this meeting.



Francisco Lloret
Presidente Asociación Española
de Ecología Terrestre (AEET)



Cèlia Marrasé
Presidenta Sociedad Ibérica
de Ecología (SIBECOL)



THE CENTENARY OF PROF. RAMON MARGALEF

In 2019 we are celebrating the centenary of Prof. Ramon Margalef. Margalef was a mostly selfmade scientist with an innate curiosity and ability to relate observations and derive theoretical trends and generalities. The Spanish Civil war forced him to start college training in natural sciences late. He quickly grew into the scientific leader of the 1951 newly established Institute of Fisheries Research (IIP-CSIC), later the Institute of Marine Sciences (ICM-CSIC), in Barcelona. In 1967, already a worldwide known ecologist, he became the first professor in Ecology of Spain at the University of Barcelona, where he continued until his retirement. Margalef turned into one of the most relevant ecologists of the XX century. He contributed to science with innovating theories about the space-time structure of the ecosystems, the relations between diversity, biodiversity, stability and connectivity, the fundamental role of energy in biological productivity and the interrelations between ecological succession and evolution, among others. Margalef studied freshwater, marine and terrestrial systems, populations and species, finding patterns and unifying principles between all. He wrote well over 550 papers and books including, "On certain unifying principles in ecology", "Perspectives in Ecological Theory", "Information Theory in Ecology" and "Our Biosphere". Contributions were not only in English but in seven different languages. Several books in Spanish strongly influenced ecological science in Spain and Latin America. Margalef was not only a brilliant scientist but also an encouraging teacher and mentor and a most humble human being. He received national and international distinctions in the fields of ecology, limnology, oceanography and science contributions in general. Among many other awards, he received the Huntsman Medal, considered the Nobel prize in oceanography, in its 1980 first edition. Since 2005, a world renown prize in Ecology, given by the Catalan government, carries his name.

Now, in 2019, the joined meeting of SIBECOL and the AEET adheres and contributes to the celebrations of the official Ramon Margalef centenary, by paying tribute to Margalef. Among other events, there will be a special session dedicated to the legacy of Margalef and a Ramon Margalef Award, sponsored by the European Ecological Federation, for the best oral presentation in theoretical ecology of an early career researcher.

PROGRAM AT A GLANCE

Monday, FEBRUARY 4 th 2019	
Poster session 1	
9:00 - 10:00	
10:30	
11:00	
11:30	
12:00	Workshops
12:30	
13:00	
13:30	
14:00 - 15:00	LUNCH
15:00 - 17:00	Meetings of AEET/AIL/SPECO/SEEEE/Marine ecologists
17:00 - 17:30	Opening Ceremony
17:30 - 18:30	Opening Lecture: Carlos Duarte
18:30 - 20:30	Welcome Mix at Palau de Pedralbes

Tuesday, FEBRUARY 5 th 2019	
Poster session 1	
9:00 - 10:00	Plenary Talk: Sara Magalhaes
10:00 - 11:00	Plenary Talk: Pierre Legendre
11:00 - 12:00	COFFEE BREAK
12:00 - 13:30	Thematic and Global Sesions: TS17/ GS03/ GS02/GS01/TS06/TS14/GS05/TS15/TS09/TS01
13:30 - 15:00	LUNCH
15:00 - 16:00	Plenary Talk: Montserrat Vilà
16:00 - 17:00	Thematic and Global Sesions: TS17/ GS03/ GS02/GS01/TS06/TS14/GS05/TS15/TS09/TS01
17:00-18:00	COFFEE BREAK
18:00-20:00	Thematic and Global Sesions: TS02/TS12/ GS02/TS16/TS06/TS14/TS18/TS13/TS21/TS20

Wednesday, FEBRUARY 6 th 2019	
Poster session 2	
9:00 - 10:00	Plenary Talk: Daniel von Schiller
10:00 - 11:00	Plenary Talk: Verónica Ferreira
11:00 - 12:00	COFFEE BREAK
12:00 - 13:30	Thematic and Global Sesions: TS02/GS03/ TS11/GS01/TS07/TS10/GS05/TS03/TS21/TS04
13:30 - 15:00	LUNCH
15:00 - 17:00	First general meeting SIBECOL
17:00-18:00	COFFEE BREAK
18:00 - 19:30	Thematic and Global Sesions: TS02/GS03/ TS11/GS01/TS07/TS10/GS05/TS03/TS21/TS04
21:00 - 23:30	Conference dinner at Fàbrica Moritz Barcelona

Thursday, FEBRUARY 7 th 2019	
Poster session 2	
9:00 - 10:00	Plenary Talk: Oscar Godoy
10:00 - 11:00	Plenary Talk: Jordi Bascompte
11:00 - 12:00	COFFEE BREAK
12:00 - 13:30	Thematic and Global Sesions: TS02/GS03/ TS11/TS22/TS07/TS10/TS05/TS19/GS04/TS08
13:30 - 15:00	LUNCH
15:00 - 17:00	Thematic and Global Sesions: TS02/GS03/ TS11/TS22/TS07/TS10/TS05/TS19/GS04/TS08
17:00-18:00	COFFEE BREAK
18:00 - 19:00	Plenary Talk: Clara Ruiz
19:00 - 20:00	Closing ceremony and awards

Plenary Talks

Opening lecture PT-1

Aula Magna, Monday 4th Feb. 17.30 h.



Rebuilding Marine Biodiversity in a Shifting Ocean

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Statements that the Biosphere is now undergoing a Sixth Great Extinction, this time driven by human pressure, have been based on global species extinction rates 100 to 1,000 fold greater than background. These are expected to continue or be aggravated further by habitat loss, pollution, biological invasions facilitated by human introductions, and climate change, among other human pressures. Yet, these extinction rates refer to land species, with the number of marine extinctions of land species accounting for only 2.6 % of the total extinction rate, largely due to hunting in the past (e.g. Stellar's cow, great Auk, etc.). Indeed, whereas the oceans are experiencing a similar warming rate as land, its 3-D, connectivity and continuity provide more opportunities for species to avoid extinction than species face on the more fragmented habitats on land. Yet, habitat loss has impacted on key marine habitats, such as seagrass, mangroves and coral reefs, where about half of the global habitat has been lost since World War II. We have, therefore, have an opportunity to avoid the 6th Great Extinction from penetrating the oceans, and to rebuild ocean biodiversity as to ensure a bright future for the oceans and, thereby, rebuild a healthy ocean capable of supplying the key resources humanity requires. Here I will outline the current status and decline of marine biodiversity and outline the solutions and actions require to rebuild biodiversity.

PT-2

Aula Magna, Tuesday 5th Feb. 9.00 h.



Plant-mediated competitive interactions among herbivores

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Coexistence of competitors lies at the intersection between ecology and evolution, shaping both communities and the evolutionary history of organisms. Although competition among herbivores has been extensively studied, the potential role of plants in mediating this interaction has been relatively overlooked. We aim to address how different aspects of the plant-herbivore interaction affect competition between two closely related herbivorous spider mite species, *Tetranychus urticae* and *T. evansi*, on tomato plants. We have shown that both species prefer upper leaves, on which they also perform better. Moreover, tomato accumulates cadmium, and both species perform better on plants with intermediate concentrations of this metal. Therefore, the two species have similar fundamental niches, even at a highly local scale. In contrast, the two spider mites interact differently with plant defences: whereas *T. urticae* induces plant defences, *T. evansi* is able to suppress them. These interactions with plant defences differentially affect herbivore habitat choice, performance and competitive interactions. Indeed, in presence of an invading competitor, each resident species reacts differently, either via avoidance or monopolization of resources. This in turn will affect species composition within and between plants. Our work thus highlights the importance of considering plant-herbivore interactions to determine the outcome of competition between herbivores.

PT-3

Aula Magna, Tuesday 5th Feb. 10.00 h.

**A temporal beta-diversity index to identify exceptional sites in space-time surveys**Legendre, Pierre¹

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The paper describes a method to test the differences between data matrices corresponding to observations made at times T1 and T2 in ecological surveys involving several sites. The objective is to identify the sites that have changed in an exceptional way in species composition between T1 and T2. The null hypothesis is that a species assemblage is not exceptionally different between T1 and T2. The problem: testing significance for dissimilarity coefficients is usually not possible because the values in a dissimilarity matrix are interrelated. However, the dissimilarity between T1 and T2 for a site is independent of the dissimilarities that concern T1–T2 data at other sites. So it is possible to compute a valid test of significance in that case. The method also allows users to examine the processes of biodiversity losses and gains through time at the different sites of a survey. This method will be of value to identify exceptional sites in ecological surveys carried out in studies of climate change. Applications of the method to different ecological communities will be shown.

PT-4

Aula Magna, Tuesday 5th Feb. 15.00 h.

**Impacts of biological invasions: synthesis, prospects and challenges**Vila Planella, Montserrat¹

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Biological invasions occur when introduced non-native species to a new region, establish and spread fast into the wild. Many non-native species leave beyond their natural enemies, are more competitive than native species, take advantage of mutualistic interactions with the native species, and can thus modify the receptive community as well as ecosystem properties. Some can also affect socio-economic sectors such as forestry, agriculture, fisheries or public health. The talk will review the ecological impacts of the invasion by non-native species globally, and how these impacts might interact with major global change drivers. I will also present some ideas on how we could better integrate phenomenological impact studies within a more general theoretical ecology framework, and examples of important challenges to value and minimize these impacts.

PT-5

Aula Magna, Wednesday 6th Feb. 9.00 h.

**The ecology and biogeochemistry of intermittent streams: an aquatic-terrestrial perspective**von Schiller, Daniel¹

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Intermittent streams, that cease to flow at some points in space and time along their course, make up an important fraction of river networks worldwide. Moreover, occurrence and intensity of drying events are increasing in many areas due to the combined effect of climate change, water abstraction, and land use alteration. Nonetheless, intermittent streams are frequently unmapped and unprotected, and their role in the ecology and biogeochemistry of river networks is largely unknown. Due to their recurrent transitions between dry and wet phases, the study of intermittent streams represents a fascinating challenge that requires the combination of conceptual and methodological approaches from aquatic and terrestrial disciplines. Here, I will summarize what we know so far about the ecology and biogeochemistry of intermittent streams and identify emergent questions and research needs in these areas. My ultimate goal is to convince the audience that by incorporating the role of intermittent streams from an aquatic-terrestrial perspective, we will greatly improve current theoretical and empirical models of river ecology and biogeochemistry.

PT-6

Aula Magna, Wednesday 6th Feb. 10.00 h.

**The use of meta-analysis to address ecological questions**Ferreira, Verónica¹

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Meta-analysis is a statistical tool for combining the results of primary studies on the same topic, taking into account study precision, to allow general conclusions and the evaluation of the consistency of results across studies. Meta-analysis is most useful when there is a large number of empirical studies addressing the same topic, when these studies present conflicting results, when sample size and the expected effect size in individual studies are low, and when specific hypotheses are difficult to test in primary studies. As it is an objective and powerful tool for summarizing evidence, the number of meta-analyses in ecology has been rising in recent years, but its use is biased towards certain fields. Meta-analyses in freshwater ecology, or addressing simultaneously multiple ecosystems or providing management support are less common. Here we will go through a few meta-analyses to understand their potential for promoting collaboration among researchers, integrating knowledge, identify research gaps and contribute for evidence based management actions.

PT-7

Aula Magna, Thursday 7th Feb. 9.00 h.



Multitrophic coexistence across ecosystems

Godoy, Óscar¹

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Ecologists have been investigating for decades the mechanisms that maintain the diversity of species within ecological communities. It is clear that the basic ingredients of this work is still to understand how direct and indirect interactions between species and the environment modulate diversity, but the approach used has created two parallel bodies of literature, niche and network theories, each with its own limitations. Niche studies following modern coexistence theory are providing the framework to understand how functional traits promote coexistence in variable environments and the number of dimensions composing a species' niche. Yet, niche studies have been limited to describe coexistence within trophic levels despite incorporating information about multi-trophic interactions. Network approaches could address this limitation, but they have ignored the structure of species interactions within trophic levels. This talk aims to show that recent advances in both theories share a mutual understanding in the determinants of species coexistence and associated mathematical toolboxes. These advances bring the opportunity to integrate both fields and set new frontiers of knowledge to explore multitrophic coexistence across landscapes. Critically, this integration leads to the expectation that both antagonistic and mutualistic interactions can potentially promote or limit species diversity. Moreover, with a rigorous extension of theory to detailed observational and experimental studies, we have readily available the opportunity to study how the structure of the network of interactions between trophic levels (e.g. nestedness, segregation, modularity) determines species coexistence within trophic levels through its modifications of niche and fitness differences.

PT-8

Aula Magna, Thursday 7th Feb. 10.00 h.



Plant-animal mutualistic networks: the architecture of biodiversity

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The mutualistic interactions between plants and the animals that pollinate them or disperse their seeds can form complex networks involving dozens or hundreds of species. These networks are highly heterogeneous, nested, and built upon weak and asymmetric links among species. From an ecological point of view, such general architectural patterns maximize the number of coexisting species and increase the range of variability that these mutualistic networks can withstand before one or more species go extinct. Therefore, mutualistic networks can be viewed as the architecture of biodiversity. However, because phylogenetically similar species tend to play similar roles in the network, extinction events trigger non-random coextinction cascades. This implies that taxonomic diversity is lost faster than expected if there was no relationship between phylogeny and network structure. From an evolutionary point of view, the indirect effects arising from these network patterns may drive trait coevolution within species-rich assemblages, so that even the most specialized species are more influenced by indirect effects than by their direct partners.

Closing lecture PT-9

Aula Magna, Thursday 7th Feb. 18.00 h.

**Connecting microbial communities: The dispersal of taxa as a major factor shaping aquatic bacterio-plankton assemblages**Ruiz González, Clara¹

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Bacteria are major players across all terrestrial and aquatic ecosystems, but how variations in taxonomic composition translate into changes in ecosystem processes is not always clear. Although the advent of sequencing technologies has fostered our understanding of the mechanisms and factors shaping bacterial assemblages, there are still limitations among microbial studies that limit our capacity to fully understand how communities function: For example, whereas biogeochemical research has long recognized the cycling and exchange of elements between all earth components, the movement of microbes across different habitats or local communities has been largely neglected, and still most microbial biogeographic research is ecosystem-specific. During the past years, the studies that have considered this potential connectivity between microbial communities have unveiled a major role of dispersal in shaping fresh- and marine bacterial assemblages, as well as an astonishing capacity of microbes to persist out of their suitable niches: For example, boreal lakes and rivers have been shown to be strongly influenced by the transport of soil taxa from the surrounding terrestrial landscape, and deep ocean communities seem largely structured by the sinking of surface microbes attached to particles. Such dispersal processes can shape the so-called 'rare bacterial biosphere' of aquatic communities and can ultimately obscure the links between taxonomy and function by explaining the presence of a large diversity fraction that is not adapted to local conditions. All this highlights the need to move microbial ecology studies towards a more comprehensive view where potential dispersal pathways and linkages between ecosystems are considered.

Legend code: GS: General session; TS: Thematic session; MT = main talk (30'); O = standard talk (15'); P = poster

General Sessions (GS)

General Session 01: Biogeography and Macroecology

Day: Tuesday 5th and Wednesday 6th February

Schedule: 12:00h 13:30h – 16:00h 17:00h | 12:00h 13:30h – 18:00h 19:30h

Location: Room M3

Conveners:

Adrián Escudero, Universidad Rey Juan Carlos, Spain

Paulo Borges, Azorean Biodiversity Group, University of the Azores (UAz), Portugal

Enric Masuti, Spanish Institute of Oceanography (IEO), Spain

GS.01. Oral talks

GS.01-0-1

Room M3, Tuesday 5th Feb. 12.00 h.

Trajectory analysis in community ecologyDe Cáceres Ansa, Miquel¹; Coll, Lluís²; Legendre, Pierre³; Allen, Robert B.⁴; Wisser, Susan K.⁵; Fortin, Marie-Josée⁶; Condit, Richard⁷; Hubbell, Stephen⁸

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Ecologists have long been interested in how communities change over time. Addressing questions about community dynamics requires ways of representing and comparing the variety of dynamics observed across space. Until now, most analytical frameworks have been based on the comparison of synchronous observations across sites and between repeated surveys. An alternative perspective considers community dynamics as trajectories in a chosen space of community resemblance and utilizes trajectories as objects to be analyzed and compared using their geometry. While methods that take this second perspective exist, for example to test for particular trajectory shapes, there is a need for formal analytical frameworks that fully develop the potential of this approach. By adapting concepts and procedures used for the analysis of trajectories in geographic space, we present a framework for describing and comparing community trajectories. A key element of our contribution is the means to assess the resemblance between trajectories, which allows users to describe, quantify and analyze variation in community dynamics. We illustrate the behavior of our framework using simulated data and two spatio-temporal community data sets differing in the community properties of interest (size distribution of individuals vs. species composition). We conclude by evaluating the advantages and limitations of our community trajectory analysis framework, anticipate potential extensions, and highlight its usefulness to address questions in several areas of ecological research.

GS.01-0-2

Room M3, Tuesday 5th Feb. 12.15 h

Modeling the climatic niche of a Mediterranean tortoise (*Testudo hermanni*, Gmelin 1789): Overlapping between *Testudo hermanni hermanni* and *Testudo hermanni boettgeri*Martínez Pastor, M^a Carmen¹; Graciá, Eva²; Giménez, Andrés³; Pérez-García, Juan Manuel⁴

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The distribution of reptiles is determined by several environmental factors, especially bioclimatic factors. Climatic change can cause the increase or decrease of the species distribution area. The analysis of the bioclimatic niche is one of the current methods that allow us to project the potential distribution of a geographic area, obtaining information on the overlapping of niches between species or lineages. The Mediterranean tortoise (*Testudo hermanni*) is a species of European distribution that is threatened, and has two genetically differentiated lineages with allopatric distribution. *T. h. hermanni* is located in the western part from the valley of the Po River and *T. h. boettgeri* in the eastern part. The objectives of this study are i) to identify the climatic variables that determine the subspecies distribution, ii) to calculate geographic distribution models and, iii) to analyze the niche overlap for both lineages. Our presence data was obtained from the bibliography and the iNaturalist platform. The climatic niche of both lineages was modeled by MAXENT. The main results of this study showed that the precipitation was the best variable explaining the distribution of the two lineages, where *T. h. hermanni* inhabit in more arid environments than *T. h. boettgeri*. Although the niches of both lineages are different, there are some areas with overlap between them, having *T. h. boettgeri* a greater potential distribution than *T. h. hermanni*.

GS.01-0-3

Room M3, Tuesday 5th Feb. 12.30 h.

Changes in taxonomic, functional and phylogenetic diversity in lichen epiphytic communities along an environmental gradient in Europe

Hurtado Aragüés, Pilar¹; Prieto, María²; Aragón, Gregorio³; Giordani, Paolo⁴; Benesperi, Renato⁵; Bianchi, Elisabetta⁶; Díaz-Peña, Eva⁷; Vicente, Rebeca⁸; Merinero, Sonia⁹; Košuthová, Alica¹⁰; Mayrhofer, Helmut¹¹; Nascimbene, Juri¹²; Grube, Martin¹³; Wedin, Mats¹⁴; Westberg, Martin¹⁵; de Bello, Francesco¹⁶; Martínez, Isabel¹⁷

(1) URJC; (2) URJC; (3) URJC; (4) University of Genova; (5) University of Florence; (6) University of Florence; (7) URJC; (8) URJC; (9) Stockholm University / Universidad Rey Juan Carlos; (10) Swedish Museum of Natural History; (11) Karl-Franzens-Universität Graz; (12) University of Bologna; (13) Karl-Franzens-Universität Graz; (14) Swedish Museum of Natural History; (15) Uppsala University; (16) Centro de Investigaciones Sobre Desertificación (CIDE); (17) Universidad Rey Juan Carlos

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Assessing how taxonomic (TD), functional (FD) and phylogenetic (PD) diversities change along environmental gradients may help us to understand the response of biological communities to environmental variation. Based on this, and focused on lichen epiphytic communities, we studied the climatic drivers shaping these communities by analysing the patterns of variation of the biodiversity facets, and the role of species turnover and intraspecific trait variability (ITV). We conducted a standardized field survey of lichen communities across 23 beech forests along a latitudinal gradient from Sweden to southern Italy. We used species inventories, trait data and a molecular phylogeny to calculate diversity metrics. For the 203 species found, we analysed richness, Shannon index and Simpson Index as measures of TD and calculated Rao indices to quantify FD and PD. We also calculated Community Weighted Means of 7 functional traits for 58 species of macrolichens. Data were analysed by using Generalized Linear Models and ANOVAs. We found different responses of TD, FD and PD to environmental variables along the gradient, and different main variables modifying these biodiversity facets with opposite effects. Thus, while precipitation and temperature determined TD variability, only temperature modified FD and PD (also affected by tree diameter). Besides, increases in temperature increased TD and diminished FD and PD. We also demonstrated that ITV was the main driver shaping FD in macrolichen communities along the gradient. Our results stress the need to adopt a pluralistic approach integrating TD, FD and PD to understand the response of biological communities to environmental variables.

GS.01-0-4

Room M3, Tuesday 5th Feb. 12.45 h.

Phylogenetic models improve niche estimation and prediction of species distributions

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Species distribution models are indeed usually fitted at the species level. But fitting models to species as independent units ignores phylogenetic niche conservatism and can lead to models with poor statistical properties and spurious results. Using computer simulations and statistical theory, I will show how hierarchical phylogenetic models that take into account the phylogenetic covariance among taxa usually outperform alternative approaches, like fitting independent models to each taxon or lumping species together. The advantages of phylogenetic models become particularly evident when modelling rare species, as information is shared across taxa. Most of these advantages extend to non-phylogenetic hierarchical models, which calls for more consideration of hierarchical approaches in species distribution modelling, even when phylogenies are not available.

GS.01-0-5

Room M3, Tuesday 5th Feb. 13.00 h.

Understanding the global patterns of tree and forest transpirationPoyatos, Rafael¹; Flo, Víctor²; Granda, Víctor³; Martínez-Vilalta, Jordi⁴

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Water availability is one of the main drivers of plant functioning because plants inevitably lose water as transpiration to assimilate atmospheric CO₂. The diverse spectrum of plant functional adjustments to maintain water balance underlie the patterns in global plant distribution and results in contrasting vegetation water use rates across the globe. Trees, in particular, can transpire huge amounts of water when it is available, but they can also survive prolonged drought periods with minimal water loss. However, large-scale datasets of evaporative fluxes from vegetation include non-biological components such as direct evaporation from soils, precluding our understanding of the global patterns of tree water use. We compiled and synthesized a global database of transpiration from sap flow measurements (SAPFLUXNET), representative of >150 tree species worldwide. Over 2 million tree-days observations were collated to quantify growing season tree transpiration, which was upscaled to forest water use using stand characteristics retrieved from the same database. We show, for the first time, how tree transpiration varies globally as a function of climate, species, tree size and stand structure. This variation results in global patterns of forest water use which largely depend on ecosystem aridity and vegetation structure. Identifying the ecological factors driving the global patterns in tree and forest water use is pivotal to understand the relationship between water availability, plant distribution and ecosystem functioning. Here we show that the compilation and synthesis of large-scale physiological datasets can aid to understand macroecological patterns of plant resource use within the framework of functional biogeography.

GS.01-0-6

Room M3, Tuesday 5th Feb. 13.15 h.

Home field advantage in temperate tree speciesArdanuy, Agnes¹; Johnson, David²; Taylor, Andy³

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Plant traits influence how trees interact with their environment, and the diverse mycorrhizal fungal associations living within plants can influence tree morphology and physiology. We hypothesized that for a given tree species conspecific soils ("home") would accumulate a larger proportion of host specialist ectomycorrhizal species in relation to heterospecific soils ("away"), and that this distinct community composition will influence tree physiological and morphological traits. We used soil cores from birch, larch and scots pine forests (three plots per forest type) in a greenhouse pot factorial experiment, in which we planted birch, larch and scots pine in "home" and "away" soils. We quantified the resource exchange between trees and mycorrhizal fungal communities during four days by reciprocal pulse-labelling of the experimental pots with ¹³C and ¹⁵N. In addition we measured ecosystem respiration and primary productivity, plant growth traits (height, branching, root:shoot, biomass), plant physiological traits (nutrient content) and fungal traits (number of colonized root tips, hyphal length, mycorrhizosphere respiration). Results to date show a home field advantage for the aboveground growth for birch while all species perform well in pine soils. These results will be discussed in relation to the ectomycorrhizal fungal communities in home and away soils.

GS.01-0-7

Room M3, Tuesday 5th Feb. 16.00 h.

Richness patterns and range size as a proxy of endemism of ferns along elevational gradients in the latitudinal context at the transition from tropics to subtropicsHernández Rojas, Adriana Carolina¹; Kluge, Jürgen²; Krömer, Thorsten³; Kessler, Michael⁴

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One of the most prominent patterns in species distribution is the latitudinal gradient of high species richness in the tropics and decreasing richness towards the poles, together with the Rapoport's rule that assumes that tropical species tend to have smaller latitudinal ranges and are thus more endemics, allowing more species to coexist in tropical versus temperate regions. How the richness patterns, endemism rates, and range sizes of ferns change with elevation in the latitudinal context is poorly explored and the transition zone from the tropics to the subtropics in Mexico offers a high potential to decipher this patterns. In order to assess richness and distributional patterns of ferns, we analyzed their assemblages along eight elevational gradients located at different latitude (15° to 23°) in this transition zone. To test if the endemism rate within assemblages increases with elevation and decreases with latitude, we used the latitudinal range of the species as a measure of its endemism. To calculate the latitudinal range, we searched for the northern and southern limits of all species within worldwide data banks and averaged the latitudinal range of all species weighted by their abundance within assemblages. This mean weighted range size of species as a measure of endemism clearly declined with elevation, whereas is increasing with latitude. Our results confirm that insular mountainous environments support small, disjointed species populations that are more prone to speciation than species inhabiting extensive habitats without genetic barriers, while climatic variables may affect the species distributions increasing latitude.

GS.01-0-8

Room M3, Tuesday 5th Feb. 16.15 h.

Temperature-size rule in caddisflies along an elevational gradientGraça, Manuel A.S.¹; Cogo, Gláucia²; Martínez Menéndez, Jesús³

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Temperature influences processes ranging from biochemical reactions to ecosystems. Temperature-size rule has been investigated for a range of organisms, but studies on freshwater aquatic insects are rare. Here, we investigated the relationship between temperature, adult size and growth in caddisflies sampled along an elevation gradient from 400 to 1600 m, as a predictor of temperature. Additionally, we measure in laboratory growth rates of the caddisfly *Schizopelex festiva* under three temperature regimes. Specimens of *Rhyacophila adjuncta*, *Hydropsyche ambigua*, and *H. siltalai* were significantly smaller at lower than at higher elevations, as predicted by the temperature-size-rule. Under laboratory conditions, growth rates for *S. festiva* at 10 °C, 15 °C and 20 °C were respectively 16.7, 18.9 and 34.7 µg.mg⁻¹.day⁻¹; i.e. faster at higher than lower temperatures. We conclude that, since aquatic invertebrates are sensitive to temperature according with the temperature-size rule, we may predict that under ongoing global warming, aquatic insects undergo through changes in size and related parameters affecting their fitness at local scales.

GS.01-0-9

Room M3, Tuesday 5th Feb. 16.30 h.

New advances in island biogeography modelling: the R package 'island'J. Ontiveros, Vicente L.¹; Capitán, Jose A.²; Arthur, Rohan³; O. Casamayor, Emilio⁴; Alonso, David⁵

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50 years ago, MacArthur and Wilson developed the Theory of Island Biogeography aiming to explain the distribution of species in a set of islands with different areas and degrees of isolation from a mainland. Despite its influential and inspiring success, the exploration of its more dynamical aspects has been largely overlooked. Here we present the 'island' R package, which builds on the simplest stochastic model underlying this theory to include species responses to environmental covariates, imperfect detectability and model selection. Our models can be regarded as effective approximations to complex community dynamics, enabling us to gain insights into community assembly, future responses to climate change or the detection of interacting species via the reconstruction of dynamic co-occurrence networks. We applied these new methods to three examples from animal, plant and microbial communities. We found higher extinction rates in higher trophic groups of coral reef fishes, we studied the process of reoligotrophication for lacustrine phytoplankton in lake Zürich, Switzerland, and we characterized the temporal scale at which richness and composition of several microbial communities varies. Inspired by the classic Theory of Island Biogeography, the R package 'island' (available on CRAN) is a powerful tool that focus on the analysis of temporal community data which are increasingly available and hold the key to address the current challenges at the interface between community ecology and biogeography.

GS.01-0-10

Room M3, Tuesday 5th Feb. 16.45 h.

Biodiversity surveys across biogeographic gradients – a comparison between aquatic eDNA and conventional methodsLúcio Pereira, Cátia¹; Sroczynska, Katarzyna²; Faísca, Pedro³; Castillo-Escrivá, Andreu⁴; Gilbert, Tom⁵; Araújo, Miguel Bastos⁶; Matias, Miguel Graça⁷

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Climate change is a major driver of environmental change in natural ecosystems. Developing predictions of its effects on biodiversity requires a deep understanding of communities' composition and species distributions. Taxonomical inventories and assessment of geographical distribution of species based on environmental DNA (eDNA) have been shown to improve detection capability, taxonomic resolution and cost-effectiveness when compared to conventional methods. However, eDNA approaches do not easily provide quantitative estimates for the surveyed species, whereas abundance and biomass data are often required. In this study, we conducted high-resolution biodiversity surveys across biogeographic gradients, ranging from semi-arid to alpine environments, using the IberianPonds Network. Field surveys combined eDNA metabarcoding and traditional approaches. Four different markers were used (16SV4, 18SV9, ITS1 and COI) to amplify DNA from the whole community, from lower (bacteria) to higher (macroinvertebrates) levels of the food web. Also, organisms were collected with conventional methods (e.g., plankton nets, kick-net), and were identified and enumerated under the microscope. Preliminary results indicate that regions with greater environmental filters, such as higher temperatures in southern regions and temperatures below zero in mountain tops during several months, have lower number of species than temperate environments. These results will be used to correlate patterns of species turnover within and between regions with key ecosystem functions (e.g., productivity, greenhouse gas emissions). Increasing the resolution of biodiversity surveys is crucial to improve predictions of climate change effects on biodiversity and their associated ecosystem services.

GS.01-0-11

Room M3, Wednesday 6th Feb. 12.00 h.

Network analysis provide new perspectives to identify plant bioregions : a case study in the Mediterranean region of FranceGuillaume, Papuga¹; Maxime, Lenormand²; Olivier, Argagnon³; Guilhem, De Barros⁴; Sandra, Luque⁵; Samuel, Alleaume⁶

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The delimitation of bioregions helps understand historical and ecological drivers of species distribution. The Mediterranean basin offers a rich mosaic of plant distribution patterns, whose description constitutes a great challenge toward a global understanding of the flora. In particular, transition areas between biomes have raised difficulties to set comprehensive limit between bioregions. We performed a network analysis of plants distribution in south of France to analyze the biogeographical structure of the French Mediterranean flora. We analyzed a large database containing 2.5 millions of geolocalized plant records, corresponding to more than 3,500 plant species. We identify biogeographical regions under the form of spatial network communities, and analyze their interactions based on the contribution of species to each bioregion. We identified 2 sub-networks that distinguish mediterranean and temperate-mountainous biota. Then, we separated eight statistically significant bioregions. Some are spatially well delimited, and match with particular geological entities. On the other hand fuzzy transitions arise between adjacent bioregions that share a common geological setting, but are spread along a climatic gradient. This is exemplified by the cluster "Mediterranean border", that constitutes a transition entity between the two biomes. The network approach provides precise insights into the relationships among bioregions. It gives analytic clues to spatially identify the Mediterranean bioregion, whose delimitation has been debated among biogeographers. This approach demonstrates how climatic gradients and geological substrate shapes biodiversity patterns in the Mediterranean, and exemplifies why fragmented distributions are common in the Mediterranean region, isolating groups of species that share a similar eco-evolutionary history.

GS.01-0-12

Room M3, Wednesday 6th Feb. 12.15 h.

Are all trait combinations possible? Assessing the functional trait space of the European aquatic invertebratesMúrria, Cesc¹; Iturrarte, Gabone²; Bonada, Núria³; Gutiérrez-Cánovas, Cayetano⁴

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In response to ecological conditions, communities differ in their functional trait composition. Evolutionary studies revealed how the rate of disparification (diversification of traits) varies over time and decreases as ecological space becomes gradually saturated, i.e., incumbent lineages limit disparification in younger clades, which was called "disparity-dependent model". In parallel, growing evidence in functional ecology supports the key role of functional traits in mediating organism's ecological functions to local ecological conditions. However, it remains unclear how evolutionary and ecological processes simultaneously shape the functional trait spectrum. We address this challenge compiling data of functional trait diversity (e.g. life cycle duration, body size, feeding habits, reproduction) of ca. 380 genera of European freshwater macroinvertebrates and testing its variance associated to phylogeny and regional- (communities located across a latitudinal gradient that differ in biogeographical history) and local-scale ecological conditions (river variability in flow intensity and water quality). Our results suggest the occupancy of the functional space is strongly aggregated, indicating that some trait combinations are impossible and the main invertebrate lineages are strong functional entities. At regional scale, functional diversity does not show significant changes across latitude as the studied communities included the majority of freshwater lineages. As expected, local community functional diversity changes in parallel to hydrological patterns, whereas decreases as environmental conditions get more adverse. Overall, the entire functional trait space of freshwater macroinvertebrates is evolutionary constrained and functional diversity is likely associate to local ecological conditions by species sorting.

GS.01-0-13

Room M3, Wednesday 6th Feb. 12.30 h.

Biogeography from space – A new tool to disentangle Iberian Forests Ecology and Distribution in Iberian PeninsulaVila-Viçosa, Carlos Magno¹; Marcos, Bruno²; Garcia, Cristina³; Gonçalves, João⁴

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Iberian Peninsula harbours both edaphic and climatic conditions that supports a wide variety of forests in contrasting environments. Due its geographic position functions as a model to understand transitional areas and ecotones between major biogeographic regions (Eurosiberian and Mediterranean). Although “classic” modelling techniques usually rely in climatic drivers, other related to ecosystem functioning dynamics and energy-matter flows, calculated from satellite remote sensing variables, are still largely unexplored. To address this, we exploited several remote sensing variables calculated from time series linked to the annual seasonal dynamics of carbon, water and energy components of ecosystems as a new potential tool to assist biogeographic delimitation and forest distribution in Iberian Peninsula. Marcescent oak forests were used as a model, in a like-for-like basis with Temperate and Mediterranean forests. An ensemble modelling approach (biomod2) was employed to assess the predictive potential of remotely sensed variables. Results show that Remote sensing drivers helped to understand the distribution of marcescent forests in transitional/ecotone areas from Eurosiberian to Mediterranean Region, inferring and explaining biogeographic regions, as well as the potential distribution of tree species in Iberian Peninsula. This is of major importance in way to understand climatic trends, and land use management and alteration and in what way it can affect forest conservation in Western Mediterranean basin.

GS.01-0-14

Room M3, Wednesday 6th Feb. 12.45 h.

Dispersal ability shapes the strength of diversity-environment relationships in spider communities on oceanic islandsMalumbres Olarte, Jagoba¹

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Understanding the mechanisms that determine the structure of ecological communities is a central goal in ecology. With the present study, we investigate local and regional processes aiming to quantify the relative importance of a number of contemporary environmental drivers on forest spider communities across three Macaronesian archipelagos (Azores, Madeira and the Canary Islands). Six plots, located within high elevation native forests, were sampled on two islands within each archipelago. Spider samples were collected using the Conservation Oriented Biodiversity Rapid Assessment (COBRA). Five variables were used to characterize the environment at the plot-level: habitat diversity, ambient and productive energy (derived from two remotely sensed datasets including NDVI) and Land-Surface temperature (LST). We used Generalized Linear Mixed-Effects Models (GLMM) to quantify the relationship between alpha, beta replacement and the environmental variables. Our results revealed that both alpha and beta diversity are best explained by the NDVI and temperature, suggesting an important role of energetic constraints in structuring spider communities in these archipelagoes. We found that the relative signature of different ecological drivers vary according to dispersal ability of a specific group of species. More specifically alpha diversity of rarely ballooning species are more strongly affected by both productive (temperature) and ambient energy (NDVI).

GS.01-0-15

Room M3, Wednesday 6th Feb. 13.00 h.

Revisiting marine vs land diversity: β -diversity patterns and body size arise as key elementsChust, Guillem¹; Villarino, Ernesto²; Irigoien, Xabier³

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Why oceans hold less number of species than land, whilst the former cover about 67% of the Earth's surface? To answer this question, we will revise: 1) the different aspects of physical differences between pelagic, benthic and land for biological dispersal and speciation, 2) the taxonomic level from phyla to genetic populations, 3) patterns of β -diversity comparing plankton, macrobenthic and tree communities, and 4) explore the implications of recent findings linking plankton body size and dispersal scales (Villarino et al. 2018) in this issue. In the mentioned paper, plankton β -diversity was compared to surface ocean transit times derived from a global circulation model, revealing that estimated dispersal scales for different groups showed a negative correlation with body size, where less abundant large-bodied communities have significantly shorter dispersal scales and larger species spatial turnover rates than more abundant small-bodied plankton. It appears, that beyond a body-size threshold, species have two pathways: the connectivity among individuals is lost, except the species develop the capacity to move. As a result, we will show that passive pelagic communities are less diverse (α -diversity and overall richness) than lower trophic levels of benthos and land due to the sedimentation and advection oceanic processes that impose demographic thresholds linked to body size (density, reproduction rate) to maintain the species contiguity, and in turn, reducing allopatric speciation.

GS.01-0-16

Room M3, Wednesday 6th Feb. 13.15 h.

Biogeography, climate and biotic interactions determine the interplay between functional, phylogenetic and taxonomic diversitiesLópez-Angulo, Jesús¹; Pescador, David S.²; Sanchez, Ana M.³; Luzuriaga, Aranzazu L.⁴; Cavieres, Lohengrin A.⁵; Escudero, Adrián⁶

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Disentangling the variation of interplay among diversity components along biotic and abiotic gradients may contribute to our understanding of community assembly processes. We assessed the interplay among functional (FD), phylogenetic (PD) and taxonomic diversity (TD) in three different mountain ranges with contrasting evolutionary histories (Europe/South America) and climate conditions (Mediterranean and Temperate climates) to know whether mechanisms that drive community assembly are similar among mountains. In each mountain region, we sampled the vegetation occurring above local treeline, covering the complete elevation gradient where this ecosystem-type occurs. We sampled 830 quadrats and registered more than 300 species, which were characterized by 5 functional traits and by phylogenetic relatedness. We used species richness and mean pairwise distances (MPD) as a measure of TD, and FD and PD, respectively. Structural equation modeling tested the model that comprised the causal hypotheses about the relationships among FD, PD and TD and abiotic (elevation, potential solar radiation and soil nitrogen content) and biotic factors (plant-plant interactions). We found a high degree of idiosyncrasy with evident differences among mountains although some critical relationships were consistent across regions. The main consistent result was that increasing elevation affected functional and taxonomic diversity, which were generally reduced in the upper elevation limit. Our results suggest the strong environmental filtering processes that usually occur in alpine environments, together with a balance between competition and facilitation affected by variations in environmental conditions likely lead to the community assembly.

GS.01-0-17

Room M3, Wednesday 6th Feb. 18.00 h.

Scavenging in the anthropocene: Human impact drives macroecological patterns of vertebrate scavenger richnessSebastián González, Esther¹

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Several hypotheses have been proposed to explain the species latitudinal pattern (i.e. communities being richer in tropical areas), but a general consensus has not been reached yet. Here, we test six hypotheses to identify macroecological patterns in vertebrate scavenger (i.e. species consuming carrion) communities. We used a worldwide dataset comprising 40 study sites where the vertebrate scavenger assemblages were estimated using experimental carcasses. We first evaluated how scavenger richness and diversity changed among seasons and biomes. Then, we studied how a set of macroecological variables related to climatic conditions and human impact affected them. Scavenger richness ranged from poor assemblages (4 species) to species-rich ones (31 species). The number of scavenger species and scavenger diversity changed between biomes and seasons. However, we found that vertebrate scavenger richness and diversity were not related to latitude, and consequently none of the latitudinal diversity hypotheses were supported. Interestingly, human impact was the main factor affecting scavenger richness. Scavenger assemblages in highly impacted areas were depleted in species richness, suggesting that anthropization may be over-riding other macroecological patterns in scavenger communities.

GS.01-0-18

Room M3, Wednesday 6th Feb. 18.15 h.

Salvage logging: a concatenation of interacting ecological/anthropogenic disturbancesLeverkus, Alexandro Bitol¹

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Large natural disturbances increasingly affect forests around the world. Collaterally, increasing amounts of forest are subject to common post-disturbance management, particularly salvage logging. Understanding and managing the world's forests increasingly hinges upon understanding the combined and interactive effects of natural disturbance and logging disturbance, including interactions so far unnoticed. Here, I apply recent advances in disturbance-interaction theory to disentangle the mechanisms through which natural disturbance (wildfire, insect outbreak or windstorm) can interact with anthropogenic disturbance (logging) to produce unanticipated effects. First, many ecological responses to salvage logging likely result from interaction modifications—i.e., non-additive effects between natural disturbance and logging. However, a systematic review encompassing 209 relevant papers showed that interaction modifications have been overlooked. Second, salvage logging constitutes an interaction chain because natural disturbances increase the likelihood, intensity and extent of subsequent logging disturbance due to complex socio-ecological interactions. Such interaction is undetectable by the typical plot-level research. Both interaction modifications and interaction chains can be driven by nonlinear responses to the severity of each disturbance. Whereas many of the effects of salvage logging likely arise from the multiple kinds of disturbance interactions, they have mostly been overlooked in research to date. These interactions imply that increasing disturbances will produce even more disturbance, and with unknown characteristics and consequences. Disentangling the pathways producing disturbance interactions is thus crucial to guide management and policy regarding naturally disturbed forests. More generally, transferring advances in ecological theory to applied research is fundamental to understand and manage ecosystems in a changing world.

GS.01-0-19

Room M3, Wednesday 6th Feb. 18.30 h

Stresses and strategies: Water use efficiency in *Juniperus thurifera* individuals along a gradient of forest expansionAcuña Míguez, Belén¹; Valladares, Fernando²; Martín Forés, Irene³

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Plant water use efficiency (WUE) is important to cope with drought, especially exacerbated in Mediterranean ecosystems, that is currently increasing as a consequence of climate change. This new climatic scenario is coupled with a process of rural abandonment, which is favouring forest expansion and densification. Our goal is to study the WUE of *Juniperus thurifera* individuals associated with the spontaneous forest expansion of this species. Seventeen sites were selected and categorized into three stages of a colonization gradient (mature forest, intermediate stage and expansive front) depending on tree size and density of adult trees. For each individual, we measured diameter at breast height (dbh), height, crown area, and $\delta^{13}\text{C}$ isotope signatures of leaves. Our results revealed that WUE of individuals vary among the three colonization stages. We observed that individuals located in the expansive front stage show higher $\delta^{13}\text{C}$ which indicates greater WUE while individuals located in the mature forest showed the lowest values of $\delta^{13}\text{C}$ isotopic signature indicating lower efficiency in the use of hydric resources. Thus, water stress seems to be greater in the expansive front possibly due to the harsh climatic conditions of the study area contrasting to processes of intraspecific facilitation occurring in mature stages. Our findings bring new light into the potential WUE of Mediterranean forests in the context of climate and land-use changes.

GS.01-0-20

Room M3, Wednesday 6th Feb. 18.45 h.

Leaf economics and xylem hydraulics drive partitioning between leaves and woodMencuccini, Maurizio¹; Rosas, Teresa²; Martinez-Vilalta, Jordi³

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The ratios between leaves, stems and roots control many ecological processes from individual to globe. However, biomass partitioning is not well understood. We present the first global analysis of the Huber value H_v , the ratio between xylem cross-sectional areas and subtended leaf areas in terminal branches of woody angiosperms and gymnosperms. We hypothesise that global patterns in H_v can be predicted based on leaf size, specific leaf area, xylem hydraulic efficiency and wood density. Using a compilation of 1100 species-averaged H_v across all major biomes, we show that H_v scales primarily with the two leaf traits and with xylem hydraulic efficiency. Our best model explains ~58% of the global variance of H_v , while accounting for phylogeny, leaf habit and type, plant growth form and climatic conditions. While all four leaf/xylem traits are found to depend on climate, climate did not directly explain H_v . This work identifies the major drivers of wood/leaf area ratios in the terminal branches of woody plants globally. Our model gives promise of a good predictive capability and should be useful for global-scale modelling of carbon partitioning, when used in conjunction with other architectural variables.

GS.01-0-21

Room M3, Wednesday 6th Feb. 19.00 h.

Spatial and temporal trends of *Geryon longipes* in the western Mediterranean seaCortes Pujol, Miquel Àngel¹; Guijarro, Beatriz²

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The deep-sea crab *Geryon longipes* is a by-catch species of the deep-water bottom trawl fishery targeting the red shrimp (*Aristeus antennatus*). The main objective of this work is to analyse the spatial and temporal trends of its standardised biomass in the western Mediterranean, from the Strait of Gibraltar to Cape Creus, including the Balearic Islands. Two data sources were used: data obtained in oceanographic surveys that are carried out annually in spring (kg/km²) and data of catches landed by the commercial bottom trawl fleet (kg/trip). Data analyses were carried out for the entire area and for each of the 13 geographical sectors considered, grouped by 5 areas. The results of the general models showed the same interannual increasing trend for both data sources. By area, similar trends were also found in both data sources, but with different geographical trends. An interannual negative trend was observed in the Alboran area, the Gulf of Vera and Catalunya; conversely, a positive trend was observed in the Levantine area and the Balearic Islands. In all areas, the highest biomass was found between 500 and 700 m. Seasonally, two peaks of high biomass were found in most of the areas, one in spring-summer and one in early winter; however, their relative importance depends on the area. This work is a first approach to the study of this species and more studies are still needed to identify the factors driving the opposite interannual trends found in nearby areas.

GS.01. Posters

GS.01-P-1

External pavilion, Poster session 1: Monday 4th-Tuesday 5th

Specialization and modularity of a bat-fly antagonistic ecological network in a dry tropical forest in northern ColombiaContreras Peinado, Laura¹; Adrián Alonso Durán, Adrián²; A. Saldaña-Vázquez, Romeo³; Gracioli, Gustavo⁴

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Ecological networks represent the energy flow and interactions among species of an ecological community. Streblidae is a family of bloodsucking flies specialized in parasitizing on bats. The purpose of this study was to investigate the specialization and modularity of a bat-fly antagonist ecological network in a tropical dry forest in northern Colombia. Bat hosts were sampled by using mist nets, while bat-flies were collected directly from the hosts by using entomological forceps. The network was built with the Bipartite package from R software. The sampling effort resulted in 270 bat flies recorded on 45 host individuals. The network showed a high specialization ($H2' = 0.67$) and a low connectance ($C = 0.30$). *Paradyschiria parvuloides* was the most specialized fly ($d = 0.95$). The interactions exhibited a high modularity ($Q = 0.57$), with five modules. This study confirms the high specialization between bats and Streblidae flies, which is influenced by factors such as fidelity to the refuge and habitat, and host abundance

GS.01-P-2

External pavilion, Poster session 1: Monday 4th-Tuesday 5th

The simultaneous expression of constitutive chemical defences and their inducibility is stronger at high elevationsCortegoso Galmán, Andrea¹; Petry, William²; Abdala-Roberts, Luis³; Kergunteuil, Alan⁴; Rasmann, Sergio⁵; Moreira, Xoaquín⁶

(1) Misión Biológica de Galicia-CSIC; (2) Institute of Integrative Biology, Eidgenössische Technische Hochschule (ETH) Zürich, Universitätsstr.; (3) University of Yucatán; (4) Institute of Biology, Laboratory of Functional Ecology, University of Neuchâtel; (5) Institute of Biology, Laboratory of Functional Ecology, University of Neuchâtel; (6) Misión Biológica de Galicia-CSIC

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Elevational gradients have been particularly useful for studying interactions between plants and their insect herbivores. In particular, it has been proposed that greater herbivory under warmer and less variable climates at low elevations has resulted in stronger herbivore selection on plant defences. However, the generality of this expectation has been called into question by conflicting empirical evidence, presumably due to unexplored defensive strategies (e.g., tolerance, induced defences or simultaneous expression of defensive strategies), as well as the unaccounted effect of climatic factors associated with elevation. We tested for the presence of elevational gradients in the individual and simultaneous expression of oak (*Quercus*, Fagaceae) constitutive leaf chemical defences (phenolic compounds) and their inducibility after feeding by gypsy moth larvae (*Lymantria dispar*, Lepidoptera), as well as in oak tolerance (regrowth ability) to herbivory. In addition, we tested the influence of climatic correlates of elevation presumably underlying such elevational gradients. For this, we performed a greenhouse experiment using one-year-old plants belonging to 18 oak species which in combination span an elevational gradient of 2423 m above sea level. Our results showed that oak species growing at higher elevations exhibited a greater inducibility of hydrolysable tannins and a stronger simultaneous expression of constitutive chemical defences and their inducibility. Climatic factors did not influence on these gradients. We did not find significant associations between constitutive defences and tolerance with elevation. Overall, this study builds towards a more robust and integrative understanding of how plant defensive phenotypes vary along ecological gradients, and their underlying abiotic drivers.

GS.01-P-3

External pavilion, Poster session 1: Monday 4th-Tuesday 5th

Environmental factors influencing the distribution and abundance of littoral invertebrates and macrophytes in Catalan wetlands (NE Spain)García Murcia, Ana¹; Romans, Elvira²; Real, Montserrat³; Alonso, Miguel⁴; Miró, Isabel⁵; Piedra, David⁶; Solà, Carolina⁷; Munné, Antoni⁸

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Within the framework of the monitoring programmes of the Catalan Water Agency, 51 wetlands were sampled in the Inner Catalan River basins between 2014 and 2018 for the assessment of their ecological status. These water bodies belonged to three different water types according to the salinity and temporality of their waters: talassohaline waters (i.e. transitional waters), permanent oligohaline waters and temporary oligohaline waters. Most of them were visited between twice and four times during this period of time whereas some others were visited once. Following the Water Framework Directive guidelines, surveys comprised the assessment of biological elements, such as littoral invertebrates and macrophytes, along with hydro-morphological variables (based on the ECELS index), physico-chemical variables (temperature, conductivity, pH, Secchi disk) and nutrient-related variables (phosphate, nitrate, nitrite, ammonia, TOC, total phosphorous, total nitrogen, chlorophyll-a). A total of 209 littoral invertebrate samples and 82 macrophyte samples were obtained. Anthropogenic pressure descriptors were assessed, and comprised eight landscape and hydro-morphological variables (e.g. water abstraction, land use, invasive species). Nutrient-related variables were considered as impact variables. Impact and pressure effects on littoral invertebrates and macrophytes were evaluated using redundancy analysis (RDA). Lake and transitional water types were also added as explanatory variables. Partition of variance (pRDA) was performed so as to find out the percentage of variance explained by each group of variables (pressures, impacts or types) on the species matrix (littoral invertebrates or macrophytes). Lake types were the main explanatory group of variables for littoral invertebrates, whereas macrophytes showed higher correlations with nutrient-related variables.

GS.01-P-4

External pavilion, Poster session 1: Monday 4th-Tuesday 5th

Aquatic ecosystem recovery from Eutrophy by means of Lanthanum Modified Benthonite (Phoslock®)Gomà, Joan¹; Pineda, David²; Torres, Daniel³; Fortuño, Pau⁴; Cañedo, Miguel⁵

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Eutrophication of lakes and reservoirs is a global problem which leads to deterioration of their ecological structure and function with one of the most common symptom being the appearance of cyanobacterial blooms. Phosphorus (P) is the main nutrient that produces the eutrophication of inland waters. Algae blooms and anoxic conditions often continue even after external P input reduction, since the sediment internal load still is an important source of P. During the last decade several restoration methods have been trialled for the "capture" of internal P-loading. Among them, the use of the chemical lake restoration Lanthanum Modified Benthonite (commercially known: Phoslock®) has received increasing attention. Foix reservoir is an hypereutrophic system, with recurrent algal blooms -mainly cyanobacteria- and severe anoxia episodes, resulting a good candidate to assess the application of Phoslock® for the reduction of internal P load as the initial step to induce ecosystem restoration. Indoor mesocosm filled with Foix water were used to monitor Phoslock® under controlled experimental conditions upon nutrients concentrations and planktonic community abundance and composition. Three treatments were applied: Controls (no Phoslock® addition); low-treatment (40 mg/L Phoslock®) and high-treatment (400 mg/L Phoslock®), corresponding to 100:1 and 1000:1 molecular ratios. The treatment of Phoslock® had a significant effect reducing PO₄-3 concentration, as well as Chlorophyll a and phytoplankton biovolume and increasing water transparency. No change of the species composition of phytoplankton and zooplankton was induced, though. The mechanism of Phoslock® to chemically capture phosphorus could provide a good solution to solve eutrophication problems in lentic ecosystems.

GS.01-P-5

External pavilion, Poster session 1: Monday 4th-Tuesday 5th

Assessing population connectivity among islands and continent through morphology in a migratory bird, the Common quail (*Coturnix coturnix*)Jiménez Blasco, Irene¹; Andrade, Pedro²; Puigcerver, Manel³; García-Galea, Eduardo⁴; Gonçalves, David⁵; Rodríguez-Teijeiro, José Domingo⁶

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Morphological variation resulting from geographic or ecological isolation can be used to infer connectivity in migratory species. The Common quail shows variation in size and male throat colour, which has been associated to migratory behaviour. Yet the movements in its atlantic distribution are not well understood. Here we assess through morphology the migration strategy and connectivity of quails breeding in Macaronesia, Iberian Peninsula (Iberia hereafter; four sites: SW, NW, SE and NE) and Menorca (Balearic Islands). We measured the weight, tarsus, wing length, wing pointedness (Holynski index), alula, tail and primary notches in 469 second-year males. Throat colour was categorised in three values, from white to rufous/black. K-means clustering analysis showed three groups, characterised as: (1) small and intermediate migrants; (2) big and less migratory; and (3) intermediate size and more migratory. Azores and Cape Verde were composed mainly by the small size group (80 and 97%, respectively) and might have evolved separately. The more migratory group was present in all the regions, being the 95% of SE and NE Iberia. In Canaries and SW Iberia it represented a third of the sample. The less migratory group was mainly present in these two regions, and represented between a third and a half of the sample in NW Iberia, Madeira and Menorca. This group had darker throats (Chisq= 98.4, d.f.=4, p

GS.01-P-6

External pavilion, Poster session 1: Monday 4th-Tuesday 5th

Evaluation of the effect of vineyard's management on natural communities using epiphytic lichen diversity as indicatorLlop, Esteve¹; Riveiro, Sheila F.²

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Agriculture is an important factor promoting changes in diversity. During the last years, agriculture in the European Union is experimenting some changes related with the way how is performed. This has led some farms to move from conventional to organic farming, which is more respectful with the environment. In this research work, the two sorts of agricultural management, applied to vineyards in the NE Iberian Peninsula, have been compared using epiphytic lichen flora of holm oak trees located near the crops. Lichen flora was studied by calculating the species richness and the percent of coverage of the holm oak branches. Significant differences were observed in the number of species and the percent of coverage based on the sort of agricultural management. Surprisingly, species richness and cover were lower in vineyards with an organic management; while a reverse situation was expected. The reason is due to the nitrogen load, which has proved to be an influencing factor over the percent of lichen coverage. The use of functional traits has shown that the type of thallus and the main reproductive form is influenced by the sort of management as well. Narrow foliose lichens showed an opposite pattern to crustose lichens; suggesting that the thallus growth form varies depending on the land use intensification. Lichens with a sexual reproduction were promoted by conventional management, while lichens with asexual reproduction were more abundant in vineyards with organic farming.

GS.01-P-7

External pavilion, Poster session 1: Monday 4th-Tuesday 5th

A phylogeographic analysis of *Drosophyllum lusitanicum* (Drosophyllaceae) reveals a pivotal biogeographic role of the Strait of GibraltarMartín-Rodríguez, Irene¹; Fernández-Mazuecos, Mario²; Ojeda, Fernando³; Vargas, Pablo⁴

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The Iberian Peninsula is regarded as a prominent Pleistocene glacial refugium in Europe. In fact, several separate small refugia have been described, being the Strait of Gibraltar (SoG) one of the most important and a prime biodiversity hotspot harbouring many relict taxa. One of such relicts is *Drosophyllum lusitanicum*, a carnivorous plant species distributed in the Iberian Peninsula and northeastern Africa. The species is circumscribed in Drosophyllaceae, the only family of angiosperms endemic to the Mediterranean Basin. Considering the complex geological history of the SoG in the last 10 Myr and the poor dispersal capacity of *Drosophyllum*, we performed a phylogeographical study using ITS and plastid sequences to ascertain whether its disjunct distribution can be explained by vicariance before the opening of the SoG or by long distance dispersal after its opening. We also investigated whether the SoG has been the major Quaternary refugium or several refugia can be detected across its present range. For this latter objective, we also used a spatial distribution modelling (SDM) approach to infer the potential distribution of *Drosophyllum* in the Mid-Holocene (-6 ky), in the Last Glacial Maximum (-21 ky), and in the Last Interglacial Period (-120 ky). Results suggested that: (i) the SoG served as a major Pleistocene glacial refugium for *Drosophyllum*; and (ii) the disjunct distribution on both sides of the SoG is explained by long distance dispersal, which occurred in at least four colonization events, likely during Pleistocene Glacial Maxima, when the distance between both shores shortened due to sea-level drop.

GS.01-P-8

External pavilion, Poster session 1: Monday 4th-Tuesday 5th

Linking global diversity, distribution patterns and life history traits in the Ocean: from bryozoans to sessile invertebratesPagès Escolà, Marta¹; Montero Serra, Ignasi²; Hereu Fina, Bernat³; Linares Prats, Cristina⁴; John Costello, Mark⁵

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Understanding biodiversity patterns and the factors driving the distribution of species has been a crucial question for ecologists. In relation, the most accepted idea in species diversity and distribution patterns is that species richness is higher near the equator. In this study, we focused on bryozoans, very common habitat-forming invertebrates that can create complex habitats, but their diversity and distributional patterns have been poorly studied to date. In this context, through studying occurrences data from open data sources (GBIF & OBIS), the goals are twofold: 1) to study species richness and endemism areas, 2) to investigate distribution patterns in order to understand which environmental variables are important from a macroecological perspective and 3) to compare the global species richness between bryozoans and other marine invertebrates groups, linking it with different demographic traits and depth ranges. In this way, bryozoans showed higher diversity rates far from the equator, where there can inhabit in shallower waters showing faster dynamics and shorter lifespans. Moreover, our maps in bryozoan endemism areas agreed with previous studies about world marine bioregions and our analyses highlighted the importance of some environmental variables such as depth or temperature in their distribution. Contrary, other organisms with higher diversity rates in the tropics, as hexacorals, showed a slower dynamics, longer lifespans, and greater depths. In conclusion, life history traits of species are linked with their distributional patterns, characterizing different responses in marine sessile invertebrates.

GS.01-P-9

External pavilion, Poster session 1: Monday 4th-Tuesday 5th

Study of the variability of carob tree natural populations on the north of MoroccoPalacios Rodríguez, Guillermo¹; Ater, Mohammed²; Navarro Cerrillo, Rafael María³; Lara Gómez, Miguel Ángel⁴; Brígido García, Consuelo Carmen⁵; Hmimsa, Younes⁶; Ruiz Gómez, Francisco José⁷

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Carob tree (*Ceratonia siliqua* L.) is a native species of Mediterranean basin which presents high interest both agricultural and restoration activities. This species is tolerant to some important diseases such as root rot caused by oomycetes, and provides other socioeconomic and environmental benefits, promoting the maintenance of rural population and, therefore, the conservation of depressed rural areas and their ecosystems. On the north of Morocco, carob pod is one of the main resources for rural populations, with 18.2% of the world production of guar gum, and many traditional uses for pods pulp. The study of natural populations variability is a key aspect in the management of genetic carob resources in those areas. This work studied the production variability of ten different populations through morphological and bromatological evaluation of carob pods and seeds, assessing the effect of environmental variables and cultural practices in those characteristics. NIRS equations were developed for protein, fat acids, sugar and fiber composition. Samples presented the same level of inter and intra-population variability, except in the case of the most intensively managed populations, in which engraftment practices were identified. Climatic variables only presented clear influence in seed yield. However, the morphological traits of pods seem to be independent of the main environmental variables. The high level of variability in the natural populations of Morocco provides an important germplasm reservoir to improve the sustainable management of this species on the Mediterranean basin.

GS.01-P-10

External pavilion, Poster session 1: Monday 4th-Tuesday 5th

Biogeography of *Arabidopsis thaliana* across its native (relict and contemporary) and introduced rangesToledo, Bernardo¹; Mancera, Arnald²; Picó, Xavier³

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The identification of the historical, biotic and abiotic factors that govern species' geographic ranges is a main goal in ecology and evolution. This is particularly relevant in a context of global climate change under which distribution ranges are expected to be dramatically affected. Nevertheless, there is much debate concerning whether geographic boundaries are driven by merely geographic and climatic characteristics and/or by biological and historical processes, such as dispersion, post-glacial re-colonization history and human activities. *Arabidopsis thaliana* represents a useful model system to assess the effects of these evolutionary and ecological processes on the distribution patterns, mostly due to the publicly high-quality genetic resources available to the research community. Although previous studies describe climatic features as main explanatory factors of the *A. thaliana* distribution, substantial differences between the actual range and the model predictions have been found for recently introduced populations. Furthermore, little is known about the specific range limits and differences of relict, contemporary and recently introduced populations and the factors that account for them. The new tools and resources, such as hybrid spatial distribution models (HSDMs) and the increase of known locations worldwide (i.e. > 7000 accessions), enable the use of more reliable distribution models accounting for biotic and abiotic factors as well as the historical dynamics of the species. This contribution will shed light on the importance of analyzing relict, contemporary and introduced ranges separately to better understand the historical and present processes shaping the observed *A. thaliana*'s distribution range.

GS.01-P-11

External pavilion, Poster session 1: Monday 4th-Tuesday 5th

Shifts in the bryophyte community of the Atlantic coastal dunes of the Iberian PeninsulaVarela Río, Zulema¹; Lobo, Sara²; Monterio, Juliana³; Branquinho, Cristina⁴

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Atlantic Coastal dunes are highly dynamic and are characterized by extreme environmental and climatic conditions such as low water availability, high salinity and nutrient-poor substrates, which make them strongly vulnerable to anthropogenic disturbance. Bryophytes, due to their poikilohydric traits can be found in dune vegetation. The importance of bryophytes cover on dune vegetation dynamics is underlined by their ability to stabilize dune surfaces, activating nutrient fixing processes, contributing to soil consolidation, and contributing to water retention. Even so, bryophytes of Atlantic Coastal dunes of Iberian Peninsula have been scarcely studied so far. In this work, we studied the vegetation of secondary dunes in 31 beaches along the West Coast of the Iberian Peninsula. In each site, we sampled four transects of 50 meters parallels to the coastline and identified bryophytes and other vegetation every 50 centimetres using the point-intercept method. We found a highly significant correlation between total moss cover and the aridity gradient along the climatic gradient. In addition, there seems to be an interspecific competition between the two dominant species *Pleurochaete squarrosa* (Brid.) Lindb. (widespread in unshaded habitats in sand dunes) and the alien invasive *Campylopus introflexus* (Hedw.) Brid. at intermediate values of aridity gradient. Implications on how the invasive moss could alter the structural and functional characteristics of these fragile habitats will be discussed.

General Session 02: Biological invasions

Day: Tuesday 5th February

Schedule: 12:00h 13:30h – 16:00h 17:00h – 18:00h 20:00h

Location: Room M2

Coordinators:

Emma Cebrian, University of Girona, Spain

Emili García-Berthou, University of Girona, Spain

GS.02. Oral talks

GS.02-O-1

Room M2, Tuesday 5th Feb. 12.00 h.

Assessing cumulative invasion risk from alien species' models

Pino, Joan¹; Lupión, Carla²; Melero, Yolanda³; Molowny, Roberto⁴

(1) CREA-UAB; (2) CREA-UAB; (3) CREA-UAB; (4) CREA-UAB

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Biological invasions are among the primary global change process threatening native biodiversity; causing a myriad of both ecological and economic impacts worldwide. Modelling the presence of alien species can be a key tool for assessing the invasion risk for a given area; therefore also to guide policy-makers in the design of appropriate management strategies. There is a wealth of information on alien species occurrences in biodiversity data banks that can be used for this purpose. However, these available data are frequently presence-only and spatially biased (i.e. some specific areas can have more data than others depending on sampling effort). To overcome these difficulties, we proposed to combine a series of presence models obtained for a large number of alien species into a cumulative invasion risk index. To do so, we first performed the maximum entropy models for the 100 most frequent alien species in Catalonia (obtained from EXOCAT databank; exocat.crea.cat) in relation to a set of climatic, topographic and landscape factors. We then calculated the invasion risk index as the species' cumulative probabilities (i.e. the sum), the mean invasion risk and its variation (SD). Results showed that the invasion risk was concentrated in the warmest areas near the coast and close the main conurbations. Our approach supports previous models performed on specific known groups (e.g. plants) but extended the results to the main alien species. In consequence, it improves our general knowledge on the spatial patterns of invasion risk.

GS.02-O-2

Room M2, Tuesday 5th Feb. 12.15 h.

A species-independent model for assessing invasion risk in a country

Galicia Herbada, David¹; Serra Varela, María Jesús²; Álvarez del Río, Miguel³

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Biological invasions are a paradigm of the human-induced global change. Accordingly, they are a major environmental concern readily incorporated into the political agenda of many countries and intergovernmental bodies. Prevention has been distinguished as the most effective and environmentally preferred way to face this problem, and there is no question that targeting areas and ecosystems at highest risk make preventive measures most efficient. However, risk assessments are usually undertaken on a species-specific basis, thus limiting their ability to make generalisations and being only successful whereas the 'equilibrium assumption' is not violated. Here, we present a simple model for assessing invasion risk that is independent of species and is based on a set of key determinants of the geographic pattern and level of invasion: environmental similarity, beta diversity, propagule pressure and ecosystem disturbance. We perform an assessment using this model for Spain at 1 km² resolution. The model identifies the geographic origin of the biological invasions that will likely affect terrestrial Spain in the next future and provides the most detailed generic spatial assessment of invasion risk within a country. We also compare these results with the present pattern of invasion. Finally, we conclude that the environment is not the main driver of the geographic pattern of biological invasions in Spain. On the contrary, the combined effect of propagule pressure and ecosystem disturbance is revealed as the most influential factor.

GS.02-0-3

Room M2, Tuesday 5th Feb. 12.30 h.

Invading the archives: how, and with how much sweat, historical documents can inform invasion biologyClavero, Miguel¹

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For millennia people have been transporting species over biogeographical barriers and introducing them into new territories. If the movement of species occurred within organized states, even old introductions may be precisely documented. However, historical documents might be difficult to access and understand for invasion biologists, while people who have traditionally dealt with these documents (mainly historians) might have not paid attention to the identity or native vs. non-native status of the species mentioned in them. In spite of these difficulties, I argue that historical documents may be relevant to understand invasion processes, by providing a too often overlooked long-term view, and that this understanding may have important implications for present-day biodiversity conservation. The functioning of the court of Philip II of Spain (second half of 16th century), including the royal family everyday life, is precisely documented by the several hundreds of thousands of documents conserved in different archives. Philip II was interested in natural history, promoting both scientific research and exploration and collecting plant and animal species, many of them non-native, in his gardens. Several 16th century documents show that the king promoted the introduction in Spain of at least three fish species (tench, common carp, and northern pike) and the Italian crayfish. This information had passed unnoticed for invasion biologists, even though these documents had already been studied by other scholars and in many cases were publicly available. Thus, the integration of scholar disciplines can suppose a step forward in the long-term study of biological invasions.

GS.02-0-4

Room M2, Tuesday 5th Feb. 12.45 h.

Seawater viability and propagule transportation of *Carpobrotus edulis* along Atlantic coastal areasSouza Alonso, Pablo¹; Lechuga Lago, Yaiza²; Guisande Collazo, Alejandra³; Pereiro Rodríguez, Diego⁴; Rosón Porto, Gabriel⁵; González Rodríguez, Luís⁶

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The clonal plant *Carpobrotus edulis* threatens valuable coastal ecosystems, displacing native species and producing severe soil physico-chemical alterations. The removal of *C. edulis* is essential for habitat restoration, but plant propagules resist adverse environmental conditions, being transported or remaining latent until conditions are suitable. The presence of *C. edulis* in coastal areas, exposed to harsh environmental forces, led us to explore survival and transportation through the coastline after fragmentation. First, we assessed the potential viability of propagules after plant fragmentation and seawater immersion. After immersion (144h), propagules showed significant survival rates (~100%), with intact capacity to grow, produce biomass, new leaves, and emit adventitious roots. Physiologically, propagules maintained their photosynthetic efficiency. Second, based on seawater viability and considering the exposed location of invasive patches, we model coastline and open-water propagule transport. A realistic ocean hydrodynamic model was elaborated using the Regional Ocean Modelling System to calculate the surface current field (NW Iberian Peninsula 40°N, 16°W to 48°N, 1°W; grid resolution=1/36°). The model was based on several environmental variables monitored during consecutive years (2012-2016), using the Atlantic-Iberian Biscay Irish Ocean Physics Reanalysis both for initial and boundary values. Surface forcing from the 12-km grid of the WRF-MeteoGalicia model was prescribed on an hourly basis. Model projections diagnosed a hypothetical scenario where *C. edulis* fragments have the potential of advection to areas significantly distant from their original locations. This fact has decisive implications for *C. edulis* management, suggesting a mechanism of medium-distance dispersal that could be especially relevant for transport across islands and archipelagos.

GS.02-0-5

Room M2, Tuesday 5th Feb. 13.00 h.

Multiple invasion events and car mediated transport drive the genetic variability of *Aedes albopictus* in Spain

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The Asian tiger mosquito, *Aedes* (*Stegomyia*) *albopictus* (Skuse 1894) is a highly invasive species that in the 1980s started a broad expansion throughout tropical and temperate regions worldwide. In the Iberian Peninsula, the mosquito was first recorded in 2004 near Barcelona. Since then, the species has first spread along the Mediterranean coast and it is now moving towards inner territories of the Peninsula. Tiger mosquito's spread capacity is contradictory because females are capable of active dispersal over short distances only. As well as for other species of the genus *Aedes*, the spread of the tiger mosquito has been linked to global shipping routes and road networks, but much remains unknown about the human role in the dispersal mechanism. This study aims to ascertain the factors that contributed to spread the species so fast across the Spanish peninsula by using genetic techniques. We collected 477 individuals of *Aedes albopictus* from 2011 to 2015, all over the current species distribution in Spain. Each individual was sequenced for two gene fragments with contrasting mutation rates for the species, the low mutation mitochondrial Cytochrome Oxidase I (COI) and the highly variable nuclear Internal Transcribed Spacer 2 (ITS2). Both COI and ITS2 markers showed high genetic variability and the presence of worldwide dominant haplotypes. A positive correlation was found between genetic diversity and colonisation time for COI, suggesting multiple colonization events. ITS2 genetic distance was best explained by modelled mosquito flux and road distance thus suggesting a rapid human-mediated dispersal.

GS.02-0-6

Room M2, Tuesday 5th Feb. 13.15 h.

Can species distribution models help on oak decline diagnosis and prevention?

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Oak ecosystems have been affected by a severe decline and mortality during the last decades, mainly caused by abiotic and biotic factors. Holm (*Quercus ilex* L.) and cork oak (*Quercus suber* L.) are the tree species more affected by oak decline in the Iberian Peninsula, mainly related to extreme drought and flooding episodes, and the presence of the oomycete *Phytophthora cinnamomi*, though, at minor scale, the xylophage insects (*Cerambyx* "complex") are also involved. The combination of both agents under climate change scenarios depicts a serious problem to face with. We used ensemble species distribution models (SDMs), to assess and analyse the core drivers of forest decline and mortality processes of *Quercus ilex* and *Quercus suber* ecosystems in Andalusia, as well as the identification of those limiting factors which are involved in oak decline. We obtained accuracy model predictions for both species (AUC>0.90). Topographic and tree cover variables showed to be the most important to predict the distribution of the oomycete in Andalusia, while stand characteristics were the most important variables to predict the distribution of the *Cerambyx* "complex". Combining the model predictions obtained for both species showed their environmental overlap. Cold, aridity and alkaline soils were found as natural agent limiting the spread of *Phytophthora cinnamomi* and cold also limits the propagation of the *Cerambyx* "complex". The conservation of the Mediterranean oak woodlands ecosystem might be linked to better silvicultural practices together with conservation and prevention measurements against the introduction of the oomycete and controls over xylophage population.

GS.02-0-7

Room M2, Tuesday 5th Feb. 16.00 h.

Exploring temporal and spatial variation of an amateur-set up trapping program of yellow-legged hornets (*Vespa velutina* Lepeletier, 1836) in a rural areaServia, María J.¹; Cao, Anxo²; Gavlová, Katerina³; Fagúndez, Jaime⁴

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Since its arrival to France in 2004, the Asian yellow-legged hornet has spread rapidly throughout Western Europe, being Galicia, in NW Spain, one of the most affected regions. Their strong predatory behavior on bees and other insects, as well as the big size of the individuals and their nests, have raised a great public alarm with multiple consequences on its management. Thus, one of the most popular control methods, albeit controversial, is the spring trapping of queens, which is being intensively adopted throughout the region. However, data on phenology and factors that might affect the effectiveness of these traps are still unknown. We registered the captures of 19 commercial traps in spring and summer 2018 in a rural area in A Coruña (NW Spain). We recorded the geographic location of each trap and performed a spatial analysis to account for spatial dependence of the captures. The ratio of captured hornets vs. non-targeted insects was ca. 1:300. Results show a coherent phenology of hornets, with queens present during the whole studied period and peaking from mid May to mid June. Workers increased their presence in June, together with a few drones. However, the number of hornets, either queens or workers, did not show apparently any pattern of spatial dependence. This suggests that factors at the fine scale, such as food resources within a few meters, might be more relevant than a landscape-scale use of the area.

GS.02-0-8

Room M2, Tuesday 5th Feb. 16.15 h.

Unraveling the origin and potential invasibility of *Lophocladia* sp in the Mediterranean SeaGolo, Raul¹; Cebrian, Emma²; Verges, Alba³

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Since the opening of the Suez Canal, a large number of invasive species have transformed the complex and diverse native communities from the Mediterranean into simpler invaded ones. Among those species, *Lophocladia lallemandii* was reported for first time in Greece and was assumed as a Lessepsian migrant. The invasiveness of these species on the Mediterranean populations will strongly depend whether it comes from warmer areas as the Red Sea (*L.lallemandii*), as has been thought so far, or from Atlantic Ocean (*L.trichocladus*). In this study, to assess whether the occupied niches from populations dwelling in the Mediterranean are explained by the original occupied niches, either in the Red Sea or in the Atlantic Ocean; or if in contrast they show an expanding behavior, Ecological Niche Modeling (ENM) was used. Concretely, we used Ecospat (Rpackage) on presence *Lophocladia* spp. data from the Red Sea and the Atlantic Ocean; and we compared them with the niches obtained for Mediterranean populations. Although populations studied could not be distinguished based on the morphological traits, they significantly differed on the ecological niche occupied. The ENM showed that whereas Atlantic and Mediterranean populations had a 50% niche overlap; Mediterranean and Red Sea populations only overlapped a 10%, suggesting closer affinity between *L.trichocladus* and Mediterranean populations. However, if we consider Mediterranean populations as the invasive *L.lallemandii*, we observe a high expansion pattern from the original niche. Finally, when we modeled the global distribution of the two species considering the particular niche from each one, both showed the same worldwide distribution..

GS.02-0-9

Room M2, Tuesday 5th Feb. 16.30 h.

Does climate change favor black locust proliferation in Mediterranean riparian forests? Prospects from an ecophysiological approachSabaté Jorba, Santiago¹; Nadal-Sala, Daniel²; Poblador, Sílvia³; Sabater, Francesc⁴; Gracia, Carles⁵

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Mediterranean riparian forests shelter several broadleaved deciduous tree species in their southern bioclimatic distribution border. However, ongoing global warming and human induced disturbances may worsen their growing conditions. Under such circumstances, black locust (*Robinia pseudoacacia* L.), is currently outcompeting autochthonous tree species. Climate change projections for the Mediterranean area indicate an overall increase in aridity. Hence, inter-specific competition success among riparian tree species could be closely related to their water use strategies. In this presentation we evaluate water use strategies for riparian tree species across a riparian soil water availability gradient. We compare three autochthonous species strategies with the invasive species *Robinia pseudoacacia*. We find that *R. pseudoacacia* is the highest water use efficient. In addition, we find that this species maintains its water balances equal all across the study site, even when soil water content is depleted during summer. We explain that fact due to its facultative phreatophytic behavior. This behavior contrasts with the non-phreatophytic *Fraxinus excelsior*, which dramatically reduces growth during summer drought, as well as the drought-intolerant *Alnus glutinosa* and *Populus nigra* species, which only remain on the stream's edge at the riparian area. Accordingly, we calibrate GOTILWA+ process-based model for *R. pseudoacacia* and *F. excelsior* using Bayesian inverse calibration from field data measurements. Then, we evaluate climate change impacts on both tree species. Our results show that in high water availability environments, climate change will have a fertilizing effect on both tree species, yet *R. pseudoacacia*'s performance will be more favored as compared to *F. excelsior*.

GS.02-0-10

Room M2, Tuesday 5th Feb. 16.45 h.

Environmental filtering governs the success of alien fishes in a large, human-impacted Mediterranean riverRadinger, Johannes¹; Alcaraz-Hernández, Juan Diego²; Cano, Carlos³; García-Berthou, Emili⁴

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Many ecosystems globally, specifically those in the Mediterranean, face declines of native species and a simultaneous invasion of alien species. However, little is known of the specific environmental factors and biotic interactions that drive such community shifts, particularly in freshwater ecosystems. Using boosted regression tree models we analyzed the occurrence and abundance of native vs. alien species in the Ebro River basin in relation to environmental variables describing climate, land use, hydrologic alteration and habitat fragmentation. Additionally, we applied a joint species distribution model to test whether co-occurrence patterns of native vs. alien species are due to environmental filtering or biotic associations. Our results point to environmental factors, rather than biotic associations, as major drivers of the proliferation of alien and the decline of native fishes in the Ebro River. Alien species dominated in the lower reaches, associated with warmer temperatures, higher shares of intensive land use and appeared facilitated by dams and river regulation. Native species richness was highest in the larger tributaries followed by a strong decline in the main stem which was related to the river network position and land use type. Fragmentation due to dams and weirs played a subordinate role to explain fish richness and abundance patterns. Given the strong temperature-control, a further range expansion of alien fishes in the Ebro with future climate change can be expected. More local-scale factors related to habitat degradation and hydrological alteration might further exacerbate the establishment and success of many alien fishes.

GS.02-0-11

Room M2, Tuesday 5th Feb. 18.00 h.

Multidisciplinary approach to study the harmful impacts of *Ostreopsis cf. ovata* blooms in mediterranean beachesVila, Magda¹; Abós-Herràndiz, Rafael²; Viure, Laia³; Giussani, Valentina⁴; Isern-Fontanet, Jordi⁵; Àlvarez, Josep⁶; Moyano, Encarnación⁷; Berdalet, Elisa⁸

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Temperature increases and man-assisted activities are favouring geographical expansion of tropical and subtropical marine species to higher latitudes. In the Mediterranean, one of the world places receiving most invasive species, the harmful tropical dinoflagellate genus *Ostreopsis* is detected, since the late 90s, in many beaches and does blooms in some of them. *Ostreopsis cf. ovata* blooms have been related to different impacts on ecosystems and human health and wellbeing including massive mortalities of benthic fauna, water quality deterioration (mucilages covering benthic seaweeds, foams at surface, water discoloration), and respiratory irritations in people exposed to marine aerosols. These negative effects have been studied with different approaches. Alimentary and fecundity studies have been addressed by ecotoxicology tests, exposing sea urchin larvae or gametes to *Ostreopsis* cultures. On the other hand, the harmful effect on humans is far to be direct because these symptoms are only detected in small periods of time during the proliferation. Thus, it has been analysed with an integrative approach, combining ecology, epidemiology and experiments along the bloom period. Surprisingly, first data analyses suggested that wind intensity and direction would play a minor role on the aerosol impacts; however, *Ostreopsis* physiology has been affected by water motion, decreasing their toxin content. Due to *Ostreopsis* massive occurrence along Mediterranean beaches, citizen science activities are ongoing in order to explore the potential respiratory symptoms in humans in new areas. The multidisciplinary approach has increased the knowledge on the impacts produced by this harmful microalga in the Mediterranean Sea.

GS.02-0-12

Room M2, Tuesday 5th Feb. 18.15 h.

Functional traits associated with establishment and spread of invasive forest pathogens in Northern EuropeOliva, Jonàs¹; Redondo, Miguel Angel²; Boberg, Johanna³; Stenlid, Jan⁴

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Globalization and climate change are bringing together hosts and pathogens that lack a co-evolutionary background. Plant pathogens of the genus *Phytophthora* are good example of these unbalanced interactions, and responsible of some of the most dramatic forest outbreaks worldwide. The impact of these new interactions, will be determined by which pathogens manage to establish and spread. By high-throughput sequencing and baiting, we studied the functional traits of *Phytophthora* communities along the introduction pathway, as well as across a climatic gradient in Sweden. Comparing community assembly pre- and post-establishment, we saw that resistant structures were a key functional trait to predict establishment. Once established, we saw that invasive *Phytophthora* species distributed in Sweden following a climatic gradient. Temperature was the main driver for aquatic *Phytophthora* species, while precipitation was the main driver for terrestrial species. Our work encourages the use of functional traits to predict establishment. It also highlights the importance of considering the physical environment (water or soil) where pathogens complete their life cycle when predicting their response to climate. During this work, we developed a novel high-throughput sequencing system based on PacBio to describe *Phytophthora* communities in water, soil or plant material, which can be used for future ecological studies.

GS.02-0-13

Room M2, Tuesday 5th Feb. 18.30 h.

Non-native minnows as drivers of trophic cascades in high mountain lakesBuchaca, Teresa¹; Sabás, Ibor²; Osorio, Víctor³; Miró, Alexandre⁴; Pou-Rovira, Quim⁵; Ballesteros, Enric⁶; Puig, Maria Angels⁷; Ventura, Marc⁸

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High mountain lakes are originally fishless, although many have had human mediated introductions of non-native trout, and recently minnows (*Phoxinus* sp.). Introductions of non-native trout can result in changes in the trophic structure of lakes with extirpation or reduction of native aquatic species and alteration of nutrient cycles and primary production. However, no studies have documented the effects of minnows on high mountain lakes, especially when they are the only fish species. In this study we present results from a survey of 45 high mountain lakes across ultraoligotrophic to mesotrophic range in the Pyrenees, representative of four major lake scenarios: fishless, with trout, with minnows and with trout and minnows. The aim was to describe the intensity of trophic cascades to both pelagic and benthic primary producers' biomass and composition among scenarios. Overall, the effects of fish were more severe in lakes where minnows were the only fish species. Lakes with only minnows had significantly lower light penetration, higher phosphorus and lower DIN to total phosphorus ratios than the other lakes, suggesting nitrogen limitation of phytoplankton growth. Biomass of phytoplankton and periphyton was also higher, coupled with a severe reduction of crustacean zooplankton and littoral macroinvertebrates. While phytoplankton tended to be dominated by chlorophytes and cyanobacteria, no clear differential composition characterised periphyton. We conclude that minnows drive a severe trophic cascade enhanced by nutrient remobilisation from the sediment, increasing the trophic status of lakes to mesotrophy. Therefore, minnows are a severe threat for the conservation status of high mountain lakes.

GS.02-0-14

Room M2, Tuesday 5th Feb. 18.45 h.

Herbivore accumulation by invasive alien plants: a problem or an opportunity?Rodríguez Parra, Jonatan¹; Cordero-Rivera, Adolfo²; González, Luís³

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Invasive alien plants can affect the structure of native communities by competing with other plants, disrupting a wide range of trophic interactions, and determining new environmental scenarios due to the ecological disequilibrium that occur in the introduced range. The aim of our study was to evaluate the accumulation of herbivore insects on invasive *Acacia dealbata* and *Carpobrotus edulis* populations, assessing the distribution and frequency of herbivore insects in both invaded and adjacent non-invaded sites. To achieve this objective, we surveyed nine forest areas invaded by *A. dealbata* and nine coastal areas invaded by *C. edulis*. We identified nine different herbivore species feeding on those invasive plants. Our results showed that invasive plants change the herbivore species composition when there is a high invasion level in the areas invaded, and the composition of these herbivores depends on the ecosystem studied. In forest areas, native herbivore species were reduced, and exotic herbivores and generalist species were incremented by the invasion of *A. dealbata*. In coastal areas, *C. edulis* incremented the presence of exotic herbivores. The variation of native herbivores in locations where *A. dealbata* and *C. edulis* are located, demonstrate local ecological changes in the invaded areas. We conclude that these invasive plants favour the presence of generalist and exotic insects, increasing the risk of insect pests and decline of specialist native species. We suggest management strategies should be implemented to reduce the impacts of *A. dealbata* and *C. edulis* on biodiversity.

GS.02-0-15

Room M2, Tuesday 5th Feb. 19.00 h.

Using Acacia derived biomass as soil amendments in a potential Win-Win situationMáguas, Cristina¹; Ulm, Florian²; Cruz, Cristina³

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Mediterranean basin ecosystems are under increasing pressure from invasive species, especially ecosystem-engineers like woody legumes, a major threat to ecosystem functioning and biodiversity as they can profoundly alter soil nutrient cycles. Many Mediterranean soils are highly oligotrophic and nutrient limited, and alterations in these cycles can be detrimental for native vegetation (adapted to low nutrient input, exhibits low growth rates). Invasive woody legumes such as *Acacia* spp. (highly invasive in Portuguese dunes and adjacent agricultural landscapes) grow rapidly, increase soil organic matter (SOM), change soil nutrient cycles and create monospecific stands that fully replace native vegetation. However, the alterations have also been shown to be initially beneficial for native plants by increasing available N, SOM and soil microbial activities. This leads to increased foliar N and plant growth rates in nearby native plants, a positive effect that is juxtaposed with the negative consequences of competition for other nutrients. Agricultural fields are also under pressure from invasion and exhibit low SOM. This creates a vicious cycle, as one of the consequences of low SOM is increased nutrient leaching, benefitting *Acacia* in adjacent unused land strips. We propose a potential win-win situation where *Acacia* biomass can be used as amendment in poor soils, thus making use of its extraordinary biomass accumulation capacity. We close local nutrient cycles by modelling existing biomass using field-based and remote sensing technology, compost the biomass to remove the seed bank and successfully apply work that can help to deepen the understanding of invasion impacts on soil level.

GS.02-0-16

Room M2, Tuesday 5th Feb. 19.15 h.

Tolerance to salinity of a native versus an invasive population of *Oenothera drummondii* one: implications for conservationZunzunegui González, María¹; Gallego- Fernández, Juan B.²; Morales Sanchez, José Ángel³

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Coastal dunes are complex and dynamic ecosystems especially sensible to invasions by plants mainly due to the frequent stressor and the existence of open patches free of plant competition. *Oenothera drummondii* is a native species from coastal dunes of the Gulf of Mexico. Nowadays this species has extended on coastal areas in temperate zones and its invasion has become a significant problem in many coastal areas. We were interested in knowing how salinity affects this species and if invasive populations presented morpho-physiological traits that would give it greater tolerance to salinity than native one. To this end, a glasshouse experiment with a native and an invasive populations irrigated with different NaCl concentrations (5 to 600 mM) was designed. The morpho-physiological performance was examined at 7, 14, 30 and 60 days after irrigation with different NaCl concentration. At the end of the experiment, after measuring free proline and Na⁺ content in leaves, plants were harvested, separated in leaves, stems and root and weighted. Although plants survived to high NaCl concentrations, increasing levels of salinity resulted in a slow reduction of the photosynthetic rate, photochemical efficiency and an increase in the use of water. Biomass allocation was modified by the different NaCl levels. No differences between native and invasive populations were found. We can conclude that *O. drummondii* manifested an extraordinary resistance to salinity, and this capacity remains on plants from different biogeographical origins. This tolerance to salinity might be one of the factors explaining its high expansion rate in coastal areas.

GS.02-0-17

Room M2, Tuesday 5th Feb. 19.30 h.

The effects of the invasive *Asparagopsis armata* on native macroalgal communities: evidences from rock pools exclusion experimentsNeto, Joao M.¹; Silva, Carla O.²; Gaspar, Rui³; Novais, Sara⁴; Lemos, Marco⁵

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Biological invasions represent threats to ecosystems, through competition and habitat destruction. *Asparagopsis armata* is a red macroalgae (Rodophyta), globally recognized as an invasive species that induces significant changes into the invaded community. This study aims to evaluate the variation observed on intertidal seaweed assemblages inhabiting rock pools with and without the presence of the invasive macroalgae *A. armata*. To achieve this objective, manipulation experiments were done on rock pools in Peniche. Biological samples were collected inside intertidal pool by removing the inner material from sampling quadrats, randomly placed on the rocky surface. Three rock pools were maintained without *A. armata* and three other with the macroalgae. In this study the variations between different rock pools were assessed. Results showed different patterns in the taxonomic composition of rock pools assemblages. From January to March, the general tendency was an increase on the number of species for pools without *A. armata*, and a decrease to pools with *A. armata*. Pools containing *A. armata* showed a more constant and conservative structure, with minor variation of its taxonomic composition than the pools from where *A. armata* have been removed. The variability between samples was always higher for the last pools after the first macroalgae removals, with the presence of some species exclusively on pools without *A. armata*. Although these first enthusiastic results, further data are needed, to observe the long-term patterns (full year of sampling) and to understand the effects of the invasive *A. armata* on native macroalgal assemblages.

GS.02-0-18

Room M2, Tuesday 5th Feb. 19.45 h.

No invader left behind: what drives the invasibility of a spore-dispersed plant, *Campylopus introflexus* (Hedw.) Brid, under the expected global changes in Portugal?Canha Pinto Hespanhol, Helena¹; Portela, Ana Paula²; Vieira, Cristiana³; Gonçalves, João⁴; Sim-Sim, Manuela⁵; Garcia, César⁶; Sérgio, Cecília⁷

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Campylopus introflexus (Hedw.) Brid. is a widespread moss in the Southern hemisphere and is one of the few classic examples of a recently introduced taxon in Europe that threatens habitats that are often species rich and of high conservation relevance. In general, it has been found that bryophyte invasions are mainly driven by climate, insularity and human pressure. However, the contribution of factors explaining bryophyte invasions may differ substantially between alien bryophyte species. In Portugal, studies about *C. introflexus* have focused in the description of invaded localities, but a comprehensive assessment of the invasibility, that is, the exploration of the environmental and anthropogenic factors driving *C. introflexus* establishment is still needed, especially under global change scenarios. We used distribution data of *C. introflexus* in Portugal, known from more than 200 mainland localities where it occupies extensive areas and numerous microhabitats. We developed species distribution models for current and future distributions of *C. introflexus* using BIO-MOD2 in the R statistical software. By using a dataset of several environmental (climate and geology) and anthropogenic factors (e.g. land-use, burnt areas, population density) we aim to identify the areas of highly susceptibility to invasion by this moss, under future global scenarios. In particular, we ask the following questions: 1) Which environmental and anthropogenic factors drive the current invasion pattern of this moss? 2) How will the predicted invasion pattern be affected by future climate changes.

GS.02. Posters

GS.02-P-1

External pavilion, Poster session 1: Monday 4th-Tuesday 5th Feb.

Performance of invasive and native plants in the same habitat: An integrated physiological and ecological approachAbdallah, Mohamad¹; Traveset, Anna²; Flexas, Jaume³

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Invasive plants species are considered as one of the most devastating ecological problems of the XXI century worldwide, threatening biological diversity and ecosystem function. Although a lot of information on the invasion processes has accumulated in the last decades, much still remains unknown about the mechanisms by which alien species out-compete native ones and displace them from the habitat in which they evolved. In this study, we contribute to such knowledge by comparing the physiological and ecological performance between species pairs (one native and one invasive species) coexisting in the same habitat. We focused on eight invasive plants inhabiting sandy coastal sides, torrents or abandoned fields on Mallorca (Balearic Islands). We collected seeds and cuttings from all species which were grown in a laboratory's growth chamber. From November 2017 to March 2018, the following physiological leaf traits were measured from each species: mass area, gas exchange, water potential (relative water content and osmotic potential), and nitrogen content. Moreover, in spring 2018, we assessed the dependence of plants on pollinators, the potential competition of each species pair for pollinators in the field, and we compared their palatability and resistance to insect herbivores. Results show differences between invasive and alien pairs, although there is strong variability in most physiological traits. Overall, no competition for pollinators was observed given the little overlap in pollinator identity. The possible differences between invasive and native species in their tolerance to abiotic stress, in their resistance to herbivory, and in their potential competition for pollinators is discussed.

GS.02-P-2

External pavilion, Poster session 1: Monday 4th-Tuesday 5th Feb.

Acting locally: Assessment of three trapping systems for the invasive yellow-legged hornet (*Vespa velutina* Lepeletier, 1836) in NW SpainCao Farré, Anxo¹; Gavlová, Katerina²; Servia, María J.³

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One of the most popular methods currently used to control the expansion of the invasive yellow-legged hornet *Vespa velutina* is the spring trapping of queens because it prevents the development of new colonies. However, despite this method being promoted even by some administrations, it is controversial because of the potential impact of non-target captures in insect biodiversity. In this work, we assessed the effectiveness and selectivity of three types of traps in a rural area of A Coruña (NW Spain) using a commercial lure. Captures were recorded every 10-20 days in spring and summer 2018. We identified the insects captured in five sites using: 1) commercial traps that are currently being provided to beekeepers to protect hives, 2) homemade traps constructed following exactly the recommendations of the regional administration, and 3) homemade traps slightly modified to facilitate the capture of hornets (larger entry) and prevent the escape of non-target species (no escape holes). Results show that commercial traps have a significantly higher effectiveness for capturing hornets than homemade traps. However, they capture also a significantly higher amount of non-target species (over 99% of the captures in the three types). Interestingly, both homemade traps capture a significantly lower amount of non-target species, but those recommended by the administration capture almost no hornets. We discuss the potential benefits and deleterious effects of this kind of trapping programs, which are being used without control in the area, and the usefulness of our data for management.

GS.02-P-3

External pavilion, Poster session 1: Monday 4th-Tuesday 5th Feb.

Tolerance syndromes in the threatened species *Medicago citrina* indicates vulnerability against herbivores in the juvenile stageCapó Servera, Miquel¹; Roig-Oliver, Margalida²; Cardona, Carles³; Cursach, Joana⁴; Bartolomé, Jordi⁵; Rita, Juan⁶; Baraza, Elena⁷

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Medicago citrina is a threatened endemic species of the western Mediterranean basin with a narrow distributional area. Specifically, it occurs in islets where herbivores are absent (Columbretes, Cabrera islets, Eivissa islets and Alicante cliffs). The species is Critically Endangered on the Red List of Spanish Vascular Flora (2008) and it is protected by national law (Real Decreto 139/2011). The absence of this species in temptative habitats is related to herbivores presence, mainly goats, rabbits and rats (Latorre et al. 2013). In this study, we report the main tolerance syndromes against herbivory. Early life stage of two phylogenetic related species, *M. citrina* and *M. arborea* (wide distributional area), were subjected to a simulation of herbivory (removal of 80% of the shoot part) in two intensities: one single cut and two recurrent cuts. Photosynthetic activity was monitored every 15 days using the chlorophyll fluorimeter JUNIOR-PAM. Thus, Fv/Fm' values were obtained and light curves of 11 steps were performed after herbivory simulation. At the end of the experiment, individuals were harvested. Results indicated one single cut mainly decreased Fv/Fm' ratio in *M. citrina* and two recurrent cuts reduced light efficiency, root and nodules dry weight in both species. Furthermore, biomass values in both treatments were lower than control ones and nodules production collapsed after herbivory simulation. In conclusion, low herbivory tolerance is detected in both species during juvenile stage, being *M. citrina* the one with more noticeable vulnerability.

GS.02-P-4

External pavilion, Poster session 1: Monday 4th-Tuesday 5th Feb.

Killing wasps on the web: the management of the invasive yellow-legged hornets (*Vespa velutina* Lepeletier, 1836) as shown in social mediaGavlová, Katerina¹; Cao, Anxo²; Servia, María J.³

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Risk assessment of invasive species is essential for taking decisions concerning control actions. The Asian yellow-legged hornet *Vespa velutina* Lepeletier, 1836 (Hymenoptera: Insecta) arrived in France in 2004 and has spread throughout Europe. Impacts of *V. velutina* derive mainly from their intense feeding activity, particularly on bees. Besides, a significant amount of money is being invested in control programs due to the social alarm they create. However, even if some control methods like trapping are currently under debate, public can easily acquire information on the species through social media. In this work, we reviewed information on *V. velutina* available on Facebook, Twitter, Instagram and YouTube, and investigated mainly how management is shown in these sites. The chronology of the main events since the arrival of this species in Europe highlights the disparate synchronisation of first records of the species in different countries and dates of first contributions in social media. The quantitative analysis of public accessing Facebook sites shows that, by the end of May 2018, the mean number of followers of the ten most popular sites was 1098.5 persons (? 110.5 SE). Interestingly, the qualitative analysis of some of the most popular and active public Facebook fan pages in Spain highlights the important role of beekeepers in providing information, with emphasis on trapping programs and nest removal. We discuss the potential influence of social media on the management of this invasive species, which might be of importance to countries where this species is not present yet.

GS.02-P-5

External pavilion, Poster session 1: Monday 4th-Tuesday 5th Feb.

Charging biocontrol batteries: Circuit Theory based forecast of *Trichilogaster acaciaelongifoliae* expansion routes in PortugalLópez Núñez, Francisco Alejandro¹; Rebelo, Hugo²; Marchante, Elizabete³

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Over the past decade biocontrol programs against invasive plants started to be implemented in Europe; in parallel, low cost Unmanned Aerial Vehicles (UAV, a.k.a. drones) technology has been applied to monitor invasive species. In Portugal, the univoltine biocontrol agent (BA) *Trichilogaster acaciaelongifoliae* was recently released against *Acacia longifolia* and has successfully established in several areas along the coast. This BA promotes galls in flower and vegetative buds, reducing seed production and growth of *A. longifolia*. Landscape analyses methods (e.g., circuit theory models) have been broadly used in conservation though little in invasive species management. Yet, modeling the landscape can help to determine which environmental variables or features shape the spatial patterns of the BA's spread. In order to assist the BA dispersal, and to assure the success of the BA program, we addressed the following questions: 1) what are the environmental drivers of the BA spread?; and 2) which landscape features favor the success of the BA establishment? We selected one study site where the BA has established three years ago and linked presence data of the BA, UAV high resolution imagery and a circuit theory approach in order to tackle these questions. Preliminary results identified a more consistent spread of the BA through areas where *A. longifolia* forms a continuous stand. Further analyses are being used to identify which conditions within *A. longifolia* stands favor the establishment of the BA. The use of these results and approach to support conservation measures and management of invasive species is discussed.

GS.02-P-6

External pavilion, Poster session 1: Monday 4th-Tuesday 5th Feb.

Belowground communication between individuals of the invasive *Carpobrotus edulis*: a way to compensate the damage by herbivores?Lorenzo Rodríguez, Paula¹; Rodríguez, Jonatan²; González, Luís³

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The anthropogenic movement of plant species around the world results in new environmental scenarios where invasive alien plants face native herbivore pressure and coexist with native plants. Interactions between exotic plants and native herbivores seem to play an important role in the invasion process of introduced species. *Carpobrotus edulis* is considered one of the alien plants that greatly impacts on coastal ecosystems in Europe, such as cliffs and sand-dunes, salt marshes and coastal shrubs. Belowground communication of *C. edulis* induces non-local compensatory responses against the attack by herbivores. Nevertheless, if the compensatory response is due to some chemical compound released by root exudates or by common mycorrhizal networks was not studied. To elucidate the role of belowground communication we grew 2 individuals of *C. edulis* in connected and disconnected pots filled with live or sterile sand and damaged or non-damaged by the native snail *Theba pisana*. Our results show that the compensatory response by *C. edulis* to herbivory leads to an increase in biomass. This response is mediated by chemical signals, probably favouring the expansion of the invasive plant. The absence of soil microorganisms produced a slight stress on *C. edulis*, regardless the damage by the herbivore. We conclude that individuals of *C. edulis* release soil-mediated chemical alarms to communicate damage by herbivores to other congeners. Besides, we suggest that soil microorganisms are important in the performance of *C. edulis*, but they do not play a significant role in the communication against herbivores.

GS.02-P-7

External pavilion, Poster session 1: Monday 4th-Tuesday 5th Feb.

Climatic niche shifts analysis in a coastal invaded plant community in Southern SpainSaldaña López, Asunción¹; González-Moreno, Pablo²; Herrera, José M.³

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We explored the changes in the climatic space of a plant community after the arrival of invasive species, a key issue regarding the vulnerability of the community to climate change (e.g. if the aggregated community climatic niche is reduced). We expected the invasive species to occupy a wider climatic range than the native species, causing also a potential negative effect on the breadth of the community climatic niche. We studied a plant community located in the southwestern coast of Spain, and consisted of 106 species native to Europe and 4 non-native species. Data on the species distributions were collected at two spatial scales -plot and global-. Data on 19 bioclimatic variables, solar radiation and wind speed were downloaded from WorldClim2.0. The database was filtered to exclude records without coordinates and to reduce spatial autocorrelation. Besides, Pearson's correlation coefficients and a VIF analysis were carried out to avoid multi-collinearity among variables. Using ordination techniques and SDMs, we assessed niche changes at both spatial scales. The amount of light (i.e. mean radiation and the mean diurnal range), temperature seasonality, and extreme conditions (i.e. the mean temperature of the driest quarter and the precipitation of the coldest quarter) explained the climatic space of the community. There is an almost complete overlap between the native and introduced ranges at the two scales. The results help detect the invasive species that cause a greater impact on the resilience of the community and the native species that are more vulnerable to extinction.

GS.02-P-8

External pavilion, Poster session 1: Monday 4th-Tuesday 5th Feb.

Thermal tolerance of the seagrass *Halophila stipulacea*: responses of native and exotic populationsWesselmann, Marlene¹; Anton Gamazo, Andrea²; Hendriks, Iris³; Duarte, Carlos Maria⁴; Agustí, Susana⁵; Savva, Ioannis⁶; Marbà, Núria⁷

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Temperature is a major driver for the geographical distribution of marine plants, which play a key role in coastal ecosystems. Therefore, studying thermal tolerance of seagrasses is critical to understand climate effects on ecosystems; however, tolerance of native and exotic populations has rarely been analysed. The seagrass *Halophila stipulacea* is a Lessepsian migrant that has spread into the Mediterranean Sea. The Mediterranean minimum temperature has been proposed as a possible factor limiting its colonization, as its westernmost records are in Italy and Tunisia. Here we conducted thermal tolerance experiments on populations of *H. stipulacea* inside (Red Sea) and outside (Crete and Cyprus; Mediterranean Sea) its native range in order to (1) compare their thermal niche (optimal temperatures, upper and lower thermal limits and activation energies) and (2) determine if the Mediterranean populations have shifted their thermal thresholds. We measured mortality, growth, rhizome elongation and metabolic rates (Gross Primary Production, Community Respiration and Net Community Production) under 12 temperature treatments ranging from 8 to 40°C. Overall, different thresholds were observed at a sublethal level: mean temperature at growth cessation for Mediterranean population was 11°C and for Red Sea populations was 14°C. The comparison between native and exotic populations suggests the adaptation of the Mediterranean *Halophila* to a colder temperature regime. This slight differentiation of thermal windows between populations might allow the species to widen its biogeographical range.

GS.02-P-9

External pavilion, Poster session 1: Monday 4th-Tuesday 5th Feb.

On the occurrence of the exotic cladoceran *Kurzia cf. media* Birge, 1879; in Albufera lake (Valencia, Spain) and surrounding wetlandsZabala Belenguer, Lucia¹; Alonso, Miguel²; Olmo, Carla³; Armengol, Javier⁴

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The presence of exotic species is nowadays common in aquatic or terrestrial ecosystems, some of these species are recognized as invader species, if they can colonize and develop their populations in the new habitats. Exotic invaders are among the most relevant environmental problems of this century. Although some exotic invertebrates are among the most known invaders, the smaller exotic planktonic or benthic microinvertebrates are not so known although they can be very abundant. Tancat de la Pipa (TP) is an old area of ricefields, covering 40 ha in the northern shore of the Albufera lake, that was transformed in a naturalised wetland designed as a pilot remediation system against eutrophication. During a limnological survey of their different aquatic systems we have identified individuals of the cladoceran *Kurzia cf. media*, a chydorid which has not been cited in the Iberian Península. After the confirmation as an exotic species, we have weekly studied their populations dynamic in Winter 2018, in several ecosystems from TP and in a station in Albufera lake, close to TP. They presented a maximum density of 22 ind/L in TP and their density in Albufera was low (2 ind/L). They also presented a high proportion of ovigerous females (in some samples > 50 %) in TP, while in the Albufera they were not found with eggs. Although their possible effect on the ecosystems is unknown, this species could be a potential invader of shallow Mediterranean wetlands and their abundance in the lake and surrounding wetlands should be monitored.

General Session 03: Biotic interactions and ecosystem functioning

Day: Tuesday 5th, Wednesday 6th and Thursday 7th Feb

Schedule: 12:00h 13:30h – 16:00h 17:00h | 12:00h 13:30h – 18:00h 19:30h | 12:00h 13:30h – 15:00h 17:00h

Location: Room M1

Coordinators:

Sergi Sabater, Institut Català de Recerca de l'Aigua (ICRA), University of Girona, Spain

Fernando Valladares, National Museum of Natural Sciences (MNCN-CSIC), Spain

GS.03. Oral talks

GS.03-O-1

Room M1, Tuesday 5th Feb. 12.00 h.

Abiotic, present-day and historical effects on species, functional and phylogenetic diversity in dry grasslands of different ageBelinchón Olmeda, Rocío¹; Hemrová, Lucie²; Münzbergová, Zuzana³

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Despite extensive evidence of land-use impacts on grassland biodiversity, changes in the underlying ecological assemblage processes remain largely unknown. Here, we evaluate how abiotic, present-day and historical landscape variables shape species, functional and phylogenetic diversity, in dry grasslands of different age. We estimated diversity patterns for a set of 272 dry grassland patches of two age-classes: old and new. Null models were also used to test whether functional and phylogenetic diversity differed from random expectations, given the levels of species diversity. Finally, we tested the effects of abiotic, present-day or historical landscape variables affecting species, functional and phylogenetic diversity and the relative importance of each variable depending on the patch age-class. We found higher species, functional and phylogenetic diversity in old compared to new patches. Null models revealed that new patches host functionally similar species. By contrast, phylogenetic diversity was a function of species diversity, indicating that species colonizing new patches are not phylogenetically more redundant. Species diversity and functional structure was mostly affected by abiotic variables in the old patches, and present-day landscape variables in the new patches. The pattern was the other way around for phylogenetic structure. Evidence suggested that the relative importance of assembly processes has changed over time, and dry grassland communities were primarily determined by dispersal in the new patches and environmental filtering in the old patches. Species colonizing new patches were functionally similar but not closely related phylogenetically.

GS.03-O-2

Room M1, Tuesday 5th Feb. 12.15 h.

Ecological interactions, stochastic structural stability and the storage effect in fluctuating environmentsAlmaraz, Pablo¹

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Species coexisting in fluctuating environments persist with a positive probability of extinction. Thus, for any stability concept to make sense in ecological systems the equilibrium should not only be dynamically stable, but also feasible: the abundance of all species at equilibrium must be positive, rendering the system structurally stable. Interestingly, the recent Arnoldi-Haegeman theorem proves that, under mild conditions, the dynamic and structural stability of equilibria refer to the same kind of stochastic perturbations. I develop a stochastic modeling approach exploring the Arnoldi-Haegeman theorem in ecological communities of interacting species. The formulation is based on the application of a Bayesian strategy to vector autoregressive models of partially identified systems. The strategy provides robust estimates of ecological interactions and stability by incorporating uncertainty arising from missing data and observation error. As an example, I apply this method to long-term time series of dominance of the major phytoplankton functional types in the global ocean, obtained from ocean color satellite missions. A latitudinal gradient of increasing structural stability with increasing environmental asynchrony provides evidence for the operation of a temporal storage effect. Reactivity, but not asymptotic resilience, accurately predicts structural stability, and the empirical ordering of the stability measures suggest that global phytoplankton communities gain reactivity before losing structural stability in fluctuating environments. These results call into question the general validity of asymptotic dynamic stability measures in ecology, and suggest that changes in the reactivity of natural communities provide early-warning signals of decreased structural stability and hence of increased likelihood of species extinction.

GS.03-0-3

Room M1, Tuesday 5th Feb. 12.30 h.

Cascading effects from plants to soil microorganisms explain how plant species richness and simulated climate change affect soil multifunctionality

Valencia Gómez, Enrique¹; Gross, Nicolas²; Quero, José L.³; P. Carmona, Carlos⁴; Ochoa, Victoria⁵; Gozalo, Beatriz⁶; Delgado-Baquerizo, Manuel⁷; Dumack, Kenneth⁸; Hamonts, Kelly⁹; Singh, Brajesh K.¹⁰; Bonkowski, Michael¹¹; Maestre, Fernando T.¹²

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Despite their importance, how plant communities and soil microorganisms interact to determine the capacity of ecosystems to provide multiple functions simultaneously (multifunctionality) under climate change is poorly known. We conducted a common garden experiment using grassland species to evaluate how plant functional structure and soil microbial (bacteria and protists) diversity and abundance regulate soil multifunctionality responses to joint changes in plant species richness (1, 3 and 6 species) and simulated climate change (3°C warming and 35% rainfall reduction). The effects of species richness and climate on soil multifunctionality were indirectly driven via changes in plant functional structure and their relationships with the abundance and diversity of soil microorganisms. More specifically, warming selected for the larger and most productive plant species, increasing the average size in the communities and leading to reductions in functional plant diversity. These changes increased the total abundance of bacteria that, in turn, increased that of protists, ultimately promoting soil multifunctionality. Our work suggests that cascading effects between functional plant traits and the abundance of multitrophic soil organisms largely regulate the response of soil multifunctionality to simulated climate change, and ultimately provides novel experimental insights into the mechanisms underlying the effects of biodiversity and climate change on ecosystem functioning.

GS.03-0-4

Room M1, Tuesday 5th Feb. 12.45 h.

Influence of prey and predator size diversity on trophic transfer efficiency in freshwater and marine ecosystems

Ersoy, Zeynep¹; García-Comas, Carmen²; Bartrons, Mireia³; Hsieh, Chih-hao⁴; Bruçet, Sandra⁵

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Individual size is considered to affect metabolic rates and predator-prey interactions, especially in aquatic systems. Individual size is thus theoretically expected to affect trophic transfer. Yet, very few empirical studies have explored the role of individual size on trophic transfer. We explored how size diversities of individual sizes of prey (phytoplankton) and predators (zooplankton) influence trophic transfer efficiency (TTE; predator:prey biomass ratio as proxy) in marine ecosystems (i.e., 106 samples across the East China Sea). Our results support previous studies on single trophic levels: transfer efficiency decreases with increasing prey size diversity and increases with increasing predator size diversity. Now, we have explored the role of size diversity on trophic transfer in different organisms and aquatic system: prey and predator fishes in lakes. Analyses of single samples collected in 400 lakes across Europe within WISER project match our previous results. Our combined results support the following general mechanisms: (1) high prey size diversity (prey fish or phytoplankton) hinders TTE to upper trophic levels, because it implies greater contribution of large preys to the community, and the larger a prey is, the more difficult it is to be handled by predators; (2) high predator diversity (predator fish or zooplankton) enhances TTE, because the more even contribution of predator sizes to the community could prey more efficiently on a variety of different sized preys (i.e., diet partitioning). Overall, our results suggest that size-based interactions between trophic levels provide understanding of changes in energy transfer with climate change and anthropogenic disturbances.

GS.03-0-5

Room M1, Tuesday 5th Feb. 13.00 h.

Positive biodiversity effects through the evolution of facilitation in mixturesSchöb, Christian¹; Brooker, Rob W.²; Zuppinger-Dingley, Debra³

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Diverse experimental plant communities are more productive than monocultures, and this biodiversity effect increases over time. This temporal change has been attributed to evolutionary selection for complementarity in mixtures, but we lack key knowledge on the role of biodiversity in the evolutionary selection of species interactions. Specifically, it is unknown whether there is evolutionary selection for increased facilitative interactions in mixed plant communities, enhancing biodiversity effects. Here we show that evolutionary selection for enhanced net facilitative plant interactions occurred only in mixtures. High biodiversity in plant communities appears therefore to select for facilitation. Evolutionary selection for niche differentiation and reduced net competition, in contrast, occurred in mixtures with mixture coexistence history, and, interestingly, in monocultures with monoculture coexistence history. Widespread declines in natural and agricultural biodiversity could therefore compromise potential evolution of facilitative interactions, cornerstone processes in nature conservation and the development of sustainable agriculture. Realising the yield potential and wider benefits of mixture cropping, may therefore be hampered.

GS.03-0-6

Room M1, Tuesday 5th Feb. 13.15 h.

Spatial variability in a plant-pollinator community across a uniform landscapeReverté Saiz, Sara¹; Bosch, Jordi²; Arnan, Xavier³; Stefanescu, Constantí⁴; Calleja, Juancho⁵; Roslin, Tomas⁶; Molowny, Roberto⁷; Hernández-Castellano, Carlos⁸; Rodrigo, Anselm⁹

(1) CREAM-UAB; (2) CREAM-UAB; (3) CREAM-UAB; (4) Museu de Ciències Naturals de Granollers; (5) Universitat Autònoma de Barcelona; (6) Swedish University of Agricultural Sciences; (7) CREAM-UAB; (8) CREAM-UAB; (9) Universitat Autònoma de Barcelona

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Large-scale spatial variability in plant-pollinator communities (e.g., along geographic gradients, or across different landscapes) is relatively well understood. However, we know much less about how these communities vary at small scales within a uniform landscape. Plants are sessile and highly sensitive to microhabitat conditions, whereas pollinators are highly mobile and, for the most part, display generalist feeding habits. Therefore, we expected plants to show greater spatial variability than pollinators. We analysed the spatial heterogeneity of a community of flowering plants and their pollinators in 40 plots across a 40-Km² area of uninterrupted Mediterranean scrubland. We recorded 3577 pollinator visits to 49 plant species. The pollinator community (170 species) was strongly dominated by honey bees (71.8% of the visits recorded). The flower and pollinator communities showed similar beta-diversity. However, pollinator beta-diversity increased drastically when honey bees were excluded from the analysis. We used structural equation models to establish the effect of direct and indirect factors on the spatial distribution of the pollinator community. Wild pollinator abundance was positively related to flower abundance. On the other hand, wild pollinator visitation rate (visits/flower) was negatively related to flower abundance, suggesting that floral resources were not limiting. Pollinator and flower richness were positively related. Pollinator species composition was weakly related to flower species composition, reflecting the generalist nature of flower-pollinator interactions and the opportunistic flower choice displayed by pollinators. Honeybee visitation rate (a measure of the use of floral resources by this species) did not affect the distribution of the wild pollinator community.

GS.03-0-8

Room M1, Tuesday 5th Feb. 16.15 h.

The role of ecosystem engineers in shaping community patterns along spatial environmental gradientsKevin, Liautaud¹; Barbier, Matthieu²; Zelnik, Yuval³; Loreau, Michel⁴

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All species affect others, to a small or large extent, through modifications of their shared environment. When a species is identified as being responsible for a notable change in abiotic conditions, this species is referred to as an ecosystem engineer. Ecosystem engineers have been shown to greatly influence species composition and community patterns at different spatial scales. Nevertheless, the processes by which ecosystem engineers create such patterns, in particular along spatial gradients, remains unclear. In this study we use a dynamical model to identify conditions - such as engineering strength, engineer niche similarity, and the dynamics of environmental conditions - under which different community patterns emerge along an environmental gradient. Notably, we show that engineering actions of species can create strong discontinuities in community composition and environmental conditions across space due to the presence of alternative stable states. We also find that similarity between ecosystem engineers' niches can lead to different types of species interactions, from indirect competition to mutualism, resulting in distinct spatial patterns of species abundances. This study highlights the importance of considering species-environment feedbacks when studying community organization along environmental gradients.

GS.03-0-9

Room M1, Tuesday 5th Feb. 16.30 h.

Beyond the plant-animal dichotomy: mixotrophy and implications for ecosystem functioningGonçalves Leles, Suzana¹; Polimene, Luca²; Bruggeman, Jorn³; Blackford, Jeremy⁴; Ciavatta, Stefano⁵; Mitra, Aditee⁶; Flynn, Kevin John⁷

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Carbon acquisition among living organisms is usually assigned to one of the two exclusive trophic strategies: autotrophy or heterotrophy. This binary classification is mainly based on macroscopic organisms, generally divided in plants or animals. In reality, from strict autotrophs to strict heterotrophs lies a gradient of mixed trophic strategies – mixotrophy – being widespread in the eukaryotic tree of life. This strategy is particularly dominant among microscopic organisms in the oceans. Mixotrophy has the potential to significantly alter our understanding of ecosystem functioning, yet little is known about how functional diversity among mixotrophs can impact marine ecosystems. To better understand their impact on ecosystem dynamics, we built a planktonic food-web model accounting for different mixotrophs and their strict auto- and hetero- trophic counterparts. The model was then used to reproduce monitoring data from a temperate coastal sea situated in the Western English Channel (UK). Mixotrophs with constitutive capacity for photosynthesis (CMs) smaller than 20 µm and mixotrophs that acquire phototrophic potential (NCMs) from diverse prey dominated in nutrient poor conditions. In turn, the importance of larger CMs and specialist NCMs increased towards light-limited environments. In addition, CMs and NCMs were found to regulate the regeneration of inorganics and boost the trophic transfer efficiency of carbon. Our results highlight the importance of assigning mixotrophic functional diversity and size in view of climate change impact on nutrient and light availability in marine ecosystems, particularly considering the increased eutrophication and stratification of coastal and open global seas.

GS.03-0-11

Room M1, Wednesday 6th Feb. 12.15 h.

Defaunation has a stronger impact on functional loss than on structural loss in seed dispersal networksDonoso Cuadrado, Isabel¹; Sorensen, Marjorie C.²; Blendinger, Pedro G.³; Böhning-Gaese, Katrin⁴; Kissling, W. Daniel⁵; Neuschulz, Eike Lena⁶; Mueller, Thomas⁷; Schleuning, Matthias⁸

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Global biodiversity faces an unprecedented impact of mankind. Species defaunation by humans is considered to be a major driver of the current biodiversity crisis. It is urgent to understand how ecosystems respond to biodiversity loss because biologically diverse systems sustain ecosystem functioning and stability. Despite its critical importance, studies analysing the consequences of defaunation for seed dispersal in entire plant communities are very rare. Here we applied a novel approach integrating the fields of interaction networks and movement ecology with a trait-based modelling framework to estimate seed dispersal distances from a community perspective. Specifically we simulated the consequences of defaunation for seed dispersal function in plant communities (in terms of seed dispersal distance) and compare this functional loss to structural losses (i.e. number of interactions and plant species) in eight plant-avian frugivore networks across the Andes. We found that in all plant-bird communities, defaunation led to a strong functional impact on seed dispersal, especially on longer seed dispersal events. Our simulations further showed that functional loss in response to defaunation is much stronger than structural loss in plant-frugivore interaction networks. These results highlighted the relevance of considering such functional aspect in network studies for a realistic assessment of the potential responses of plant communities under current global change.

GS.03-0-12

Room M1, Wednesday 6th Feb. 12.30 h.

Simulating forest pest dynamics in Mediterranean pine plantationsSuárez Muñoz, María¹; Bonet García, Francisco Javier²; Hódar Correa, José Antonio³

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Global change is causing important disturbances on Mediterranean forest ecosystems. Predicting how such disturbances will change ecosystem functioning and services is one of the greatest challenges that ecology will face in the coming decades. Among Mediterranean ecosystems, pine plantations are of high importance due to their abundance. They constitute a good example to study the impacts of global change in the Mediterranean basin since their low biodiversity and poor management status cause them to be highly vulnerable. In Spain, episodes of decay and mortality are being reported, causing alarm among scientists and society. In this work, INSTAR model is introduced. INSTAR is an Agent-Based Model aiming to simulate the population dynamics of pine processionary moth (*Thaumetopoea pityocampa*) under different climate and land use scenarios. The model uses minimum and maximum temperatures to simulate the development of each life stage of the pest. In each execution, the biological cycle of the pest is simulated in terms of number of individuals at each life stage and their position and movement among a pine forest. The first calibration of INSTAR has been completed and the model successfully reproduces pest phenology, spatial distribution and influence of extreme temperatures on the pest population. In this contribution, we will show the results of several experiments in two different areas of southeast Spain. Model results will be compared with field observations in order to assess its performance and draw conclusions for further experiments, aiming to predict population dynamics under different climate scenarios.

GS.03-0-13

Room M1, Wednesday 6th Feb. 12.45 h.

Flows matter: momentum and stoichiometry in running waters and beyondIbáñez Martí, Carles¹; Caiola, Nuno²

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New hypothesis on flows of matter in fluids and how they affect the ecology and ecophysiology of plants and animals are formulated. The main assumption is that load matters more than concentration when determining the ecophysiological features of species (stress, tolerance limits, optimal habitat, etc.) living in environments where water and air move significantly (rivers, oceans, windy terrestrial ecosystems, etc.). Examples are tolerance of fauna to oxygen or suspended sediment load. We hypothesize the most relevant variable in running waters is load not concentration. To test the hypothesis experiments with fish and oxygen are being planned. The hypothesis is that fish can better tolerate hypoxia with higher water flow. Another hypothesis is that there is an optimum water flow for oxygen uptake. The effects of changing load will be different across organisms and materials. Molecules (i.e., oxygen) are in the “dissolved” fraction and uptaken by diffusion. Their exchange rate may affect body and water stoichiometry. Particles (i.e. sediments) are in the “particulate” fraction and are uptaken by “ingestion”. Their effect (impact) is associated to their momentum. The border between “particles” and “molecules” is likely not clear. Small particles or big molecules may both have “physical” and “chemical” effects on organisms. There are many theoretical and applied implications to explore, with links to metabolic theory, ecological stoichiometry, climate change impacts, environmental flows, etc.

GS.03-0-14

Room M1, Wednesday 6th Feb. 13.00 h.

Testing the Janzen-Connell effect in mediterranean forest communitiesPerea Martos, Antonio Jesús¹; Garrido Sánchez, José Luis²; Fedriani Laffitte, José María³; Alcántara Gámez, Julio Manuel⁴

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The Janzen-Connell effect has been traditionally used as a mechanism explaining species coexistence in tropical forests, but little is known about its occurrence in Mediterranean ecosystems. According to this effect, a sapling located under a conspecific canopy individual would have more chance to be infected by a specialist pathogen than one located further away. As a consequence, biodiversity far away adult plants results enhanced. Here we examine this in two Mediterranean forest communities through two fungus-plant pairs: *Cycloconium* sp. and *Quercus faginea*, and *Gymnosporangium* sp. and *Crataegus monogyna*. We have analysed in a spatially-explicit way whether fungal infection patterns are related to the spatial distribution of saplings around conspecific adult individuals, in order to detect negative density dependent patterns evidencing possible Janzen-Connell effects. Our results show that infection probability of *Quercus faginea* by *Cycloconium* sp. seems to be linked to saplings density around adults and that higher densities occurred far away from adult plants. In addition, infected saplings showed aggregated patterns around each others. This evidences a possible Janzen-Connell effect: infection probability was higher at higher saplings densities and this happened far away conspecific adult plants. As a consequence, we observe that saplings near conspecific adult plants are overdispersed and show a low probability of infection. Although in a less marked way, this was also so with *Gymnosporangium* sp. and *Crataegus monogyna*.

GS.03-O-15

Room M1, Wednesday 6th Feb. 13.15 h.

Introduced goats and pine martens as seed dispersal rescuers of *Chamaerops humilis* in Mallorca (Balearic Islands)Muñoz-Gallego, Raquel¹; Fedriani, José M.²; Traveset, Anna³

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Megafauna extinctions often lead to the disruption of plant-animal mutualisms, such as the seed dispersal service, which might entail severe consequences for plant populations and entire communities. This is especially patent in anachronistic plant species whose legitimate dispersers have gone extinct. Nevertheless, their contemporary persistence might be possible thanks to surrogate dispersers, called "seed dispersal rescuers". The Mediterranean dwarf palm *Chamaerops humilis* is an endemic fleshy-fruited species typically dispersed by mammals. Despite being very important and widespread in some of the Mediterranean islands, no information exists about its seed dispersal in these depauperated-fauna systems. In this study, we aim at identifying and quantifying the relative importance of introduced seed dispersers on the island of Mallorca (Balearic Islands), where the plant is very abundant and no native mammals exist. Specifically, we assess the seed dispersal effectiveness (SDE) for introduced goats (*Capra hircus*) and pine martens (*Martes martes*) as main seed dispersal rescuers of *C. humilis*. We found that, quantitatively, goats were more important than pine martens, as 88.2% of the seeds found in field transects were dispersed by the former. Regarding the qualitative component, our preliminary results from germination tests revealed a greater germination enhancement by pine marten, with 62.5% of emerged seedlings as far. Therefore, we conclude that, paradoxically, these two alien species are effective seed dispersal rescuers of *C. humilis* in this and probably other Mediterranean islands, where humans triggered the extinction of its native dispersers, as it could have been the goat-like *Myotragus balearicus* in Mallorca and Menorca.

GS.03-O-16

Room M1, Wednesday 6th Feb. 18.00 h.

An empirical demonstration of theoretical models revealing the role of allelopathy as a mechanism driving phytoplankton biodiversity in systems of $n=2$ and $n>2$ coexisting speciesBarreiro Felpeto, Aldo¹; Roy, Shovonlal²; Quintero, Ángela³; Ferreira, Catarina⁴; Vasconcelos, Vitor Manuel⁵; Roy, Shovonlal⁶; Quintero, Ángela⁷; Ferreira, Catarina⁸; Vaconcelos, Vitor⁹

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It has been hypothesized that in aquatic ecosystems, where numerous species of phytoplankton survive on a few resources (which Hutchinson termed as the Paradox of the Plankton) allelopathy could be a mechanism that contributes to maintain phytoplankton community diversity through regulation of competitive exclusion which is normally an inevitable outcome of resource competition. However, although several theoretical models support this hypothesis, no experimental results are available yet. Here, with a two-species system exhibiting a trade-off between resource-use-efficiency and allelopathy (the non-allelopathic chlorophyte *Ankistrodesmus falcatus* and the allelopathic cyanobacteria *Phormidium* sp.) we present the first experimental evidence demonstrating that allelopathy promotes the coexistence of two phytoplankton species on a single limiting nutrient (nitrate). Our experimental results are predicted by a relatively simple theoretical model including nitrate competition and allelopathic interactions as drivers of population dynamics. In this system, the dynamics of nitrate play a key role since nitrogen is an important component of the allelopathic compound produced by *Phormidium* sp. (portoamides). These results were extended, theoretically and empirically, to a > 2 species system, by including a non-allelopathic strain of the cyanobacteria *Microcystis aeruginosa*. The competitive ability of all these species for the limiting nutrient (nitrate) was initially determined, as well as their reciprocal allelopathic interactions. The experiments of long-term population dynamics that demonstrated the model predictions were performed in continuous culture systems over periods of up to 90 days, using nitrate as the only limiting resource.

GS.03-0-17

Room M1, Wednesday 6th Feb. 18.15 h.

Plant-herbivore-predator interactions in newly established oak forest stands: Who drives the trophic cascade?Valdés Correcher, Elena¹; Van Halder, Inge²; Barbaro, Luc³; Hampe, Arndt⁴; Castagneyrol, Bastien⁵

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Woodlands often form network of more or less connected forest patches whose character can alter trophic cascades such as plant-herbivore-predator systems. Little is known about how these organisms and their interactions are affected by the landscape context. We investigated herbivore-predator interactions in 18 oak stands in Aquitaine, south-western France, chosen along a gradient of patch size and isolation. We measured leaf insect herbivory and bird predation on artificial caterpillars, and recorded the abundance and diversity of insectivorous birds within patches. Leaf-miner abundance increased with patch isolation but was not affected by patch size. The percentage of leaf area removed by chewing insect herbivores increased with patch size, and this effect was stronger in isolated patches where herbivory was higher. Bird predation rate increased with patch area, but was not affected by patch isolation. In contrast, abundance and diversity of insectivorous birds increased with both oak patch area and isolation. Predation rate and bird or abundance diversity were unrelated and either predation rate nor bird diversity had a significant effect on herbivore damage. Altogether, our results indicate that the size and isolation of oak stands can affect trophic interactions among trees, insect herbivores and their vertebrate predators, but that these effects can be independent of each other. Thus, they do not confirm results from other study systems that predators tend to control levels of herbivory.

GS.03-0-18

Room M1, Wednesday 6th Feb. 18.30 h.

Incorporating the ecology of forest pests into landscape dynamic modelsCanelles Trabal, Quim¹; Brotons, Lluís²; Aquilué, Núria³; Duane, Andrea⁴; Moran, Alejandra⁵; Pla, Magda⁶

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Identifying and incorporating the main drivers of change into landscape models is essential for the understanding and prediction of forest landscape dynamics. Landscape modelling has been historically focused on the simulation of vegetation dynamics under the influence of abiotic disturbances, such as fire, wind throws, forest management activities and, more recently, climate. Models addressing the impact of biological origin disturbances on forest vegetation are still rare. In this paper we present a study of the pine processionary moth (*Thaumetopoea pityocampa*) as an example of a landscape-scale biological disturbance, and we assess its presence, recurrence and dispersion patterns in a Mediterranean landscape. We present a methodology to detect the presence and recurrence of the pine processionary moth by comparing time series of the NDVI index obtained through LANDSAT images. We derived then the species distribution model considering the effects of climatic, topographic, ecological and land-use variables. Our results provide quantitative support to understand the presence, dispersion and dynamics of the pest, being this information essential to further investigate future pest dynamics and its interaction with other disturbances under a global change context.

GS.03-0-19

Room M1, Wednesday 6th Feb. 18.45 h.

Avian and rodent responses to the olfactory landscape of fear in a Mediterranean cavity communityAvilés Regodón, Jesús Miguel¹; Parejo, Deseada²; Expósito-Granados, Mónica³

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Avoiding predation is critical for animals, and cues informing on predation risk can trigger stereotyped fear responses in prey which may have cascading effects on community dynamics. Olfactory information may play a fundamental role in the assessment of a predation threat because predators produce characteristic body odors that may act as modulators of memory and emotion in prey, but its role in habitat selection and community structure of birds has been neglected. Here, we demonstrate for the first time that fear to predation induced by odor cues may have ecological consequences altering composition and phenology in a Mediterranean cavity community composed by rodents and non-excavator hole-nesting birds. We experimentally increased the perception of predation risk at a patch scale by applying odors of a carnivore predator and found that Risky-odor plots were less occupied than plots with a Nonrisky-odor treatment and than Control plots. Also, there was a trend in birds, but not in rodents to settle down first in Control and Non-risky plots than in Risky ones. Finally, the odor treatment influenced the relationship between avian and rodent abundance: avian and rodent abundances were inversely related in Control and Non-risky odor plots, but avian abundance did not increase with low rodent abundance in Risky-odor plots, suggesting that birds avoided them.

GS.03-0-20

Room M1, Wednesday 6th Feb. 19.00 h.

The importance of littoral algae habitats for juvenile coastal fish in the MediterraneanHinz, Hilmar¹; Reñones, Olga²; Gouraguine, Adam³; Johnson, Andrew⁴; Moranta, Joan⁵

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The provision and value of nursery habitats by the coastal zone is one of the most frequently mentioned and recognized ecosystem services in the valuation of coastal marine ecosystems while our understanding of these habitats is still at best sketchy. The present study aims to quantify the importance of littoral algae habitats of varying composition for juvenile fish that are typically found in the littoral zone of the Mediterranean, namely *Diplodus vulgaris*, *Symphodus ocellatus*, *Coris julis* and *Thalassoma pavo*. The study related juvenile density assessed through visual census to physical and biological habitat parameters. In particular, the study focused on measuring habitat parameters related to the key requirements for juveniles i.e. shelter and food. The results of our study showed strong seasonal variations in algae cover and height during the main settlement peaks in spring and at the end of summer. Seasonal changes were also reflected in prey abundances within algae habitats. Differences in prey density did exist between algae morphotypes but in many cases these were not significant. Except for *S. ocellatus* we detected no significant association of juvenile density with any particular algae morphotype. *S. ocellatus* appeared in higher abundances in habitats dominated by Dictyotales which providing the highest cover during late summer. These results are opposed to studies that reported high associations of this species with *Cystoseira*, an alga which was abundant at some of the sampled sites. This study shows that algae fish associations may be context dependent and that several algae morphotypes may fulfil similar functions.

GS.03-0-21

Room M1, Wednesday 6th Feb. 19.15 h.

Detrital foodwebs in freshwaters: a model system to assess biodiversity and ecosystem functioning relationships under global changePascoal, Claudia¹; Cassio, Fernanda²

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Freshwater ecosystems are biologically rich and play major roles in providing ecosystem services, but they are mostly altered and vulnerable to the impacts of global change. Decomposition of plant litter in forest streams is a key process that depends on the riparian vegetation, environmental factors and decomposer communities. We used plant-litter decomposition, a key-ecosystem process, fungal decomposers and invertebrate detritivores as a tractable model system to assess impacts of global change on biodiversity and ecosystem functioning in freshwaters. Our results showed that diversity of aquatic fungi has positive effects on litter decomposition and fungal biomass production, suggesting complementary effects between aquatic fungal species. Experiments with freshwater invertebrate shredders showed that species richness determines rates of leaf breakdown due to facilitation, complementary resource use or the presence of highly productive species. Results from experiments involving multi-trophic levels helped to explain top-down and bottom-up controls within foodwebs in more realistic approach. Finally, we found evidence that those relationships are mod biodiversity and ecosystem functioning relationships are greatly modulated by environmental factors (e.g., temperature, eutrophication or chemical contaminants) as shown by data retrieved from experiments along environmental gradients.

GS.03-0-22

Room M1, Thursday 7th Feb. 12.00 h.

Contrasting the Tri-trophic interactions hypothesis: plant quality vs. parasitoidsGonzález Megías, Adela¹; Menéndez, Rosa²; Hodar, José Antonio³; Shaw, Mark⁴

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Herbivores can interact with many plant species, enemies (i.e. parasitoids), and other herbivores associated to the same plants. Therefore, different selective pressures would shape the resulting host use and diet breadth. The tri-trophic interactions hypothesis (TTI) has been proposed to explain the relative performance and coexistence of dietary specialist and generalist herbivores by integrating the effects of host-plant quality, herbivore diet breadth and natural enemies. TTI hypothesis predicts diet specialisation as a benefit in the presence of natural enemies and in low-quality plants, since plant quality increases the effects of natural enemies more for generalists than specialists species. We assessed the ecological drivers of host-plant use by butterflies of the Pieridae family in a semiarid region in southeast of Spain. Over seven years we collected pierid caterpillars in the field obtaining parasitoids preference and pressure. We also performed lab and field experiments to assess host preferences and parasitoid effects. Our food web consisted of 10 host plant species, 7 pierid butterfly species and 4 parasitoid species. We discuss our findings in line with the Tri-Trophic Interactions hypothesis.

GS.03-0-23

Room M1, Thursday 7th Feb. 12.15 h.

Assessing ecosystem functions mediated by multi-trophic trait interactionsMoretti, Marco¹

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Ecosystem functions and underlying services are strongly influenced by multitrophic relationships with functional traits playing a central role in structuring them. Assessing which traits and functional components of biodiversity mediate such interactions and affect ecosystem function under different stressors is still poorly known. Most studies on trophic interactions have been focused at the species level, limiting our mechanistic understanding on biotic control over ecosystem service delivery. Also very rarely, negative interactions mediated by e.g. antipredatory strategies have been considered. Drawing on experimental and observational studies with various invertebrate taxa (millipedes and, grasshoppers) I will highlight examples using trait-based approaches to investigate the relationships between consumers and resources and trying to answer the following questions. Are there particular traits of consumers or their resources that can help us predict ecosystem processes? Can assessing functional diversity of terrestrial invertebrates help us inform ecosystem management practices? Do traits of consumers and their resources covary in space and if so, are there particular trait matches that allow us to predict predator-prey interactions? I will then discuss the strengths and limitations of trait-based approaches and whether they indeed move ecology towards a more predictive science.

GS.03-0-24

Room M1, Thursday 7th Feb. 12.30 h.

From headwaters to estuaries: are the longitudinal gradients reflected in the processes and communities?Feio, Maria João¹; RQ Serra, Sónia²; Serra, Sonia³; Neto, João M⁴

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Conceptually, communities and processes change gradually over the river continuum, responding to longitudinal gradients. Yet, several aspects remain unclear: 1) the relative importance of litter decomposition, biofilms growth and primary productivity in large river and estuarine sections; 2) the determinant environmental gradients for the invertebrate communities and ecosystem processes (salinity, temperature, light, sediment); 3) the effect of increasing salinity in the invertebrate communities and processes; 4) the most important biological adaptations (traits) to the longitudinal gradients. This study aimed to fill these gaps using the Mondego river (Portugal) as a temperate river model. In 6 sections (headwater, middle, and 4 large river sections with increasing salinity) we analysed total and microbial decomposition, biofilms growth, primary production, structural and functional patterns of invertebrate communities and abiotic factors. Sections differed in functional patterns and invertebrate communities (PERMANOVA: $p=0.001$). Decomposition rates increased from headwaters to the estuary with a stronger segregation of the sections of higher salinity (nMDS). Headwaters had the lowest biofilm growth and primary production in opposition to middle section; intermediate values were found in the larger river sections, independently of salinity level. Invertebrate communities reflected the salinity gradient in the large river sections, and differed from upper and middle sections. Richness increased from headwaters towards the middle section and decreased towards the estuary. Differences were found over the longitudinal gradient (FCA) in dispersal, feeding habits, number of generations/year, reproduction and respiration. Different environmental variables (salinity, substrate, riparian vegetation) explained functional and invertebrate communities' patterns (constrained analysis).

GS.03-0-25

Room M1, Thursday 7th Feb. 12.45 h.

The indirect effect of temperature on herbivores mediated by their host plantsValls, Aleix¹; Harmon, Jason²

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Previous temperature experiments with herbivores (pea aphids, *Acyrtosiphon pisum*) and host plants (broad beans, *Vicia faba*) exposed to an array of long time constant temperatures showed treatment effects on aphid population growth and plant development. Direct effects of temperature to aphids were expected, but how does temperature indirectly influence aphids via their host plants? We first planted fava seeds at different times in each temperature (16°C, 24°C, 32°C) so plants would be the same size at infestation. Plants were then moved to a common environment and infested with aphids. Any differences in aphid fecundity would be due to the plants history at different temperatures. However, we found no treatment effects on aphids suggesting that after standardizing for plant development, plant history did not play a substantial role in temperature effects. Our second, complementary experiment used plants that were planted at the same time and kept in a common environment (22°C). Some plants were then randomly assigned to temperature treatments (16°C, 24°C, 32°C) and infested with individual aphids. Half those plants stayed in the treatment with their aphids and the other half were replaced each day for five days with plants from the common environment. Aphid fecundity varied with temperature, but replacing plants had no effect suggesting no difference in aphid performance on plants kept in experimental temperatures over five days versus only one. Together, these results suggest that in our lab experiments differential plant development over long time periods is the primary mechanism for indirect effects of temperature on aphids.

GS.03-0-26

Room M1, Thursday 7th Feb. 13.00 h.

Contrasting effects of beekeeping and land use on plant-pollinator networks and pathogen prevalence in Mediterranean semiarid ecosystemsMartínez López, Vicente¹; Ruíz, Carlos²; Muñoz, Irene³; Ornos, Concepción⁴; Higes, Mariano⁵; Martín-Hernández, Raquel⁶; De la Rúa, Pilar⁷

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The knowledge about mutualistic interaction networks between pollinators and plants is crucial to establish protection measures given the current decline of populations of insect pollinators. Land use changes and interspecific transmission of pathogens stands among the different stressors related to such decrease. However, most of the research effort has been focused on specific taxa and rarely at community level in less-study semiarid ecosystems. Here, we investigate plant-pollinator (Apoidea) and pathogen-pollinator networks in the Iberian Southeast during late winter and spring of 2017. We selected nine areas under a variable degree of land use and beekeeping intensity. We test the effect of these two variables on the structure of pollination networks as well as the role of honey bees in the spill over of pathogens (*Nosema apis* and *Nosema ceranae*) to the wild bee community. Interaction diversity in plant-pollinator networks was greater at the end of the spring while weighted connectance slightly decreased. Land use had a poor impact on plant-pollinator networks, but greater at distances lower than 250m from the study plots. Density of honey bees decreased along the study period and so the prevalence of *N. ceranae*. Contrastingly, density of wild bee communities did not vary in time, but the prevalence of pathogens increased in spring by the end of the study. Results corroborate the impact of honey bees on wild bees also in semiarid ecosystems by promoting the spread of pathogens in the landscape even after honey bees density decreases.

GS.03-0-27

Room M1, Thursday 7th Feb. 13.15 h.

Climate mediates the biodiversity-ecosystem stability relationship globallyGarcía Palacios, Pablo¹; Gross, Nicolas²; Gaitán, Juan³; Maestre, Fernando⁴

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Portfolio effects - stating that biodiversity can increase ecosystem stability - have received wide research and political attention. Recent experiments suggest that climate change can impact how plant diversity influences ecosystem stability, but most evidence of the biodiversity-stability relationship obtained to date comes from local studies performed under a limited set of climatic conditions. Here, we investigate how climate mediates the relationships between plant (taxonomical and functional) diversity and ecosystem stability across the globe. To do so, we coupled 14 years of temporal remote sensing measurements of plant biomass with field surveys of diversity in 123 dryland ecosystems from all continents except Antarctica. Across a wide range of climatic and soil conditions, plant species pools and locations, we were able to explain 73% of variation in ecosystem stability, measured as the ratio of the temporal mean biomass to the standard deviation. The positive role of plant diversity on ecosystem stability was as important as that of climatic and soil factors. However, we also found a strong climate-dependency of the biodiversity-ecosystem stability relationship across our global aridity gradient. Our findings suggest that the diversity of leaf traits may drive ecosystem stability at low aridity levels, whereas species richness may have a greater stabilizing role under the most arid conditions evaluated. Our study highlights that, to minimize variations in the temporal delivery of ecosystem services related with plant biomass, functional and taxonomic plant diversity should be particularly promoted under low and high aridity conditions, respectively.

GS.03-0-28

Room M1, Thursday 7th Feb. 15.00 h.

Drivers of ecosystem metabolism in coastal confined waterbodies: three years of high-frequency data in the restored saltmarsh of La Pletera, GironaBas Silvestre, Maria¹; D. Quintana, Xavier²; Compte, Jordi³; Gascón, Stéphanie⁴; Boix, Dani⁵; Menció, Anna⁶; Obrador, Biel⁷

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Coastal lagoons are among the major productive systems in the planet, providing an important range of ecosystem services and resources. However, aquatic metabolism estimates in lagoons using the diel, "free-water" changes in dissolved oxygen (DO) concentrations are scarce in comparison with lakes or rivers. The ecosystem metabolism, as the balance between the major carbon pathways, was calculated in two confined coastal waterbodies located in the restored saltmarsh of La Pletera. La Pletera saltmarsh is a protected area composed by a set of brackish to hyperhaline lagoons hydrologically driven by sudden and unpredictable flooding events and long periods without surface water inputs. Daily net ecosystem production (NEP), gross primary production (GPP) and ecosystem respiration (ER) were computed using a Bayesian approach on three years of high frequency data. The results showed differences in the metabolic rates for both lagoons through the seasons and highlighted the role of water and nutrient inputs as fundamental drivers of daily variability in GPP, ER and NEP. Ecosystem metabolism is presented as a useful technique to understand the functioning of such highly variable ecosystems as well as for monitoring their ecological status to understand the response of these habitats to different kind of disturbances.

GS.03-0-29

Room M1, Thursday 7th Feb. 15.15 h.

Top-down control across a biogeographical gradient: the role of temperature and body size of predatorsCastillo Escrivà, Andreu¹; Lúcio Pereira, Cátia²; Sroczyńska, Katarzyna³; Faísca, Pedro⁴; Bastos Araújo, Miguel⁵; Matias, Miguel⁶

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Current knowledge about trophic structure is based on bottom-up (resources) and top-down control (predator pressures). Some factors can determine the strength of these two regulations across different ecosystems, such as abiotic environmental conditions (e.g., temperature), nutrient supply and predator traits. Recently, some studies pointed out the role of the body size of the predators on the top-down control. However, we are still far to disentangle the relative role of different factors affecting trophic interactions. The aim of the present study is to analyze which factors determine zooplankton grazing on phytoplankton (as a model of top-down control) in a biogeographical gradient. For this purpose, we used six experimental stations of mesocosms across the Iberian Peninsula: Murcia, Toledo (semiarid regions), Évora (mediterranean), Porto (temperate), Jaca and Peñalara (alpine). In each location, we estimated the grazing rate in eight mesocosms (a total of 48 mesocosms). Our preliminary results show that temperature and community structure of predators affect top-down control in these mesocosms. Generally, grazing rates were higher in those regions with higher temperatures. We can explain this with the expectation that we had higher metabolic rates of predators at higher temperatures. But, temperature can indirectly affect top-down control changing the community structure of the predators, modifying their body size or acting as an environmental filter. Future studies have to take into account these temperature effects on organisms to predict changes in ecosystem functions in the current scenario of global warming.

GS.03-0-30

Room M1, Thursday 7th Feb. 15.30 h.

Resilience of Alpine grassland, livestock and wild ungulates under a forest encroachment scenarioCalleja Alarcón, Juan Antonio¹; Jarque, Laia²; Espunyes, Johan³; Lurgi, Miguel⁴; Büntgen, Ulf⁵; Bartolome, Jordi⁶; Peñuelas, Josep⁷; Serrano, Emmanuel⁸

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The abandonment of rural activities and the rise in global temperatures has led to encroachment of grasslands by woody plants, reducing habitat heterogeneity and impacting biodiversity of Alpine semi-open habitats. Under that scenario, local overgrazing of high-quality meadows by livestock and wild ungulates is hence expected during summer. In this work we first explored the impact of a hypothetical shrub expansion on the foraging efficiency of livestock (horses, cattle and sheep) and the Pyrenean chamois (*Rupicapra pyrenaica*). Then, we performed a field manipulation to assess the functional response, in terms biomass production and nutritional value, of selected herb and woody species to overgrazing. Our results showed that chamois, due to their higher trophic plasticity, might be less affected by 'shrubification' compared to livestock, which relied more on herbaceous plants. Regarding the plant response, overgrazing did not change biomass production and quality of woody cushion-like plants (e.g., *Calluna vulgaris*) but increased biomass and chemical quality of herb species (e.g., *Festuca* spp). These results reveal that subalpine grasslands may show some kind of resilience to the indirect impacts of global change.

GS.03-0-31

Room M1, Thursday 7th Feb. 15.45 h.

Substrate-mediated competitive interactions between marine diatoms and heterotrophic bacteriaCermeno, Pedro¹; Alcaraz, Miquel²; Arín, Laura³; Berdalet, Elisa⁴; Peters, Francesc⁵; Sala, Montse⁶; Marrasé, Celia⁷

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In marine plankton ecosystems, diatoms and heterotrophic bacteria (HB) compete for inorganic nitrogen (N) and phosphorus (P). It has been shown that the outcome of this competition is in favor of diatoms when silicate (Si) is in excess and in favor of HB when Si is depleted. However, the supply of organic compounds, so pervasive in marine plankton ecosystems, could alter the outcome of these competitive interactions. Here, we evaluate the response of natural plankton communities to glucose addition, Si addition, and glucose plus Si addition in laboratory microcosms to which N and P were also added by default. The addition of glucose boosted the growth of HB, which prevented diatoms from thriving. We found that HB were superior competitors as long as labile organic compounds fuelled their metabolic activity, yet, once glucose was consumed, the biomass of diatoms increased conspicuously in the glucose plus Si addition treatment. These substrate-mediated competitive interactions contribute to regulating the structure and succession of marine plankton in nature and provide us with technical know-how to design highly efficient synthetic communities with applications in wastewater treatment and quality biomass production.

GS.03-0-32

Room M1, Thursday 7th Feb. 16.00 h.

The phylogenetic distance between coexisting plants shapes the effects of mycorrhizal symbiosis on plant-plant interactionsMontesinos Navarro, Alicia¹; Valiente-Banuet, Alfonso²; Verdú del Campo, Miguel³

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The coexistence of closely related plant species can be limited by the tendency of relatives to share natural enemies, but the phylogenetic pattern derived from mutualistic interactions has been usually disregarded. Therefore, we lack a deep understanding on whether mutualistic interactions such as mycorrhizal symbiosis tend to enhance or reduce phylogenetic diversity in plant communities. We test whether the effect of mycorrhizal symbiosis on plant-plant interactions depends on the phylogenetic distance between the plant species involved. We used two recently published meta-analyses compiling studies reporting the strength of plant-plant interactions in the presence or absence (or reduced abundance) of mycorrhizal fungi. Our results show that the strength of plant facilitation through mycorrhizal symbiosis increases with the phylogenetic distance between the nurse and facilitated plant species. We discuss the potential mechanisms that might underlie this phylogenetic pattern, and the implications for understanding plant-plant interactions.

GS.03-0-33

Room M1, Thursday 7th Feb. 16.15 h.

Stable isotopes as a tool in elucidating diversity effects on N and C allocation in forage swardsAljazairi López, Salvador¹; Ribas, Ángela²; Llurba, Rosa³; Nogues, Salvador⁴; Ferrio, Juan Pedro⁵; Voltas, Jordi⁶; Sebastià, María Teresa⁷

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Stable isotope analysis has proved to be a useful tool in elucidating many ecological processes. Using d15N and d13C, we analyse results from a field experiment to investigate plant diversity effects on the N and C cycle, interaction with fertilization, and greenhouse gas exchanges in forage plant. The sown proportion of three plant species (a grass, a legume and a non-legume forb) were studied in monoculture and mixture. The nitrogen and carbon dynamics, from soil to air, were measured together with forage yield. We conducted isotope measurements during 4 years after sward establishment, before and after fertilization with pig slurry to assess the N and C dynamics in different plant species. Results support the hypothesis that nitrogen cycling, the balance between carbon and nitrogen, and the emission rates are affected by plant sown diversity and by fertilization. The nitrogen dynamics, d15N and d13C of monocultures were modified when plants were in mixture. Non-legume monocultures only have one source of N from the soil, however in the mixture co-benefits were observed from transference of nitrogen fixed by legumes to non-legume plants. N dynamics on plants was also modulated by fertilization because N availability was higher in fertilized compared to non-fertilized soils, and non-legume plants used less N transferred from legumes under fertilization. The C/N balance was affected by sown diversity and by fertilization. Finally, plant composition also affected gas exchange with the lowest gas emission found in the mixture, suggesting that diversifying forage systems with mixtures could contribute to mitigation of GHG.

GS.03-0-34

Room M1, Thursday 7th Feb. 16.30 h.

Evaluating how plant-pollinator network structure affects plant reproductive successMagrach, Ainhoa¹; Bartomeus, Ignasi²

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Natural ecosystems across the globe are increasingly suffering from the pressures of on-going global change. Pollinators, in particular, have been reported to decline in abundance and diversity in different parts of the world, with potential implications for many plant species given the dependence of 87.5% of plant species on pollinators for reproduction. Although a strong body of research has focused on pollinator visitation frequency and plant reproduction, most of these efforts have been done at the individual species level, largely ignoring community-level implications. Indeed, interaction network structure can affect pollinator functional roles, their visitation patterns to different plant species and ultimately the pollination service they deliver to plants. Thus, a major knowledge gap at the moment is a mechanistic understanding of how pollinator visitation and the structure of plant-pollinator visitation networks affect plant reproduction. Here, we use 16 well-resolved plant-pollinator networks from Mediterranean shrub ecosystems to evaluate how pollinator species diversity, community composition and interaction network structure affect plant reproduction for 19 species of plants. Further, we link pollinator visitation frequencies with the efficiency of individual pollinator species. To this end, we use data on fruit and seed set for all plant species as well as data on the efficiency of a single visit by different pollinator species on 12 of these plant species. This work represents one of the first efforts linking pollination visitation and plant reproduction from a community-wide perspective using a well-replicated dataset.

GS.03-0-35

Room M1, Thursday 7th Feb. 16.45 h.

Funcionamiento del plancton como indicador de estado trófico a partir de datos de densidad y biomasa cuantitativos y cualitativosMontagud Tarrasó, Daniel¹; Soria, Juan²; Sendra, Maria Dolores³; Alfonso, Teresa⁴; Soria Perpinyà, Xavier⁵; Vicente, Eduardo⁶

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El presente estudio se basa en el análisis de los índices biológicos para la determinación de la calidad de las aguas en aplicación de lo dispuesto en la Directiva Marco del Agua, más concretamente trata de observar en qué unidades (biomasa o densidad planctónica) responden mejor estos índices. Para ello se ha estudiado los datos fisicoquímicos y biológicos relacionados con el estado trófico de embalses heterogéneos pertenecientes a la demarcación de la Confederación Hidrográfica del Ebro. El muestreo de dichos embalses fue realizado desde 2013 a 2017. Se han considerado los índices basados en fitoplancton (Phytoplankton Reservoir Trophic Index, PRTI) y zooplancton (Zooplankton Reservoir Trophic Index, ZRTI) estudiando los datos en muestras tanto cualitativas como cuantitativas en densidad de individuos y en biomasa por unidad de volumen. El funcionamiento de estos índices como indicadores de estado trófico se ha validado frente al Trophic State Index (TSI) de Carlson (Carlson 1977). Los resultados obtenidos muestran que las ocho variantes de los índices de estado trófico basados en plancton están correlacionadas significativamente con el TSI. A partir de ello se deduce que sería suficiente para establecer el estado trófico de un embalse siguiendo los criterios de calidad de la Directiva Marco del Agua y teniendo en cuenta los recursos necesarios que cada variante requiere.

GS.03. Posters

GS.03-P-1

External pavilion, Poster session 2: Wednesday 6th - Thursday 7 th Feb.

Clam harvesting severely impacts the ecology of a *Zostera marina* seagrass meadowBarañano, Carlota¹; Fernández, Emilio²; Méndez, Gonzalo³; Morán, Paloma⁴

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Physical disturbances are known to severely impact the ecological integrity of seagrass meadows. Nevertheless, comparatively little attention has been devoted to assess the effect of clam harvesting on these ecosystems. In this investigation, we studied a subtidal *Zostera marina* meadow located in the Ría de Vigo (Spain), assessed the decrease of carbon storage capacity, the changes experienced in the seascape, the loss of genetic diversity associated to the physical disturbance and the resilience after cessation of the extraction activity. We found that clam harvesting reduced by 50% the sedimentary carbon stock reaching similar levels to those recorded in un-vegetated areas. The manual traction gear characteristic of the shell-fishing activity also severely disrupted the spatial distribution of this species, significantly increasing population fragmentation. Four months after cessation of the extraction activity, the biomass and density values of *Z. marina* reached similar values to those measured in the non-impacted site. However, the reproductive patterns appeared to be affected by the physical disturbance, with the sexual reproductive effort being significantly lower at the impacted (4%) as compared to the non-impacted sites (10%). Genetic relationships between samples of *Zostera marina* were analyzed by means of AFLP markers. Significant differences were detected between sampling areas confirming our hypothesis that the studied physical disturbance may alter population resilience to environmental stressors. Our results showed that clam harvesting exert a profound effect on the population ecology of *Zostera marina* meadows and on the carbon stocks of these ecosystems, potentially compromising seagrass conservation.

GS.03-P-2

External pavilion, Poster session 2: Wednesday 6th - Thursday 7 th Feb.

The effect of past forestry activity on sessile oak forests on the xeric limit (Montseny massif)Bou, Jordi¹; Vilar, Lluís²

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While the sessile oak (*Quercus petraea*) may be widely distributed across Europe, it is somewhat rare on the N.E. Iberian Peninsula, its southern distribution and xeric limit. Understanding the relationship this forest has with not only climate factors, but also with past human activity is important. The aim of this study is to analyse the distribution and structure of these forests and also describe the forest dynamic over the last 50 years. The work was focused on the southernmost sessile oak forest, the Montseny Massif populations, which have a marked Mediterranean influence. We produced a high resolution map (1:5000) of them in the Montseny area and performed a diachronic analysis. At same time, we inventoried sessile oak stands to assess the forest structure. The results show that *Q. petraea* currently covers only 64.1 ha, and forest density ranges from 382.2 to 2993.6 stems ha⁻¹, while basal area spans 31.8 to 99.8 m² ha⁻¹. With regard to its recent development, 44% of what is now dense forest was, in 1956, much more dispersed while 11% of it consisted of open spaces or shrubs. The relationship of this coverage changes with the current forest structure, shows that during the last 50 years, the sessile oak forests have been recovering from previous forestry activity in the massif, which should be taken into account if we want to predict the future status of these forests in the xeric limit, because the effects of climate change can be masked by this dynamic.

GS.03-P-3

External pavilion, Poster session 2: Wednesday 6th - Thursday 7 th Feb.

Invariant patterns of spatial association networks suggest general mechanisms of species coexistence

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According to the competitive exclusion principle, strong competitors should exclude species with low competitive abilities, and yet, natural assemblages hold several ecologically similar species. Despite decades of investigation, general mechanisms explaining this diversity paradox are still under debate. Curiously, coexistence studies have normally ignored the spatial structure of ecological assemblages. The spatial organization of species at fine scales may not only inform about important assembly mechanisms but it might also promote species coexistence per se. Here we analysed 380 assemblages encompassing data from a variety of biomes and taxa and described their aggregation and segregation patterns by positive and negative association networks. We found that these networks are similarly organized with more than 80% of the assemblages showing modular positive networks and highly connected negative ones. These results points to two alternative –but not exclusive– mechanisms of species coexistence based either on the presence of several microhabitats or on modular positive interactions. The generality of our findings suggests the existence of general mechanisms involved in the assemblage of species. Nevertheless, further studies are required to clarify the relative contribution of species interactions and habitat preferences to this pattern.

GS.03-P-4

External pavilion, Poster session 2: Wednesday 6th - Thursday 7 th Feb.

Resolving the links between nutrient and carbon budgets in the Burrishoole catchment

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Lake ecosystems are sensitive indicators of catchment modification. Owing to increased anthropogenic pressures and variations in climatic conditions, there is a need to understand and detect these changes by monitoring susceptible parameters at appropriate timescales. The Burrishoole catchment is situated on the northwest Atlantic coast of Ireland in County Mayo. This site has been monitored for fisheries research since the late 1950s and now there is a well-developed environmental program in place to better understand the physical, chemical and biological dynamics of the system to be able to predict future undesirable scenarios for fisheries as well as to preserve this natural ecosystem. As part of the monitoring programme in the catchment, this project aims to address the current gap in the aquatic system by quantifying and investigating nutrient (nitrogen N, and phosphorus, P) cycling to gain a fuller understanding of the drivers of productivity. Previous and ongoing studies which aim to resolve the carbon budget for the Burrishoole catchment will be drawn upon to link carbon budgets to macro nutrient dynamics through the utilisation of high frequency monitoring and the measurement of seasonal and trophic dynamics of the main carbon and nutrient pools, microbial, phytoplankton and zooplankton populations. Furthermore, considering a humic behaviour of the catchment, isotopic and stoichiometric analysis will be carried out to determine the reliance of the ecosystem on allochthonous carbon and to determine the nutritional quality and potential implications for consumer production and internal nutrient cycling within the system.

GS.03-P-5

External pavilion, Poster session 2: Wednesday 6th - Thursday 7 th Feb.

The effect of grazing management on soil and forage properties in subalpine Pyrenean pasturesCastillo García, Miguel¹; Alados, Concepción L.²; Pueyo, Yolanda³; Giner, María de la Luz⁴

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Pastures play an important socio-economical role in the sustainability of rural life-style and help preserving a variety of natural resources. Pasture degradation is a first order problem for our society and this can be produced both by overgrazing and land abandonment (i.e. shrub encroachment). An appropriate grazing management is essential to maintain pastures productivity and diversity. Pasture management cannot be sustained without preserving soil processes and resources (i.e. hydro-physical, nutrient and biological properties) as they affect pastures productivity and diversity and vice versa. The aim of this study is to understand plant-soil-livestock grazing interactions in subalpine Pyrenean pastures. To do so, we surveyed soil (nutrient status, hydro-physical and microbiological properties) and vegetation (forage quality in terms of protein and fiber composition, productivity and diversity) properties along grazing gradients in 18 sampling points (i.e. subalpine grasslands with different grazing intensities). We found a positive relationship among the intensity of grazing, the nutritional quality of forage and plant community composition, confirming the role of animal-pasture positive feedbacks in pasture preservation. We also found that grazing affected to a greater extend vegetation than soil compartments of the ecosystems (i.e. grazing effect was mainly direct to the plant community and not through soil properties). Our results give light about the functioning of grazed ecosystems, and highlight the importance of maintaining adequate grazing levels to preserve these valuable ecosystems.

GS.03-P-6

External pavilion, Poster session 2: Wednesday 6th - Thursday 7 th Feb.

Differences in soil properties and mycorrhizal communities among old and new *Fagus sylvatica* forestsCorreia, Marta Raquel Cardoso¹; Espelta, Josep Maria²; Pino, Joan³; Rodríguez-Echeverría, Susana⁴

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The abandonment of agricultural land in the last century has led to the expansion of woodlands and forests in Southern Europe. Agricultural practices may have a long-lasting legacy in soil abiotic and biotic properties which can shape the composition and dynamics of these new forests. Ectomycorrhizal (EcM) fungi are key components of temperate and Mediterranean forests since they associate with the dominant tree species enhancing access to nutrients and water and regulating nutrient cycling. The long lasting conversion of forests into agricultural land resulted in the almost complete disappearance of EcM fungi since crop species do not form this type of mycorrhiza. Thus, spontaneous re-establishment of new forests should also imply the re-colonization by EcM fungi. Yet, little is known about the diversity and composition of EcM fungi communities in new forests established on abandoned pastures and croplands. Paired old and new beech (*F. sylvatica*) forests were identified in a mountainous area in Catalonia (Northeast Spain) based on aerial photographs from 1956, actual land cover maps and dendrochronological analyses. We collected root and soil samples in 6 old and 8 new beech forests to analyze soil abiotic properties and the EcM fungal community. We found significant differences among both types of forests although these differences were also mediated by local conditions that affected forest regeneration, soil abiotic properties and EcM fungal communities.

GS.03-P-7

External pavilion, Poster session 2: Wednesday 6th - Thursday 7 th Feb.

A long-term vegetation sampling (LOTVS) database and its applicationsde Bello, Francesco¹; Götzenberger, Lars²; Galland, Thomas³; Conti, Luisa⁴; Valencia, Enrique⁵; Gotzenberger, Lars⁶; Galland, Thomas⁷; Conti, Luisa⁸; Leps, Jan⁹; Valencia, Enrique¹⁰

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Understanding how biodiversity, and biotic interactions, contribute to maintain community stability in time is essential to the temporal sustainability of multiple ecosystem functions in the face of global change. The establishment of permanent plots and long-term vegetation surveys are of crucial importance in this context. Though there are independent groups and networks collecting long-term ecological data around the world, no major efforts have been made to unify and standardize these data to achieve a worldwide perspective. This work will introduce an initiative, covering already up to ~80 datasets and more than 7800 plots, each with long-term vegetation surveys sampled for at least six years, done by a number of data contributors. We will present preliminary results and discuss some of the most important applications of this platform such as (i) verifying whether asynchrony (i.e. compensatory dynamics) in temporal fluctuations between species in a community is widespread pattern in plant communities worldwide, and (ii) testing the extent of the interplay between asynchrony and species diversity in affect community stability. Then, by combining plot data with species functional traits, we will show results (iii) evaluating the effect of functional traits in population stability and species asynchrony and (iv) assessing the changes in community functional structure among years and their relation with community stability. The platform (LONg-Term Vegetation Sampling, i.e. LOTVS) offers the opportunity to address critical ecological questions on the drivers of community temporal stability at a global scale and the opportunity for strengthening the collaboration between researchers from different biomes.

GS.03-P-8

External pavilion, Poster session 2: Wednesday 6th - Thursday 7 th Feb.

Impact of minnows on the survival of quillworts in Pyrenean lakesGacia, Esperança¹; Buchaca, Teresa²; Ballesteros, Enric³; Sabas, Ibor⁴; Ventura, Marc⁵

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The quillwort *Isoetes lacustris* L. is a common aquatic plant in shallow eastern Pyrenean lakes. Indicator of extreme oligotrophic environments and soft-water conditions, its high recovery time after massive population mortalities (> 60 years) makes it especially vulnerable to changes in the environment. The lakes of the Pyrenees are naturally fishless with transparent waters. Yet, brown trout was introduced since ancient times followed recently by other salmonids and minnows. Recent studies have demonstrated the impact of minnows in the biodiversity and trophic structure of Pyrenean lakes with a strong pressure on the abundance of zooplankton and benthic invertebrates and consequent blooming of algae both at the water column and at the benthos. Under these conditions, and since algae compete for light with benthic macrophytes, we hypothesize that minnows represent a threat to quillworts by indirectly reducing light availability (and thus carbon fixation) and affecting the potential survival of populations. Ten Pyrenean shallow lakes representative of three scenarios -fishless, with trout and with minnows-, were sampled for meadow structure, carbohydrate content and reproductive potential in 2015, 2016 and 2018. Population recruitment, carbohydrates and reproductive effort were reduced in the presence of minnows. Trout lakes showed similar values to fishless lakes. This study demonstrates the impact of non-native minnows on the survival of soft-water isoetid populations throughout loss of reproductive potential (less spores and lower carbohydrates) and regression (i.e. no recruitment) of the meadows, revealing that minnows represent a major threat for the ecological integrity of vegetated shallow lakes of the Pyrenees.

GS.03-P-9

External pavilion, Poster session 2: Wednesday 6th - Thursday 7 th Feb.

Caterpillar predation based on colour selection in Mediterranean forestsHernández Agüero, Juan Antonio¹; Polo, Vicente²; Simón Barriuso, Diego³; García Guerra, Miguel⁴; Ruíz-Tapiador, Ildefonso⁵; Cayuela, Luis⁶

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Colours are used as signals in nature. Those signals are used in intra-specific communication, as in sexual selection, as well as in inter-specific communication, as warning signals for predators. As a result of the latter, predators could select their preys based on their colour. This relation has been reported on birds, taking into account that birds are mainly visual animals. Predation rates in insectivorous birds can be estimated directly in artificial nests with cameras or field observations. There are also other possibilities to assess indirectly the relative rates of predation, like the use of model caterpillars. We developed a field study in two Mediterranean forests to estimate caterpillar predation rates and colour preference by birds. We placed eight plasticine caterpillars of eight different colours in fifteen trees (five *Quercus ilex*, holm oak, five *Acer monspessulanum*, the Montpellier maple, and five *Cistus ladanifer*, gum rockrose) at each locality, and we measured the damage weekly for seventeen weeks. The results showed no particular colour preference of caterpillar by birds in any of the two localities. This might indicate that colours are not used as warning signals for predators, and also that birds are not able to select their preys by their colours.

GS.03-P-10

External pavilion, Poster session 2: Wednesday 6th - Thursday 7 th Feb.

Radial growth patterns during early stages of mistletoe infestation in Iberian pinewoodsHódar Correa, José Antonio¹; Herrero, Asier²

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Mistletoe (*Viscum album* ssp. *austriacum* L.) is a perennial and hemiparasitic plant that takes water, photosynthates and mineral nutrients from their tree hosts. Mistletoes can reduce tree growth, enhance defoliation and alter carbon balance and water use efficiency of their hosts. Further, mistletoe is considered as a predisposing and contributing factor of drought-induced forest decline. However, there are no studies analyzing the effect of mistletoe in young adult trees during early stages of infestation. In this study, we analyzed radial growth patterns in not-infested trees and trees with low infestation degree along an altitudinal gradient. Individuals of *Pinus nigra* Arnold and *P. sylvestris* L. were sampled in two mountain ranges in southern Iberian Peninsula. Overall, 50 non-infested and 40 infested *P. nigra* and 10 non-infested and 10 infested *P. sylvestris* were cored. Sampled individuals were young adults with an approximate diameter at breast height of 25-30 cm. After removing the effect of size, growth tendencies were compared among infested and non-infested trees. Growth patterns are similar for infested and non-infested trees at initial lifespan stages. However, infested trees show a decrease in growth during recent years, with a stronger reduction at warmer and drier low elevations. Thus, it seems that mistletoe can reduce tree growth even during early stages of infestation in young adult trees. Our results help to deepen in the processes and mechanisms related to mistletoe effects on tree performance and could be used to design management actions to diminish its effects on forest health.

GS.03-P-11

External pavilion, Poster session 2: Wednesday 6th - Thursday 7 th Feb.

Regional and local factors shaping coastal dune plant communities along a climatic gradient in the Iberian PeninsulaLobo Dias, Sara¹; Serrano, Helena²; Branquinho, Cristina³; Hortal, Joaquín⁴

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The processes defining the composition and structure of communities are a crucial topic in ecology, mainly about how the factors interact to determine species' occurrences at different scales. Coastal dune vegetation is exposed to harsh environmental and climatic factors that shape and filter the community, being a unique ecological model to conduct studies along climatic gradients. The native vascular plant community of coastal dunes of Iberian Peninsula forms an open structure usually with low cover of shrubs, strictly adapted to the extreme habitat, but showing compositional and functional variation along the Atlantic Coast of the Iberian Peninsula. In this work we analysed which are the most important abiotic factors, at both local and regional levels, that drive plant communities and species trait changes. We studied the total perennial vascular vegetation of the secondary dune in 34 sites along the Atlantic Coast of the Iberian Peninsula (from Galicia to Doñana), in transects parallels to the coastline stratified by the aridity gradient from 0,4 to 1,6 and homogenising as much as possible the habitat conditions. Preliminary results seem to show that aridity is an important driver of species richness at regional scale, but only in sites limited by water availability.

GS.03-P-12

External pavilion, Poster session 2: Wednesday 6th - Thursday 7 th Feb.

Sex ratios or density-dependency: What drives *Juniperus thurifera* recruitment during forest expansion?Martín-Forés, Irene¹; C. Bastías, Cristina²; Magro, Sandra³; Acuña Miguez, Belén⁴; Álvarez, Pablo⁵; Valladares, Fernando⁶

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In contrast with a large effort in policies supporting active afforestation, autonomous forest expansion and its potential for passive restoration have been usually overlooked. Yet, as a consequence of the abandonment of rural landscapes a rewilding process has taken place in Europe over the past decades, characterized by an increase in forest surface. We study tree recruitment associated with the autonomous forest expansion of *Juniperus thurifera* in Mediterranean-climate regions. As *J. thurifera* is a dioecious tree species, we hypothesize that tree recruitment will be affected by sex-ratio, being enhanced with shorter geographic distance to female trees with high fecundity rate. Likewise, we expect this process to be positively density-dependent through an intraspecific facilitation process due to the harsh climatic conditions of the area. The study was conducted in a forest expansion gradient including three stages: mature forest, transition zone and colonization edge. Seventeen plots were selected in which both adults and sapling individuals of this species were georeferenced. Adult tree density and cover of woody species were recorded at plot level and individual traits such as diameter at breast height, height, crown projection, sex and fecundity rate were measured for each adult tree. Mixed-effects models and bivariate point pattern analysis were conducted. Our results suggest that both intra and interspecific facilitation processes mostly drive *J. thurifera* tree recruitment. Our findings bring new insights into the process of spontaneous forest establishment and its potential to be considered as an effective and affordable passive restoration technique in the context of global change.

GS.03-P-13

External pavilion, Poster session 2: Wednesday 6th - Thursday 7 th Feb.

Intraspecific variability of plant traits related to grazing resistance in a Mediterranean semiarid plant community (NE Spain).Pueyo Estaún, Yolanda¹; Barrantes, Olivia²; De Frutos, Angel³; Alados, Concepción L.⁴

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In arid and semiarid regions, rangelands occupy large extensions and sustain rural economy. It is well known that aridity promotes grazing resistance plant traits that reduce forage quality. This has been tested at community scale and large environmental gradients, but it is uncertain whether this trend is relevant within a plant community undergoing narrow climatic variability, such as the one expected under predicted climate change. The objective of this work was to investigate trait variability related to grazing resistance under two contrasting aridity conditions and different grazing treatments in a Mediterranean semiarid plant community NE Spain. At those locations, we collected leaves of the four dominant plant species at the community, two grasses (*Lygeum spartum* and *Stipa lagasca*) and two shrubs (*Salsola vermiculata* and *Artemisia herba-alba*). We evaluated intraspecific variability on protein, phosphorous, ashes and fiber content at those locations. We found that, in general, aridity decreased forage quality, while grazing increased it. There were differences between species, having shrubs larger forage quality than grasses. Given that grazing increased the abundance of shrub species, the positive effect of grazing on forage quality was at both species and community level. Our results have implications for Mediterranean semiarid rangelands management facing climate change.

GS.03-P-14

External pavilion, Poster session 2: Wednesday 6th - Thursday 7 th Feb.

Main forcing factors controlling spatial and temporal distribution of Zooplankton in the northeastern continental shelf of the Gulf of Cadiz (NE Atlantic Ocean)Rodríguez-Gálvez, Susana¹; Prieto, Laura²; Navarro, Gabriel³; Ruiz, Javier⁴

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The spatial and temporal distribution of zooplankton (> 200 µm) biomass of the northeastern continental shelf of the Gulf of Cadiz (NE Atlantic Ocean) was analyzed monthly during six annual cycles. This analysis was performed with the aim of deriving the main forcing factors controlling variability of this community at different time and spatial scales. This continental shelf is rich in chlorophyll and able to sustain high concentrations of primary producers even over the warm periods. This permanent chlorophyll signal enables an effective transfer toward other components of the food web such as zooplankton, and later towards fish communities. These conditions become this continental shelf into a markedly suitable area for the reproduction of many fish species. Zooplankton biomass is an important factor controlling biodiversity and biomass of fish communities, with its ecological and socio-economic consequences.

GS.03-P-15

External pavilion, Poster session 2: Wednesday 6th - Thursday 7 th Feb.

Study of fungal and oomycete plant pathogens in soils of holm oak dehesas of Andalusia: Influence of site conditionsRuiz Gómez, Francisco José¹; Quero, Jose Luis²; Sánchez-Cuesta, Rafael³; Navarro Cerrillo, Rafael María⁴

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Dehesas ecosystem on the Iberian Peninsula is threatened by oak decline, which consists of a multifactorial syndrome involving plant pathogens, insects, climatic variables, and cultural practices as drivers. However, root rot caused by *Phytophthora cinnamomi* and other oomycetes is considered the main factor triggering this decline. New metabarcoding techniques allow forest researchers and ecologists to assess biodiversity and microbiota composition in macroscale areas, with a high detail level. In this work, soils of 26 plots representative of the occidental dehesas ecosystems of Andalusia were studied for plant pathogen presence and abundance. Total DNA was extracted from soil samples, and ITS1 was amplified for fungal and oomycete taxa using ITS1/2 and ITS6/7 barcoded primers. Plant pathogens associated to *Quercus ilex* L., and some abundant taxa of pathogens related with other *Quercus* spp., were selected and their abundance was studied through unsupervised statistical methods to classify the different stands according to pathogen abundance, defoliation, and environmental variables. The most frequent taxon was the *Fusarium* complex, followed by *Phytophthora plurivora*, *P. cinnamomi* and *P. quercina* in this order. *Phytophthora* spp. were key taxa in the differentiation between zones, being *Pythium spiculum* less relevant. The most oriental zone, Pedroches, was clearly discriminated from the rest. The composition and diversity of pathogens did not present significant relationship with defoliation. Knowledge of diversity and structure of plant pathogen soil community would be an indicator of ecosystem dynamics and health status of plant species, and a useful tool for environmental management and biodiversity conservation.

GS.03-P-16

External pavilion, Poster session 2: Wednesday 6th - Thursday 7 th Feb.

Charophyte meadow performance under the effect of UV radiation alters the benthic community and system functioningSegura Martínez, Matilde¹; Puche, Eric²; Rodrigo, Maria A.³; Sánchez, Ester⁴; Rojo, Carmen⁵

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Charophytes, freshwater macroalgae, are organisms vulnerable to changes in their ecological conditions derived from reductions in the depth of the aquatic ecosystems they inhabit, due to the lack of water inputs and high evaporation (i.e. increases in nutrients and salinity, deeper penetration of UVR). All these circumstances are known processes included in what is currently termed as Global Change, which has more severe consequences in semi-arid regions such as the Mediterranean. The changes undergone by charophytes can alter the biota related to them such as periphyton living on the plants and sediment; ultimately, they could alter ecosystem processes such as the nitrogen cycle or carbon fixation. Considering these facts, our objective was to verify that higher doses of UV radiation may harm the charophytes, as well as the periphytic and the subsurface sediment communities. For this reason, we carried out an experiment based on mesocosms located in a protected coastal wetland. Twelve mesocosms formed with plastic nets delimited an area of 0.25 m². Four treatments were used (three replicates for each): two radiation qualities provided by the use of different filters x presence and absence of charophytes. After one month, composition and abundance of periphyton and microbial communities in the sediment were analysed. Methods include flow-cytometry, genetic studies of sediment microbial diversity and microscopy. Results confirm our hypothesis: the presence of charophyte meadows promotes more diversity and abundance of the aquatic community and a more heterotrophic composition in the sediment, finally allowing more carbon sinking and nitrogen loss.

GS.03-P-17

External pavilion, Poster session 2: Wednesday 6th - Thursday 7 th Feb.

Behavioral dominance – discovery trade-off by ants along an elevational Mediterranean gradientSilvestre Granda, Mariola¹; Seoane, Javier²; Azcárate, Francisco Martín³

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Dominance-discovery trade-offs are considered to play an important role shaping communities. However, some controversial exceptions have been reported in the last years. Here, we assess whether the occurrence of a dominance-discovery trade-off in ant assemblages might be dependent on environmental context. To do so, we studied four sites regularly distributed along a Mediterranean elevational gradient in Central Spain, ranging from 670 to 1800 m a.s.l. We set 40 observations per site, each consisting of a mixed bait rich on proteins, lipids and carbohydrates, which was offered to the ants for two hours. We calculated a trade-off index for each observation, based on the Spearman correlation between the dominance and discovery abilities of the species that interacted around each bait. Discovery ability was taken as the species order of arrival to baits, while dominance status was obtained as the ratio of winning interactions from a database of 4.096 interspecific interactions recorded on baits displayed in the study area. Species richness in the study sites was estimated by pit-fall trapping (12 traps per site). We observed a marked tradeoff at intermediate altitudes, coinciding with more productive sites and richer assemblages. In these sites, temporal niche overlap is also high (own data in prep.). In contrast, the trade-off was less clear or non-existent in assemblages at the lowest or the highest elevations. Then, we think that the behavioral dominance-discovery trade-off do play an important role in ant assemblages, but only when interspecific competition pressure is intense.

GS.03-P-18

External pavilion, Poster session 2: Wednesday 6th - Thursday 7 th Feb.

Floral scent roles in breeding system of two mediterranean clamatis species (Ranunculaceae)Tomàs, Joan¹; Gil, Lorenzo²; Llorens, Lleonard³

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The wide variety of floral forms of angiosperms and the diversity of floral aromas have been described as evolutionary features that have determined the interaction with pollinators. In the present work, we identified for the first time the volatile compounds emitted by flowers of two Mediterranean climber shrubs *Clematis cirrhosa* and *C. flammula* (Ranunculaceae), using headspace solid-phase micro-extraction and detection by gas chromatography-mass spectrometry. Moreover, this study aimed to identify flowers visitors and to evaluate the contribution of pollinators to the reproductive success of the plants, depending to floral morphology, floral scent and according to the flowering season (spring vs. autumn). A total of 40 volatile compounds belonging to three chemical groups were identified. The monoterpenes compounds represented more than 90 % of the major components identified in both species. Several compounds, such as α -pinene, are common in both species and are shown in similar amounts. Others, such as Limonene or (Z)- β -ocimene show very notable qualitative and quantitative differences. The presence of derivatives of the Ocimene group and Linalool in *C. flammula*, and the presence of compounds such as Camphor and Lavandulol in *C. cirrhosa* are noteworthy. The different emission patterns of volatile floral compounds, together with the morphological and position differences of the flowers for each species contribute to the attraction of a specific group of pollinators.

GS.03-P-19

External pavilion, Poster session 2: Wednesday 6th - Thursday 7 th Feb.

Influence of thinning and canopy type on soil chemical composition on mixed forests of the western PyreneesYeste Yeste, Antonio¹; Blanco, Juan A.²; Imbert, J. Bosco³; González de Andrés, Ester⁴; Lo, Yueh-Hsin⁵; candel-Pérez, David⁶; Castillo, Federico J.⁷

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Nowadays, the admixture of tree species is being increasingly recognised as a key factor in sustainable forest management favouring the growth of mixed forests over monospecific ones. Mixed forests are considered as more resilient ecosystems and they may even provide ecosystem services more effectively than pure stands. On the other hand, these advantages are linked to the increment of ecosystem complexity, meaning that further research concerning species interactions and ecosystem functioning is needed in order to efficiently manage mixed stands. Especially, how soil characteristics influence important processes in forest ecosystems like nutrient cycling has been relatively less studied. Keeping these ideas in mind, we carried out a study focused on how soil chemical properties are influenced by thinning and canopy type. The research area was located in the south-western Pyrenees (province of Navarra, Spain) where canopy was either dominated by one tree species, Scots pine (*Pinus sylvestris*) or beech (*Fagus sylvatica*), or co-dominated by both of them. Two thinning intensities were considered, 0% and 30% extraction of basal area. Soil samples from the two upper layers (0-13 and 13-26 cm deep) were taken on May and October 2017 and laboratory analysis were undertaken to assess main nutrient elements concentrations (C, N, P and cations). Variability in the results between treatments evidence the complexity of the forest functioning. The differences found are likely linked to species-specific processes such as a higher nutrient uptake by beech compared to Scots pine, differences in litterfall production and the alteration of the understorey.

General Session 04: How Ecology serves the Society: services and nature-based solutions

Day: Thursday 7th Feb

Schedule: 12:00h 13:30h – 15:00h 17:00h

Location: Room A3

Coordinators:

M. Amelia Martins-Loucao, Center for Ecology, Evolution and Environmental Changes (CE3C), University of Lisbon (UL), Portugal

Arturo Elosegui, University of The Basque Country (UPV/EHU), Spain

GS.04. Oral talks

GS.04-0-1

Room A3, Thursday 7th Feb. 12.00 h.

Temporal dynamics of Mediterranean forest ecosystem services and their relationships with climate and local biodiversity

Roces-Diaz, Jose V¹; Banqué-Casanovas, Mireia²; De Cáceres, Miquel³; de-Miguel, Sergio⁴; Garcia-Valdes, Raul⁵; Morán-Ordóñez, Alejandra⁶; Vayreda, Jordi⁷; Martínez-Vilalta, Jordi⁸

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Mediterranean forest are responding to different drivers of Global Change. These drivers include a general decline of human use of the landscape and a growing impact of different disturbances such as extreme climatic events. These drivers are expected to impact forest ecosystems, their biodiversity and their ecological functioning. However, the recent impact of these (or other) drivers on the ecosystem services (ES) provided by these forests still remains partially unexplored. Exploring recent impacts should constitute one of the basis for accurate and consistent predictions of ES provision. We have used a network of more than 3,400 inventory plots in Northeastern Spain to assess recent changes in forest ES. These plots have been surveyed three times during last decades (approximately in 1990, 2000 and 2015). We analysed changes in structure and composition and used (previously tested) ecological models to estimate a series of ES. We obtained spatially explicit indicators (a grid with 5x5 km of cell size) for the three reference periods for the following ES: food (mushrooms) provision, water provision, timber provision, climate regulation and erosion control. Preliminary results did not show huge differences among ES for this period, however some of these indicators showed a slight decline, apparently related with inter-annual variability of climatic conditions. In addition we did not find strong relationships between these changes on ES supply and the spatial patterns (or observed) changes of forest biodiversity (tree species richness and Shannon diversity index). However, these potential links should be explored with more detail in further analysis.

GS.04-0-2

Room A3, Thursday 7th Feb. 12.15 h.

Are protected areas preserving ecosystem services and biodiversity? Insights from Catalonia

Lecina-Diaz, Judit¹; Alvarez, Albert²; de Cáceres, Miquel³; Vayreda, Jordi⁴; Herrando, Sergi⁵; Retana, Javier⁶

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Research on ecosystem services has become a major approach to assess ecosystems and their contribution to human well-being. At the same time, global concern on the protection of natural areas has increased substantially over the past 25 years. However, it still remains unclear to what extent protected areas with different protection status are also effective in maintaining ecosystem services. In our study, we determine the role of protected areas in preserving ecosystem services (carbon stocks, water provision, habitats of community interest and geological-interest sites) and biodiversity (woody richness, bird richness and overall biodiversity) in Catalonia. We consider two main protection levels: intermediate (e.g. Natural Parks, Partial Nature Reserves, Provincial Parks) and low (e.g. Natura 2000). Specifically, we aim (1) to quantify and compare protected areas (with different protection status) and non-protected areas in terms of land cover type, ecosystem services and biodiversity; and (2) to quantify the degree of spatial overlap of areas of high values (hotspots) of ecosystem services and biodiversity outside and inside protected areas with different protection status. Neither carbon stocks nor water provision were higher inside than outside protected areas, and we also did not find significant differences between the two levels of protection. Nevertheless, the coverages of both habitats of community interest and geological-interest sites were higher inside than outside protected areas. Finally, we found no differences in the biodiversity indicators considered. This study provides an essential framework to the debate on conservation and land-use management strategies in the Mediterranean region.

GS.04-0-3

Room A3, Thursday 7th Feb. 12.30 h.

Future provision of ecosystem services by Mediterranean forests under global changeMorán Ordóñez, Alejandra¹; Ameztegui, Aitor²; de Cáceres, Miquel³; de Miguel, Sergio⁴; Brotons, Lluís⁵; Coll, Lluís⁶

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Mediterranean forests represent a good example of biodiversity-rich and complex socio-ecological systems, with a long history of human use/management. These forests have historically played a key role in providing important services and goods to society and are currently threatened by global change. In this study we evaluate the changes in ecosystem service provision by forests of black pine (*Pinus nigra*) and Scots pine (*Pinus sylvestris*) under eight different future scenarios, using as case study the forests of central Catalonia (NE Spain). Future scenarios resulted from the combination of different socio-economic, management and climate change assumptions. We used the process-based model SORTIE-ND to simulate spatially-explicit forest dynamics in 261 forest plots of these species (1ha plots; National Forest Inventory) under each scenario. We use the outputs of SORTIE-ND (predictions of changes in forest structure and composition over time) as inputs of different empirical and process-based models to estimate changes in the provision of the following ecosystem services: harvested timber, carbon storage, mushroom yield, regulation of water quantity and prevention of soil erosion. We also assess whether or not there are trade-offs between ecosystem services provision and if those trade-offs hold over time and between scenarios. Preliminary results suggest provision of ecosystem services does not change substantially among scenarios, except for harvested timber which was much higher in the scenario assuming forest management aimed at increasing biomass production under a high-end climate change scenario. In any case, greater differences between scenarios arise for longer time horizons or more severe emissions scenarios.

GS.04-0-4

Room A3, Thursday 7th Feb. 12.45 h.

Model based on Ecosystem Services for the implementation of compensatory measuresPeña, Lorena¹; Onaindia, Miren²; Ametzaga, Ibone³; Fernández, Beatriz⁴

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Although some European countries, such as Germany or France, have developed a comprehensive system for the implementation of compensatory measures, other countries such as Spain or Portugal have not developed them yet. Therefore, we present a model designed for the county council of Biscay (Basque Country, Spain) to develop compensation measures based on the evaluation of the ecosystem services (ES) lost due to the development of a liner infrastructure, as well as, the assessment of the suitability of the compensatory measures proposed in the project to compensate for the total loss of those ES. The model is based only in 2 steps so that users, mainly administrative technicians working in this field, can easily use it: 1st To fill in the area (ha) of each compensable ecosystem that will be impacted by the project to evaluate the value of the ES that are lost, and then, the model calculates how much surface area of each ES lost is necessary to compensate, using a compensation factor based on the value of the ES. 2nd To fill in the compensatory measures (restoration, conservation or creation of ecosystems) that are proposed within the project, to determine how much is compensated for each ES with each compensatory measure that is expected to establish. To test the model, the Plan of the Unbe corridor was used as a pilot case. At present, the county council of Biscay is considering the implementation of this compensatory system in the execution of new projects.

GS.04-0-5

Room A3, Thursday 7th Feb. 13.00 h.

Designing a green infrastructure network for the maintenance of ecosystem services and biodiversityLanzas, Monica¹; Hermoso, Virgilio²; de Miguel, Sergio³; Bota, Gerard⁴

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Growing concern for the maintenance of ecosystem services (ESS) leads to the need of holistic landscape planning to enhance sustainable use of ESS and maintenance of the biodiversity that supports them. The EU is currently developing policy to regulate the maintenance of ESS and enhancing connectivity among protected areas (PAs). This is known as the network of Green Infrastructure (GI). However, there is not a working framework defined yet to plan the spatial design of this network of GI. Here, we use Marxan with Zones, to prioritize the spatial distribution of different management zones that resemble a potential network of GI. These zones included a conservation zone, mainly devoted to protecting biodiversity; a GI zone, that aimed at connecting PAs and maintaining regulating and cultural ESS; and a management zone devoted to exploiting provisioning ESS. We also develop a sensitivity analysis increasing the ESS target to explore trade-offs that may occur when managing together biodiversity and ESS. We use Catalonia as a case study for demonstrating this novel methodology. We found that targets on different ESS could always be achieved at least for intermediate targets. However, we found out that there was a threshold on these target over which trade-offs appeared between maintaining regulating and cultural ESS and biodiversity vs. getting access to provisioning ESS. This methodological approach could help designing a structural framework to integrate biodiversity and ESS management in holistic plans and decision making and at the same time meeting European mandates concerning the design of GI networks.

GS.04-0-7

Room A3, Thursday 7th Feb. 15.00 h.

Peer Community in: a free public system for peer-reviewing and highlighting preprintsBourguet, Denis¹; Guillemaud, Thomas²; Facon, Benoit³

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In order to offer an alternative to the current system of publication - which is particularly expensive and not very transparent - we have initiated the Peer Community in (PCI, <https://peercommunityin.org>) project. PCI is a non-profit scientific organization that aims to create specific communities of researchers reviewing and recommending, for free, unpublished preprints in their field (i.e. unpublished articles deposited on open online archives like arXiv.org and bioRxiv.org). Each PCI is a group of several hundreds recommenders playing the role of editors who recommend such preprints based on peer-reviews to make them complete, reliable and citable articles, without the need for publication in 'traditional' journals (although the authors can submit their recommended preprints afterwards). Evaluations and recommendations by PCI Evol Biol are free of charge. When a recommender decides to recommend a preprint, he/she writes a recommendation text that is published along with all the editorial correspondence (reviews, recommender's decisions, authors' replies) by PCI Evol Biol. The preprint itself is not published by PCI Evol Biol; it remains in the preprint server where it has been posted by the authors. The first Peer Community in has been launched in 2017: Peer Community in Evolutionary Biology (PCI Evol Biol). More than 370 recommenders have already joined PCI Evol Biol. PCI Paleontology and PCI Ecology have been launched in January 2018 and this latter PCI already counts 280 recommenders.

GS.04-0-8

Room A3, Thursday 7th Feb. 15.15 h.

Role of scavengers in the nature's contribution to peopleAguilera Alcalá, Natividad¹; Morales-Reyes, Zebensui²; Martín-López, Berta³; Moleón, Marcos⁴; Sánchez-Zapata, José Antonio⁵

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In current societies, scavengers play an important role as providers of nature's contribution to people (NCP), such as pest and disease control or carcass removal. Yet, very few is known about the nonmaterial NCP (i.e. nature's effects on subjective and psychological aspects of people's quality of life) provided by scavengers to societies. With the aim to determine which species of obligate and facultative scavengers provide different nonmaterial NCP in Spain (recreational and aesthetic experiences, learning and inspiration, and supporting identities) we collected data from different sources on internet: nature photography, wildlife watching tours, appearance in outreach magazine, records of human observations, scientific paper published and searches in Google trend. We also aim to identify which ecological variables determine their capacity to provide the nonmaterial NCP. We found that gray wolf was the most prominent species in the provision of multiple nonmaterial NCP. Aesthetical experiences were mainly provided by species that are non-threatened, with small body mass and small home range, such as common genet and corvids. Recreation and learning by civil society were provided by threatened species with high body mass and large home range, such as gray wolf and brown bear. The knowledge acquired by scientists was mainly provided by mesocarnivores. Finally, supporting identities was related with those non-threatened and social mammals with high fecundity and nocturnal activity, such as gray wolf and wild boar. Recognizing that all species of scavengers are essential to provide nonmaterial NCP can raise awareness in society and hence contribute to their conservation.

GS.04-0-9

Room A3, Thursday 7th Feb. 15.30 h.

Reach and habitat scale hydraulic characteristics influence stream respiration in a stream receiving inputs from a wastewater treatment plant effluentMeredith, Warren¹; Drummond, Jen²; Tobella, Marta³; Ribot, Miquel⁴; Schumer, Rina⁵; Sabater, Francesc⁶; Martí, Eugènia⁷

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Stream metabolism (especially respiration) can be influenced by the availability of fine particulate organic matter (FPOM) in streambeds; which also can be influenced by the hydraulic characteristics of the streams both at reach- and habitat-scale. Yet, little is known about how in-stream channel hydraulics influence respiration rates. Also, in urban streams, inputs from wastewater treatment plant (WWTP) effluents can influence dynamics of FPOM standing stocks beyond the hydraulic constrains of the receiving streams. The aim of this study was to examine how hydraulic characteristics at reach- and habitat-scales can influence in-stream respiration receiving WWTP inputs. We compared reach-scale respiration among three geomorphically modified reaches located downstream of a WWTP effluent. Within each reach we also measured the habitat-scale variability in respiration rates associated with the streambed POM. Measurements were done during baseflow summer conditions, when metabolism was expected to be high. We used the resazurin-resorufin metabolic tracer as a proxy for aerobic ecosystem respiration. At the habitat scale, we found that the % of OM rather than the POM standing stock was a key factor controlling streambed sediment respiration, and that this POM quality property was influenced by the WWTP input. In addition, we found a decoupling between reach- and habitat-scale respiration driven by differences in hydraulics (i.e., travel time and transient storage) among the selected reaches. This study suggests the relevance of FPOM on the stream metabolism as well as the importance of hydraulic characteristics at different scales to understand both FPOM dynamics and its implications for stream metabolism.

GS.04-O-10

Room A3, Thursday 7th Feb. 15.45 h.

The Network for European Mountain ResearchClaramunt López, Bernat¹

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The Network for European Mountain Research (NEMOR) is a network of institutions -public or private- undertaking research in mountain areas, who want to promote research in, and for the sustainable development of, these areas. NEMOR was established in 2017. It builds on concerted collaboration between researchers across different disciplines and European countries. To present, two key outcomes of this collaboration have been: (1) the Strategic Research Agenda 'Mountains for Europe's Future', based on the H2020 Societal Challenges, which was launched in Brussels on 26 April 2016, and (2) "European Mountains Test-beds for Europe to face global changes", a document based on the three pillars of the UN Sustainable Development Goals, presented in Barcelona in May 2018. Both position statements advocate the need to continue and promote mountain research in Europe. Key objectives of NEMOR are (1) Advocate for European mountain research, covering the spectrum from basic to applied, transdisciplinary, research; (2) Enable discussion of research priorities addressing mountain regions; (3) Foster and connect mountain networks and inter/trans-boundary partnerships; (4) Initiate, coordinate and enhance activities with reference to the priority topics with a view toward the European Commission's new research programme (FP9) and other funding instruments; (5) Recognize the functions of mountains for Europe as a whole and enable connections to relevant organizations and institutions; and (6) Serve as the interlinkage from European to global mountain topics in support of MRI's vision. In this communication, we aim at presenting NEMOR to potentially interested researchers and institutions.

GS.04-O-11

Room A3, Thursday 7th Feb. 16.00 h.

Myths about forest and water, the need for evidence-based knowledge for the design of Green Infrastructure NetworksBarquín Ortiz, Pepe¹; Pérez-Silos, Ignacio²; Álvarez-Martínez, José Manuel³

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Green infrastructures encompass natural and semi-natural features that provide benefits to people. These features might range from hedges to woodlands and from wetlands to rivers. The thinking behind Green Infrastructure Networks (GINs) focus on the spatial arrangement of these features in the landscape. In the actual scenario of global change, the conservation or restoration of different landscape features (e.g. riparian forests, floodplains, wetlands, hillside forests, etc..) are being proposed as a cost-effective approach for improving river ecosystems. In fact, landscape features are very relevant for the conservation of rivers, as these linear ecosystems integrate many landscape modifications. An adequate GIN design could provide the needed landscape solution to mitigate land use changes and to help these ecosystems to gain resistance and resilience to climate change effects. In this contribution we review a number of critical issues in relation to the interaction between forest and rivers that need to be taken into account for the future design of GINs. This review explores some ecological principles that should orientate how restoration and conservation management actions could be planned to maximise the ecological benefits for both terrestrial and aquatic ecosystems.

GS.04-O-12

Room A3, Thursday 7th Feb. 16.15 h.

Developing an approach to Implement green infrastructure networks as an adaptive measure against global change in mountain areas of the Iberian PeninsulaPérez-Silos, Ignacio¹; Álvarez-Martínez, José Manuel²; Casado, Jesús³; Silió-Calzada, Ana⁴; del Jesús, Manuel⁵; Barquín, José⁶

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The main goal of this study has been designed a Green Infrastructure Network (GIN) for 3 Spanish mountain National Parks (Picos de Europa, Sierra de Guadarrama and Sierra Nevada) as global change adaptation elements. Two key elements will be followed: the conservation of an adequate landscape structure and the improvement of the hydrological functioning of the catchment. This design has allowed to explore the effects of global change in three contrasting areas and, subsequently, the adoption of the most effective nature-based solutions depending on the environmental features and their change. In each case study, current and future landscape structure was mapped using a methodology based on remote sensing. Both maps were an input for modelling hydrological functioning using a hydrological model and several geospatial analysis tools. Two climatic scenarios were modeled: current situation and a future projection under a Business as Usual scenario of Climate Change. Finally, a multicriteria analysis were applied to the generated information in order to optimize the design of the GIN. Furthermore, the proposed solutions were agreed with local agents, so it can serve to guide future management plans in the chosen areas. The results showed significant differences between the three National Parks. While in Picos de Europa a strong increment in the forest extension was the main driver of change with respect to hydrology, in Sierra de Guadarrama and Sierra Nevada the landscape change pattern was lower, being changes over precipitation, snow and temperature the major impacts over hydrological dynamics.

GS.04-O-13

Room A3, Thursday 7th Feb. 16.30 h.

Nature-based solutions for hydro-meteorological risk reduction in European mountain regionsAndrés Pastor, Pilar¹; Doblas, Enrique²; Pino, Joan³; Vayreda, Jordi⁴; Molowny-Horas, Roberto⁵

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In Europe, the warming climate projected by General Circulation Models will intensify the hydrological cycle, meaning higher rates of evaporation, changes in the ratio liquid to soil water precipitation and potential changes in precipitation amount and seasonality. In turn, these changes will alter soil moisture, groundwater reserves and the frequency of flood and drought episodes and rainfall-related landslides, and debris flows. Mountains amplify risks, and even more so under extreme weather events. The impacts of extreme hydro-meteorological events in mountain areas often affect entire river basins. Some of the natural hazard-related disasters in urban and coastal areas such as flooding caused by landslide dam breaks during and after storms are due to processes and events like flash floods and landslides that initiate in hilly and mountainous regions higher up in the river basin. Since May 2018, the PHUSICOS project (EC, H2020) pretends to demonstrate the effectiveness of nature-based solutions (NBSs) and their ability to reduce the impacts from small, frequent events (extensive risks) in European rural mountain landscapes. The NBSs considered in the project are based on modifying the vegetation cover and/or managing the excessive amount of surface water runoff during extreme events. However, revegetation measures have to be adapted to overcome natural restrictions such as aridity or scarcity of plant alternatives for actions above the tree line. Demonstration areas are being monitored in the Spanish/French Pyrenees, the Serchio River Basin (Italy), the Gudbrandsdalen valley (Norway), the Kaunertal Valley in Austria and the Isar River Basin in Germany.

GS.04. Posters

GS.04-P-1

External pavilion, Poster session 2: Wednesday 6th - Thursday 7 th Feb.

Scavenger research: ecosystem services, social perceptions and indigenous and local knowledgeMorales Reyes, Zebensui¹; Moleón, Marcos²; Sánchez-Zapata, José Antonio³

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Humans and vertebrate scavengers have been closely related since the origin of the earliest hominids and since then, scavengers have provided multiple ecosystem services to humans. In recent years, research on the role of carrion in ecosystems and its consumption by scavengers (i.e., scavenging) has increased markedly. By contrast, studies related to ecosystem services provided by scavengers and regarding social perceptions of scavengers and indigenous and local knowledge (ILK) on carrion and scavenging seem quite scarce. In this study, we conducted two literature reviews to describe the existing scientific publications: i) on carrion, scavenging and associated ecosystem functions and services and, ii) on social perceptions and attitudes toward scavengers, and ILK on carrion and scavenging. Additionally, we used the reviewed articles to create two semantic networks of the terms occurring in the title and abstract of the articles obtained in the two searches. On the one hand, the literature review showed a scarce scientific attention on the ecosystem function and services provided by scavenging species until very recently. Spain stands out as one of the pioneer countries in the study of scavenging services. The review also exposed a notable lack of research dealing with freshwater and marine scavengers. On the other hand, the review revealed that social perceptions and attitudes towards scavengers, as well as ILK on carrion and scavenging, remain virtually unexplored. Most studies have focused on social perceptions of vertebrate scavengers (mainly vultures), the identification of anthropogenic threats to vultures and human-predator conflicts related to livestock predation.

GS.04-P-2

External pavilion, Poster session 2: Wednesday 6th - Thursday 7 th Feb.

Conflicts and services provided by ungulates: scientific priorities and shepherd' perceptionsPascual Rico, Roberto¹; Morales Reyes, Zebensui²; Martín López, Berta³; Sanchez Zapata, José Antonio⁴

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Nature's contributions to people (NCP) are all the contributions of living nature, both positive (i.e., ecosystem services) and negative (e.g., human-wildlife conflicts), to the societies' quality of life. Biodiversity's contributions can be conceived by society as beneficial or as detrimental depending on the environmental and cultural contexts. Wild ungulates play this dual role as providers of services and as sources of conflicts worldwide. We examined scientific interests and shepherds' perceptions regarding the provision of NCP by wild ungulates. In this study, we reviewed scientific articles of human-ungulates relations, either conflicts or benefits, in Europe; and we also conducted questionnaires to shepherds in mountainous systems of Spain where domestic and wild ungulates cohabit. Then, we compared if the scientific priorities match with the perception of shepherds. We found that both stakeholders identified more detrimental than beneficial NCP. However, there are some mismatches between scientific priorities and shepherds' perceptions. Overall, scientific research did not address the shepherds' interests, which might influence their attitudes towards wildlife. Moreover, even when scientific priorities and shepherds' perception match in terms of conflicts and ecosystem services they point to different species. The emphasis on detrimental rather than beneficial NCP made by scientists and shepherds can reinforce the idea that wildlife, in particular ungulates, are detrimental instead of improving our quality of life. Therefore, future research on human-ungulate relations should be more balanced and include beneficial NCP provided by ungulates and the existing damages experienced by the different stakeholders.

General Session 05: Microbial ecology

Day: Tuesday 5th and Wednesday 6th February

Schedule: 12:00h 13:30h – 16:00h 17:00h | 12:00h 13:30h – 18:00h 19:30h

Location: Room M6

Coordinators:

Ramon Masana, Institute of Marine Sciences (ICM-CSIC), Spain

Pep Gasol, Institute of Marine Sciences (ICM-CSIC), Spain

Marta Goberna, Desertification Research Centre, University of Valencia (CIDE-UV), Spain

Emili Casamayor, Center for Advanced Studies of Blanes (CEAB-CSIC), Spain

GS.05. Oral talks

GS.05-0-1

Room M6, Tuesday 5th Feb. 12.00 h.

Microbial community phylogenetics and the performance of ecosystemsGoberna, Marta¹; José A., Navarro-Cano^{1,2}; Verdú, Miguel³

(1) INIA; (2) CIDE, CSIC-UV-GV; (3) CIDE, CSIC-UV-GV

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Quantifying the contribution of the multiplicity of processes that assemble microbial communities, and linking microbial diversity to ecosystem functioning are two key targets in ecology. We address both questions in water-limited terrestrial ecosystems that are characterized by a mosaic of plant patches, where resources accumulate, surrounded by stressful low-cover areas. This mosaic begets large environmental variability and is an excellent scenario to untangle both the drivers of community assembly and the diversity-ecosystem functioning relationship. We initially combined the environmental distribution of traits associated with abiotic stress tolerance or competitive abilities with phylogenies, to discern between abiotic and biotic mechanisms underlying the coexistence of phylogenetically related bacteria. Such a phylogenetic pattern has been detected in bacterial communities worldwide and attributed to abiotic filtering. Our results partly support this view, but suggest that biotic filters play a major role in community assembly. To quantify the contribution of each process, we added spatial and environmental information to co-occurrence networks so as to ascribe non-random associations between pairs of bacterial taxa to dispersal limitation, abiotic filtering, positive or negative biotic interactions. We detected a prevailing impact of abiotic factors but also a remarkable contribution of ecological interactions, and found that each process leaves a consistent phylogenetic signature. We finally quantified ecosystem functions related to microbial pools of materials and biogeochemical process rates. Plots accumulating recently-divergent lineages at low levels of anciently-divergent lineages show the highest levels of ecosystem functions. Results suggest that tracking microbial evolutionary legacies may enhance the predictions of essential ecosystem functions.

GS.05-0-2

Room M6, Tuesday 5th Feb. 12.15 h.

RTCC: A Randomized trait community clustering index to unveil consistent environmental thresholds in community assemblyAlonso, David¹; Capitan, Jose Angel²; Ortiz-Álvarez, Ru˙diger³; Ontiveros, Vicente J⁴; Menéndez-Serra, Mateu⁵; Casamayor, Emilio⁶; Gimenez, David⁷

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Mechanisms by which local communities are formed from a general species regional pool, such as dispersal, abiotic tolerance, and biotic interactions are difficult to disentangle. Similarities and differences of the phenotypes within local co-occurring species can help infer the contribution of these underlying forces. Developing robust methods in order to separate and quantify such shaping forces is a current primary aim for community ecologists. To provide fresh approaches to general ecology from the study of microbial communities, we develop the RTCC method, a trait-based approach that allows: i) to characterize the deterministic or the stochastic role of an environmental variable in the process of community assembly; ii) and to determine consistent thresholds in the value of an environmental variable along a gradient. We analysed the spatial-temporal changes of a regional microbial pool locally sorted along a strong environmental gradient (0.1 to 40‰ salinity) in 14 water bodies of the Monegros Desert through a trait-based approach. Environmental filtering emerged as the preeminent deterministic force above a certain threshold (c.a. 5‰ salinity) whereas biotic and abiotic factors coexist below. Our method can help understand how the environment affects community assembly, which enables quantitative predictions for the ecological impact of environmental changes.

GS.05-0-3

Room M6, Tuesday 5th Feb. 12.30 h.

Radial Oxygen Loss determines abundance and composition of ammonia oxidizing bacteria and archaea in the rhizoplane of *Typha* sp.Bañeras, Lluís¹; Hernández del Amo, Elena²; Gich, Frederic³

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Oxidation of ammonia in water and sediments is highly dependent on the availability oxygen. Emergent macrophytes increase oxygen concentrations in the rhizoplane due to continuous oxygen leakage from roots, thus generating an aerobic microenvironment in close contact to the root surface. However, the impact of oxygen leakage on the abundance and diversity of ammonia oxidizers has not been extensively quantified. The aim of this study was to quantify to what extent oxygen permeability on *Typha* sp. roots affected the spatial distribution of ammonia oxidizing archaea (AOA) and bacteria (AOB) in an estuarine salinity gradient. Oxygen leakage at different parts of root hairs was estimated as potential diffusion rates from oxygen micro-profiles. AOA and AOB diversity and abundance in root sections were inferred by barcode amplicon Illumina sequencing of the 16S rRNA gene, and quantitative PCR of the *amoA* and 16S rRNA genes. AOA and AOB abundances increased according to salinity. For most roots, a higher abundance of ammonia oxidizers was found in the middle section, coinciding with higher oxygen diffusion rates. Relative abundance of AOB was higher compared to AOA both in the root surface and the sediment adjacent to it. However, AOA/AOB ratio increased in the root surface, suggesting a selection effect. Overall, we were able to show that conductivity and plant roots exerted a selection effect on ammonia oxidizers, although this effect may be limited to small portions of the root surface due to changes on oxygen leakage.

GS.05-0-4

Room M6, Tuesday 5th Feb. 12.45 h.

Living in the cold. Thermophiles in temperate soilsGonzalez Grau, Juan Miguel¹; Gomez Fernandez, Enrique Jose²; Delgado Romero, Jose Antonio³; Santana, Margarida⁴; Cruz, Cristina⁵

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Soils are highly heterogeneous environments and hold a huge microbial diversity. Microorganisms play a major role in the cycling of nutrients and the maintenance of soil ecosystems. Nevertheless, scarce information is available on the living conditions of microorganisms and in most cases their actual contribution to soil functioning. In this study, we use some soil thermophiles as a model to evaluate the potential living strategy of ubiquitous soil bacteria. Thermophilic Firmicutes (e.g. *Parageobacillus* related bacteria) are present in soils mainly as viable cells and live in temperate soils taking advantage of periodic heat events. Results showed that the thermophiles actively participate in the cycling of C, N, S and P in soils processing organic matter and making inorganic nutrients available to either plants or other microorganisms. Besides, their extracellular enzymes, which represent the limiting step of organic matter mineralization in soils, are apparently well fitted to function under high temperature and low water availability usually encountered during extreme heat events at upper soil layers. Global warming trends are expected to induce more frequent extreme heat events and so the role of soil thermophiles is expected to be enhanced in a near future. Soil thermophiles represent a model type of microorganisms that can help us to understand the living strategies of microorganisms thriving in soils. The role of soil thermophiles is of interest to understand the functioning of soils, and specially arid-like environments, with important consequences at local soil ecosystems and global scales.

GS.05-0-5

Room M6, Tuesday 5th Feb. 13.00 h.

Prokaryotic life and survival in the deep ocean

Sebastián, Marta¹; Sánchez, Pablo²; Gómez-Letona, Markel³; Mainguy, Jean⁴; Ruiz-González, Clara⁵; Marrasé, Cèlia⁶; Arístegui, Javier⁷; Acinas, Silvia⁸; Duarte, Carlos M⁹; Gasol, Josep M.¹⁰

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The bathypelagic ocean is one of the largest ecosystems on Earth, and contains half of the ocean's microbial biomass. Bathypelagic microbial activity strongly relies on surface-derived particles, but there is growing evidence that the carbon released through solubilisation of these particles may not be sufficient to meet the energy demands of deep ocean prokaryotes. In this talk I will present a summary of our latest research on how deep ocean prokaryotes cope with carbon deprivation, respond to sudden pulses of carbon and survive in this energy limited environment, using a multifaceted approach that combines bulk rate measurements with single-cell techniques, 16S-rDNA sequencing and metagenomics.

GS.05-0-6

Room M6, Tuesday 5th Feb. 13.15 h.

Aerobic metabolism in the “absence” of oxygen: photosynthesis and respiration in Oxygen Minimum Zones

García-Robledo, Emilio¹; Revsbech, Niels Peter²

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Oxygen Minimum Zones (OMZs) are vast areas of the ocean characterized by a surface layer with high primary productivity and an oxygen-deficient intermediate layer. The development of ultra-sensitive oxygen sensors allowed the quantification of oxygen concentration in OMZs. In situ measurements using STOX (Switch Trace Oxygen) sensors revealed the existence of an anoxic core in some OMZs, where concentrations dropped below the detection limit of the sensors (few nanomolar). In these Anoxic Marine Zones (AMZs), anaerobic processes thrive and some processes such as denitrification and anammox dominate microbial metabolism, being responsible for 30-50% of the marine nitrogen losses to dinitrogen. In the AMZs, dense populations of *Prochlorococcus* have been found at the upper part of the anoxic core, forming a secondary chlorophyll maximum (SCM) at the bottom of the photic zone. The photosynthetic activity of the SCM was investigated during several cruises in AMZs. Water from the SCM was collected and incubated in full glass bottles under conditions similar to those found in situ: dim bluish light and trace-oxygen concentrations. Oxygen production was monitored by high-resolution sensors at resolutions of 1-10 nM while carbon fixation rates were simultaneously measured by isotopes. Our results show that oxygenic photosynthesis in the SCM supplies significant amounts of O₂ to the otherwise anoxic environment. The tight coupling of oxygen consuming processes maintain oxygen concentration below detection levels. Indeed, transcriptomic analysis of the microbial community in the SCM revealed the enhanced expression of genes for aerobic processes, such as nitrite oxidation.

GS.05-0-7

Room M6, Tuesday 5th Feb. 16.00 h.

Partitioning of prokaryotic community structure and prokaryotic function by basin, depth and water mass across the Mediterranean Sea and the adjacent Atlantic OceanGasol, Josep M¹; Sebastián, Marta²; Ortega-Retuerta, Eva³; López-Letona, Markel⁴; Gómez-Consarnau, Laura⁵; Álvarez, Marta⁶; Álvarez-Salgado, Xosé Antón⁷; Arístegui, Javier⁸

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The Mediterranean Sea is a unique small-scale ocean with a few remarkable characteristics: the deep waters are warm (minimal temperature is ca. 12°C), has strong east-to-west gradients in nutrient availability and phosphorous limitation and in relative water transparency, and various shallow sills partition it into clearly defined basins, with the coexistence of different varieties of deep water masses in the bathypelagic. These characteristics strongly contrast with those of the nearby North Atlantic Ocean at the same latitude. Understanding the characteristics of the Mediterranean prokaryotes might illustrate what to expect in a future more oligotrophic global ocean. In May 2014 we sampled an E to W transect in the Mediterranean that also included a few stations in the North Eastern Atlantic Ocean. We compared the structure of the prokaryotic communities in all these basins using flow cytometry and high-throughput sequencing of the 16S rDNA gene, and the potential activity using radioactive tracers (tritiated leucine) and metagenomics. In the deep waters we defined water masses and studied their characteristic microbial and genetic imprints. We will discuss the characteristics of the microbes thriving in the Mediterranean ocean by basin, depth layer and water mass, alongside with a discussion of the factors that determine the changes in the activity, abundance, single-cell properties, community structure and genomic potential across these habitats.

GS.05-0-8

Room M6, Tuesday 5th Feb. 16.15 h.

Changing the paradigm of virus survival strategies in the SeaVaquer, Dolors¹; Castillo, Yaiza Mercedes²; Lara, Elena³

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In aquatic systems it is described that lysogeny (a prophage inserted in the DNA of the bacterial host) should be the dominant viral life cycle in oligotrophic waters, which are characterized by a low nutrient concentration, low primary production and slow growing bacterial cells. While, according to the kill the winner hypothesis lytic phages prevail in high productive systems where bacterial hosts are abundant. However, the analysis of several public datasets revealed that lysogeny increased in eutrophic systems. These findings are in agreement with the recently proposed Piggyback-the-Winner model, which also suggests that lysogeny is more successful than the lytic cycle when bacterial hosts are abundant. The model assumes that viruses “exploit” their hosts through lysogeny instead of killing them, making this fact advantageous for both. Thus, the prophage stage of the virus is propagated from the “happily” growing bacteria to the new bacterial generations, being the host protected by the prophage from new viral infections and predation by grazers. The finding that aquatic environments with high host abundances has fewer virus per host when the host abundance is low, challenge the paradigm on the relative roles of lytic and lysogeny viral strategies.

GS.05-0-9

Room M6, Tuesday 5th Feb. 16.30 h.

Growth rates of bacterioplankton in the coastal NW MediterraneanSánchez, Olga¹; Sebastián, Marta²; Mabrito, Isabel³; Gasol, Josep Maria⁴; Ferrera, Isabel⁵

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Growth rate is a crucial trait to understand the contribution of prokaryotes to food web dynamics and biogeochemical cycling. Bulk bacterial growth rates are generally low, (0.05 to 0.10 day⁻¹), although it has been demonstrated that particular groups can grow much faster. However, there is a general lack of information on what controls the growth rates of different prokaryotes. In the last years, we have carried out manipulation experiments at several seasons under different light regimes, in which grazing, resource competition and viruses were reduced, using coastal seawater from the Blanes Bay Microbial Observatory, NW Mediterranean. Growth rates of different bacterioplankton groups, including the Bacteroidetes, Rhodobacteraceae, SAR11, Gammaproteobacteria and its subgroups Alteromonadaceae and the NOR5/OM60 clade, were calculated from changes in cell numbers using Catalyzed Reporter Deposition Fluorescence In situ Hybridization. Maximal growth rates were achieved when both predation pressure and nutrient limitation were minimized, but in general the response to predation removal was stronger than to nutrient availability. In all the experiments conducted, the group Alteromonadaceae presented the highest rates, although all groups largely responded to the different treatments. Comparison of light and dark treatments pointed out in some experiments to a certain increase in the growth rates of groups containing photoheterotrophs, such as the Rhodobacteraceae and the NOR5 clade. Additionally, we measured the cellular activity at the single-cell level with Bioorthogonal noncanonical aminoacid tagging. Overall, these results are valuable to set thresholds on growth rates and to estimate prokaryotic contribution to the structure and function of microbial communities.

GS.05-0-10

Room M6, Tuesday 5th Feb. 16.45 h.

Oasis in the desert: mesopelagic microbes rely on fish for labile DOM supplyMorán, Xosé Anxelu G.¹; Røstad, Anders²; Ansari, Mohd I.³; Silva, Luis⁴; García, Francisca C.⁵; Kaartvedt, Stein⁶; Irigoien, Xabier⁷; Huete-Stauffer, Tamara M.⁸; Calleja, Maria L.⁹

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Vertical migration of mesopelagic fish, swimming hundreds of meters on a daily basis, is the largest movement of animal biomass on Earth. However, its effect on heterotrophic bacteria and archaea inhabiting their daytime residing depths is only starting to be unveiled. We will present the findings gathered at one station in the central Red Sea over the last 3 years. Heterotrophic prokaryotes from 500-600 m depth seem to be supplemented by fish-derived labile dissolved organic matter (DOM) in a clear diel cycle, resulting in specific growth rates comparable to the epipelagic zone. Consumption rates of up to 5 $\mu\text{mol C L}^{-1} \text{d}^{-1}$ were paralleled by sustained increases in microbial biomass in short-term incubations of predator-free water conducted in different periods of the year. Mesopelagic prokaryotes were substantially larger than their shallower counterparts and they also showed significantly higher growth efficiencies, especially during daytime, supporting the existence of an overlooked supply of organic compounds. DOM quality indicators, including the presence and dynamics of protein-like substances, support the lability of diurnal inputs. If widespread, these diel hotspots of labile DOM may change our view of microbial food webs and biogeochemical cycling in the twilight ocean.

GS.05-0-11

Room M6, Wednesday 6th Feb. 12.00 h.

Airborne microorganisms and particles in the littoral of Barcelona

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Air pollution takes a heavy toll on people's health. Anthropogenic pollution affects not only the land, but also marine environments where it enhances bacterial production. In spite of the importance of pollution, the extent to which the pollution plume moves offshore, as well as the abundance and composition of microorganisms associated with it, have not been studied. In order to fill this gap, we had a cruise in the area between Barcelona and Mallorca aboard the R/V García del Cid during September 2017, where we conducted 8 transects parallel to the coast of Barcelona. In the transects, we followed the concentration of particles and black carbon. We took also integrated samples for chemical analyses and for abundance and diversity of airborne microorganisms. Our results show that the concentration of particles in the air above the sea is highly influenced by the distance to the city but also by the direction and intensity of winds and by rainfall. Concentration of airborne microorganisms, bacteria and fungi, followed a different pattern, being less influenced by the distance to the coast. These results, together with those of microbial identity of airborne microbes will be discussed in the presentation.

GS.05-0-12

Room M6, Wednesday 6th Feb. 12.15 h.

Application of the Theory of Island Biogeography to predict the fate of the airborne microbiome in future climatic scenarios

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Atmospheric transport represents a widespread mechanism for global microbial dispersal, and a main driver of microbial biogeographical patterns. Atmospheric transport can help spread diseases and potentially affect pristine ecosystems uncoupled to direct human influence. The fate of airborne microbes is influenced by environmental variables and climatic stresses, with unpredicted effects on biodiversity and ecosystem services. However, studies on the influence of environmental variables and future climatic scenarios on temporal dynamics and fate of airborne microbes are missing. Using a 7 yr. temporal monitoring of airborne microbes collected in the Central Pyrenees (LTER node Aiguastortes), we have developed a new predictive method, firmly rooted on the Theory of Island Biogeography, that addresses dynamically the temporal evolution of biodiversity in response of associated environmental covariates linked to future climatic scenarios. Our models suggest that atmospheric variables, as temperature or irradiance, play a complex role as environmental filter, specially for Bacteria, while the dynamics of fungi is more influenced by the origin of the air masses. In the worse case scenario, the models predict a general reduction of richness in Eukarya (mostly fungi) of up to a 4% while for Bacteria a more complex response is predicted reducing diversity in about 2%. Our results highlight the need of new theoretical and predictive tools, coupled to high-quality information collected by long-term monitoring, to predict and understand the complex consequences of future climatic scenarios.

GS.05-O-13

Room M6, Wednesday 6th Feb. 12.30 h.

Drivers of the diversity and composition of soil microbial communities along a latitudinal gradient in the Andes mountains

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Soil microbial communities play key roles in maintaining multiple ecosystem functions and services, including nutrient cycling, primary production, litter decomposition and climate regulation. All these processes, fundamental for human life, are driven by the community composition and diversity of the soil microbiota, which in turn is regulated at large scale by aridity, soil pH and vegetation type. In spite of these general patterns local conditions can also affect soil microbial communities, especially in harsh environments, such as alpine ecosystems, where nurse plants lead to great changes in soil properties and are crucial for maintaining biodiversity. However, the role of nurse plants in regulating the diversity and community composition of soil microbes in such environments remains unexplored. Here, we selected four sites following a latitudinal gradient from 18°S to 51°S along the Andes mountains, and collected soil samples from open areas without vegetation and under dominant cushion *Azorella* plants, an important nurse species at high altitude and latitude in the Andes. Microbial communities were dominated by Proteobacteria, Actinobacteria and Ascomycota. Contrary to our expectations we did not find a strong decrease in microbial abundance and diversity associated with aridity. However, there were clear differences in the composition of microbial communities among sites with microbial groups defined by the level of aridity and UV irradiance. The presence of *Azorella* had an overall positive effect on microbial abundance and diversity and changed the composition of soil microbial communities with different effects depending on the location.

GS.05-O-14

Room M6, Wednesday 6th Feb. 12.45 h.

Environmental factors driving the temporal variation in spore deposition in a Mediterranean forest

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In this study, we used simple spore traps placed in forest plots to sample fungal spores weekly, simultaneously to fungal fruiting body samplings during the autumn season. Trapped spore samples were quantified by qPCR and analyzed by metabarcoding of the ITS2 region to study the fungal community composition. Our aim was to describe the spatio-temporal dynamics of the deposited spore community, to understand how rainfall events may affect spore deposition and to study whether trapped fungal spores reflect the fruiting body community. Our results showed that spore community is hyperdiverse. Spore community composition changed considerably over time due to the emergence of ephemeral fruiting bodies and rapid spore deposition. Community compositional changes across sampling weeks were higher than across sampling plots. Although spore deposition in traps also occurred in absence of rainfall events, both fungal diversity and fungal spore abundances were positively correlated with precipitation events. Especially high was the correlation between rainfall and spore abundances of puffballs (e.g. *Bovista*, *Lycoperdon*). There was positive correlation between fruiting body yields and spore abundance in time for five out of seven species. There was no relationship between fruiting body yields and their spore abundance at plot level, indicating that some of the spores captured in each plot were arriving from the surrounding areas. We provide new insights on the large functional diversity associated to spore deposition and shows that this deposition may be driven by rainfall events. Further research could help to identify the spore deposition patterns for most common fungal species.

GS.05-0-15

Room M6, Wednesday 6th Feb. 13.00 h.

Redox transition in space and time at the sediment-water interface: "Hot spots" of biogeochemical and microbial activityCorzo, Alfonso¹; García-Robledo, Emilio²; Jiménez-Arias, Juan Luis³; Haro, Sara⁴; Soria, Sara⁵; Bohórquez, Julio⁶; Lara, Miguel⁷; Paaps-pyrou, Sokratis⁸

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Redox transitions are generally coupled with large changes in oxygen concentrations occurring over a wide range of spatio-temporal scales. These changes in oxygen availability affect microbial metabolism, organic matter mineralization pathways and numerous abiotic redox-dependent physicochemical and mineralogical processes. Therefore, redox transitions represent "hot spots" of intense microbial and biogeochemical activity in space and time. The sediment-water interface in aquatic environments represent a redox transition in space, from the generally oxic conditions in the water column to anoxic conditions a few mm below the sediment surface. In addition, the sediment-water interface undergoes important temporal changes in oxygen availability during the daily light and dark cycles in photic sediments, during tidal immersion and emersion periods in marine sediments and seasonal changes in hypolimnetic sediments. Here, we show examples of the effects of such redox transitions at microscale on biogeochemical characteristics for different aquatic ecosystems, with emphasis on the microbial-mediated processes. We use results obtained in marine sediments under different photoperiod and tidal stage, and from hypolimnetic sediments from an acid mine drainage contaminated reservoir subjected to experimental redox transitions. Differences in the exchange of solutes, organic matter degradation, and coprecipitation - dissolution of dissolved organic carbon and nitrogen with redox-sensitive compounds, affect considerably C and N cycling at the sediment-water interface during redox transitions. The management of aquatic ecosystems in the Anthropocene, the stimulation of the natural neutralization of contaminant in the environment and the design and application of ecotechnological bioremediation treatments requires a better understanding redox transitions.

GS.05-0-16

Room M6, Wednesday 6th Feb. 13.15 h.

Evaluation of the effect of water flow and light availability in the biofilm community and its relationship with geosmin appearanceEspinosa Angona, Carmen¹; Abril, Meritxell²; Ricart, Marta³; Vendrell, Lidia⁴; Ordeix, Marc⁵; Sellarès, Núria⁶; Llenas, Laia⁷; Colón, Joan⁸; Ponsá, Sergio⁹

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Hydro-morphological alterations in water bodies caused by human activities can affect the ecosystem functioning and generate important water quality problems. One of these problems is the bad odors and taste in river waters caused by geosmin, a metabolite produced mainly by cyanobacteria associated to the benthic biofilm. This is one of the main problems detected in the Ter River (Catalonia, NE Spain) in recent years, which leads to consumer complaints and economic losses for water supply companies. However, the environmental factors associated with its production are still not clear. This study aimed to evaluate the effects of water flow velocity and light availability on biofilm development and the geosmin appearance. We performed a mesocosm experiment in 12 experimental channels receiving water from the Ter River in late winter – early spring. Five increasing flow velocities were set and combined with two light intensities, full or reduced by 80%, which simulate a well-developed riparian cover. The nutrient and geosmin concentrations were analyzed, as both structural and functional biofilm parameters. Both flow velocity and light availability had a clear effect on biofilm development. Algal biomass was higher in those channels with full irradiation and higher flow velocities. Regarding the algal community, diatoms predominated in all channels; however, the proportion of cyanobacteria increased (20% of the community) at the lowest flow velocity, where the biovolume of the geosmin producer *Oscillatoria* was significantly higher under low irradiation. These results pointed out potential implications for stream ecosystem management to control the geosmin appearance in water bodies.

GS.05-0-17

Room M6, Wednesday 6th Feb. 18.00 h.

Contrasting microbial nitrogen-transforming networks in mountain lake benthic habitatsPalacin-Lizarbe, Carlos¹; Camarero, Lluís²; Hallin, Sara³; Jones, Christopher M⁴; Caliz, Joan⁵; Casamayor, Emilio O⁶; Catalan, Jordi⁷

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Microbial nitrogen (N) transforming networks of freshwater low-nutrient systems are poorly known. We have studied these networks in the main benthic habitats of eleven mountain lakes (i.e., lithic biofilms, sediments with elodeid and isoetid macrophytes, helophyte belts (*Carex*), and littoral and deep non-vegetated sediments). We assessed the abundances of N-functional genes involved in denitrification, nitrification, DNRA and anammox pathways by qPCR (i.e., *nirS*, *nirK*, *nosZ* (clade I and II), archaeal and bacterial *amoA*, *nrFA*, and *hzo*) and the associated bacterial community by sequencing the 16S rRNA gene. All processes occur alongside each other in the habitats studied. However, the N-transforming networks cluster into four main types characterised by the dominant pathways and associated bacterial community. The fate of nitrite is the main diverging point, DNRA dominates in the deep part of the lakes – thus recycling the reactive nitrogen (Nr) - while denitrifying *nirS* nitrate reduction dominates in the surface sediments of the shallow, warmer and more productive lakes - losing Nr. N₂ emissions may prevail in lithic biofilms (high *hzo*, *nosZ* genes) and N₂O in *nirS*-dominated areas. Archaeal ammonia oxidisers typify the nitrifying hotspots located near the isoetid rhizosphere and in the rocky littoral sediment of high-altitude lakes.

GS.05-0-18

Room M6, Wednesday 6th Feb. 18.15 h.

Ecology and evolution of host-associated microbial networksBaldo, Laura¹; Barluenga, Marta²

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Gut microbial communities exert a fundamental role in their host biology, ecology and evolution, ranging from digestion to a potential role in promoting host speciation. Several studies have now linked their diversity to several host adaptive traits (such as the trophic niche) and shown that compositional aspects of the gut microbiota (taxonomy and abundances of taxa) can follow their host evolutionary history. It is, however, still unclear how these microbial communities are structured within a gut and whether the interactions established among community members (leading to co-occurrence or exclusion of bacterial taxa) are conserved over eco- and evolutionary time frames. Here we used the explosive radiations of cichlid fishes and comparative network analyses of their gut microbiota to explore the stability and potential adaptive role of these microbial interactions. We do so by looking at both conserved and discriminatory topological network features (hub species and modules) as a function of the host geography, phylogeny and dietary preferences across a large dataset spanning 2 continents, 9 lakes and more than 280 fish specimens. Our results reveal the extent of selective pressures and dynamic forces acting on this complex symbiotic ecosystem.

GS.05-0-19

Room M6, Wednesday 6th Feb. 18.30 h.

Cell size and vacuole prey content in mixotrophic phytoflagellatesFelip, Marisol¹; Ballen-Segura, Miguel Angel²; Catalan, Jordi³

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The distinction between autotrophic and heterotrophic organisms becomes ambiguous in unicellular eukaryotes; many of them are mixotrophic: even conducting photosynthesis, can be voracious predators. Many organisms traditionally considered phytoplankton can ingest prokaryotes; and thus are commonly named, mixotrophic phytoflagellates. This lifeform occurs in a wide range of phylogenetically diverse eukaryotes and is broadly distributed in oligotrophic marine and freshwater ecosystems. Cell size is a master functional trait that affects any aspect of the protist biology. Several trophic models point to optimal strategies depending on the cell size and environmental conditions. They suggest mixotrophs to fill a cell-size intermediate position between smaller autotrophs and larger heterotrophs. There is little experimental and observational data to contrast these hypotheses. The phagotrophic activity is difficult to quantify in natural assemblages. We used the catalysed reporter deposition - fluorescence in situ hybridisation protocol (CARD-FISH), which allows the visualisation of labelled prokaryotes inside protists, to analyse the food vacuole content in a set of samples from 20 Pyrenean lakes. We found a large number of phytoflagellates covering a broad cell-size range and taxonomic diversity that were actively feeding on prokaryotes. Protist cell size became a determinant of both the population proportion of cells with ingested-prokaryotes and the number of them ingested. The pattern was particularly clear for the ingestion of Actinobacteria but was also observed for the other targeted prokaryotic groups (Archaea, β -Proteobacteria, Cytophaga-Flavobacteria of Bacteroidetes). Our results demonstrate a size-structured phagotrophic activity in natural communities of phytoflagellates, cell size thresholds and prokaryote groups targeted preferentially.

GS.05-0-20

Room M6, Wednesday 6th Feb. 18.45 h.

Resilience of the bacterial community to the ice-cover seasonality of the mountain lakesZufiaurre, Aitziber¹; Felip, Marisol²; Sala, Marc³; Camarero, Lluís⁴; Juhanson, Jaanis⁵; Bonilla-Ross, German⁶; Hallin, Sara⁷; Catalan, Jordi⁸

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High mountain lakes remain ice-covered for a large part of the year, and the snow accumulated prevents light penetration. Former biogeochemical studies had indicated a high bacterial metabolic activity in these conditions that seem to continue in the hypolimnion during the ice-free period in deep lakes. In this study, using 16S rRNA gene sequencing data from monthly monitoring of a Pyrenean lake, we investigated the annual variation of the bacterioplankton community that drives some of these biogeochemical changes. Our results show that the richest community occurs during the ice-covered period and many components are highly resilient to the drastic changes occurring during thawing, summer stratification and autumn mixing. The lowest richness values occur in the epilimnion. Verrucomicrobia, Acidomicrobia, Acidimicrobia and Planctomycetes increase during the ice-covered period, while Alpha-, Betaproteobacteria and Bacteroidetes, also common during the ice-cover season, are the main indicators of the ice-free. A relevant part of the OTUs found, including some of the most abundant, do not present seasonal fluctuations, defining a stable background assemblage. The deepest water column layer shows the episodic presence of a distinctive community, with OTUs belonging inter alia to Nitrospira, Desulfobacter and Crenotrichaceae. The community probably reflects the particular conditions of the benthic boundary layer upon deep sediments. The current global warming is shortening the ice-covered period and at some point may jeopardise the current resilience of these under-ice rich assemblages and suddenly switch to a rather different characteristic community better adapted to the ice-free season conditions.

GS.05-0-21

Room M6, Wednesday 6th Feb. 19.00 h.

Alternation of bacterial and archaeal production along a nitrogen gradient in saline wetlandsReche, Isabel¹; Batanero, Gema L.²; Green, Andy J.³; Amat, Juan A.⁴; Vittecoq, Marion⁵; Suttle, Curtis A.⁶

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Saline wetlands constitute globally about 45% of the total volume of inland waters. These wetlands are highly productive systems with high nutrient and organic carbon concentrations, reaching extremely high microbial productions. However, in comparison with freshwater and hypersaline ecosystems, there are few studies linking their biogeochemical peculiarities with their predominant microbial components, particularly in oligo- to euhaline waters. We selected nine wetlands complex including 112 ponds along the western Mediterranean basin from the Camargue to Odiel marshes including Sardinia, and Tunisia. We analyzed two spatial scales: among ponds within a given wetland, and among wetlands. We identified the main drivers of the microbial patterns in the wetlands using generalized linear models (GLMs). Prokaryotic heterotrophic and cyanobacteria abundance, bacterial and archaeal heterotrophic production were the dependent variables. The predictors were: wetland complex (i.e. a local fixed categorical variable), temperature, salinity, total dissolved nitrogen and total dissolved phosphorus as continuous variables. GLMs for each microbial variable showed that, after controlling for physico-chemical variables, variation among wetland complexes had a significant effect (i.e. there were local effects). Apart of these effects, the predictors retained in the best GLM varied for each microbial variable. Unexpectedly, our results showed that salinity, phosphorus and dissolved organic carbon concentration were not the main factors involved in the control of the microbial components in these wetlands. In fact, all selected best GLM's indicated that total dissolved nitrogen affected negatively bacterial production whereas archaeal production was significantly stimulated. Bacterial and archaeal production seemed to alternate along the nitrogen availability.

GS.05-0-22

Room M6, Wednesday 6th Feb. 19.15 h.

Assessment of the effect of WWTP effluents on the resistome of streambed bacterial communities by means of a manipulative pollution experimentBorrego, Carles¹; Sánchez-Melsió, Alexandre²; Turon, Anna³; Pereda, Olatz⁴; Solagaistua, Libe⁵; Larrañaga, Aitor⁶; von Schiller, Daniel⁷; Elosegi, Arturo⁸

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The chronic discharge of wastewater treatment plant (WWTP) effluents into streams affect the structure of streambed bacterial communities and their associated resistome. To assess this impact, researchers usually compare the composition of bacterial communities and the abundance of ARGs between control and impact sites located upstream and downstream the discharge point, respectively. Most often, however, the upstream site is not as pristine as expected and the actual effect of pollution is difficult to appraise. To overcome this limitation, we conducted a BACI (Before-After, Control-Impact) design experiment in the field to assess the effects of a WWTP effluent on streambed bacterial communities that were never exposed to such impact. We diverted part of the effluent of an urban WWTP into a small, unpolluted tributary stream. 100-m long reaches up- and downstream from the diversion point were selected to study, the one upstream used as control, and both reaches were studied for a year prior and a year after the diversion. Streambed biofilm samples from both reaches and periods were collected every two months, subjected to DNA extraction and interrogated for changes in the composition of streambed biofilm communities and abundance of ARGs. Similar to the subtle effects caused by the effluent discharge on several indicators of microbial activity (see the abstract by Elosegi and co-workers), the changes observed on the composition of bacterial communities and their resistance profile were mainly driven at long-term by the environmental conditions imposed by seasonality rather than by the pollution introduced into the stream.

GS.05. Posters

GS.05-P-1

External pavilion, Poster session 2: Wednesday 6th - Thursday 7 th Feb.

Carbon and nitrogen dynamics in soils affected by different fire recurrences: A laboratory approach to test the effect of different pyrogenic materialsAlbert-Belda, Enrique¹; Lorenzo Illán, Teresa²; Moreno Rodríguez, José Manuel³; Hinojosa Centeno, María Belén⁴

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Mediterranean ecosystems are characterized by their resilience to fire. However, alterations in fire regimes might increase their vulnerability owing to changes in soil biogeochemical cycling. Here we evaluated the effect of various pyrogenic materials in the dynamic of C and N of soils affected by different fire recurrence. Soils previously burned 0, 1, 2 or 3 times were exposed to heat, simulating a medium intensity fire, and to the addition pyrogenic material (charcoal, ash or charcoal+ash) in the laboratory. CO₂ production, magnitude of priming effect (PE) and the dynamics of available nitrogen were evaluated during three months. C mineralization rate was higher in unburned than in burned soils. However, burned soils increased their CO₂ production as a consequence of ash addition. Unburned soils showed no PE when pyrogenic materials were added. A positive PE was observed in burned soils treated with pyrogenic materials, showing higher magnitude in soils treated with ash or charcoal and ash. With regards to nitrogen, unburned soils showed higher NH₄⁺ concentration and lower concentration of NO₃⁻ than burned soils. Nevertheless, the effects of the heat and pyrogenic materials added were not significant for nitrogen inorganic forms, nitrification or N mineralization rates. We conclude that the presence of ash can have an important role in modulating C mineralization of burned soils, at least in the short-term.

GS.05-P-2

External pavilion, Poster session 2: Wednesday 6th - Thursday 7 th Feb.

Functional changes of microbial communities in fluvial biofilms under a multiple stress scenarioArgudo Fernández, Marla¹; GICH, Frederic²; Rubio-Gracia, Francesc³; HELENA, Guasch⁴

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Human actions are a threat to the ecological integrity of river ecosystems. Biological communities living in fluvial systems reflect the historical and current effects of the combined impacts of chemical, physical, and biological stressors. Moreover, it is well-known that microbial communities are key components of fluvial biofilms and any perturbation in the activity and diversity of these leads significant impacts in terms of nutrients cycling and ecosystem integrity. The aims of this study were to determine the impact of multiple-stress on structure and function of microorganisms and their influence on trophic levels and vice versa. A field experiment was carried out in the Osor River (north-east of Spain) in summer 2017. Five sampling points were selected following a gradient of zinc pollution and hydrological alteration. At each site, enclosures were set up to get different experimental conditions: with and without the presence of fish. Biofilm samples were collected for genetic molecular, nutrients uptake and bioaccumulation analysis. Ammonium uptake was higher than phosphate. The highest Zn concentration in water and in biofilms was found in the site affected by both stress factors. It was on average 386 µg·l⁻¹ and 154 mg·g⁻¹ respectively. Furthermore, it matched with the lowest abundance of Ammonium Oxidizers Archaea (AOA) as well as the lowest ammonium uptake values suggesting an inhibitory effect on the growth of AOA but it was not influenced by the presence or absence of fish. Overall, the affectation of the functional role of microorganisms by multiple-stress can be concluded.

GS.05-P-3

External pavilion, Poster session 2: Wednesday 6th - Thursday 7 th Feb.

Seasonal dynamics of the marine diatom genus *Chaetoceros* in two different environmental coastal areas of the NW Mediterranean SeaArin, Laura¹; Delgado, Maximino²; Balagué, Vanessa³; Estrada, Marta⁴

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Chaetoceros is one of the most abundant and diverse diatom genus in the oceans. It is ecologically relevant due to its worldwide distribution and the fact that different species may reach bloom concentrations, mainly in coastal zones. Therefore, these organisms play an important role in the food webs and in the biogeochemical cycles of carbon and silica. However, little is known about the ecology of *Chaetoceros*, in part due to the difficulty of recognizing the different species in fixed samples. In the present work, concentrates of live phytoplankton (> 20 µm) were analysed in order to identify and count *Chaetoceros* species in monthly surface samples (from February 2017 to July 2018) of two different environmental coastal areas of the NW Mediterranean: Blanes and Barcelona. The objective was to relate the seasonal dynamics of the different *Chaetoceros* species with the environmental factors of these two coastal zones. We identified 40 species/morphotypes of *Chaetoceros*; the most abundant were *C. vixvisibilis*, *C. curvisetus*, *C. contortus* and those belonging to the *C. lorenzianus* complex. These taxa presented maximum abundances at different times of the year responding to different ecological conditions. Although the months of "blooming" for each *Chaetoceros* species were in general the same in both coastal areas, the intensity of the peaks were different. The diverse environmental parameters that control the different *Chaetoceros* succession patterns are discussed.

GS.05-P-4

External pavilion, Poster session 2: Wednesday 6th - Thursday 7 th Feb.

Characterization and inoculation of arbuscular mycorrhiza of different origins in organic orchard soilEpelde, Lur¹; Urra, Julen²; Anza, Mikel³; Lanzen, Anders⁴; Garbisu, Carlos⁵

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The use of arbuscular mycorrhiza appears as an environmentally friendly alternative to the intensive use of chemical fertilizers, which is particularly interesting for organic agriculture. In this study, we first characterized the arbuscular mycorrhizal community structure within and in adjacent non-cultivated areas of organic vegetable-orchards through ITS metabarcoding analysis. Then, we multiplied native mycorrhiza of different origins using trap plants and established a microcosm experiment where these mycorrhiza were inoculated in one of the orchard soils. Two consecutive crops of lettuce were grown in these inoculated soils, and plant productivity and nutritive quality were measured at the end of each growing period. Agricultural management practices carried out in the organic orchards, even if organic, had a negative impact on the mycorrhizal communities. Apart from that, their inoculation, irrespective of their origin, increased the production of lettuce. However, the inoculation did not substantially modify the abundance and structure of the soil mycorrhizal community.

GS.05-P-5

External pavilion, Poster session 2: Wednesday 6th - Thursday 7 th Feb.

Molecular impact of environmental factors in N₂ fixing bacteria associated to *Posidonia oceanica*Fernández Juárez, Víctor¹; Jaén-Luchoro, Daniel²; Ramis-Munar³, Guillem³; Bennàsar Figueras, Antoni⁴; Agawin Romualdo, Nona Sheila⁵

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Posidonia oceanica meadows are sites of high rates of nitrogen fixation. The nitrogen fixation process is carried out by microorganisms called diazotrophs, which converts di-nitrogen (N₂) gas into inorganic nitrogen, and it is suggested to play a key role in the sustenance of *P. oceanica* meadows and all organisms associated. Environmental factors such as phosphorous (P) and iron (Fe) or biological factors can be important in survival and adaptation of these communities, however information on this is scarce. Through cell culture of bacteria associated to different parts of *P. oceanica* we pretend to describe how external factors affect growth, N₂ fixation rates and others biochemical parameters like alkaline phosphatase activity (APA), oxidative stress via reactive oxygen species (ROS) production detection, siderophore and secondary metabolites production and even apoptosis. Here, we present the results of nutritional changes in the media combining different concentration of P and Fe in different N₂ fixing bacteria associated to *P. oceanica*. This study showed how P and Fe alter all the parameters above mentioned, showing how bacteria have to adapt to survive. One these mechanisms can be the activation of little genetic modules called toxin-antitoxin (TA) system. All together these results can be biomarkers to detect how diazotroph in *P. oceanica* respond, adapt and survive to environmental factors, taken into account that changes in the response of N₂ fixing population had as a consequence direct effect on *P. oceanica* meadows health, and therefore in the numerous services in the ecosystem that provide to the Mediterranean Sea.

GS.05-P-6

External pavilion, Poster session 2: Wednesday 6th - Thursday 7 th Feb.

Antibiotic resistance risk associated with the use of cow manure-derived amendments in conventional and ecological agricultureGarbisu, Carlos¹; Epelde, Lur²; Jauregi, Leire³; Alkorta, Itziar⁴

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The application of organic amendments of animal origin into agricultural soil can increase crop yield and enhance soil physicochemical and biological properties. Nonetheless, this agricultural practice entails a variety of environmental risks. Among these, contamination of agricultural soil and crops with antibiotic residues, antibiotic resistant bacteria, antibiotic resistance genes and mobile genetic elements, stands out due to the concomitant risks for human health. Here, we studied the environmental risks, associated to the well-known abuse and misuse of antibiotics in livestock production, derived from the use of organic amendments of animal origin as fertilizers. To this purpose, we applied cow manure-derived amendments (slurry, fresh manure, composted manure), obtained from conventional and ecological farms, to agricultural soil. Then, lettuce plants were grown in the amended soils. Apart from measuring soil physicochemical parameters, at harvest time, we studied the effect of treatments on soil and plant microbial community structure and composition (by means of next generation sequencing), as well as on the abundance of antibiotic resistance genes and mobile genetic elements (by using the Fluidigm Biomark HD System – qPCR). Finally, microbial biomass (total bacteria and fungi according to qPCR) was quantified in soil and plant samples. In general, the application of organic amendments resulted in an increase of soil microbial biomass. In addition, a variety of antibiotic resistance genes were detected in amended soils and, to a lesser extent, in lettuce plants. The composition of microbial communities differed among treated soils, but no clear differences were detected in terms of Shannon's diversity.

GS.05-P-7

External pavilion, Poster session 2: Wednesday 6th - Thursday 7 th Feb.

Photosynthetic activity and radiative energy balance in microbial mats under different irradiance and tidal stagesHaro, Sara¹; Brodersen, Kasper E.²; Bohórquez, Julio³; Pappaspyrou, Sokratis⁴; Corzo, Alfonso⁵; Kühn, Michael⁶

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Microbenthic photosynthetic communities are important primary producers in intertidal marine habitats where physical forcing factors such as irradiance and tidal state change on daily basis. However, little is known how these changes affect the photosynthetic activity of microphytobenthos. We estimated the radiative energy budget and spatial distribution of the photosynthetic efficiency within the euphotic zone of a microbial mat during immersion and emersion under increasing irradiance (100, 400 and 800 $\mu\text{mol photon m}^{-2} \text{s}^{-1}$) using combined microsensor measurements of oxygen (O_2), temperature and scalar irradiance. Less than 1 % of the energy incident was conserved by photosynthesis under either tidal condition. At low to moderate incident irradiance, the light use efficiency was similar during immersion and emersion whereas at the highest irradiance, light use efficiency was 30% lower under emersion compared to immersion. This was probably due to the relative rapid warming of the sediment during emersion and to more light energy being deviated from the photosystems via non-photochemical quenching. Local photosynthetic efficiency was only affected at higher irradiances ($> 400 \mu\text{mol photon m}^{-2} \text{s}^{-1}$) during tidal cycles. Maximum photosynthetic efficiency depth depended on tidal state likely due to differences in the vertical distribution of phototropic biomass. Migratory movements might explain the differences observed in the light utilization efficiency and the radiative energy balance in photosynthetic microbial mats between immersion and emersion.

GS.05-P-8

External pavilion, Poster session 2: Wednesday 6th - Thursday 7 th Feb.

Effects of fire on soil enzyme activities: A reviewHinojosa Centeno, M^a Belén¹; Albert-Belda, Enrique²; Torres-Bonilla, Mireya³; Moreno Rodríguez, José Manuel⁴

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A review of studies examining the impacts of fire on 27 different soil enzyme activities (EAs) is presented. The most studied EAs related to the C cycle have been β -glucosidase and phenol oxidase; related to the N cycle, urease; related to the P cycle, alkaline and acid phosphatases and; related to the S cycle, arylsulfatase. Dehydrogenase activity has been the most studied EA in relation to general microbial activity. Results show that fire affects EAs, but the direction and magnitude differ greatly depending on the nature of each enzyme, initial soil characteristics, vegetation, type of fire or time since fire, among other factors. In general, prescribed fires and low-intensity wildfires and experimental burns do not significantly affect the majority of EAs reviewed. In contrast, high intensity fires decreases many EAs. This decrease is associated mainly to direct thermal denaturation, to changes in soil organic amount and quality, and decrease in microbial biomass. However, there were cases where soil EAs increased after fire. This positive effect has been related to changes in soil pH, increase of organic matter, long-term decrease of soil nutrients, and an increase of specific microbial groups that excrete them. EAs are highly responsive to disturbances caused by fire and their analysis can be very useful in assessing the health of soils affected by fire. However, further research is still needed to elucidate the underlying mechanisms driving their responses to fire.

GS.05-P-9

External pavilion, Poster session 2: Wednesday 6th - Thursday 7 th Feb.

Long-term effects of a biochar application on soil microbial abundance, structure and function in a Mediterranean agroecosystemLlovet Martin, Alba¹; Mattana, Stefania²; Chin-Pampillo, Juan³; Gasco, Gabriel⁴; Domene, Xavier⁵; Ribas, Angela⁶; Alcañiz, Josep Maria⁷

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Soil microorganisms regulate key ecosystem services such as decomposition and nutrient availability for crops. Biochar is a carbon rich soil amendment, which potentially affects soil biota through varied mechanisms i.e., improving soil habitability (e.g. increased pH, soil moisture) or providing refuge from predators and sources of organic matter and inorganic nutrients. Negative, null or positive effects of biochar on soil microbial community structure and function have been reported, but mostly in laboratory conditions and short-term field trials, while little is known about the effect of naturally aged biochar. For this reason, we conducted a long-term field experiment (6 years) to examine microbial responses following additions of a pine gasification biochar at application rates of 0, 12 and 50 t ha⁻¹ in a field mesocosm study under Mediterranean conditions with barley cultivation. We selected 5 sampling dates representing the different stages of plant development and fertilization events. Measured parameters included microbial biomass, basal respiration, metabolic quotient (qCO₂), enzymatic activities, GHG emissions, mineralization indicators (nitrate and exchangeable ammonium), and decomposition rate as measured by the teabag index. Results were contrasting depending on the biochar dose. While decomposition rate increased for the 12 t ha⁻¹ treatment, this trend was not significant for the 50 t ha⁻¹ treatment. The other studied parameters showed no significant differences between any of the treatments. The lack of strong long-term effects of biochar on microbial parameters might be at least partly the result of the depletion of the labile C fraction present in fresh biochar.

GS.05-P-10

External pavilion, Poster session 2: Wednesday 6th - Thursday 7 th Feb.

Structure of the microbial community across the Deep Chlorophyll Maximum in the North Western MediterraneanMarín-Vindas, Carolina¹; Sebastián, Marta²; Gasol, Josep M.³; Massana, Ramón⁴; Balagué, Vanessa⁵

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The deep chlorophyll maximum (DCM) is a seasonal phenomenon in the Mediterranean Sea, and a very dynamic feature that may have associated a broad spectrum of microbial niches. To study so, we performed a vertical high-resolution vertical sampling of the DCM to explore the structure of the microbial community in the northwest Mediterranean Sea during fall. We analyzed the Chlorophyll-*a* concentration, nutrients (nitrate, nitrite, silicate, ammonium and phosphate), the abundance of bacteria and eukaryotes, and their diversity through Illumina amplicon sequencing (16S and 18S rRNA gene) in the pico and nanoplankton size fraction, and bacterial heterotrophic production across the DCM. We studied the changes of microbial groups across the DCM and also focused on the vertical connectivity of the different communities. Our results show that the DCM is much more heterogeneous than hitherto assumed.

GS.05-P-11

External pavilion, Poster session 2: Wednesday 6th - Thursday 7 th Feb.

The Margalef's Mandala: a legacy continuously evolvingMarrase, Celia¹; Alcaraz, Miquel²; Arin, Laura³; Berdalet, Elisa⁴; Estrada, Marta⁵; Guadayol, Òscar⁶; Pinhassi, Jarone⁷; Sala, Montserrat⁸; Peters, Francesc⁹

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The Margalef's Mandala visualizes in a two-dimensional space the role of nutrients and turbulence in shaping the phytoplankton communities. This Mandala, published in 1978, comprises fundamental concepts of plankton ecology related to species succession and energy fluxes. During forty years this conceptual framework has been continuously evolving and numerous authors adapted it to integrate the variety of processes underlying plankton dynamics at different spatio-temporal scales. We now know that turbulence affects different interactions and activities of plankton components such as predator-prey encounter rates and nutrient uptake by osmotrophs. These processes also depend on the nutrient load for a particular system and ultimately determine ecosystem metabolism. We show empirical evidence of plankton responses to turbulence under a range of nutrient concentration and osmotroph abundance conditions. These data led to building-up an extended version of Margalef's mandala, that we call "the fan", applicable to system metabolism.

GS.05-P-12

External pavilion, Poster session 2: Wednesday 6th - Thursday 7 th Feb.

Microbial abundance in the Arctic OceanNavarro, Nuria¹; Mas, Jose Antonio²

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The aim of this study was to increase understanding of the role of the microbial loop in the Arctic Ocean. The microbial loop is a micro-food chain that works within (or alongside) the classical food chain. In the microbial loop the smallest organisms, the heterotrophic bacteria and picoplankton, are key to maintaining the flux of carbon and energy within marine ecosystems. Like other oceans, the Arctic Ocean is dominated by microbial biomass although much less is known about microbial abundance in the polar region compared to lower latitudes. Although exposed to extreme environmental conditions, such as low temperature and intense seasonal variation in primary production and carbon flux, there is still controversy about what are the main factors controlling microbial abundance in the Arctic Ocean and how they will be influenced by global environmental changes. Bacteria and picoplankton samples were collected from 14 stations in the Arctic Ocean at different latitude, from 66°N to 80°N, to investigate whether there is a gradient in microbial abundance, with increasing numbers from north to south. In addition, to study whether the geographic variation in microbial abundance is large only in the first 100 m of the water column, while at greater depths bacteria are uniformly few, we collected samples through the water column at different depths, from 5 to 2800 m (4-11 depths at each station). We estimated microbial abundance (high DNA bacteria, low DNA bacteria, picocyanobacteria and picoeukaryotes) with flow cytometry.

GS.05-P-13

External pavilion, Poster session 2: Wednesday 6th - Thursday 7 th Feb.

Who supports the deep chlorophyll maximum in acidic lakes? The role of the bacterial communitySoria Piriz, Sara¹; Lara, Miguel²; Jiménez-Arias, Juan Luis³; Papaspyrou, Sokratis⁴; Úbeda, Bárbara⁵; García-Robledo, Emilio⁶; Bohórquez, Julio⁷; Gálvez, José Ángel⁸; Corzo, Alfonso⁹

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The interactions between phytoplankton, bacteria and nutrients leading to the formation of deep chlorophyll maximum (DCM) in acid lakes are little understood. Here, we studied the Sancho reservoir (Iberian Pyritic belt, Huelva, Spain), an acid mine drainage impacted water body (pH 3.5 - 4.0), where a strong DCM forms during the stratification period. The observed DCM (always below the 1% irradiance level) showed the maxima photosynthetic capacity and dark respiration rates of the entire column. Total bacterial abundance highly correlated with dissolved inorganic carbon concentration (DIC, $r = 0.74$). Given that DIC concentrations in acid lakes are low, DCM development and position might depend on the close coupling between DIC regeneration by bacteria degradation in the hypolimnion ($71.43 \pm 21.83 \text{ mmol C m}^{-2} \text{ d}^{-1}$) and photosynthetic production consuming DIC at this depth ($1.25 \pm 0.7 \text{ mmol C m}^{-2} \text{ d}^{-1}$). This hypothesis was successfully tested by means of a 1D reactive transport model which predicted the phototrophic biomass spatial distribution as a function of irradiance and DIC. Model outcomes suggest that the vertical position of DCM depends on both light penetration ($R^2 > 0.72$) and diffusive flux of DIC produced by hypolimnetic heterotrophic bacteria ($R^2 > 0.95$). Rates of DIC regeneration were better explained by including a term of anaerobic respiration accounting for the hypoxia conditions at depth, since oxygen dark respiration was very low. Overall, results support the role of DIC as a key resource for acid lakes DCM, which traditionally has been underestimated in compare to nitrogen or phosphorus.

GS.05-P-14

External pavilion, Poster session 2: Wednesday 6th - Thursday 7 th Feb.

Seasonal variability of autotrophic and heterotrophic picoplankton in the coastal upwelling off Galicia (NW Spain)Varela, Marta M¹; Guerrero-Feijoo, Elisa²; Hernando-Morales, Victor³; Bode, Antonio⁴; Teira, Eva⁵

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We combined flow cytometry and CARD-FISH to investigate the seasonality of the picoplankton abundance and community composition at two contrasting sites within the coastal upwelling off Galicia (A Coruña and Vigo). Autotrophic picoplankton abundance (particularly *Synechococcus*) was strongly influenced by seasonality at both sites, showing their maximum concentration in summer and early autumn. Heterotrophic picoplankton was the most regular component, being more abundant between spring and late summer at both ecosystems, when also showed a significantly increase the contribution of HNA cells. Eubacteria domain evidenced the dominance of Alphaproteobacteria, with a strong contribution of SAR11 peaking during the summer at surface waters (>30 % of total DAPI counts) off A Coruña. By contrast, Bacteroidetes (CFB) was the most abundant group off Vigo on an annual basis, showing a peak during summer (>50% of the DAPI counts). Gammaproteobacteria accounted for 11% and 6% of the DAPI counts off A Coruña and Vigo, respectively, but it not shows any obvious seasonal structure. Roseobacter tended to be more abundant in Vigo than A Coruña. Overall, the downwelling period off A Coruña was associated to higher salinity and inorganic nutrients concomitant with the dominance of *Prochlorococcus*. By contrast, the upwelling period at both ecosystems was highly associated with Chla and the quality of organic matter, and dominated by picoeukaryotes and major groups of Bacteria (i.e. CFB or Roseobacter). Moreover, *Synechococcus* abundance was associated to relatively high temperature, concomitant with the dominance of SAR 11 and LNA cells at both Vigo and A Coruña ecosystems.

Thematic Session 01: Better together: bridging terrestrial and aquatic biogeochemical cycles

Day: Tuesday 5th February

Schedule: 12:00h 13:30h – 16:00h 17:00h

Location: Room A4

Coordinators:

Anna Lupon, Centre d'Estudis Avançats de Blanes (CEAB-CSIC), Spain / Sveriges lantbruksuniversitet (SLU), Sweden

Núria Catalán, Institut Català de Recerca de l'Aigua, Spain

Sílvia Poblador, Universitat de Barcelona, Spain

Ada Pastor, Aarhus Universitet, Denmark

Terrestrial processes can strongly affect the structure and function of aquatic biomes by determining lateral inputs of energy and nutrients. Watershed topography and land cover, soil processes and erosion, wild fires, tree phenology or riparian forests status are examples of terrestrial features shaping in-stream biogeochemical processes. To fully understand the role of terrestrial systems on the functionality of aquatic ecosystems, an integrative watershed perspective is needed. However, paradoxically, terrestrial and aquatic processes are often studied separately and confined within their ecosystem boundaries, which ultimately neglect interactions among ecosystems and limit our understanding on global biogeochemical cycles. This session offers the opportunity to provide a broad overview of aquatic-terrestrial linkages, integrating a wide array of approaches and perspectives to consolidate common grounds among disciplines. We welcome novel contributions investigating the influence of terrestrial systems on aquatic cycles across biomes, ecosystems, and environments (e.g. pristine, human-influenced). In particular, we are interested in studies exploring the biogeochemical links between terrestrial and aquatic systems across different spatial and temporal scales.

TS.01. Oral talks

TS.01-O-1

Room A4, Tuesday 5th Feb. 12.00 h.

Riparian zones and streams are biogeochemical reactors within Mediterranean headwater catchmentsBernal Berenguer, Susana¹; Lupon, Anna²; Martí, Eugènia³; Sabater, Francesc⁴

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Mediterranean catchments naturally experience marked changes in hydrological connectivity that span from droughts to floods. Yet, our understanding of how this hydrological regime influences nitrogen (N) cycling and transport throughout the catchment and within stream ecosystems is still limited. We will address this question by combining results from previous studies conducted in Mediterranean headwater catchments under a wide range of hydrological conditions. Our results show that hillslopes are disconnected from the fluvial network most of the time, and that biological activity in hillslope soils is water limited. Riparian aquifers make the most of stream discharge, and further, riparian soils are N sources to streams because of high net nitrification rates. During large storms, abrupt increases in soil water content lead to pulses of microbial activity throughout the catchment, which further increases N availability. However, most of this N is quickly flushed out towards the stream, and cannot be taken up by biota. During the vegetative period, riparian tree evapotranspiration regulates stream discharge by dropping off groundwater table, which favors water movement from the stream towards the riparian zone. These reverse fluxes contribute to increase both water residence time and nutrient biogeochemical processing within the stream-riparian interface. Nevertheless, our results indicate that the alternation of droughts and floods amplifies N losses and limits the N retention capacity of Mediterranean catchments compared to more humid systems. An integrated view of hillslope-riparian-stream linkages is fundamental for understanding patterns and drivers of N export in catchments subjected to some degree of water limitation.

TS.01-O-2

Room A4, Tuesday 5th Feb. 12.15 h.

The case for a “Dominant Source Layer” conceptualization of riparian zones in catchment biogeochemistryLedesma, José L. J.¹; Köhler, Stephan J.²; Grabs, Thomas³; Laudon, Hjalmar⁴; Bishop, Kevin H.⁵; Futter, Martyn N.⁶

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In natural and semi-natural areas, freshwater quality is primarily determined by substances mobilized from surrounding soils, i.e. the riparian zone (RZ). Hydrological connectivity is a key aspect to consider when assessing RZ biogeochemical functioning and potential impacts on surface water quality. Of particular importance within hydrological connectivity is the vertical dimension, characterized by a ‘Dominant Source Layer’ (DSL). A novel conceptualization developed in boreal catchments suggests that the most important hydrological and biogeochemical processes for stream chemistry occur within a relatively small RZ volume, the DSL. This concept explains timing and amount of water and solute transfer from soils to surface waters and highlights the critical importance of a narrow layer within riparian soils that contributes most of the water and solute fluxes to streams. The concept is based on the characteristic relationship between riparian groundwater tables and stream runoff, consequence of the exponential decrease in hydraulic conductivity with depth. The novelty of the DSL is that it operationalizes the classical “hot spot” and “hot moment” concepts by providing testable hypotheses. In this presentation, I will summarize the research that led to the development of the DSL concept. I will also provide specific examples of its use in the boreal region and of its potential applicability in Mediterranean catchments.

TS.01-0-3

Room A4, Tuesday 5th Feb. 12.30 h.

Nutrient fluxes in the Mediterranean Basin: are river exports good tracers of what happens on land?Romero, Estela¹; Sadaoui, Mahrez²; Lassaletta, Luis³; Bouwman, Lex⁴; Beusen, Arthur⁵; Sardans, Jordi⁶; Penuelas, Josep⁷; Ludwig, Wolfgang⁸

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Global water resources have deeply changed in the past century, and large changes are expected to occur in the near future as a consequence of human activities and global warming. The water cycle is tightly intertwined with the biogeochemical cycles of major elements -including carbon (C), nitrogen (N) or phosphorus (P)- so that changes in water resources may affect the fluxes and stocks of these elements in terrestrial and aquatic systems. Likewise, population growth and dietary change are placing unprecedented demands on food production, leading to increasing inputs of N and P worldwide. The Mediterranean Basin houses 60% of the population of the world's water poor countries, and large divergences in the socio-economic development exist between the north and the south, including differences in water use and agricultural practices. Our study combines data on river discharge for over 500 Mediterranean rivers with data on the terrestrial inputs of N and P from the IMAGE model (5' x 5' spatial resolution) to assess what are the main nutrient fluxes in the different regions and what is the fraction of the total inputs that is exported to the sea. The study addresses differences between nitrogen and phosphorus fluxes in the north and the south, and examines to what extent nutrients' export to the coast and retention on land are modified by water management practices. A key feature of the study is the description of nutrient fluxes in southern Mediterranean basins, which have hitherto been poorly characterised.

TS.01-0-4

Room A4, Tuesday 5th Feb. 12.45 h.

Streamwater response to changing atmospheric sulphur and nitrogen deposition in two mountain areas in the Northeastern Iberian PeninsulaAvila Castells, Anna¹; Molowny-Horas, Roberto²; Camarero, Lluís³

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A number of studies have analyzed the trends of atmospheric deposition in response to changes of emissions in central and northern Europe and how this has affected ecosystems as reflected by streamwater chemistry and the export fluxes from the catchment. However, the Mediterranean region has received less attention. To fill this gap, in this presentation we will analyse bulk precipitation long-term trends in two mountain ecosystems in the North-eastern Iberian Peninsula, namely a dense holm-oak forest (*Quercus ilex*) in the Montseny mountains near Barcelona (period 1984-2017) and a sparsely forested alpine site in Aigüestortes National Park (Pyrenees; period 2004-2014). Annual mean concentrations in bulk precipitation varied in parallel in the two mountain sites. Surprisingly, although the Pyrenees are more remotely located from regional industrial and traffic sources, bulk deposition fluxes were similar between the two zones, and total deposition fluxes (adding dry deposition) were only slightly lower in the Pyrenees. The two catchments responded differently to deposition for S: while S net exports decreased in Montseny, they remained constant in Aigüestortes. However, the two sites responded similarly for N by increasing the net export of DIN. This indicates a quicker response to declining S deposition at Montseny than at the Pyrenean site, and suggests the onset of a trend to eutrophication at both sites.

TS.01-0-5

Room A4, Tuesday 5th Feb. 13.00 h.

Water scarcity enhances the influence of wastewater treatment plant inputs on stream nutrient dynamicsMartí Roca, Eugènia¹; Castelar, Sara²; Ribot, Miquel³; Merbt, Stephanie N.⁴; Tobella, Marta⁵; Sabater, Francesc⁶; Gacia, Esperança⁷; Drummond, Jennifer⁸; Bernal, Susana⁹

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In urban landscapes, effluents from wastewater treatment plants (WWTP) supply nutrients, organic matter, emergent contaminants, and bacteria to receiving streams. These inputs, influenced by the dilution capacity of the receiving stream, affect in-stream biogeochemical processes and alter the amount and fate of nutrients and other solutes transported downstream. Additionally, the WWTP influence on in-stream nutrient uptake can vary over time and across sites due to the interaction between WWTP inputs and the characteristic hydrological regime of receiving streams. In regions with water scarcity, intermittent streams can have low dilution capacity; and therefore, a higher potential to be affected by WWTP inputs. At its extreme, these intermittent streams may even turn into permanent downstream of the WWTP inputs, and during summer the receiving stream may be 100% WWTP effluent. Thus, at annual scale, seasonal variation of physical and chemical parameters upstream of the WWTP can be dampened by the constant inputs from the WWTP. In this talk, we will illustrate how inputs from WWTPs can regulate the hydrological and chemical regime of receiving streams subjected to water scarcity, and discuss how these inputs influence temporal dynamics of in-stream nutrient uptake. In this context, we propose that it is critical to design WWTP operation procedures taking into account the characteristics of receiving streams for an integrated management of water resources in urban landscapes, especially under water scarcity conditions.

TS.01-0-6

Room A4, Tuesday 5th Feb. 13.15 h.

Linking terrestrial and aquatic carbon processing: Environmental conditions of floodplains control the fate of leaf litter inputs in riversdel Campo, Rubén¹; Martí, Eugènia²; Bastias, Elliot³; Barberá, Gonzalo⁴; Sánchez-Montoya, María del Mar⁵; Cerezo, Rosa⁶

(1) IGB-Berlin; (2) Centre d'Estudis Avançats de Blanes (CEAB-CSIC); (3) Centre d'Estudis Avançats de Blanes (CEAB-CSIC); (4) CEBAS-CSIC; (5) Universidad de Murcia; (6) Universidad de Murcia

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Leaf litter can be retained in floodplains for several months before entering the river as lateral inputs. During this period, abiotic and biotic factors modulated by environmental conditions of the floodplain can alter the chemical quality of leaf litter and consequently alter its later processing in the river. Thus, we analysed the effect of contrasting environmental conditions of floodplains on the chemical composition of particulate and dissolved organic matter (POM and DOM) fractions of leaf litter and their subsequent processing in the river. To do this, we firstly exposed reed leaf litter under open- and closed-canopy habitats of three floodplain sites with contrasting climate (continental, arid- and humid-Mediterranean), to finally monitor its decomposition in a river using litterbags and the biodegradation of their leachates in a parallel laboratory assay. The exposure of leaf litter in floodplains dropped the biodegradability of their leachates due to the decrease of nutrients and labile DOM compounds, independently of the conditions of floodplain sites and habitats. Conversely, contrasting environmental conditions among floodplain sites caused the chemical differentiation of leaf litter exposed in each site, which in turn translated into different decomposition rates in the river. In particular, the nutrient balance in leaf litter during its floodplain exposure (impoverishment by leaching vs enrichment by immobilization) was the main driver of decomposition rates in the river. Therefore, our results demonstrate that the exposure of leaf litter in floodplains had important implications on the role of leaf litter as nutrient and energy subsidy for aquatic decomposer communities.

TS.01-0-7

Room A4, Tuesday 5th Feb. 16.00 h.

Using optical proxies to study terrestrial inputs of dissolved organic matter (DOM) in different Spanish Mediterranean wetlands types: Patterns and implications for its carbon cycling and metabolic functioningRochera Cordellat, Carlos¹; Picazo, Antonio²; Miralles-Lorenzo, Javier³; Morant, Daniel⁴; Corrales-González, Maykoll⁵; Santamans, Anna C⁶; Torrella, Enrique⁷; Florín, Máximo⁸; Camacho, Antonio⁹

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The bioavailability of dissolved organic matter (DOM) in wetlands is of relevance for the global carbon cycling. In this study, mechanisms of transport, production, turnover and accumulation of DOM were studied in a set of wetlands representing each of the main wetlands types within the Mediterranean Spanish region. This comprised waterbodies with a contrasting ecological functioning and watersheds showing different land uses and characteristics. Our methodological approach consisted in the measurement of absorbance and fluorescence characteristics of DOM to assess its nature and origin, being cost-effective when compared to other molecular analyses. DOM in lakes varied spatially and temporally, both in quantitative and qualitative terms, depending of its source material and environmental processing. Both natural and anthropogenic sources of DOM represented the allochthonous inputs, partly representing carbon fluxes from the terrestrial surrounding environment. On the other hand, the alteration of its chemical composition in the lakes responded to microbial and/or photolytic processing. Photobleaching, that involved transformation of polymeric DOM into smaller molecules, was more remarkable in sites showing long water residence times. The oxygen consumption rates and the nucleic acid content heterogeneity of bacterial populations as measured by flow cytometry were estimated to assess the effect of these diverse DOM scenarios in the heterotrophic metabolism of wetlands. Our findings provide a basis for modelling studies of the carbon cycle to understand the role of these Mediterranean ecosystems in climate change. This work was supported by project CLIMAWET (GL2015-69557-R) funded by MINECO and FEDER-EU Funds.

TS.01-0-8

Room A4, Tuesday 5th Feb. 16.15 h.

Stream microbial organic matter utilization: effects of the geomorphological features in High-ArcticPastor, Ada¹; Freixa, Anna²; Skovsholt, Louis J.³; Wu, Naicheng⁴; romaní, Anna⁵; Riis, Tenna⁶; Riis, Tenna⁷

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In the Arctic, rapid environmental changes contribute to enhanced mobilization of organic matter from the watershed to the streams. Microbial extracellular enzymes are important mediators of stream organic matter processing in streams, but limited information is available for those remote areas. Here, we studied the variability of microbial extracellular enzyme activity in High-Arctic biofilms. We evaluated twelve stream reaches in North-East Greenland draining geomorphological features with contrasting soil organic matter. We determined stream nutrient concentrations and biofilm biomass, and evaluated extracellular enzyme activities involved in catalyzing the cleavage of a range of organic matter compounds (i.e. β -glucosidase, phosphatase, β -xylosidase, cellobiohydase and phenol oxidase). Moreover, we compared our results in High Arctic to those previously found in warmer climates. Among streams draining contrasting geomorphological features, we found significant differences on microbial organic matter utilization with the highest phosphatase and phenol oxidase activities in solifluction areas compared to alluvial areas, thus indicating a high coupling between terrestrial and stream ecosystems. Besides dissolved organic carbon, nitrogen availability was the main driver controlling enzyme activities in High Arctic suggesting that organic matter mineralization could be enhanced under high nutrient availability. Along a latitudinal gradient, biofilm enzymatic activities were generally low in High Arctic, especially for those related to the decomposition of plant material, compared to warmer climates. Overall, our study provides novel information on the controls of organic matter usage by High-Arctic stream biofilms, which is highly relevant due to the predicted increase in nutrient availability under global change scenarios.

TS.01-MT-9

Room , Tuesday 5th Feb. 16.30 h.

Unifying conceptualizations of organic matter degradation across freshwater and soil ecosystemsKothawala, Dolly¹

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The global carbon cycle contains large and highly reactive pools of organic matter (OM) held within soil and freshwater ecosystems, respectively. Due to the complexity of biogeochemical processes within each environment, ecosystem-specific conceptualizations of OM degradation have emerged independently of developments in the neighboring ecosystem. For this reason, there is a strong incentive to withdraw from the particulars of ecosystem specific results and evaluate how emerging concepts regarding controls of organic matter (OM) degradation compare across ecosystem boundaries. In the soil community, there is growing recognition that the persistence of OM is not simply linked to its molecular recalcitrance, and rather can be a function of environmental and biological variables. In contrast, there is mounting evidence that molecular composition regulates OM reactivity in freshwaters. As ecosystems are rapidly being altered by anthropogenic perturbations including climate change, there are important implications for ecosystem stability, including how it functions as a carbon source or sink. Thus, it is important to focus on identifying key consolidating factors in our understanding of OM reactivity, with the aim of developing a conceptualization that is robust and flexible across ecosystem boundaries.

TS.01. Posters**TS.01-P-1**

External pavilion, Poster session 1: Monday 4th - Tuesday 5th Feb.

Influence of land and anthropogenic processes in the ecological function of shallow saline lakesCORRALES-GONZALEZ, MAYKOLL¹; ROCHERA, CARLOS²; PICAZO, ANTONIO³; CAMACHO, ANTONIO⁴

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This study, as part of ECOLAKE (CGL2012-38909) and CLIMAWET (CGL2015-69557-R) projects, investigates ecological patterns of saline endorheic lakes from Central Spain, which are among the most important in the western Mediterranean. Most are temporal with a hydroperiod controlled by rainfall and evaporation. Factors driving its productivity operated depending on salinity, flooding period and threatened level. Seasonal evapo-concentration of nutrients occurred in all lakes regardless they were polluted or not. However wastewater pouring increased even more nutrient concentrations in both water and sediments and impacted the activity of planktonic autotrophs. Inlets also promoted water desalinization and disturbed the normal ecological functioning of lakes. Decaying of macrophytes, mainly occurring in threatened lakes, also contributed to increase nutrient loads in sediments. The accumulation of this plant material would explain the higher amounts of residual-P observed in the sediments of some lakes. However, phosphorus immobilization was mainly due to precipitation with divalent cations (either Ca or Mg). In some lakes, seasonal drying favored the transformation of inorganic phosphorus into soluble phosphorus, becoming rapidly available for algal uptake, thus promoting primary production at the autumn recharge of lakes. Regarding nutrients stoichiometry, the occurrence of wastewater inlets determined molar ratios in such a way that they were enriched in phosphorus relative to carbon and nitrogen. The autumn recharge of lakes also enhanced the entrance of allochthonous organic material from watersheds showing a high C:N relationship.

Thematic Session 02: Biodiversity conservation in the face of global change

Day: Tuesday 5th, Wednesday 6th and Thursday 7th February

Schedule: 18:00h 20:00h | 12:00h 13:30h - 18:00h 19:30h | 12:00h 13:30h - 15:00h 17:00h

Location: Aula Magna

Coordinators:

Pedro Abellán, Universidad de Sevilla, Spain

David Sánchez-Fernández, Universidad de Castilla-La Mancha, Spain

Andrés Millán, Universidad de Murcia, Spain

Ongoing global change is one of the largest threats to biodiversity and to natural systems, with climate change impacts being often synergistic with other change drivers, including invasive species and land use changes. Thus, previous conservation tools and principles must be revisited to take into account how species and habitats are able to respond to the changing scenario. The aim of this session is to bring together a wide range of ecologists to provide an updated and broad perspective of the current developments in the study of biodiversity responses to global change, where future threats potentially lay and how they may be mitigated or adapted to. Topics covered will include methodologies and approaches to assess and predict biodiversity responses to global environmental changes, the observed and predicted impacts and responses (e.g. species' geographic shifts, genetic adaptation, phenotypic plasticity, or changes in phenology), as well as the translation of all this information into conservation strategies for biodiversity conservation (e.g. restoration, spatial planning or extinction risk assessment).

TS.02. Oral talks

TS.02-MT-1

Room Aula Magna, Tuesday 5th Feb. 18.00 h.

Biodiversity erosion in Azorean arthropod communities in the face of global changeBorges, Paulo¹

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Azorean islands have a relatively small proportion of the original native forest (around 3-5%) that are located mostly above 500 m altitude. These forests host a unique community of arthropods that occupy two main habitats, the soil and the canopy of endemic trees and shrubs. Using species abundance distributions (SADs) we investigate the impact of land-use changes on the rarity patterns of native and exotic species at local and regional scales. Exotic species are dominant in human made habitats and are expanding in the soil of Azorean native forests. The same process is not occurring in the canopies of Azorean endemic trees, suggesting that native forest canopies act as physical barriers to the colonization of exotic arthropods. There is a general trend of hyperdominance with few species having more than 50% of all abundance on communities, with endemics dominating in the canopies and native non-endemics in the soil. Most of the endemics were assessed as Critically Endangered or Endangered by the IUCN and face two main threats: habitat degradation due to the spread of invasive plants and climate change. Knowing changes on abundance, range-size contraction and expansion will be crucial for halting biodiversity loss in Azores. A long-term monitoring strategy is already in place and we suggest the implementation of a "Global Island Monitoring Scheme (GIMS)" for the long-term coordinated survey and monitoring of native island forest biota.

TS.02-O-2

Room Aula Magna, Tuesday 5th Feb. 18.30 h.

Integrating multiple approaches to identify winners and losers in high-diverse marine benthic communities in the face of global changeLinares, Cristina¹; Gómez-Gras, Daniel²; Pagès-Escollà, Marta³; Montero-Serra, Ignasi⁴; Aspillaga, Eneko⁵; Capdevila, Pol⁶; Gori, Andrea⁷; López-Sendino, Paula⁸; Medrano, Alba⁹; Rovira, Graciela¹⁰; Viladrich, Nuria¹¹; Ledoux, Jean-Baptiste¹²; Hereu, Bernat¹³; Garrabou, Joaquim¹⁴

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Coastal ecosystems are increasingly impacted by several local and global stressors including overfishing, pollution, and climate change. The cumulative effects of multiple threats have driven local extinctions with the subsequent alteration of the structure and composition of benthic ecosystems, but less is known about how global change is altering the ecosystem functioning of highly diverse temperate reefs in the Mediterranean Sea such as coralligenous assemblages. This habitat exhibits a high structural complexity and is dominated by long-lived algae and sessile invertebrates, which exhibit low dynamics and belong to a variety of taxonomic groups, harboring between 10-20% of Mediterranean species. Coralligenous species are affected by several local and regional stressors and understanding how different species and populations will respond to anthropogenic pressures is key to develop sound management strategies and conservation actions. The aim of this presentation is to show how the combination of multiple approaches such as long-term field monitoring, aquaria experiments, demographic and spatial modeling is crucial to identify the winners and losers at the species and population level, potential range shifts and changes in reproductive phenology. The contrasting responses observed among different species and populations to global change unravel the complexity to anticipate potential changes in the future configuration of coralligenous assemblages but also highlight some promising capacity of this highly diverse habitat to buffer global change effects.

TS.02-0-3

Room Aula Magna, Tuesday 5th Feb. 18.45 h.

Disentangling the interactive effects of climate change and exotic pathogens on seedling performance of coexisting Mediterranean tree speciesSerrano Moral, María Socorro¹; Pérez, Francisco José²; Gómez-Aparicio, Lorena³

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The structure and function of Mediterranean mixed oak forests is seriously threatened by climate change and exotic pathogens, specifically the soil-borne pathogen *Phytophthora cinnamomi*. These two factors have been individually studied in some detail, but nothing is known about their interactive effects on plant performance and species coexistence. To explore these interactive effects, we conducted an experiment in growth chambers where seedlings of *Quercus suber*, *Quercus canariensis* and *Olea europaea* were planted in pairs under different scenarios of drought (control vs. 30% rainfall reduction), warming (control vs. 3°C increase) and pathogen presence (control vs. soil infected with *P. cinnamomi*). At the end of the experiment, the severity of radical symptoms was evaluated. Preliminary results showed that the different climate-change scenarios did not influence the severity of the root disease. The three tree species showed severe symptoms of disease in all climatic scenarios, including *O. europaea* (a species so far described as resistant to *P. cinnamomi*) and *Q. canariensis* (a species considered as tolerant to the pathogen). Our preliminary results do not support interactive effects of climate change and *P. cinnamomi* infection on root damage, suggesting that these two stress factors could act simultaneously limiting seedling performance in Mediterranean forests. Our results also provide novel evidence of a much higher susceptibility of dominant Mediterranean tree species to *P. cinnamomi* than previously thought, which can seriously threaten the long-term conservation of Mediterranean mixed forests.

TS.02-0-4

Room Aula Magna, Tuesday 5th Feb. 19.00 h.

Trending shifts in Pyrenean snowbed vegetation through ten yearsIlla Bachs, Estela¹; Lluent, Artur²; Carrillo, Empar³

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Snowbed vegetation grows in the snowiest patches of alpine environments, where within few meters there is a succession of different plant communities, 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 are able to live there. Some of the effects of climate change in temperate mountains are the increase of temperatures and the reduction of snow precipitation, which imply an increase of the growing period through the reduction of snow cover and an early snowmelt. Thus, snowbeds will become favourable environments for generalist plant species from the surrounding habitats, more competitive than snowbed specialists. During the years 2003-2005 we established permanent transects following the snowmelt gradient in the southern Pyrenees. Along those transects, and at regular intervals, we noted all the species present and their abundances, and we classified the samples of each transect into different vegetation groups by means of fuzzy-c-means partitions. Ten years after, we repeated the same methodology in the same places. Our results show how all the vegetation groups found in the different transects have slightly moved towards the snowiest end of the snowbed transect, meaning that grassland communities are colonizing snowbed communities. At species level, snowbed specialists are reducing their frequency and moving towards the snowiest end of the transect, whereas some typical grassland species are becoming more abundant. The changes occurred in only ten years confirm that snowbed vegetation is seriously threatened in the southern Pyrenees.

TS.02-0-5

Room Aula Magna, Tuesday 5th Feb. 19.15 h.

The eye of the storm: assisted migration and evolution for conservation Mediterranean mountain plantsGarcia Fernandez, ALFREDO¹; Morente, Javier²; Lara, Carlos³; Sacristan Bajo, Sandra⁴; Tabares, Pablo⁵; Ruiz Checa, Raquel⁶; Torres, Elena⁷; Iriondo, Jose María⁸; Prieto, Samuel⁹; Rubio Teso, Maria Luisa¹⁰

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ABSTRACT The propositions of strategies that allow species conservation under current global change have been under the scientific debate. Manipulative strategies, such as assisted evolution or assisted migration, have been declared as essential tools for many species, unable to migrate to other habitats or adapt to new conditions. However, opposite positions against manipulative approaches (the creation of "anthropogenic parks") require the development of pilot studies for ensure the successful of these techniques and suggest some practical guidelines that lead future approaches. In this study, a combination of in-situ and ex-situ experiments have been proposed to ensure the best strategy for conservation *Silene ciliata*, as a representative plant species of the endangered Mediterranean high mountain communities. We assed translocation experiments, germination tests and response to differential cold stratification to different populations from several mountains ranges along Europe. Results showed opposite patterns according to its population origin and the proposed experiment. Local adaptation responses have been related to plant survival in the field experiments, meanwhile some populations ignore the effects of cold stratification for seed germination. Several microevolutionary processes and different population native status could explain the unequal responses in each study. Our approach face the complexity of manipulative experiments and the necessity to improve the knowledge of the focus species to ensure the successful of the conservation measurements that will be propose in the face of global change.

TS.02-0-6

Room Aula Magna, Tuesday 5th Feb. 19.30 h.

Combining literature-based and data-driven fuzzy models to predict brown trout (*Salmo trutta* L.) spawning habitat degradation induced by climate changeMuñoz-Mas, Rafael¹; Marcos-García, Patricia²; Lopez-Nicolas, Antonio³; Martínez-García, Francisco J.⁴; Pulido-Velazquez, Manuel⁵; Martínez-Capel, Francisco⁶

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A fuzzy rule-based system combining empirical data on hydraulic preferences and literature information on temperature requirements was used to foresee the brown trout (*Salmo trutta* L.) spawning habitat degradation induced by climate change. The climatic scenarios for the Cabriel River (Eastern Iberian Peninsula) corresponded to two Representative Concentration Pathways (4.5 and 8.5) for the short (2011–2040) and mid (2041–2070) term horizons. The hydraulic and hydrologic modelling were undertaken with process-based numerical models (i.e., River2D© and HBV-light) while the water temperature was modelled assembling the predictions of three machine learning techniques (M5, Multi-Adaptive Regression Splines and Support Vector Regression). The predicted rise in the water temperature will not be compensated by the more benign lower flows. Consequently, the suitable spawning habitat will be reduced between 15.4-48.7%. The entire population shall suffer the effects of climate change and will probably be extirpated from the downstream segments of the river.

TS.02-0-7

Room Aula Magna, Tuesday 5th Feb. 19.45 h.

Domestic Biodiversity for the Wild Biodiversity ConservationVelado Alonso, Elena¹; Gómez Sal, Antonio²

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Global change is acting over a biosphere already transformed by the human uses, and the current wild biodiversity is largely a consequence of that process. That kind of biodiversity has coexisted with the domesticated biodiversity, in which is included the variety of cultivated species, livestock breeds and adapted agrarian landscapes. Both kinds of biodiversity usually have maintained a well-assembled relationship. The first linked to conservation functions -regulation services- and the second to production -supply for human population-. One of the most conspicuous agents of the agrarian biodiversity are the livestock breeds, specially the grazing ungulates. The effect on the structure and functions of the natural ecosystems made by these agents, depend on the management intensity of the production system. In this work the spatial pattern of domestic ungulate diversity -129 breeds- in peninsular Spain is analysed. In addition, the relationship of the agrarian diversity with the diversity pattern of wild vertebrate species is explored. Finally, the coincidence between these spatial patterns is discussed considering the land variations and complexity. We conclude evaluating the possible synergies that, for the conservation of wildlife, can result from an adequate management of domesticated diversity in the context of global change.

TS.02-0-8

Room Aula Magna, Wednesday 6th Feb. 12.00 h.

Dispersal limitation is the main driver of macrophyte community assembly patterns in Mediterranean pondsGarcía Girón, Jorge¹; Wilkes, Martin²; Fernández Aláez, Camino³; Fernández Aláez, Margarita⁴

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Metacommunity ecology is a vibrant area of research that has received increased attention in recent years, since it provides a framework to assess the underlying trait and dispersal processes that create non-random and ecologically meaningful patterns in species assemblages across the landscape. However, studies addressing the role of dispersal constraints and environmental filtering on aquatic macrophytes are strikingly scarce and most of them come from temperate and boreal latitudes. We performed community variation partitioning using redundancy analysis (RDA) and applied a trait- and dispersal-based community assembly model to test for the role of niche-based environmental filtering and dispersal limitation on macrophyte communities in 51 ponds distributed across the northern part of the Iberian Plateau. Analyses showed that dispersal constraints were the major driving forces of incidence-based structure in Iberian pond macrophytes, particularly among wind-dispersed species. This dispersal limitation interfered with environmental filtering in determining assemblage structure by hindering species' tracking of local environmental conditions. After accounting for this, the community assembly model revealed that species' traits were involved in determining abundance structure. These results suggest that dispersal limitation primarily acts on species' occurrences, whilst the local environment was more important in determining species' abundances when geographic distances allowed them to reach nearby habitat patches. We suggest that conservation and management strategies should focus on community assembly patterns and processes operating on multiple scales, thus considering species-specific dispersal and colonization abilities and landscape factors beyond the target patch, such as dispersal constraints and habitat isolation.

TS.02-0-9

Room Aula Magna, Wednesday 6th Feb. 12.15 h.

Effect of salinity and temperature in emergent properties of the community hatched from zooplankton egg banksJarma, Dayana Ayelen¹; Gilbert, Juan Diego Gilbert²; Ramírez, José Manuel Ramírez³; Guerrero, Francisco Guerrero⁴; Jiménez Melero, Raquel Jiménez Melero⁵

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Despite of the great biodiversity that small ponds shelter and of their social and ecological value, they are one of the most threatened ecosystems in the world. Fortunately, many of them are also very resilient due to their egg bank, a cryptic diversity which is able to escape time for decades, even centuries, waiting for favourable environmental conditions that allow it to bloom. It is necessary to have an insight into which environmental cues trigger the end of this dormancy state and how these determine the structure of the emergent community. This study assesses the combined role of temperature and salinity on the emergency of the egg bank of rotifers, cladocerans, copepods and ostracods, at an endorheic saline pond placed in the southeastern of the Iberian peninsula (Jaén, Spain). Pond sediment was incubated during four months at three different salinities and two temperatures, by means of a completely crossed, balanced and five replicated bi-factorial experimental design. Multivariate and univariate analyses showed a significant effect of temperature, salinity and the interaction of both, on the composition, structure and richness of the community. Salinity effect was stronger than that of the temperature. Our findings suggest that under high salinities the trajectory that the emergent community might follow is very unpredictable. In the current frame of global change an increment of salinity and temperature is forecasted; this might drive changes on the current patterns of diversity through differential hatchings and decrease the resilience of these ecosystems; intensifying their degradation.

TS.02-0-10

Room Aula Magna, Wednesday 6th Feb. 12.30 h.

Beta-diversity changes in response to anthropogenic salinisation and dilution of riversGutiérrez Cánovas, Cayetano¹; Sánchez-Fernández, David²; Cañedo-Argüelles, Miguel³; Millán, Andrés⁴; Velasco, Josefa⁵; Acosta, Raúl⁶; Fortuño, Pau⁷; Otero, Neus⁸; Soler, Albert⁹; Bonada, Núria¹⁰

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As a result of global change, the ion concentration of rivers is changing worldwide. Many freshwater rivers are being salinised by anthropogenic salt inputs (e.g. salt mines, de-icing salt), whereas naturally saline rivers are being diluted by human activities (e.g. agricultural drainages). As aquatic organisms show a strong specificity along the natural salinity gradient according to their differential tolerance to osmotic pressure, both impacts are driving great changes in the community composition (beta-diversity) of river ecosystems. However, it remains unclear if salinised and diluted rivers would resemble the observed community along the natural salinity gradient or if they would result in novel communities. We hypothesise that altered communities could resemble communities with the same natural salinity if the original taxa are replaced by the organisms better adapted to such osmotic pressure, outweighing opportunistic, generalist colonisers. Alternatively, altered communities could differ from natural communities if opportunistic, generalist colonisers tend to replace original communities. Here, we test these hypotheses using river macroinvertebrates from reference (freshwater and naturally saline rivers) and altered conditions (salinised and diluted rivers). To this end, we compare taxonomic and functional compositional patterns in response to altered salinity by quantifying the contribution of species/trait replacement and nestedness to overall community changes. Our results will help to better understand the role of resistance and resilience processes and predict the trajectories of biological communities in response to natural and anthropogenic salinity changes.

TS.02-0-11

Room Aula Magna, Wednesday 6th Feb. 12.45 h.

Long-term changes in metacommunity assembly mechanisms in Mediterranean rivers

Bonada, Núria¹; Acosta, Raúl²; Cañedo-Argüelles, Miguel³; Castro, Daniel⁴; Cid, Núria⁵; Fortuño, Pau⁶; Gutiérrez-Cánovas, Cayetano⁷; Múrria, Cesc⁸; Sòria, Maria⁹; Tarrats, Pol¹⁰; Verkaik, Irama¹¹; Prat, Narcís¹²; Acosta, Raul¹³; Cañedo-Argüelles, Miguel¹⁴; Castro, Daniel¹⁵; Cid, Núria¹⁶; Fortuño, Pau¹⁷; Gutiérrez-Cánovas, Cayetano¹⁸; Múrria, Cesc¹⁹; Sòria, Maria²⁰; Tarrats, Pol²¹; Verkaik, Irama²²; Prat, Narcís²³

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Metacommunities are explained by a combination of local environmental factors, dispersal limitation and stochastic events. Most metacommunity studies aim at understanding assembly mechanisms in space, considering metacommunities as relatively stable units. However, recent studies have shown that metacommunity assembly mechanisms can vary considerably in time, especially in highly dynamic ecosystems (e.g. Mediterranean streams). So far, these studies have exclusively focused on seasonal changes, neglecting interannual variability. Mediterranean rivers are characterized by hydrological patterns that vary seasonally and interannually, with wet and dry seasons and years, respectively. This situation provides a unique opportunity to assess metacommunity dynamics at different temporal scales. We analysed long-term changes in macroinvertebrate metacommunities collected in 15 unimpacted sites sampled annually and biseasonally since 1996. We found that local environmental factors were more important during wet years because stream network connectivity was favoured, whereas dispersal limitation was more relevant during dry years due to a loss of flow connectivity leading to habitat isolation. However, the importance of environmental factors versus dispersal limitation varied depending on the dispersal ability of the taxa considered. Our results contribute to understand and mitigate the effects of water scarcity on Mediterranean freshwater biodiversity. This is especially relevant for future scenarios of increasing water demand and climate change.

TS.02-0-12

Room Aula Magna, Wednesday 6th Feb. 13.00 h.

Effects of flow intermittence on species traits of invertebrate community in Mediterranean streams

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Worldwide, many streams are increasing or suffering the intermittency of their water flow as result of the increasing human demand for water and the aridity caused by climate change. Higher intermittency in water flow is expected to alter the structure and dynamics of aquatic communities, ultimately affecting ecosystem functioning. For instance, aquatic communities show a strong specificity along spatial and temporal changes according to their differential tolerance to change. In spite of its importance it has not been sufficiently studied. In these sense, the objectives of this study are: (i) to analyze to which extent the intensity and frequency of flow intermittency affects the EPT communities (Ephemeroptera, Plecoptera and Tricoptera) and, (ii) analyze taxonomic and functional diversity patterns and the composition similarity among these communities. To do so, we selected 33 streams across Catalonia (NE Spain) with different intensity and frequency of flow intermittency measured in situ. We expect a negative relationship between species richness and composition, and flow intermittency characteristics that ultimately translates into differences in beta diversity (i.e. changes in species composition among streams). Furthermore, we expect that community dissimilarities will be due to species turnover in the streams where natural flow intermittency occurs, promoting specialization through the development of specialized traits. In contrast, when the flow intermittency is due to anthropogenic stress we expect higher species nestedness (i.e. the presence of generalist tolerant species). These results could help to better predict the climatic change effects on diversity and ecosystem functioning in Mediterranean streams.

TS.02-0-13

Room Aula Magna, Wednesday 6th Feb. 13.15 h.

A metacommunity perspective for adapting biomonitoring in dynamic river ecosystems under water scarcityCid Puey, Nuria¹; Bonada, Núria²; Cañedo-Argüelles, Miguel³; Sarremejane, Romain⁴; Heino, Jani⁵; Soininen, Janne⁶; Stubbington, Rachel⁷; Datry, Thibault⁸

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Flow regimes are changing worldwide in response to climate change and exacerbated water demands. Global predictions include a reduction in mean annual discharge and an increase of flow intermittence in several regions of the world. Many streams and rivers are becoming fragmented by flow intermittence posing a risk to freshwater biodiversity and challenging the implementation of EU environmental policies (i.e. Water Framework Directive and Biodiversity strategy). In fragmented river networks, the assessment of the biological quality may be inaccurate because current biomonitoring approaches do not consider that biotic communities are affected by dispersal and species sorting mechanisms changing with time. Here, we propose that the metacommunity perspective can provide more accurate assessments of the biological quality by integrating dispersal (i.e. organisms' dispersal ability and spatial connectivity) with the niche-based approach traditionally used in biomonitoring. We use intermittent rivers and ephemeral streams (IRES) as model systems and explore different groups of aquatic organisms with contrasting dispersal abilities with the aim of adapting current biomonitoring metrics to recognize metacommunity dynamics. The consideration of different spatial scales (local vs. regional) and temporal dynamics (wet vs. dry periods) will be vital to optimize management strategies and propose adaptation and mitigation measures to face on-going and future environmental changes.

TS.02-0-14

Room Aula Magna, Wednesday 6th Feb. 18.00 h.

Revisiting the past two decades of the EU's LIFE program: where are we and where to from here?Hermoso López, Virgilio¹; Clavero, Miguel²; Villero, Dani³; Brotons, Lluís⁴

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The EU has made significant conservation efforts in the last two decades, guided by the Birds and Habitats Directives, currently under evaluation. Despite these efforts a large proportion of priority species are still in unfavourable condition and continue declining. For this reason, a thoughtful review of the implementation of conservation efforts in Europe is needed to identify potential causes behind this poor effectiveness. We compiled information on the distribution of all conservation funds under the LIFE-Nature, the main financial tool for conservation in Europe. We found that LIFE-Nature has not adequately covered continental conservation needs. The majority of funds have been directed towards non-threatened species or regions of low conservation priority. To fill this gap, we demonstrate a method that could be used to identify priority Natura 2000 sites and species therein that could guide investment in the future. We used the software Marxan to prioritise the allocation of conservation funds among all Natura 2000 sites. We found that there are some Natura 2000 sites of exceptional value as they hold species that do not occur elsewhere in the network or they do it very rarely. These priority sites were concentrated mainly on islands and in the South Western, Eastern and Northern extremes of Europe's mainland thus reflecting patterns in species richness and endemism. We propose that prioritisation exercises like the one shown here could be used to inform a top-down EU regulation mechanism by providing lists of site and species priorities that better reflect European conservation needs.

TS.02-0-15

Room Aula Magna, Wednesday 6th Feb. 18.15 h.

Integrating policy, social and ecological needs into freshwater conservation: bridging the gap between knowledge and practiceCañedo-Argüelles, Miguel¹; Hermoso, Virgilio²; Herrera-Grao, Tony³; Barquín, Jose⁴; Bonada, Núria⁵

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Designing and implementing freshwater protected areas following ecological and socio-economic criteria could greatly increase the conservation status of freshwater ecosystems. Although this is a challenging task, current developments in systematic conservation planning make it possible. Here we present an operational framework for integrating ecological, economic and social needs into freshwater conservation planning using River Protected Areas (RPAs) in the Ebro catchment (Spain) as a case study. A public participation process was performed to define the conservation criteria RPAs should meet, resulting in a detailed list of conservation features and constraints that was poorly covered by the current network of RPAs in Spain. The current network of RPAs failed to adequately protect aquatic biodiversity, since 48% of the taxa did not meet the conservation target, including 7 species of vulnerable invertebrates and 3 of vulnerable fish species. When MARXAN was run without restrictions, none of the current RPAs was selected, suggesting that the current network of RPAs is not efficiently meeting the conservation demands expressed through public participation. Besides resulting in a more efficient and enhanced protection of river ecosystems, the approach presented here allowed for integrating a wide variety of conservation preferences into the design of RPAs.

TS.02-0-16

Room Aula Magna, Wednesday 6th Feb. 18.30 h.

Routes and hubs of mammal species persistence in Europe under global change - an overview of ecological, conservation and socio-economic opportunitiesALAGADOR, DIOGO¹; CERDEIRA, JORGE ORESTES²; ARAÚJO, MIGUEL BASTOS³

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In the last decade, conservationists gained consciousness about the impacts of climate change over the persistence of species. Local population processes and connectivity are key factors to understand species adaptation to such changes. Here we introduce a novel analytic concept to plan conservation for multiple species, assuming temporal changes of environmental conditions (climate and land-use) for several time-periods ahead. This concept represents spatio-temporal planning-units (persistence routes), for which a persistence proxy is depicted for each species, based on the simultaneous assessment of local suitability of the areas composing the routes and the connectivity properties of those areas (e.g. potential dispersal) through time. In this study, we identify the largest persistence routes for 30 mammal species in Europe from current-time to 2080, under climate/land-use change scenarios. For each species, we evaluate where/when such routes converge (hubs) and their extent coverage by protected areas and five land-use classes. The persistence associated to the "best" routes ranges widely among species (two orders of magnitude). While covering 30% of Natura-2000 sites, persistence routes do only sustain >10% of total persistence of eight species and only two species presented >10% persistence in routes covered by protected areas. The whole route-set for the 30 species covers 35% of European croplands and only 15% of grasslands. Matching key areas for the persistence of conservation-concerned species with land-uses and established conservation efforts, policy-makers gain an overview on the policies to develop and the actions to undertake in order to keep Europe in the forefront of biodiversity conservation worldwide.

TS.02-0-17

Room Aula Magna, Wednesday 6th Feb. 18.45 h.

Identifying high priority areas for marine top predators in southern EuropeGarcía Barón, Isabel¹; Giakoumi, Sylvaine²; Santos, M. Begoña³; Saavedra, Camilo⁴; Granados, Igor⁵; Louzao, Maite⁶

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Marine Protected Areas (MPAs) are recognised as an important tool for the effective management of marine environments. The design of ecologically coherent MPA networks is typically based on the identification of key areas showing the highest abundance of species of conservation concern. These networks must consider the spatial distribution of human activities as well so that possible conflicts can be minimised. To achieve this, it is essential to regularly monitor the spatial and temporal abundance patterns of species and communities to document the location of key areas as candidate sites for MPAs. This work aims to identify priority areas for the conservation of marine predators that could be included within the MPA network. Within this framework, we used PELACUS oceanographic surveys, which are carried out every spring over the northern Spanish continental shelf. Here, cetacean and seabird sightings are recorded, and their abundance and distribution estimated based on Distance Sampling methodology. We run density surface models with the 2007-2016 data to obtain relative abundances for several species and to identify key areas where predictions showed the highest abundance for all analysed species. Then, we developed an integrative method to highlight priority areas for marine top predator conservation through a free decision-support tool (Marxan), where fishing effort was included as a proxy to predator-fishery interactions. Our study contributes to the identification of important concentration areas in the southern Bay of Biscay that could help design a reserve network based on criteria defined for multiple species and that considers human activities.

TS.02-0-18

Room Aula Magna, Wednesday 6th Feb. 19.00 h.

Facilitated adaptation as a conservation tool in the present climate change scenario: possibilities and limitationsIriondo Alegría, José María¹; García Fernández, Alfredo²; Lara Romero, Carlos³; Morente López, Javier⁴; Prieto Benítez, Samuel⁵; Rubio Teso, María Luisa⁶; Ruiz Checa, Raquel⁷; Sacristán Bajo, Sandra⁸; Tabarés Sibille, Pablo⁹; Torres Lamas, Elena¹⁰

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The challenges raised by climate change demand new conservation and restoration approaches. One of the tools recently taken into consideration is facilitated adaptation, which involves increasing the frequency of alleles of adaptive value in a population by selecting individuals that carry these alleles. Here we present a review of its antecedents and theoretical context to evaluate its applicability as a potential restoration tool. Facilitated adaptation is framed in the context of assisted evolution, focused on improving the ability of organisms to adapt to stressful environments, or to accelerate recovery after unfavorable periods. Five stages can be identified in the process of facilitated adaptation: 1) Determination of the desired phenotype, 2) identification of the implicit genotypes, 3) evaluation and, if necessary, provision of genetic diversity, 4) selection of the individuals that carry the desired genotypes, and, finally, 5) reinforcement of the target populations with individuals carrying the desired phenotype. This approach may offer important benefits to biodiversity because of its potential to generate adapted individuals to future changing conditions, to accelerate natural processes where the present degradation does not allow natural recovery, or to restore altered processes and attributes in the ecosystems. However, it can also entail risks, mainly genetic, that need to be considered. Reduction of genetic diversity due to selection, decrease of fitness due to correlated effects, and loss of naturalness are among the main risks at the population level. Therefore, the application of this approach must be carefully assessed by weighting the benefits against the risks.

TS.02-O-19

Room Aula Magna, Thursday 7th Feb. 12.00 h.

Preliminary results of the International Drought Experiment on gypsum annual plant communities in Central SpainSánchez Álvarez, Ana María¹; López-Rubio, Roberto²; S. Pescador, David³; Escudero, Adrián⁴

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Variability in rain amount and timing are the main source of niche differentiation promoting species coexistence and high diversity values in Mediterranean annual plant communities. Consequently, predicted changes in rain patterns under climate change scenarios will very likely affect annual species assembly processes. Here we presented the preliminary results (three years data) of a field experiment devoted to determine the effect of a 50% rain reduction on annual communities. Rain reduction followed the experimental design of International Drought Experiment (<https://wp.natsci.colostate.edu/droughtnet/activities/international-drought-experiment/>) whose goal is to determine how and why terrestrial ecosystems may differ in their sensitivity to extreme drought. Rain shelters were established in 2015 summer covering seven 30x30 m plots in a gypsum area in the Tájus valley in Central Spain. Annuals were annually recorded at the flowering peak in four 30x30 cm subplots below each rain shelters and in control plots. To identify processes affected by drought every species was characterized by measuring functional traits related to the leaf economics spectrum (specific leaf area (SLA) and leaf dry matter content (LDMC)), reproduction trade-offs (seed mass and reproductive ratio), establishment of size hierarchies (plant height), and resource uptake (root:shoot dry mass ratio). Then the communities were described in terms of their taxonomic (species composition, Simpson diversity and evenness) and functional structure (community weight means, CWM, and mean pair distance, MPD). Results show an important effect of year but also a clear signal of drought in species composition and specially in the functional structure of the community.

TS.02-O-20

Room Aula Magna, Thursday 7th Feb. 12.15 h.

Functional adjustments of *Arenaria tetraquetra* subsp. *amabilis* to contrasting environmental conditionsGarcía López, María Auxiliadora¹; Olano, José M.²; Pistón, Nuria³; Pugnaire, Francisco I.⁴; García-Cervigón, Ana Isabel⁵

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Climate change is one of the main threats for biodiversity conservation in Mediterranean mountains. Low winter temperatures combined with summer drought pose serious limitations for plant growth and survival. The altitudinal ascent of plant species is constrained in mountain summits; however, intra-specific variation in functional traits may influence their adaptive potential. Understanding functional adjustments of plants to current environmental constraints is thus essential to forecast the response of Mediterranean mountain flora to global warming. For this purpose, we evaluated variations in plant morphology, xylem anatomy and leaf functional traits in four high-mountain populations of a cushion plant species, *Arenaria tetraquetra* subsp. *amabilis*, differing in orientation (north vs. south-facing slopes) and elevation (high vs. low) in the Sierra Nevada Mountains, southern Spain. We showed that south-facing plants were more compact and had less photosynthetically active leaves per stem than north-facing individuals. Leaf area was not affected by either orientation or elevation. However, leaf mass per area (LMA) increased at the lowest sites, especially in the north-facing slope. Percentage of conductive area and the estimated xylem-specific hydraulic conductivity were higher in plants facing north and at low elevation, as expected according to the most favorable water and thermal conditions. In addition, conductive vessels were more grouped at both highest sites, increasing their hydraulic redundancy. Our study shows that trait modulation in *A. tetraquetra* depended on environmental conditions, and will probably allow greater population viability under future climatic scenarios.

TS.02-0-21

Room Aula Magna, Thursday 7th Feb. 12.30 h.

Xylem adjusts to maintain hydraulic efficiency at different elevations in the widespread species *Nothofagus pumilio*García-Cervigón Morales, Ana Isabel¹; Fajardo, Alex²; Caetano, Cristina³; Camarero, J. Julio⁴; Olano, José Miguel⁵

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Trees adjust the configuration of their conductive system in response to changes in water availability and temperature. Dominant theory indicates that trees experience a safety/efficiency trade-off: under drier or colder climatic conditions trees reshape xylem anatomy to minimize embolism risk by producing conduits of smaller lumen area, but at the expense of a reduction of hydraulic conductivity. However, recent evidence is questioning the universality of this trade-off, particularly at the intra-specific level. Species growing across broad climatic gradients provide an ideal framework to assess intra-specific xylem adjustments under contrasting environmental conditions. We evaluated xylem anatomical traits of *Nothofagus pumilio* (Nothofagaceae) across an altitudinal gradient (four elevations from closed forest to treeline) and five locations spanning 18° of latitude in central and southern Chile. We collected branch sections of eight individuals per site and measured mean vessel lumen area (MVA), hydraulic diameter (Dh), vessel density (VD), percentage of conductive area (CA) and vessel solitary fraction per ring (RVSF) in the last five growth rings. The theoretical hydraulic conductivity (Ks) was estimated from these anatomical measurements. MVA decreased with elevation, thus supporting the increase on safety with elevation and therefore with lower temperature. Variation of xylem traits was mainly explained by latitude (15.5 %), whereas the effects of elevation and its interaction with latitude were marginally significant. However, Ks remained constant along both the elevational and latitudinal gradients, suggesting that the xylem of this widespread species is able to maintain efficiency in combination with different levels of safety along its distribution range.

TS.02-0-22

Room Aula Magna, Thursday 7th Feb. 12.45 h.

Combined effects of climate and exotic pathogens increase mortality and hinder natural regeneration of an important oak species at its southern distributionMatias Resina, Luis¹; Abdelaziz, Mohamed²; Godoy, Oscar³; Gómez-Aparicio, Lorena⁴

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Global change is altering the performance of plant species worldwide. However, these pressures usually differ across the species' distribution range. To properly assess the combined effect of global change drivers at species level, we need to evaluate its consequences across their complete distribution. To evaluate the current trends in population dynamics across species' distribution and the factors implied on population decline, we selected ten sites separated about one degree in latitude across the core distribution of *Quercus suber*, following a transcontinental aridity gradient, and determined the variations in key ecological indicators of population performance: reproductive investment, demographical structure, dominance of recruitment bank, defoliation and mortality. Demographic structure was determined by latitude, precipitation and *Phytophthora cinnamomi* abundance (a soil borne-pathogen causing death in *Q. suber*). We detected a trend towards reduced sapling densities at the southern distribution, with a demographic structure dominated by old trees. The low sapling density at the southern edge translates into a loss of dominance respect other woody species, suggesting an ongoing alteration of community structure. Population density, precipitation and pathogen abundance were the main causes of tree mortality across the species distribution, with a higher abundance of *P. cinnamomi* at central-latitude populations. Our results allow the early detection of declining trends and the evaluation of the main risks for the maintenance of important forest, and suggest an ongoing range displacement of the species driven by the recruitment collapse at the southern edge of the distribution and a high potential for range expansion at northern populations.

TS.02-O-23

Room Aula Magna, Thursday 7th Feb. 13.00 h.

Exploring the real dynamics of plant populations at large environmental scalesGarcía Gonzalez, Maria Begoña¹; Tejero, Pablo²; Silva, Jose Luis³; Pizarro, Manuel⁴; Pardo, Iker⁵; Gomez, Daniel⁶

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The vulnerability of organisms is often associated to low abundance, in terms of narrow distribution and/or small population size. Similar to other conservation biology paradigms, however, we need to go beyond iconic study cases or predictive theoretical models and test it at large scales. Plants show a large variety of life histories as a consequence of adaptation to prevalent environmental conditions where species and populations occur. Their population dynamics (population growth rate, temporal variability) reflects a successful way of persisting in the long-term, and therefore they offer a good opportunity to carry out a comprehensive test of factors involved in population persistence and vulnerability in a fast changing world. This information is essential to assess current real changes and evaluate future potential losses. Here we test the effect of distribution area, population size, threat status, habitat type, and species biology, on plant population trends and temporal fluctuations, across more than 200 sites occurring over a wide environmental gradient. A recent citizen science project launched in NE of the Iberian Peninsula is allowing us to gather a huge amount of information on annual population growth rates, and compare the performance of endemic vs widespread plants, large vs small populations, alpine vs arid habitats, long-lived vs short-lived plants.... Results show the real beating of biodiversity across a variety of life forms and environmental conditions, and evidence high stability among groups of plants that a priori should be considered as highly vulnerable.

TS.02-MT-24

Room Aula Magna, Thursday 7th Feb. 15.00 h.

Urbanisation and the loss of avian functional biodiversitySol, Daniel¹; Trisos, Christopher²; Jeliaskov, Alienor³; Pigot, Alex⁴; Múrria, Cesc⁵; González-Iagos, Cesar⁶; Pavoine, Sandrine⁷

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Global species diversity is currently diminishing rapidly by the alteration of natural habitats through land use intensification. A hotly debated question is whether biodiversity is similarly decreasing at local scales, the scale where ecosystem functions and services are most relevant. Recent global syntheses suggest substantial declines in local species richness from land use changes, but it is currently uncertain whether and how these changes are restructuring the functional diversity that sustain ecosystem functioning and services. Our primary interest here is in evaluating changes in functional diversity along the urban-wildland land use gradient, combining an improved global dataset of well-characterized bird assemblages with complete species-level information of traits describing how species interact with their environment. Using quadratic entropy as an integrative way to estimate biodiversity, we show that functional diversity is significantly reduced in intensively urbanised habitats compared with natural vegetation. This loss primarily results from a decrease in abundance evenness and is amplified by non-random shifts in functional composition. Despite the existence of substantial functional redundancies, the loss of certain traits due to urbanisation should have important effects on ecosystem functioning and services.

TS.02-0-25

Room Aula Magna, Thursday 7th Feb. 15.30 h.

Predicting Citril finch response to climatic change: An analysis of survival and recruitment rates in relation to meteorological covariatesSenar, Juan Carlos¹; Borrás, Antoni²; Conroy, Michael³; Cabrera, Josep⁴; Cabot, Josep⁵

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Most work on the effect of climatic change on extinction risk of different species has been done modelling their future distributions. However, since it is the intrinsic ability of each species to withstand climatic shifts which determines vulnerability to environmental changes, a better approach is to analyse local population dynamics against meteorological covariates. This may allow a better appraisal of the resulting population-specific responses to climatic change. Here we use a data set of 6,967 Citril finches *Serinus citrinella* trapped at a Pyrenean locality from 1991 to 2014. We used survival and recruitment as an overall measurement of fitness, and related both parameters to a set of meteorological variables using CJS and Pradel models of capture/recapture (CR). We found survival, both of adult and juvenile birds to be highly affected by the number of rain days during June, to the point that less of 6 rain days entails a negative population increase rate. No variable affected recruitment rate. Number of rain days in June has been reduced during the last 50 years, so that currently we have less than 6 days, and it is forecasted to be reduced in the Pyrenees by an additional 10-25% by 2050. Demographic parameters obtained from CR models and climate rain projections for the Pyrenees allowed us to predict that the species could be extinct in this area in the next 50 years. Results emphasize the usefulness of population dynamics approaches to analyze the extinction risk of different species.

TS.02-0-26

Room Aula Magna, Thursday 7th Feb. 15.45 h.

Predicting effects of land use changes on population viability of a vertebrate species using a spatially explicit individual-based modelJiménez Franco, María Victoria¹; Graciá, Eva²; Rodríguez-Caro, Roberto³; Wiegand, Thorsten⁴; Botella, Francisco⁵; Giménez, Andrés⁶

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Mediterranean ecosystems are suffering habitat loss and fragmentation caused by human activities. These change drivers are one of the main threats to biodiversity on a global scale. In this study we evaluate the impacts of three types of land use changes (intensification, scrub and forest area increase) on the population viability of animal populations, comparing these results with control scenarios without land use changes. The land use transformations studied were based on different real landscape scenarios of a Mediterranean ecosystem, occurred from the middle of the last century to nowadays (1956 to 2010) in the southeastern Spain. We applied a spatially explicit individual-based model to simulate the effects of land use changes along time on the emerging demographic parameters of a long-lived species (*Testudo graeca*) with low movement capacity and movement patterns depending on land uses. The results of this study showed that traditional dryland crops abandonment to scrub had a low impact on demographic parameters, being the transformation to pine forest areas and intensification the scenarios with the highest impact on population viability. Specifically, the increase of intensive agriculture and urban infrastructures caused population extinctions in less than 200 years. This modelling study could be extrapolated to different Mediterranean scenarios in order to predict the effects of land use changes on population viability and establish conservation strategies for endangered species.

TS.02-0-27

Room Aula Magna, Thursday 7th Feb. 16.00 h.

Effect of anthropic pressure on mammals in the Pyreneesde la Cueva, Inés¹; Claramunt, Bernat²

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In a world where nature conservation and management are compromised by an increasingly anthropised landscape, understanding the effects of human presence on wildlife is fundamental. We evaluated how human pressure, measured as presence of humans or domestic animals (cows, horses and sheep) and closeness to anthropic variables, affects the presence of mammals in the Pyrenees. We studied four mammal species: two potential competitive herbivores (*Capreolus capreolus* -roe deer- and *Rupicapra pyrenaica* -chamois-), a carnivore (*Vulpes vulpes* -fox-) and a species that is becoming a plague in rural areas (*Sus scrofa* -wild boar-). Presence or absence of these species were detected by sixty camera-traps placed from May to November during 2016 and 2017. These were situated in groups of five, at various elevations, habitat types and anthropisation degree (from a Natural Park to a ski resort). By means of the Presence Software, we analysed the occupancy and detection probabilities of each of the four species when co-occurring with humans or domestic animals, while adding the effect of site and survey variables, for each period. We found evidences that all the species avoided domestic animals and that anthropic variables affected their occupancy. This probability had, however, different pattern over the years depending on the species. Temperature explained the occupancy variation and maintenance between the two years for roe deer and fox, and we noticed that the two ungulates had opposite occupancy patterns, suggesting an interspecific competition.

TS.02-0-28

Room Aula Magna, Thursday 7th Feb. 16.15 h.

Groundwater drawdown drives ecophysiological changes of woody vegetation in a Mediterranean coastal ecosystemNunes Antunes, Cristina¹; Chozas, Sergio²; West, Jason³; Zunzunegui, María⁴; Díaz Barradas, María Cruz⁵; Vieira, Simone⁶; Maguas, Cristina⁷

(1) cE3c, FCUL Portugal; (2) Centre for Ecology Evolution and Environmental Changes, Universidade de Lis; (3) Texas A&M University; (4) Universidad de Sevilla; (5) Departamento de Biología Vegetal y Ecología, Universidad de Sevilla; (6) PPG - Ecologia, Instituto de Biologia, Universidade Estadual de Campinas; (7) Centre for Ecology Evolution and Environmental Changes, Universidade de Lis

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Predicted droughts and anthropogenic water use will increase groundwater lowering rates, intensifying groundwater limitation, particularly for Mediterranean semi-arid ecosystems. These hydrological variations might initiate differential functional responses of the vegetation. Yet, our ability to predict the impacts of groundwater changes in these ecosystems is still poor. Thus, we aimed to better understand the impact of falling water table on the physiology of woody vegetation by addressing the following questions: i) how is woody vegetation ecophysiological performance affected by water-table depth? and ii) does the vegetation response to increasing depth to groundwater differ among water-use functional types? To answer these questions we examined variation in physiological parameters and water-uptake depth of the dominant woody vegetation along a water-table depth gradient in a Mediterranean coastal ecosystem under anthropogenic water extraction pressure. We found that groundwater drawdown did negatively affect the ecophysiological performance of woody vegetation and that depth to groundwater was the most important driver of ecophysiological adjustments. Plant functional types, regardless their water-sources-use strategy and differing water-uptake depth responses, consistently declined their water content and generally reduced carbon and nitrogen acquisition with increasing depths to groundwater. They showed distinct operating physiological ranges, but common physiological sensitivity to greater water table depth. These results strongly suggest that hydrological drought affect physiological fundamental processes, constraining the performance of woody vegetation. Moreover, our study establishes the basis for predicting the physiological performance of woody vegetation that now face changing hydrological conditions caused by water extraction and climate change in this Mediterranean coastal ecosystem.

TS.02-0-29

Room Aula Magna, Thursday 7th Feb. 16.30 h.

Analysis of species richness in Barcelona beaches using a citizen science based approachAparicio Camín, Nuria¹; Comaposada, Andrea²; Paül, Elisabet³; Maceda, Alberto⁴; Piera, Jaume⁵

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The Barcelona coastline is a humanized landscape where beaches stand out, being part of the city history. The 10 beaches in Barcelona, with nearly 5 km in total length, are public spaces, easily accessible and integrated into the city. During the last decades, particularly after the Olympic Games in 1992, environmental efforts have been promoted to ensure that the beaches provide not only an opportunity to enjoy leisure activities, but also offering public spaces to move from an urban world to the natural world of the sea. However, despite such efforts, very little is known about their biodiversity and their potential changes with the urban environmental activities. The main goal of this contribution is to provide the first analysis of species richness in Barcelona beaches, based on the observations reported in the citizen science platform called Natusfera. The analysis will evaluate the contributions from two different activities: the snorkel trips offered during the bathing season, where the observations have been included in the Natusfera's project "Marine biodiversity in the Barcelona beaches" and those observations reported during the international bioblitz "City Nature Challenge 2018", where Barcelona was among the top 10 cities reporting marine organisms. Overall, the results showed that photographic citizen science observations are a potential tool for determining species richness while promoting people participation in coastal monitoring. We believe that this type of social participative methods can be applied worldwide as a complementary way to monitor and predict biodiversity responses to global environmental changes or impacts to human activities.

TS.02. Posters

TS.02-P-1

External pavilion, Poster session 1: Monday 4th - Tuesday 5th Feb.

Vulnerability and adaptation to climate change in aquatic endemics of Sierra Nevada: the AQUALPINE projectAbellan, Pedro¹; Sánchez-Fernández, David²; Velasco, Josefa³; Ribera, Ignacio⁴; Arribas, Paula⁵; Pallarés, Susana⁶; López-Martínez, María Ángeles⁷; Soria, Francisco Javier⁸; Millán, Andrés⁹

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Responding to the threat of climate change requires accurate predictions of how species will respond to future environmental changes, in order to be able to identify and prioritise vulnerable species and facilitate conservation adaptation and management. Climate change impacts on aquatic ecosystems are predicted to be especially strong at high altitudes, where the duration and timing of snow cover and melting can have disproportionately large effects on hydrology and water temperature. The Sierra Nevada mountains harbour a unique representation of the Iberian mountain freshwater ecosystems, including alpine lagoons and ponds. Here, we present the AQUALPINE project (and some preliminary results), which aims to study the main factors that drive vulnerability to climate change of high-mountain aquatic insects using an integrative approach considering the two determinants of climate change vulnerability: persistence capacity and potential of colonization. Notably, it focuses on two threatened, endemic taxa of water beetles restricted to alpine lentic freshwaters of Sierra Nevada (*Agabus nevadensis* and *Hydroporus sabaudus sierranevadensis*, both in the family Dytiscidae). The specific aims are to: (1) update the information about the distribution of these taxa and assess the status of their populations; (2) estimate their persistence capacity using thermal physiology experiments; (3) estimate their future potential distributions using species distribution models; and (4) assess their vulnerability to climate change and provide management strategies. Overall, we expect to make a substantial advance in the knowledge of the drivers of vulnerability to projected climate change in high-mountain freshwater taxa, including the design of specific conservation strategies.

TS.02-P-2

External pavilion, Poster session 1: Monday 4th - Tuesday 5th Feb.

Distributional shifts of a habitat-forming seaweed at its southern range edge: multidecadal impacts on intertidal assemblagesÁlvarez Losada, Óscar¹; Martínez Díaz-Caneja, Brezo²; Arrontes Junquera, Julio³; Fernández González, Consolación⁴; Viejo García, Rosa María⁵

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Autogenic engineers are key species in ecosystems, as they provide structure and modify the availability of resources for other species. Corals, seagrasses or canopy-forming algae are examples of autogenic engineers or habitat-former species in the marine environment. Canopy-forming seaweeds experienced a recent and worldwide reduction linked to anthropogenic activities and climate change. In the Iberian Peninsula, the brown seaweed *Fucus serratus*, which was very abundant at mid-intertidal shores of NW Spain in 1990's, gradually disappeared westwards since the start of this century. The local extinction of this canopy-forming alga started in W Asturias and subsequently propagated towards Lugo coast. The changes in intertidal assemblages associated to the disappearance of this species were recorded in a sampling survey carried out in intertidal shores of W Asturias and Lugo at different times (1990's and the period 2007 to 2018). Assemblages of Asturias in 1990's, when *F.serratus* was abundant, closely resembled those present in Lugo in 2007-2009, with understory assemblages dominated by coralline erect and encrusting algae. Furthermore, in an experiment carried out in locations of Lugo, the removal of *F.serratus* canopies provoked a fast divergence of assemblages from those developed in unmanipulated, control areas, and the progressive convergence towards assemblages where *F.serratus* was locally extinct (Asturias). At present, intertidal macroalgal assemblages from both coastal areas are very similar, with absence of canopies and dominance of turf-forming species. The loss of canopy-forming macroalgae is triggering the homogenization of intertidal assemblages along N Spain, with potential losses of productivity in the coastal system.

TS.02-P-3

External pavilion, Poster session 1: Monday 4th - Tuesday 5th Feb.

Are the microhabitat preferences of insects a good refuge for biodiversity and tool for restoration in rivers? Study case in Galicia, NW SpainÁlvarez Troncoso, Romina¹; Martínez, Yasmina²; Gutiérrez, David³; Garrido, Josefina⁴

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Freshwater invertebrate species found in running waters show complex and dynamic distribution patterns and are influenced by many environmental drivers. Those with most impact on aquatic invertebrates are the geomorphology of the streambed (Reid et al. 2010; Skuja and Spungis 2010), land uses (Townsend et al. 1997; Hughes 2006; Helms et al. 2009), hydraulic conditions such as current velocity, depth and width (e.g. Feio et al. 2005a; Statzner and Doledec 2011), longitudinal gradient, stream size and tributary position (Vannote et al. 1980; Minshall et al. 1985; Heino et al. 2005), water quality and health of rivers (e.g. Benetti and Garrido 2010; Pérez-Bilbao et al. 2014; Kibichii et al. 2015) and substrate type (e.g. Buss et al. 2004; Urbanic? et al. 2005; Barbero et al. 2013). However, studying the different microhabitats present at the sampling sites is essential to understanding the structure of the assemblages inhabiting them and the correlation between species and the environment (Sarr et al. 2013). Substrate availability can also explain the spatial and temporal patterns of invertebrates in freshwaters (Barbero et al. 2013) and can enormously contribute to the biodiversity conservation. The evaluation of results and the main conclusions will be shared in the communication of this work.

TS.02-P-5

External pavilion, Poster session 1: Monday 4th - Tuesday 5th Feb.

Elevational Patterns of Saproxyllic Coleoptera in MountainsBookwalter, Jamie¹; Claramunt, Bernat²; Caballero, Berta³

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Mountain species are particularly sensitive to climate change as their limited distributions are often isolated. Furthermore, climate change and land use shifts are driving the upward range migration of many mountain species, resulting in a loss of habitable areas at the upper altitudinal distributions in summit areas. Elevational gradients have been used in the past decades to extrapolate temporal effects of climate change upon ecological processes, but the distribution and diversity of many mountain species are unknown. This study examines the temporal patterns (seasonal and annual) of the assemblage composition of saproxyllic coleoptera at two elevations in high altitude black pine forests in the Pyrenees. We expect 1) lower species richness in higher altitudes, 2) the species found at the higher altitude sites to be found at the lower sites as well, and 3) the functional roles of organisms will predict distribution patterns similarly or better than taxonomic classifications. In this poster we will present the preliminary results of the analyses of the 2017 samples, including 37 families from 7640 individuals, and 6 new Andorran records of beetles belonging to the Ptinidae family.

TS.02-P-6

External pavilion, Poster session 1: Monday 4th - Tuesday 5th Feb.

Translational ecology in the Sierra Nevada National Park

Cabello, Javier¹; Moreno, Ricardo²; Ramos, Blanca³; Bonet, Francisco Javier⁴; Henares, Ignacio⁵; López-Rodríguez, María D.⁶; Suárez, María⁷; Pacheco, Manuel⁸; Ros, Andrea⁹; Sánchez, Javier¹⁰

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Researchers have to increase the interaction with managers to produce actionable science for the efficient protection of biodiversity. To advance in this goal we implemented a science-policy interface in the Sierra Nevada National Park with the aim to response to the following questions: a) How much scientific knowledge regarding the ecosystems and biodiversity of this protected area is available? b) How much of that knowledge is potentially usable by managers? and finally, c) How much of it is actually used? To do so, we characterized both the potential and the real interaction between science and policy by analyzing the published research and management reports since the National Park was established. We found that management actions can be characterized according a gradient in the type of evidences used. Such actions ranged from those completely based on scientific knowledge to other ones based only on the manager's experience. We also identified the fields with high potential for the science-management interaction as those topics of major interest for managers with usable scientific evidences published. Besides, since the research was based on the collaborative work between scientists and managers, one of major outcomes obtained was the mutual knowledge on the epistemology, interests and constraints of both groups. These results will allow us progress in the objective of doing protected areas useful laboratories for science, but also making science more efficient for the management of parks.

TS.02-P-7

External pavilion, Poster session 1: Monday 4th - Tuesday 5th Feb.

Response of biodiversity to urbanization and urban green infrastructure across Europe

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Urbanization is one of the main drivers altering biodiversity from the individual to the ecosystem level. It reduces, fragments and deteriorates the amount of available habitat. Urbanization introduces new disturbances (e.g. pollution) and disrupts species interactions, such as competition or parasitism, by introducing exotic species or promoting few native ones (e.g. honeybees). Nonetheless, urbanization is not a uniform process. There is compelling evidence that certain urban designs can support native biodiversity that provide ecosystem services and functions. Particularly, the spatial configuration and composition of green infrastructure and the degree of urban compaction are key factors influencing the connectivity, quality, quantity and heterogeneity of urban habitats ultimately determining the ecological and conservation value of cities. The goal of this project is to study the influence of urbanization and urban green infrastructure on biodiversity from a local (Zürich) to a European scale (including Antwerp, Paris, Poznan, Tartu and Zürich) and following a multi-taxa (bees, wasps, bats and nocturnal insects) approach. Analytically, we will use a combination of data ranging from individual traits, demography, interaction networks and taxonomic and functional community composition. The results of this study should lead to a better understanding of the ecology of urban environments applicable to improve city design and planning in an urbanizing world.

TS.02-P-8

External pavilion, Poster session 1: Monday 4th - Tuesday 5th Feb.

Berberomeloe majalis (Linnaeus, 1758) (Coleoptera, Insecta): Biological and social studies in the province of Cádiz (Andalusia, Spain)Cortés-Fossati, Fernando¹

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Meloidae Gyllenhaal, 1810 is a Coleoptera Family whose members are vernacularly known as “blisters beetles” because of the blistering effect of their cantharidin-based defence mechanism. Meloidae species are interesting due to the complexity of their hyper-metabolic development, which even includes parasitoidism in other Insect orders. One of the largest beetles of Europe and the most common crawling Meloidae species in the Iberian Peninsula is *Berberomeloe majalis* (Linnaeus, 1758). This ibero-maghrebian species presents a very complex biology and a low dispersion capacity. Because of that, it was considered appropriate to carry out a Biology and Social study focused on southernmost European populations located in the Cadiz province to detect potential singularities in this region and to provide specific information about regional spatial distribution and a better understanding for the species specially in the Andalusian Autonomous Region, where 4 species of Meloidae family have already been evaluated with some threat category. 493 specimens were studied in vivo. All the specimens presented post-tergal banding, so black habitus were not detected. Spatial distribution is being updated as well as its ethology and temporality of life cycle. Certain ecosystems do not include *B. majalis*. The species prefers sparse vegetation areas with bare soil patching where females carry out ovodeposition. Traditional uses and a non-registered vernacular name of *B. majalis* have been collected for this region. Preliminary conservation status information seems at least to indicate that it would be necessary to pay attention to state of populations, leastwise in peri-urban and most human-influenced areas.

TS.02-P-9

External pavilion, Poster session 1: Monday 4th - Tuesday 5th Feb.

Environmental heterogeneity drives macrophyte beta diversity patterns in permanent and temporary ponds in an agricultural landscapeFernández-Aláez, Margarita¹; Fernández-Aláez, Camino²; García-Criado, Francisco³; García-Girón, Jorge⁴; Santiago, Felisa⁵

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Understanding beta diversity patterns is particularly important for managing and preserving freshwater ecosystems. However, there has been limited empirical research exploring the drivers of these fundamental components of beta diversity in the context of pond environments in agricultural landscapes, in which hydroperiod length usually emerges as the principal constraint of aquatic communities. The purpose of our work was to examine the contribution of substitution and subset structuring processes on macrophyte beta diversity patterns of sixteen and ten permanent and temporary Mediterranean waterbodies, respectively. We also set out to test the role of local environmental factors and geographic isolation in community structuring, and to check whether hydroperiod length influences community heterogeneity and the relative importance of the substitution and subset fractions of beta diversity. We found that temporary ponds were environmentally and biologically less heterogeneous and supported lower richness than permanent waterbodies. Similarly, beta diversity almost entirely reflected patterns of species substitution rather than subsets in our dataset, regardless of hydroperiod length. Local environmental conditions were the main drivers of macrophyte community structuring, whereas spatial effects were negligible. Overall, our results suggest that local environmental variables operating through niche processes were the primary mechanisms driving macrophyte beta diversity patterns, thus highlighting the importance of environmental heterogeneity for maintaining pond community diversity in agricultural landscapes. Accordingly, conservation initiatives and ecosystem management strategies should include permanent and temporary pond clusters comprising wide environmental gradients in their efforts to ensure high levels of regional biodiversity.

TS.02-P-10

External pavilion, Poster session 1: Monday 4th - Tuesday 5th Feb.

The monitoring program of the Natural Parks of Catalonia (NW Mediterranean Sea)

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The monitoring program of the Catalan Natural Parks started in 1990 in Medes Islands, and in 2006 in the Cap de Creus Natural Park, with the objective of evaluating the conservation status of benthic ecosystems in these areas in relation to the human activities and environmental factors, and to serve as a tool to inform the management and conservation actions. This monitoring is based on several ecological and economically relevant species and habitats, which show a high diversity of responses to different stressors due to their different biological attributes such as life strategies, population dynamics, life cycles and behaviors. This monitoring give a long-term perspective of the natural dynamics of species and habitats, and has provided unexpected results hardly observable in punctual studies. In addition, parallel research and experimental studies gave us a more precise comprehension about the key processes for populations functioning and their response to perturbations which, indeed, allow us to better understand their long-term dynamics. Long-term monitoring programs combined with experimental studies, including species with different life history traits, give us a more complete comprehension about the strength of processes on species and populations, the factors and stressors that shape marine benthic communities at different scales, and their responses to different stressors. This information allows us to design efficient tools for the management of these areas, such as the regulation of human uses and the design of restoration actions. This combination is especially useful for conservation when integrates different management regimes such as MPAs and non-protected areas.

TS.02-P-11

External pavilion, Poster session 1: Monday 4th - Tuesday 5th Feb.

Biodiversity and conservation value of the vertebrate fauna of a highly humanized area under a gradient of human pressure

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We have examined the composition and distribution of the vertebrate fauna within a grid of 20 10x10 km cells around the metropolitan area of Seville (Spain). This highly impacted area includes mostly urban spaces and Mediterranean agricultural landscapes. The main goal of this study was to determine the conservation value of this fauna in an a priori poor habitat and secondly to analyse the relationship between landscape structure and vertebrate diversity distribution. The conservation value was estimated after a ranking of cells based on several criteria as species richness, rarity, vulnerability and an index combining the previous criteria. The results show that: 1) a high conservation value can be reached in marginal habitats and 2) a main gradient of landscape heterogeneity related to human land uses could be defined in the area and that the response of species richness to this gradient varied depending on the group considered. This study highlights the importance of the fauna from areas with traditionally low conservation value. Also, it points out the importance of heterogeneity as a planning criterion and for definition of management directives in order to maintain biodiversity in the areas that will cover most of the earth surface in the near future.

TS.02-P-12

External pavilion, Poster session 1: Monday 4th - Tuesday 5th Feb.

A contribution for the management and conservation of the coastal/lowland habitats of MadeiraMartins, Anabela¹

(1) w/o

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Madeira archipelago harbours a high heterogeneity of environments and vegetation belts where bryophytes occur, ranging from the sea level to the highest peaks. In particular, the coastal/lowland habitats include about 230 bryophyte species (circa 40% of the Madeiran bryoflora). A significant fraction of this flora is under threat, reflecting human pressures such as the loss and degradation of habitats as a result of construction and leisure/touristic infrastructures, the effects of climate change, and the emergence and spread of invasive alien plant species. As examples, the mosses *Acaulon muticum* and *A. triquetrum* show very restricted area of occurrence (Ponta de São Lourenço), and their main threat include "Human intrusions & disturbance-Recreational activities". Another example is the liverwort *Riccia atlantica*, an endemic taxon restricted to the lowlands. In the present study, 15 and 18 sites and a total of 30 and 35 plots, previously sampled in 2007, were recently sampled in 2018 across the coastal habitat/lowland habitats in Madeira Island and Porto Santo aiming to: (i) analyze the potential changes in bryophyte diversity and species composition in a sequence of 11 years, with a special focus on the endemic and threatened groups; and (ii) investigate the impact of the intervention type, including agriculture, grazing, fire, landslide, construction and invasive alien plants. Our findings contribute to the effective management and conservation of coastal/lowland non-vascular and vascular plants biodiversity on Madeira. In the near future, we may extend this study to other habitats of Madeira and across the Macaronesia region.

TS.02-P-13

External pavilion, Poster session 1: Monday 4th - Tuesday 5th Feb.

Compilation and analysis of fauna data for Iberian arthropods: the IberArthro projectMillán Sánchez, Andrés¹; Sánchez Fernández, David²; García Barros, Enrique³; Hortal, Joaquín⁴; Guisande, Castor⁵; Miguel Lobo, Jorge⁶; Munguira, Miguel L.⁷; Romo, Helena⁸; Torralba, Antonio⁹; Yela, José Luis¹⁰

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Arthropods constitute the most diverse metazoan phylum on the planet: they comprise around 63% of all living organisms in any terrestrial region and 86% of all animal species; that is, four out of five known animal species are arthropods. It seems therefore difficult to address a global study of biodiversity, or its conservation, without taking into account this biological group. When we face with the challenge of describing biodiversity patterns in the Iberian Peninsula (one of the global hotspots of biodiversity), we find an insurmountable limitation to date: the scarcity of distributional data available for most species of arthropods (known as the "Wallacean shortfall"). The IberArthro project aims to overcome this limitation, and represents an unprecedented advance both in our knowledge on the distribution of Iberian arthropod biodiversity and on its conservation. The specific objectives of this project are: i) to continue with the management and development of the Iberian arthropod distribution database and the GeoBrink platform, improving its functionality and expanding the number of records and taxonomic groups included; ii) to develop new freely available tools allowing the analyses of biological databases; and (iii) to apply these tools to the already compiled database (containing 820000 records for almost 1700 invertebrate species). This will allow us to advance on our understanding of the distribution of biodiversity, generating reliable species distribution models and identifying priority areas for conservation, to finally assess the effectiveness of the current network of protected spaces in representing these high and interesting arthropod biodiversity.

TS.02-P-14

External pavilion, Poster session 1: Monday 4th - Tuesday 5th Feb.

Enhancing mediterranean forest resilience to climate change: the case of *Pinus halepensis*-*Tetraclinis articulata* mixed forest.Moya Pérez, Juan Miguel¹; Esteve Selma, Miguel Ángel²

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The *Pinus halepensis* – *Tetraclinis articulata* mixed forests (located in the southeast of the Iberian Peninsula) are an ecotone especially vulnerable to the climate change effects. The species distribution models (SDMs) suggest a radically different behavior for the climate change time slice 2020-2050, where *P. halepensis* tends to a regressive behavior and *T. articulata* to expand. This work analyzes the first experiences of interspecific competition weakening carried out within the framework of the LIFE13 NAT/ES/000436 project. Removing *P. halepensis* in areas with *T. articulata* presence accelerated its reproductive maturity (64.28%) and doubled the mean number of cones produced per mature tree, increasing its demographic activity. A spatial design is also developed to transfer the experiences to all *P. halepensis* – *T. articulata* formations. In addition, the *P. halepensis* areas weakened by the 2014-2016 drought that are close to *Tetraclinis* specimens with the ability to benefit from the situation are studied.

TS.02-P-15

External pavilion, Poster session 1: Monday 4th - Tuesday 5th Feb.

Thermal tolerance and acclimatory ability in subterranean fauna: implications for biodiversity conservation under global changePallarés Párraga, Susana¹; Ribera, Ignacio²; Pérez-Fernández, Toni³; Colado, Raquel⁴; Wesener, Thomas⁵; Sánchez-Fernández, David⁶

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Subterranean species are interesting models to explore the acquisition and loss of traits related to the colonization of these singular ecosystems, featured by permanent darkness and highly stable environmental conditions. Cave-specialists could have lost their acclimatory ability to face high temperatures, which is likely costly to maintain in a resource-limiting environment. This may put these species (with limited possibilities for behavioural adjustments or dispersal) in a vulnerable position in a warming context. However, differences in acclimation capacity could be present in species depending on their degree of specialization to subterranean environments (e.g. troglobites vs. troglaphiles) and the timeframe of the colonization of these systems. We determined the acclimation capability of two phylogenetically distant arthropod species with different subterranean specialization: a troglobiont undescribed species of the genus *Glomeris* (Myriapoda, order Glomerida) and the troglophile *Atheta subcavicola* (Hexapoda, order Coleoptera). We exposed groups of individuals to 13 (control), 20, 23 and 25°C for one week. Subsequently, surviving individuals were exposed to 30°C until death. A positive relationship was found between acclimation temperature and survival time at 30°C in both species. Such acclimation ability, especially surprising for the cave-dwelling *Glomeris*, contrasts with the lack of thermal plasticity previously reported in other ancient cave lineages (leiodid beetles). These results suggest that species that presumably colonised the subterranean environment only recently (e.g. *Glomeris* sp.) may retain physiological capabilities associated with surface life. Therefore, the fate of subterranean biodiversity in the face of global change could depend on the evolutionary history of the different subterranean lineages.

TS.02-P-16

External pavilion, Poster session 1: Monday 4th - Tuesday 5th Feb.

Reproduction and behavior effects of CO₂-mediated acidification in zooplankton: *Cypridopsis vidua* as model organismParra Anguita, Gema¹; Espinoza, David²

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The amount of CO₂ in the atmosphere worldwide reaches 400 ppm which means, an increase of 143% from the pre-industrial level. The anthropogenic CO₂ emissions will cause a drop of 0.3-0.4 pH units on the ocean surface by the year 2100. In this study, the main objective was to know the consequences of this acidification for zooplankton, using as experimental model the specie of ostracod *Cypridopsis vidua*. The Aquamedic AT Control CO₂ injection system was used to provide the experimental conditions. An acute exposure test (48 h) in which CO₂ was injected, achieving 6.05, 6.55 and 7.05 pH values, was conducted with 4 replicates and controls. Results shown mortality rates, 100%, 50% and 27% respectively. A chronic test was also carried out (21d) in which CO₂ injection was maintained at 7.30 and 7.80 pH. In this case there was a significant decrease in reproduction rate (< 40%) and consequently in recruitment. Moreover, a significant effect on phototactic behavior was detected. CO₂ exposure lead to a negative phototactic behavior. This finding suggests that by the beginning of the next century, the most sensitive zooplankton organisms may be affected beyond their tolerance thresholds that could lead to changes in zooplankton biodiversity.

TS.02-P-17

External pavilion, Poster session 1: Monday 4th - Tuesday 5th Feb.

Main drivers of vegetation in high mountain miresPérez Haase, Aaron¹; Batriu, Efre²; Anadon-Rosell, Alba³; Ninot, Josep Maria⁴; Mercadé, Arnau⁵; Pladevall-Izard, Eulàlia⁶; Espuny, Jaume⁷; Carrillo, Empar⁸

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In the Pyrenees, high mountain areas hold a noticeable diversity of wetland types, where many temperate and boreo-alpine mire specialist species thrive. Altogether, Pyrenean mires form an archipelago of tiny areas hosting high natural values among a matrix of drier habitats, chiefly coniferous forests and short grasslands. A number of mire types correspond to Habitats of Community Interest, thus land managers have to ensure their conservation. Despite most of Pyrenean mires are included within protected natural areas, we still lack a detailed knowledge of their geographical and ecological distribution. Also, we ignore the impact of the main threats to their conservation at landscape scales. This information is necessary to correctly perform conservation policies. To address these issues, we sampled the vegetation composition, environmental data and main threats indicators of about 180 plots in the Central Pyrenees. Also, we mapped all the wetlands larger than 1,000 m² for GIS analysis. At regional scale, temperature (altitude) was a major driver of vegetation variation, whereas water table depth and groundwater mineral content were the main factors at local scale. Moreover, we evidenced that pasture was a threat to conservation through trampling and grazing, although it affected secondarily the plant composition. Pine encroaching was of minor concern, except for a few sensitive mire systems.

TS.02-P-18

External pavilion, Poster session 1: Monday 4th - Tuesday 5th Feb.

Reporting changes on species distributions using citizen science observations: The example of *Trithemis kirbyi* and *Natusfera*Perich Prujà, Aina¹; Leahy, Kristian²; Piera, Jaume³

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A critical question in biogeography is how species will respond in front of current rates of climate change: we may find many examples in the scientific literature reporting changes in species distributions worldwide that could be linked to climatic effects. A particular case is the dragonfly species *Trithemis kirbyi* Sélys, 1891, originally distributed in Africa and southern Asia and associated to arid areas, that has been reported in the last years in the Iberian Peninsula. New observations in northern territories are among the most interesting to confirm the expansion rate of this species. In this sense, the participation of non-academic experts that may contribute with new observations (what it is known as citizen science) could be very helpful, since this type of collaboration allows to cover a much wider monitoring area. The number of potential observations (and the covered area) may increase much more if volunteers do not require previous training nor expertise on identifying the reported observations. As an example, in this contribution we report probably the northernmost observation of *Trithemis kirbyi* in Catalonia (in the population of Albanyà, near the French borderline) using the citizen science platform *Natusfera*. This platform allows collaborative identification of the reported observations. We believe that this type of collaborative platforms could be used extensively to monitoring changes on species distributions, being a complementary tool for biogeographic studies.

TS.02-P-19

External pavilion, Poster session 1: Monday 4th - Tuesday 5th Feb.

Human-dominated habitats and avian biodiversity in Mediterranean agricultural landscapesPrenda Marin, José¹; Fuste-Etxeberria, Amaia²; Ramos-Merchante, Adrián³; Negro, Juan José⁴

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Understanding the multifaceted relationship between biodiversity and land-use intensity is key to conservation policy. At the same time, agriculture is a fundamental land-use factor underlying declines in biodiversity, especially in Mediterranean areas. To characterize this relationship in a Mediterranean region, we investigated the bird fauna in an urban-agricultural gradient in southern Spain. Our goals were to: (1) compare the composition of the avifauna found in different habitat patches within a 5 km radius circle centred in a small town, including pure urban habitat, winter cereals, summer herbaceous crops, olive groves and riverbank habitats; (2) assess the faunal change occurred in a gradient of direct human influence measured as distance from the urban centre; and (3) provide a baseline for future comparisons. The abundance and species richness of farmland birds were affected both by the habitat type and the existence of direct human activities. The results of this study show that farm management, vegetation cover and landscape composition all influence bird biodiversity. Heterogeneous landscapes comprising high water availability and woody vegetation support most species of birds.

TS.02-P-20

External pavilion, Poster session 1: Monday 4th - Tuesday 5th Feb.

Global Change effects on biodiversity conservation of mayfly and stonefly species in Pyrenean high mountain streamsPuig, María Ángeles¹; Camarero, Lluís²; Osorio, Víctor³; Ventura, Marc⁴; Fochetti, Romolo⁵; Ubero-Pascal, Nicolás⁶

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Long-term studies are needed to analyse the effects of Global Change on mayfly and stonefly stream communities, especially on endemic, relict or rare species. Long-term studies allow contrasting the available information, and detecting doubtful data, about the distribution range of species associated to floods or extraordinary high snow melt flows. These climatic events cause that some individuals drag downstream from upper reaches and sources, and they cannot survive in these downstream stretches along the time. To know the impact of Climate and Global Change on mayfly and stonefly distributions in high mountains, it has been analysed the Pyrenean databases (LTER-Aigüestortes National Park and Andorra) from 1978 to the present. The decrease in the altitudinal range of some target species has been observed, such as *Rhithrogena loyolaea* and others *Rhithrogena* sps, *Habroleptoides berthelemyi*, *Arcynopteryx dichroa*, *Perla grandis*, *Taeniopteryx hubaulti* and *Protonemura vandeli*. These species have decreased not only the lower limits, but also the upper ones limit in association with the increase of stream water temperatures in summer. The daily average temperature in streams above the forest treeline is more than 2°C higher than the downstream forested reaches. Flow management for hydropower production magnifies the effects of Climate Change on mayfly populations, especially on rheophile species with increasing parasitism that induce infertile females. This research was funded by GECA, MAYSTONS and Life+ LimnoPirineus projects, and supported with information of the Long-term Observatory of Pyrenees (LOOP).

TS.02-P-21

External pavilion, Poster session 1: Monday 4th - Tuesday 5th Feb.

The historical collapse of the marine-catfishes fisheries in the Patos Lagoon Estuary, RS, BrazilVieira, João¹; Lemos, Valeria²; Silva, Mauricio³

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This paper summarize the conflict among preservation effort, lack of enforcement, economical industrial power and social, economic and cultural conflicts with traditional fishing communities at Patos Lagoon Estuary (PL). We use the sea-catfish fishery as an emblematic example of the artisanal fishery collapse of PL. *Genidens barbatus* and *G. planifrons* are classified as endangered (IUCN-Brazil) and are important fishing resource for hundreds of fishermen's families in PL. Sea-catfishes (1000-1200 mm MaxTL) mature late (8-9 years; 430 mm TL), are long-lived (36 years), and show low fertility (32 to 272 eggs). The semi-anadromous life cycle favors fishing during reproduction. Males remains in PL incubating eggs and larva until 3 months and at the end of the summer juveniles (> 60 mm TL) were incidentally caught by the pink shrimp fishery. Before 1980, adults marine-catfishes represented the second most important fishing resource in PL. Landing were around 4,600t/year between 1960-1980, declining to 800t/y in the early 1980s and reaching less than 400t in the following years. At least five factors may explain the marked decrease in biomass: i) excess of fishing effort; ii) fishing during the reproductive period and/or during oral incubation of eggs; iii) incidental capture of juvenile by pink shrimp fishery; iv) failures in fisheries monitoring and v) lack of fishing enforcement. Recent sea-catfishes stocks management plans address their ecological, social, cultural, economic importance, and fishing effort control, but the low Brazilian government power to provide fishing enforcement and the lack of fishing monitoring can result in a messy results.

Thematic Session 03: Carbon cycling within and across ecosystems: from land to ocean

Day: Wednesday 6th February

Schedule: 12:00h 13:30h - 18:00h 19:30h

Location: Room A2

Coordinators:

Daniel von Schiller, University of the Basque Country (UPV/EHU), Spain

María Almagro, Basque Centre for Climate Change (BC3), Spain

Cristina Romera-Castillo, Institute of Marine Sciences (ICM-CSIC), Spain

Rafael Marcé, Catalan Institute for Water Research (ICRA), Spain

Biel Obrador, University of Barcelona (UB), Spain

The global carbon cycle connects terrestrial ecosystems, freshwaters and oceans. However, terrestrial ecologists, limnologists and oceanographers often work in isolation. We propose to bridge the divide across these disciplines to better integrate the knowledge on the carbon cycle from different ecosystems into the global carbon cycle. Knowledge sharing and collaboration among different disciplines of ecology will help us to better approach global scientific challenges and environmental issues. In this session, we seek studies that examine carbon cycling (gaseous emissions, decomposition, metabolism, etc.) within all types of ecosystems. We especially look for studies that examine carbon cycling along the land to ocean continuum and/or compare carbon cycling across terrestrial-aquatic and/or freshwater-marine boundaries.

TS.03. Oral talks

TS.03-MT-1

Room A2, Wednesday 6th Feb. 12.00 h.

On nutritional and other constraints on carbon cyclingPeñuelas, Josep¹; CREAM-CSIC-UAB-UB, GEU²

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Carbon dioxide and nitrogen (N) fertilization effects on ecosystem carbon sequestration may slow down in the future because of emerging nutrient constraints, climate change reducing the effect of fertilization, and expanding land use change and land management and disturbances. Further, record high temperatures and droughts are leading to negative impacts on carbon sinks. We suggest that, together, these two phenomena might drive a shift from a period dominated by the positive effects of fertilization to a period characterized by the saturation of the positive effects of fertilization on carbon sinks and the rise of negative impacts of climate change. We will discuss the evidence and processes likely leading to this shift. We will focus on nutritional constraints on C cycling in the land-freshwater-ocean system. The interactions between carbon (C) and the nutrient cycles, especially N and phosphorus (P), are important to the biosphere's storage of carbon. Increasing riverine fluxes of C, N, and P to the coastal ocean, together with atmospheric nitrogen loading of coastal environments will stimulate primary production and respiration/decomposition of organic C leading to changes in the trophic, oxic and pH status of coastal marine environments. Finally, we will argue that process-based C, N and P land-ocean models and measurements of the land-freshwater-ocean system are needed to realistically project this century carbon-climate feedback, and to conduct a more realistic investigation of the impact of climate change on land, freshwater and ocean ecosystems.

TS.03-O-2

Room A2, Wednesday 6th Feb. 12.30 h.

Response of the carbon cycle to climate change: a climatic regulation ecosystem service approach in different types of aquatic ecosystemsMorant, Daniel¹; Picazo, Antonio²; Rochera, Carlos³; Miralles-Lorenzo, Javier⁴; Santamans, Anna C.⁵; Doña, Carolina⁶; Camacho, Antonio⁷

(1) Universitat de València; (2) University of Valencia; (3) University of Valencia; (4) University of Valencia; (5) University of Valencia; (6) University of Valencia; (7) University of Valencia

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One of the most important services ecosystems play in a climate change framework is climate regulation. They are capable of assimilating carbon from the atmosphere, thus mitigating climate change. The functionality of the systems with respect to this regulatory service can be understood by the study of their carbon cycle. The objective of the work was to understand the functioning of the carbon cycle in some types of aquatic ecosystems, as well as to assess the response capacity to predicted environmental changes in order to evaluate the climatic regulation service. A carbon cycle model was developed and applied to several types of inland and coastal wetlands, which maintain a close interaction with the environment, making them especially vulnerable to environmental changes. Preliminary results showed a strong carbon sink capacity, with significant variations between types. Overall, results evidenced the importance of these ecosystems in climate mitigation. On the other hand, the application of the same model under different environmental conditions revealed the possible response of the studied ecosystem types to these changes. Temperature, salinity and hydroperiod were studied as key variables influenced by climate change with significant consequences in the carbon cycle. Generally, carbon budget capacity was slightly increased due to raises in temperature predicted by future climate scenarios. However, alteration in the natural chemical and hydrological features of the systems revealed the weakness of the regulatory capacity. This work was supported by the project CLIMAWET (GL2015-69557-R) funded by MINECO and FEDER-EU Funds.

TS.03-0-3

Room A2, Wednesday 6th Feb. 12.45 h.

Automated measurements of greenhouse gases fluxes from tree stems and soils: magnitudes, patterns and driversBarba Ferrer, Josep¹; Poyatos, Rafael²; Vargas, Rodrigo³

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Tree stems exchange CO₂, CH₄ and N₂O with the atmosphere but the magnitudes, patterns and drivers of these greenhouse gas (GHG) fluxes remain poorly understood. Our understanding mainly comes from static-manual measurements, which provide limited information on the temporal variability and magnitude of these fluxes. We measured hourly CO₂, CH₄ and N₂O fluxes at two stem heights and in adjacent soils within an upland forest. For these fluxes, we analyzed their diurnal and seasonal variability, their drivers (temperature, soil moisture, sap flow) and the co-variation amongst the fluxes. Tree stems were a net source of CO₂ ($3.80 \pm 0.18 \mu\text{mol m}^{-2} \text{s}^{-1}$; mean \pm 95% CI) and CH₄ ($0.37 \pm 0.18 \text{ nmol m}^{-2} \text{s}^{-1}$) but a sink for N₂O ($-0.016 \pm 0.008 \text{ nmol m}^{-2} \text{s}^{-1}$). Time series analysis (i.e., wavelet coherence analysis) showed temporal correlations between these gases with temperature or sap flow at the 1-day time period for certain days. CO₂ and CH₄ showed a clear seasonal pattern explained by temperature, soil water content and sap flow. Temporal correlations were not consistent throughout the growing season, highlighting the importance of automated measurements. Relationships between stem, soil fluxes and their drivers suggest that CH₄ stem emissions could be partially produced belowground. Our findings demonstrate that accounting for diurnal and seasonal variation of stem GHG fluxes is needed to better understand the underlying mechanisms of GHG stem emissions, to accurately upscale ecosystem-level GHG fluxes and to move towards process-based ecosystem models that include CH₄ and N₂O fluxes from tree stems.

TS.03-0-4

Room A2, Wednesday 6th Feb. 13.00 h.

Resilience of carbon sequestration to ecosystem transitionsPagès, Jordi F.¹; Mateo, Miguel Ángel²; McKinley, Emma³; Mateo, Miguel Ángel⁴; McKinley, Emma⁵; Skov, Martin W.⁶

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Understanding the relationship between ecosystem stability and carbon (C) sequestration is necessary, given increasing pressures linked to climate change. Hence our main questions: (1) are C-stocks resilient to ecosystem transitions, and (2) are C-fluxes in dynamic areas faster/slower than in stable ones? To answer these questions we extracted soil cores from 'dynamic (D)' and 'stable (S)' areas in saltmarsh habitats around Wales. These areas had been previously identified using a GIS containing historical aerial images. Stable areas had been continuously vegetated for at least the past 100 years, while dynamic areas had transitioned back and forth from vegetated-unvegetated states, at least once in the past century. Upon extraction, sediment cores were analysed under an X-ray fluorescence scanner to assess elemental signatures at each cm and subsampled to assess C-stocks and fluxes. Our results show that total carbon sequestration was higher in stable areas. The lower C-stocks of cores from dynamic areas resulted from the low C-density of the sediment accreted during unvegetated periods. Nevertheless, C-fluxes were faster in those layers of sediment accreted during short vegetated phases in dynamic cores, than in the single vegetated layer present in cores from stable areas. Thus, our results show that while recovery of C-sequestration ES from an unvegetated state is fast, due to the higher C-accretion rates of newly established saltmarshes, stable saltmarshes are more valuable C-sinks due to their long-term stability. These results highlight the importance of taking into account ecosystem stability and persistence when evaluating ES.

TS.03-0-5

Room A2, Wednesday 6th Feb. 13.15 h.

Dissolved organic carbon leaching from plastics stimulates microbial activity in the oceanRomera-Castillo, Cristina¹; Pinto, Maria²; Langer, Teresa³; Álvarez-Salgado, Xose Antón⁴; Herndl, Gearhard⁵

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More than 5.25 trillion of plastic pieces have been estimated to be floating at the sea surface. Plastic marine debris on beaches and floating in seawater is exposed to solar UV radiation undergoing weathering degradation. It can develop surface cracks and fragment into progressively smaller particles reaching microscopic sizes (< 5 mm, microplastics). Detrimental effects of plastics on marine organisms at different trophic levels have been widely reported, making plastic pollution a global environmental concern. However, the impacts of plastic debris on the lowest trophic levels, such as the microbial food web, remain enigmatic. Plastic is known to leach organic compounds to the aquatic media. The smaller the piece, the higher its surface to volume ratio and its potential for leaching. However, the contribution of plastic leaching to the dissolved organic carbon (DOC) pool in the ocean and its impact on the lowest trophic levels, such as the microbial food web, is still unknown. In this work we present experimental evidence that plastics release dissolved organic carbon (DOC) into the ambient seawater stimulating the activity of heterotrophic microbes. It is predicted that plastic waste entering the ocean will increase by 10-fold over the next decade, resulting in an increase in plastic-derived DOC that could have unaccounted consequences for the activity of marine microbes and for the ecosystem.

TS.03-0-6

Room A2, Wednesday 6th Feb. 18.00 h.

Bridging the gaps by tea – a simple approach to collaboration in ecosystem scienceDjukic, Ika¹; Kepfer-Rojas, Sebastian²; Kappel Schmidt, Inger³; Steenberg Larsen, Klaus⁴; Beier, Claus⁵; Berg, Björn⁶; Verheyen, Kris⁷; TeaComposition et al.⁸

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In order to study ecosystem processes as well as to analyze environmental changes and develop appropriate mitigation measures “big data” involving comprehensive datasets collected over multiple temporal and spatial scales and diverse ecosystems is needed. One attempt to meet these requirements was made within the TeaComposition initiative, a global litter decomposition study. Within the TeaComposition initiative we use a standardized and low-cost method, in the form of household tea bags (Rooibos and Green tea), for studying long-term plant litter decomposition rates and its drivers. So far, 570 terrestrial and 350 aquatic sites across 9 biomes around the world are involved in the TeaComposition initiative, with >80,000 tea bags being deployed. We could show that litter quality was the predominant controlling factor in early stage litter decomposition, explaining about 65 % of the variability in litter decomposition at a global scale. The effect of climate was not litter specific and was of significance only under unfavorable decomposition conditions or when data were aggregated at the biome scale. This initiative underlines the importance of collaborative effort between experimentalist and observers essential for addressing litter carbon cycling across terrestrial and aquatic ecosystems.

TS.03-0-7

Room A2, Wednesday 6th Feb. 18.15 h.

Plant litter fluxes in the forest-stream interface: breakdown and transport play a key role in seasonal tropical streamsTonin, Alan¹; Boyero, Luz²; Bambi, Paulino³; Gonçalves Júnior, José Francisco⁴

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Terrestrial plant litter fuels heterotrophic forest streams, but we know little about how litter fluxes vary within and among tempo-spatial scales, particularly in the tropics. We quantified several processes related to litter dynamics by sampling litter at multiple sites in three streams of the Brazilian Cerrado biome – which is tropical and strongly seasonal – for two years, and assessing the relative contribution of different spatial (among and within streams) and temporal scales (inter-annual, inter- and intra-seasonal) to total variability. Overall, spatial variability of litter fluxes and storage was two-fold higher (65%) than temporal variability (33%), except for litterfall, which varied less spatially (24%) than temporally (76%). Litter transport was a major determinant of litter budgets across streams through different seasons: litter inputs and transport were higher in the wet than the dry season (1.45 vs. 0.92 and 1.43 vs. 0.06 g litter m⁻² d⁻¹, respectively), while outputs by breakdown were similar between seasons (0.88 vs. 0.94 g litter m⁻² d⁻¹, respectively). Our results show how litter fluxes and storage may be variable within a relatively small spatial scale (i.e., within stream reaches), suggesting that high within-stream replication is necessary for long-term, large-scale predictions. Further, we demonstrate that seasonal variation in storage (hence its availability to consumers) is mostly mediated by downstream transport losses in tropical seasonal streams, despite the largest removal of litter by breakdown on a year- and reach-scale basis. Our findings entail important repercussions for stream functioning in a scenario of predicted shifts in rainfall seasonality in the tropics.

TS.03-0-8

Room A2, Wednesday 6th Feb. 18.30 h.

Remineralisation of particulate organic matter from different marine phytoplankton assemblagesCabrera Brufau, Miguel¹; Marrasé Peña, Cèlia²; Cermeño Ainsa, Pedro³; Sala Farré, María Montserrat⁴; Arín Carrau, Laura⁵

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The efficiency of the biological pump strongly depends on the composition and susceptibility to bacterial degradation of the Particulate Organic Matter (POM). Earth system models usually assume that the primary production gets recycled within the water column following a pre-established remineralisation profile. However, the shape of this profile, which depends on the origin and lability of the POM, has a great impact on the final amount of organic carbon that reaches the deep ocean and sediments. With relatively large cell sizes and mineral covers that protect and ballast the cells, diatoms and coccolithophorids greatly contribute to carbon export in silica rich and silica depleted environments, respectively. With the aim of assessing the remineralisation of POM in the mesopelagic zone, a series of degradation experiments with POM of different origin were performed. By enriching surface seawater with two sets of nutrients (one with silica and one without), blooms of diatoms and coccolithophorids were induced in the lab. The POM produced by each bloom was then transferred to dark containers with bacterial assemblages from mesopelagic waters (200m) and the remineralisation process was followed for 3 weeks. Inorganic nutrients concentration, abundance of prokaryotes, bacterial extra-cellular enzyme activity, particulate and dissolved organic carbon concentration, optical characteristics of the dissolved organic matter, pH and alkalinity were among the measurements used to monitor the process. We will discuss the importance of phytoplankton composition on POM remineralisation efficiency in the context of ocean carbon sequestration.

TS.03-0-9

Room A2, Wednesday 6th Feb. 18.45 h.

Soil respiration in drylands: controlling abiotic factors and thresholds

Almagro Bonmati, María¹; Rey, Ana²; Inclán, Rosa M.³; Barba, Josep⁴; Vargas, Rodrigo⁵; Marañón, Sara⁶; Serrano-Ortiz, Penélope⁷; Estruch, Carme⁸; Guidolotti, Gabriele⁹; Chang, Chaoting¹⁰; Llovet, Joan¹¹; Martínez-Mena, María¹²; Carbone, Mariah¹³; Lo Cascio, Mauro¹⁴; Grünzweig, José¹⁵; Stenberg, Marcelo¹⁶; Talmon, Yiftach¹⁷; McCulley, Rebecca¹⁸; Perez-Quemada, Jorge¹⁹; Correira, Alexandra C.²⁰; Banza, João²¹; Caldeira, María C.²²; Nogueira, Carla²³; Bugalho, Miguel N.²⁴; Carrara, Arnaud²⁵; Curiel Yuste, Jorge²⁶

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Soil respiration (SR) is a major component of the global carbon cycle and plays a crucial role in terrestrial ecosystems feedback to climate change. Although the importance of drylands for the global carbon cycle has been long recognised, a proper understanding of the response of SR to environmental variables in these ecosystems is still lacking. In contrast to the continuous response of SR to temperature typically found in mesic ecosystems, the dependence of SR to temperature is strongly modulated by seasonal patterns of moisture availability in arid, semiarid, and Mediterranean ecosystems. Empirical modelling is an essential tool for predicting ecosystem responses to climate change as well as provide important data for feeding and calibrating process-based models. Many studies on SR dynamics and its abiotic drivers in drylands have been published recently but so far these data have not been gathered and analysed properly to identify the thresholds and the relationship between them in these dry environments. This synthesis study aims to explore whether there is a general trend in the observed thresholds of soil temperature and moisture for SR variation, and their relationships with local climatic variables, across 48 arid and semiarid natural and managed ecosystems with different climate regimes (maritime, continental and alpine). Preliminary results show higher threshold values of soil temperature at the warmest sites while lower threshold values of soil water content were observed at the driest ones, suggesting an important adaptation of the soil system to the site-specific abiotic conditions.

TS.03-0-10

Room A2, Wednesday 6th Feb. 19.00 h.

Major effects of alkalinity on the relationship between metabolism and dissolved inorganic carbon dynamics in lakes

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Several findings suggest that dissolved inorganic carbon (DIC) dynamics and carbon dioxide (CO₂) emissions in lakes are not always directly linked to changes in metabolic rates, but can be associated to exogenous DIC inputs from the watershed, as well as interactions with the dissolved inorganic carbon equilibria. Alkalinity has been described as a determining factor in regulating the relative contributions of biological and inorganic processes to carbon dynamics in lakes. Here we analyze the relationship between the net ecosystem production (NEP) and DIC at different time scales in several lakes of contrasting alkalinity and trophic state. We use high frequency data from state-of-the-art automatic monitoring stations to explore the sensitivity of DIC to changes in oxygen and the effects of seasonal variations and episodic events (such as storms) on the NEP-DIC relationship. Results suggest that in most of our studied lakes, a large part of the measured variability in dissolved oxygen and DIC reflects non-metabolic processes. Furthermore, at low alkalinity, DIC dynamics appear to be mostly driven by aquatic metabolism, but this relationship weakens with increasing alkalinity. Direct external DIC inputs, as well as calcite precipitation are likely the main processes at cause.

TS.03-0-11

Room A2, Wednesday 6th Feb. 19.15 h.

Characterizing dissolved organic matter produced by marine bacterioplankton: Release rates, chemical composition and bioavailability for natural microbial communitiesOrtega-Retuerta, Eva¹; Devresse, Quentin²; Crispi, Olivier³; Caparros, Jocelyne⁴; Joux, Fabien⁵; Obernosterer, Ingrid⁶

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Marine bacterioplankton play a key role in organic matter processing in all aquatic ecosystems. However, while their role as dissolved organic matter (DOM) degraders has been extensively studied, the view of bacterioplankton as sources of dissolved organic compounds, a process that largely affects the pathways for DOM storage and cycling in the ocean, remains underexplored. We quantified and characterized DOM produced by two model bacterial strains from different taxonomic groups: *Photobacterium angustum* (gammaproteobacteria) and *Sphingopyxis alaskensis* (alphaproteobacteria). Grown with glucose as the sole carbon source, the two strains released up to 24% of the consumed glucose as bacterial DOM. The quality of the bacterial derived DOM was different between the two strains. *Photobacterium angustum* produced DOM enriched in protein-like compounds, while DOM from *Sphingopyxis alaskensis* was rich in humic-like organic matter. We subsequently explored bacterial DOM bioavailability for Mediterranean Sea natural communities. We showed that bacterial DOM from the two strains induced different cell growth rates and enzyme activities in natural communities. We conclude that bacterial DOM cycling patterns in the ocean vary depending on both the composition of DOM producers and degraders.

TS.03. Posters

TS.03-P-1

External pavilion, Poster session 2: Wednesday 6th - Thursday 7 th Feb.

Point source inputs shift controls of fine particulate organic matter standing stocks in an intermittent streamDrummond, Jen¹; Bernal, Susana²; Meredith, Warren³; Schumer, Rina⁴; Martí, Eugènia⁵

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The river continuum concept predicts the systematic processing of dissolved and particulate organic matter from headwater streams towards the ocean. However, increased inputs of fine particles, nutrients, carbon and microbes to stream ecosystems from wastewater treatment plant (WWTP) effluents may disrupt the natural pattern of carbon processing along fluvial networks by potentially promoting in-stream biogeochemical reactions which can increase respiration rates and CO₂ emissions to the atmosphere. Variability of these effects may be exacerbated in intermittent streams due to the extreme hydrologic regime of these ecosystems. For one year, we studied the temporal variation of streambed fine particulate organic matter (FPOM) standing stocks and the associated metabolic activity (i.e., aerobic respiration estimated with the resazurin-resorufin tracer system) in an intermittent Mediterranean stream receiving inputs from a WWTP. This period covered a wide range of hydrologic conditions, including both high flows and extreme drought (no dilution of WWTP effluent inputs). Samples of FPOM were collected bimonthly upstream and along a 1km-reach downstream of the WWTP input. Higher FPOM was observed downstream of the WWTP and was related to the time since the last high flow event. Metabolic activity was correlated to time since the last high flow event upstream, but % OM downstream, demonstrating that WWTP inputs induce a shift in the factors controlling stream metabolism along the river continuum. Moreover, the increases in metabolic activity in the WWTP receiving stream expanded along the stream, suggesting that shifts in stream functioning generated by WWTP inputs persist along fluvial networks.

TS.03-P-2

External pavilion, Poster session 2: Wednesday 6th - Thursday 7 th Feb.

Carbon and nitrogen cycling in dehesas from Western AndalusiaIbáñez Raffaele, María de las Mercedes¹; Aljazairi, Salvador²; Leiva, María José³; Sebastià, María Teresa⁴

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Dehesas provide many ecosystem services, including those related to the carbon (C) and nitrogen (N) cycles. The typical "tree-grassland" configuration of dehesas results in a marked spatial heterogeneity. In addition, the tree layer is not always monospecific, and mixed-species stands are frequent. To our knowledge, there are not assessments of the carbon and nitrogen cycles in dehesas integrating soil, vegetation and atmosphere, based on the tree-open grassland configuration. We carried out an analysis of the C and N distribution in dehesa compartments in two locations of Western Andalusia: Doñana and Sierra Norte. We assessed effects of tree canopy (under canopy, UC vs. open grassland, OG) and tree species identity (*Quercus ilex*, *Quercus suber* and *Pinus pinea*, the latter only present in Doñana). We measured total C and N, δ¹³C and δ¹⁵N on soil, roots, and aboveground biomass; and greenhouse gas (GHG) fluxes (CO₂, CH₄ and N₂O). There were both canopy and tree identity effects, with *P. pinea* behaving differently from oaks. Vegetation composition changed with canopy, with legumes only present in OG. UC vegetation was ¹³C depleted, suggesting lower water stress than in OG. UC vegetation was also more ¹⁵N depleted than OG, mainly pine UC, indicating different N sources. Roots had higher C content in UC than in OG, except under pine canopies, where the reverse pattern was found. Ecosystem and soil respiration were higher in UC than in OG, especially under pine. Finally, there was generally N₂O uptake, except under the pine canopy, where there were N₂O emissions.

TS.03-P-3

External pavilion, Poster session 2: Wednesday 6th - Thursday 7 th Feb.

Major role of biogenic carbon fluxes on the net carbon footprint of small hydropowerObrador, Biel¹; Gubau, Marina²; von Schiller, Daniel³; Marcé, Rafael⁴; Gómez-Gener, Lluís⁵

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Water reservoirs are relevant sources of carbon dioxide (CO₂) and methane (CH₄) to the atmosphere. However, the role of biogenic carbon emissions has been poorly integrated in assessments of the carbon footprint (CF) of hydropower, particularly in reservoirs with less than 10 MW installed capacity (ie, minihydropower). Here we present a life-cycle assessment of the CF of minihydropower, defined as the ratio between greenhouse gas emissions and energy produced, in a set of reservoirs in the northern Iberian Peninsula. We quantified the net CF by including emissions derived from land flooding, as well as emissions related to dam construction, maintenance and decommissioning, at a temporal scale of 100 years. The emissions related to land flooding included estimates of emissions prior to dam construction as well as current biogenic emissions (i.e., diffusive and ebullitive emissions from the reservoir surface, emissions downstream the dam, and negative emissions by organic carbon burial in the sediments). The highest emission fluxes were those from water surface (mostly as ebullitive CH₄ fluxes), and from air-exposed sediments of the reservoirs (as CO₂). Except in the smallest reservoirs, biogenic fluxes were clearly dominating the emission budget over construction and maintenance emissions. Carbon burial in sediments is highlighted as a key component of the CF of hydropower, which shows extremely high variability in small to medium size reservoirs.

TS.03-P-4

External pavilion, Poster session 2: Wednesday 6th - Thursday 7 th Feb.

Ecological modeling of marine biogenic isoprene (C₅H₈) emissions in the Southern OceanRodríguez-Ros, Pablo¹; Nissen, Cara²; Cortés, Pau³; Gruber, Nicolas⁴; Simó, Rafel⁵; Vallina, Sergio⁶; Vogt, Meike⁷

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The strength and direction of the aerosol-induced radiative climate forcing in the atmosphere is one of the biggest uncertainty sources in global warming projections. In the pristine polar marine atmosphere of the Southern Ocean (SO), where cloud formation processes are strongly influenced by aerosol emissions, an important part of particle formation occurs due to the oxidation of biogenic trace gases emitted by the sea. Isoprene (C₅H₈) is a volatile organic compound (VOC) produced eminently by phytoplankton species in the oceans and is a precursor of secondary organic aerosol (SOA). In this work, for the first time, we implemented the isoprene production rates of diatoms, coccolithophores and other phytoplankton species into a high-resolution SO set-up of the regional mechanistic marine ecosystem model ROMS-BEC. We calculated the annual integrated SO production and emission rates and found that the contribution of the SO phytoplankton to the global oceanic emission of isoprene is 0.332 (± 0.049) Gt C year⁻¹, which equals, even surpass, some global oceanic estimates. We also found that isoprene emissions co-vary with the SO net primary production, and that diatoms are the main isoprene producers. Finally, in order to validate the model results, we used sea surface concentration data of isoprene, and associated environmental and ecosystem variables, recompiled from three different research cruises in the SO: "TransPEGASO" (South Atlantic Ocean), "PEGASO" (Weddell Sea, Oarkney Islands & South Georgia Islands) and "ACE Expedition" (complete circumnavigation of the SO).

Thematic Session 04: Diversity and distribution of species in tropical ecosystems

Day: Wednesday 6th February

Schedule: 12:00h 13:30h - 18:00h 19:30h

Location: Room A4

Coordinators:

Manuel J. Macía, Universidad Autónoma de Madrid, Spain

Luis Cayuela, Universidad Rey Juan Carlos, Spain

A fundamental aim in ecology and biogeography is to understand patterns of species diversity and distribution and the underlying mechanisms that drive them across their habitat ranges at different spatial scales. This is particularly challenging in tropical ecosystems, as they harbor an amazing diversity of plants, animals and microorganisms in terrestrial and aquatic environments. Different processes can explain tropical community assemblages, including deterministic processes such as abiotic and biotic filtering, stochastic processes, and species' evolutionary history. However, teasing apart the relative importance and significance of any of these three processes in explaining tropical community assemblages, their understanding is still a challenge for ecologists and biogeographers. This session will cover the study of patterns and processes of diversity in tropical ecosystems throughout the world, at the time that it will serve as a meeting forum for tropical research groups.

TS.04. Oral talks**TS.04-MT-1**

Room A4, Wednesday 6th Feb. 12.00 h.

Shifts in functional, taxonomic and phylogenetic diversity along a climate gradient in western AfricaOliveras Menor, Imma¹; Aguirre-Gutiérrez, Jesús²; Malhir, Yadvinder³

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It is now well-established that the terrestrial Biosphere is facing rapid changes as results of land-use and climate change. Most ecosystems are suffering alterations in their functioning by either the loss of species or shifts in species abundances. There are many challenges associated at deciphering the climate change impacts on forest ecosystems because of complex interactions between community composition and physiological responses of individual species to a given environmental change. Here, we investigate the relationship between functional trait, taxonomic and phylogenetic diversity and their responses to a changing climate along a rainfall gradient in Ghana, west Africa. The study uses a network of > 25 long-term plots spread along a climate and soil gradient in Ghana where we have forests census of at least 30 years as well as functional trait data. Along the gradient and through time, we investigate if significant changes in functional, taxonomic and phylogenetic diversity have occurred, and whether these changes have occurred in the same direction. We also aim to decipher the role of climate drivers of shifts in biodiversity.

TS.04-O-2

Room A4, Wednesday 6th Feb. 12.30 h.

Functional traits mediate niche partitioning in epiphytic orchid communitiesVentre Lespiaucq, Agustina¹; Ospina-Calderón, Nhora²; Flanagan, Nicola³; Escudero, Adrián⁴

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A basic principle in ecology is that coexistence is promoted by niche differences among species, mediated by functional traits. However, how species partition their niches in hyper-diverse ecosystems such as tropical forests stands as a major challenge in ecology. In particular, niche partitioning in epiphytic orchid assemblages is a major knowledge gap in current tropical ecology, with information restricted to a few target species. To tackle this question, we investigated high-diversity assemblages of epiphytic orchids in the tropical Andes to explore biotic and abiotic predictors of species coexistence. We expected community composition and leaf functional traits to change with the identity of the host tree, and with the particular position occupied within a tree due to the vertical gradient in abiotic factors of the forest. We sampled 500 individuals of 30 orchid species in 18 host trees at five trunk heights between 1 and 10 m. Host trees did not affect community composition or traits. By contrast, the vertical gradient of light, temperature and humidity affected several community features. Species richness and abundance fell from high to low positions in the forest. Specific leaf area increased and succulence decreased from high to low positions, consistent with a reduction in light availability and an increase in air humidity. These results suggest that functional traits mediate niche partitioning in epiphytic orchid communities along resource gradients. Our findings also point towards the physical structure of the forest -which determines the vertical environmental gradient- as an important factor promoting epiphytic orchid diversity.

TS.04-0-3

Room A4, Wednesday 6th Feb. 12.45 h.

Ecological mechanisms shaping woody plant community structure in tropical montane forests: a multi spatial functional approachBañares-de Dios, Guillermo¹; Macía, Manuel Juan²; Arnelas, Itziar³; Carvalho, Gabriel Martins⁴; Espinosa, Carlos Iván⁵; Granzow-de la Cerda, Iñigo⁶; Salinas, Norma⁷; Cayuela, Luis⁸

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Understanding the processes and factors shaping natural communities structure is fundamental for community ecology. Traditionally has been proposed that ecological mechanisms such as environmental filtering, biotic interactions or stochastic processes play a key role in community assembly, but important contradictions still exist regarding which ones are more relevant. In this sense, a hierarchical assembly model has been proposed, to analyse how these mechanisms and their relative importance vary at different spatial scales. Null models have become broadly used to detect if any of those mechanisms are operating. However, it is crucial that models incorporate certain restrictions related to spatial scale assumptions that guarantee its full ecological sense, although unfortunately this has been more often the exception rather than the norm. In this study we apply a multi- scale approach to investigate the effects of environmental filtering, biotic interactions or stochastic processes on community assembly in a very complex and highly diverse tropical montane forest. We measured woody plant functional diversity on different traits (leaf thickness, specific leaf area, wood density), which has proved to convey better ecological information than the classical indexes based on species composition and abundances, in 60 0.1 ha. plots and subdivided in 0.01 ha subplots, scattered along elevational gradients in two protected areas in Peru and Ecuador. Then, we compared functional diversity distribution and changes at different spatial scales: among subplots and among plots. Our preliminary results suggest that even at the smallest spatial scale, environmental filtering is the overruling mechanism for woody plant community assembly.

TS.04-0-5

Room A4, Wednesday 6th Feb. 13.15 h.

Temporal, spatial and environmentally driven variation in soil microbial communities in French Guiana tropical forestsRamírez Rojas, Irene¹; Verbruggen, Erik²; Van Langenhove, Lendro³; Verryckt, Lore⁴; Soong, Jennifer L.⁵; Stahl, Clément⁶; Grau, Oriol⁷; Asensio, Dolores⁸; Urbina, Ifigenia⁹; Courtois, Elodie A.¹⁰; Margalef, Olga¹¹; Peguero, Guille¹²; Hérault, Bruno¹³; Janssens, Ivan .A.¹⁴; Peñuelas, Josep¹⁵; Schimann, Heidi¹⁶

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Soil microorganisms play fundamental roles in ecosystem processes, from altering soil structure to influencing aboveground communities and plant performance by nutrient cycling. Despite this importance, basic questions about their ecology are still unanswered such as 1) which are the main determinants of the composition of different groups of microbes, and 2) whether their ranking is stable at different time-points. Answering these questions is necessary to evaluate whether forest microbial communities can be expected to change in response to various pressures currently acting on tropical rainforests. In this study we sampled twelve 20x20 m plots replicated over two locations in French Guiana which form part of the Imbalance-P project plots. Within each location, plots are evenly distributed along a natural (micro-) topographical variation so that higher and lower sites are equally represented. Soil samples taken in the dry and wet season were analyzed using amplicon DNA sequencing and nutrient content, soil texture, and plant community composition were assessed. Results indicate that local topographical variation plays an important role in structuring bacterial and fungal communities, which show low overlap between the two distinct locations but are fairly temporally stable. Ongoing partitioning of variance caused by spatial distance, plant species composition, and soil environmental variability will tell us which of these drivers will explain most of the community variation we observe, and the stability with time.

TS.04-0-6

Room A4, Wednesday 6th Feb. 18.00 h.

Are community-wide signaling patterns driven by acoustic interactions?Moreira Sugai, Larissa Sayuri¹; Llusia, Diego²; Silva, Thiago³

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Competition for the acoustic space can selectively induce divergence in traits to minimize both confusion between similar signaling species and interference over the background noise (from biotic or abiotic sources). For vocalizing species, the pattern of character displacement in acoustic characteristics has long been assessed through analyses in specific clades or pairs of related species. Notwithstanding, recent theoretical lines suggest that the legacy of evolution can feedback in the organization of local communities. In parallel to trait-based and ecophylogenetics approaches, a pattern of acoustic partitioning and greater phylogenetic dissimilarities in local communities are expected under strong competition for the acoustic space. Here, we assess the acoustic structure of chorusing anuran assemblages and address its potential evolutionary and ecological drives. We combined phylogenetic and acoustic data (through automated recording units from sunset to sunrise for three days/site) from 26 species distributed over 40 sites along environmental gradients in the Pantanal wetlands. Additionally, we used both in-situ and remote sensing techniques to characterize the local environment and infer the strength of environmental filtering. We evaluated if the acoustic output for is competitively structured towards a divergent pattern using null models that account for hierarchical structured of the signaling communities and covariates as environmental structure and temperature. Our approach embraces the underappreciated role of acoustic interactions to the understanding of how species organize and coexist in natural communities.

TS.04-0-7

Room A4, Wednesday 6th Feb. 18.15 h.

Fruiting seasonality across the Neotropics: patterns and climatic correlatesMendoza Sagrera, Irene¹; Morellato, L. Patrícia²; Peres, Carlos A.³

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Tropical plant communities comprise an outstanding diversity of species, which also have a large variety of life cycles. Species within a given tropical community can reproduce all year-round or simultaneously during a shorter period of the year or season. However, large-scale patterns of fruit seasonality and their climatic drivers are still poorly understood in the tropics. We therefore aimed to test hypotheses relating climate and fruiting seasonality throughout the Neotropics. Our rationale is that intra-annual fruit production in tropical ecosystems responds to the seasonality of climatic conditions. We collated information on fruiting phenology from 104 sites covering different rainfall regimes and three major vegetation types (rainforest, seasonal forest and savanna). We extracted the circular standard deviation of the number of species bearing fruits each month as a proxy of fruiting season length and explored its relationship with six environmental predictors using a Generalized Additive Model per vegetation type. Fruit seasonality was statistically significant for 50% of the study sites, but the overall degree of seasonality was low, most sites showing prolonged fruiting seasons. Fruiting season length responded non-linearly to the seasonality of thermal amplitude and rainfall, albeit not for savannas. Despite the general belief that fruiting extends over the entire year in relatively aseasonal tropical regions, half of analysed Neotropical sites were subjected to some degree of fruiting seasonality. The dependence of fruit phenology on the spatial and temporal variation of climatic predictors detected here suggests that fruiting availability is sensible to climate change scenarios.

TS.04-0-8

Room A4, Wednesday 6th Feb. 18.30 h.

Seasonal environmental changes in tropical and temperate temporary ponds and their influence on amphibian and bird metacommunities

Gálvez Núñez, Ángel¹; Alambiaga, Iván²; Bonilla, Fabián³; Camacho, Antonio⁴; Castillo-Escrivà, Andreu⁵; De Manuel, Berenice⁶; Monrós, Juan S.⁷; Morales, Lilliam⁸; Olmo, Carla⁹; Rueda, Juan¹⁰; Sahuquillo, María¹¹; Sasa, Mahmood¹²; Armengol, Xavier¹³; Mesquita-Joanes, Francesc¹⁴

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Environmental variables have been classically related to the occupancy patterns of species. With the introduction of the ideas of speciation, colonization and extinction in community dynamics, spatial and temporal variables started to gain importance in the study of species distribution and metacommunities. To disentangle the influence of temporal, environmental and spatial variables in metacommunity structure of tropical and mediterranean temporary ponds, we surveyed 60 water bodies: 30 in Costa Rica and 30 in Spain. We sampled each site on three different seasons through one year, corresponding to the infilling, the expected maximum volume of water (intermediate period) and the desiccation period. In each pond, we measured in situ abiotic and biotic environmental variables and collected water samples in order to analyze nutrients and ions. Finally, we acquired data on the occurrence of amphibians and birds. In addition, some landscape variables were gathered using GIS. After a multivariate analysis, our results show that environmental variables remain relatively constant during the whole year in tropical ponds, whereas some variables such as temperature, pH or vegetation can notably discriminate seasons, in mediterranean ponds. As for metacommunities of vertebrate animals, we found a larger influence of environment than space, especially on birds, although space seems to play also a significant role. Thus, we conclude that pure environmental effects cannot explain bird and amphibian species distribution.

TS.04-0-9

Room A4, Wednesday 6th Feb. 18.45 h.

The role of seed dispersal processes in the community assembly of seasonally dry tropical forests

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The importance of the seed dispersal process in the structuring of ecosystems is widely recognized. However, for seasonally dry tropical forests, information about this process is still scarce compared to tropical rainforests. This work focused on the importance of seed dispersal for structuring woody communities in the Southwestern Ecuadorian dry forests. We first characterized the seed dispersal spectrum, to then analyze the effect of dispersal syndromes in the spatial patterns, and the role of megafauna in woody plants regeneration. We found that most of plants requires the assistance of animals for seed dispersal. However, when we considered the individual abundance of each species the most of community corresponded to anemochorous individuals. Subsequently, we evaluated the relative importance of dispersal syndromes and environmental heterogeneity in the formation of plant spatial patterns. We found that differences in seed dispersal capacity can contribute to the structuring and maintenance of the set of species in the studied tropical dry forest, although environmental heterogeneity exerts an additional effect (and in some the only one) limiting the spatial distribution of the most species of our community. On the other hand, the results also revealed a great variation in the spatial patterns between species with the same syndrome. Some autochorous species showed less aggregated patterns than expected. That variation can be explained by secondary dispersal process. In our study site, we found that at least six species considered as autochorous were dispersed by *Odocoileus virginianus*. This interaction is key for species without obvious adaptations for seed dispersal.

TS.04-0-10

Room A4, Wednesday 6th Feb. 19.00 h.

Assessing the presence of Nipa palm (*Nipa fruticans*) in Kwa Iboe river estuary and corss river estuary: A brackish water environment of Akwa Ibom Sate, Southern NigeriaEbong, Mbuotidem Sampson¹

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The coastal brackish water environment of Akwa Ibom state is assessed of the presence of Nipa palm. The study areas were majorly the Cross River estuary and Qua Iboe river estuary and three sample points were drawn from both estuaries using 10m by 10m quadrat spaced at 100m interval. Species diversity was determined using the Simpson's diversity index and the results were; 0.93, 0.91 and 0.89 for James Town, Douglas Creek and Stubbs Creek respectively. Margalef's index was used to calculate species richness and Lawson's subjective classification was used to classify it into rare, occasional and common. The results showed the dominance of Nipa palm along side the indigenous *Rhizophora racemosa* indicating the positive nature of the invasiveness of the Nipa palm in the Cross River estuary and Qua Iboe Estuary: a brackish water environment of Nigeria.

TS.04-0-11

Room A4, Wednesday 6th Feb. 19.15 h.

How does disturbance, ontogeny and growth rate change nutrient storage in wood in trees growing in poor tropical soils?Grau, Oriol¹; Héroult, Bruno²; Sardans, Jordi³; Janssens, Ivan⁴; Peñuelas, Josep⁵

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The aboveground biomass in French Guiana forests is amongst the highest in Amazonia, whereas nutrient content in the soil, particularly soil phosphorus (P), is amongst the lowest. A plausible hypothesis to explain this paradox is that aboveground biomass and/or productivity depend on the nutrients that are internalized through fast resorption and internal storage. Only very few studies have focused on this issue and there is very little information on that. Some recent studies suggested that tropical trees may be under selection to allocate excess P to storage so as to mitigate P limitation when the P demands of plant growth exceed P supply from the soil. P allocation may thus be a key component of specialised edaphic niches in tropical regions worldwide and that the allocation of limiting nutrients to woody biomass is an important functional characteristic influencing species distributions along edaphic gradients in tropical forests. Large trees with high biomass accumulation and high potential to store nutrients at nutrient-poor sites may even outcompete small trees with low biomass accumulation and lower nutrient-storage potential. In this study we explored the mechanisms that enable a high accumulation of aboveground biomass with a very low nutrient content in the soil. To answer these questions we investigated if the internalization of nutrients in trees correlates with their size, biomass, productivity and abundance in the forest by controlling for 1) competitive pressure, 2) ontogenic development and 3) functional strategy.

TS.04. Posters

TS.04-P-1

External pavilion, Poster session 2: Wednesday 6th - Thursday 7 th Feb.

Discrepancies between diversities around individual species reveal the role of plant-to-plant interactions in the assembly of a tropical dry-forest?Gusman, Elizabeth¹

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We employed an individual-species approach based on the plant's eye perspective to disentangle the effects of individual species on community assembly in a dry tropical forest of southern Ecuador. We completely mapped a forest plot of 9 ha, and measured several functional traits (leaf area, specific leaf area, wood density, seed mass and maximum height) for tree and shrub species. We tested the hypothesis that facilitative interactions would be prevalent in this dry forest. For this, we compared the distribution of taxonomic (TD), functional (FD) and phylogenetic (PD) diversity in the neighborhood of the studied species with the diversity expected under a null model combining habitat filtering and stochastic assembly. We found that in the fine spatial scales where species interactions are expected to occur (i.e., neighborhoods of 1-20 m) eight species did not show any significant pattern for TD, FD or PD. Eleven species showed evidences of facilitation (i.e., accumulated more TD than expected) but in some cases the facilitated neighborhoods had more FD or PD than expected, suggesting the joint effect of facilitation and competition based on niche differences. One species showed less TD than expected, accompanied by lower FD and higher PD, suggesting competition based on fitness differences.

TS.04-P-2

External pavilion, Poster session 2: Wednesday 6th - Thursday 7 th Feb.

Dry juniper woodlands in a subtropical oceanic island: climatic conditions and plant biodiversity in El Hierro, Canary IslandsRomo, Ángel¹; Cortés, Amparo²; Salvador-Franch, Ferran³; Salvà-Catarineu, Montserrat⁴; Boratyński, Adam⁵; Dering, Monika⁶; Padrón, Pedro⁷

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Juniperus turbinata subsp. *canariensis* is an endemism located in the Canary and Madeira Archipelagos. The biggest populations of this endemic juniper are located in the island of El Hierro. Some physical factors (air temperature, air humidity, altitude, type of soil) and their relationship with plant biodiversity are studied since 2012. Soils are generally classified as being shallow, stony and well-drained. Woodlands are associated with soils having medium to low fertility and episodic availability of water near the soil surface. Exhaustive relevés were drawn up to identify all the plants present in the plots studied, located in the same places where the data loggers were installed. The dry woodlands cover 1/10 of the island's surface, where 1/5 of the amount of vascular flora present on El Hierro island is found. Juniper woodlands occur on soils that have developed from recent volcanic parent material and belong to one of three soil orders (Aridisols, Entisols, and Inceptisols). The most significant differences are in summer/winter soil temperature, and winter soil moisture. Differences are detected also in relative humidity data between the north (to windward) and south (to leeward) faces of the island. These differences are reflected in the biodiversity with the presence of hygrophilous plants on the windward and thermophilous plants on the leeward. These results highlight the relationship of climatic conditions with the biodiversity of the dry juniper woodlands. This kind of dry woodlands located on an oceanic island is sensitive to climatic change and should be conserved for its hot-spots of biodiversity.

TS.04-P-3

External pavilion, Poster session 2: Wednesday 6th - Thursday 7 th Feb.

Biosystematic study of myxomycetes in montane forest (Wayquecha Biological Station, Peru)Treviño Zevallos, Italo Francisco¹; Lado Rodriguez, Carlos²

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The first study on the diversity of Myxomycetes in the montane forest of Peru is presented. The study was carried out at the Wayquecha Biological Station, located in the department of Cusco (Peru), at 2930 m of elevation, and administrate by the Association for the Conservation of the Amazon Basin (ACCA). The sampling was carried out in February (wet season) and early June (dry season) of 2018. In total, more than 70 species of Myxomycetes have been recorded, with greater richness in the wet season, but alternating with sunny days, which produced a temporary dryness of the substrates. Representatives of the 5 orders of Myxomycetes have been recognized in this territory. The order Physarales was the most diverse in both seasons and the order Echinosteliales was the least represented. By genera, Physarum and Didymium were the most diverse. For substrates, most species show preference for leaf litter, follow by rotting branches of small diameter.

TS.04-P-4

External pavilion, Poster session 2: Wednesday 6th - Thursday 7 th Feb.

Distribution and beta diversity of tree species in igapó forests (Negro River basin - Brazilian Amazon)Vizoni Scudeller, Veridiana¹; Vegas-Vilarrubia, Teresa Elena²

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We analysed the large-scale (landscape) spatial distribution of tree species in the Negro River basin (igapó forests) located in Brazil by considering all available floristic and phytosociological studies from reliable sources. We classified each species according to its frequency of occurrence and built a similarity matrix and applied principal coordinate analysis to preserve distances generated from any similarity measured. Finally, we established groups (a posteriori) and applied both multi-response permutation procedures and indicator species analysis to verify the habitat preference of each species. Among 19 surveys conducted in igapó forests, at least 604 woody taxa were recognised, and 384 taxa were identified to the species level. Igapó tree species were not as frequent or abundant as were other tree species of the Amazon upland forest, although they were widely distributed in other forest types. The Sorensen similarity index was low ($S_s = 0.16$), and it was very low ($S_s < 0.05$) in 12.28% of the combinations. Generally, the highest similarity values were recorded between surveys that were spatially close. The multivariate analyses suggested the existence of a strong vegetation gradient along the Negro River with 57.5% of species restricted to one survey of occurrence. This trend is particularly notable from the point at which the Branco River strongly discharges into the Negro River. No species show high values for the range distribution or local abundance, although four were considered moderately frequent. The upper parts of the main rivers exhibit indicator species that are less frequent downstream.

Thematic Session 05: Ecological networks: addressing the complexity of multi-specific interactions

Day: Thursday 7th February

Schedule: 12:00h 13,30h - 15:00h 17:00h

Location: Room M6

Coordinators:

Pedro Jordano, Estación Biológica de Doñana (EBD-CSIC), Spain

Irene Mendoza, Estación Biológica de Doñana (EBD-CSIC), Spain

Complex networks of ecological interactions emerge as the natural result of community assembly processes. In recent years, significant advances took place in their description and analysis, unveiling unexpected details about their topology and structure. Yet we are still far from understanding the processes and consequences of network complexity. Quantifying and characterizing this complexity is urgent and demands that a large fraction of these interactions be experimentally or computationally probed. This is challenging and has tremendous interest, as rapid and effective actions for conservation and restoration of human-disturbed ecosystems urgently require the identification of the minimum amount of complexity that has to be restored in order to guarantee ecosystem persistence. This session focuses on what we know about the macroscopic properties of complex ecological interaction networks: the new statistical approaches for the characterization and identification of links, the identification of functional modules and compartments, and the exploration of interaction complementarity and redundancy from a functional viewpoint. Then we aim to identify current challenges for knowledge in the field of network ecology and offer an overview of current approaches.

TS.05. Oral talks**TS.05-MT-1**

Room M6, Thursday 7th Feb. 12.00 h.

Where do networks end? Towards the circumnavigation of biological communitiesHeleno, Ruben¹; Timoteo, Sérgio²; Costa, José³

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Although the founders of modern ecology readily recognized the importance of biotic interactions as the cement that keeps biological communities up and running, until recently, we still lacked a satisfactory tool to bring together species and interactions under a same quantitative and predictive framework. Unsurprisingly, since their incorporation into ecology interaction networks rapidly occupied that gap by providing such desirable tool. Nevertheless, while the advent of ecological networks finally allow us to have a go at understanding complexity, for many, this still comes with a bittersweet feeling as such understanding is in itself hindered by the excessive simplification of portraying natural communities as fixed snapshots of interactions between one or two groups of species. I will review current efforts made to push the frontiers of common bipartite networks by formally integrating information from discrete spatial, temporal, and functional network components. While the road to such meta-networks or multilayer networks is still uncertain, this seems a most promising step to potentiate the use of ecological networks towards their original goal: make sense out of the intrinsic complexity of natural communities.

TS.05-O-2

Room M6, Thursday 7th Feb. 12.30 h.

Meta-analysis of tripartite networks shows keystone species can't multitaskTimóteo, Sérgio¹; Heleno, Ruben²

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All species engage in multiple types of biotic interactions with other species around them, thus defining their multidimensional ecological niche space (Eltonian niche). Through these interactions, some species hold a particularly relevant role on ecosystem functioning, that is disproportional to their abundance – Keystone species. While ecological networks stand out as a most powerful tool to explore species interaction patterns at the community level, most networks are still limited to two interacting groups (e.g. flowering plants and nectivorous animals), being poorly informative regarding the potential multidimensional importance of keystone species. Here we compile information from 18 tripartite networks and using a meta-analytic approach we examine if the importance of species tends to be maintained across different ecological functions (e.g. if plants are as an important resource for herbivores as they are for pollinators, or for seed dispersers), and whether this is driven by their abundance. We show that the importance of a certain species to the species from other level, i.e. species strength, is only very weakly correlated between two ecological processes in which that species takes part. In contrast, estimates of species abundances are significantly correlated across different ecosystem functions. Taken together, our results show that species that are disproportionally important in relation to their abundance, i.e. keystone species, tend to be so only for one dimension of their niche space.

TS.05-0-3

Room M6, Thursday 7th Feb. 12.45 h.

Spatial cascades in networks connected by dispersal and foragingGarcía Callejas, David¹; Gravel, Dominique²; Molowny-Horas, Roberto³; B. Araújo, Miguel⁴

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The net impacts of species on the rest of their ecosystem are difficult to predict and quantify, due to the many indirect effects triggered by their activities. In particular, the effects of direct interactions may propagate in space and generate indirect effects in other species and spatially disconnected locations, in what can be termed "spatial cascades". Although the spatial propagation of interaction effects is ubiquitous in nature, it has thus far not been addressed systematically in either theoretical or empirical studies. As a first approximation, one may expect spatial cascades to display different properties depending on the mode of movement of the species involved. For example, the existence of a predator-prey interaction in one location may alter the dispersal of the prey species to neighbouring communities, varying the indirect effects between these spatially disconnected locations. Similarly, if a predator species forages sporadically outside its reproductive area, it will indirectly link the dynamics of the different locations in which it forages. We present the first theoretical results on how interaction effects are spatially propagated depending on the mode of movement of the species involved. We show that spatial cascades triggered by foraging or dispersal display markedly different distributions of net effects in the communities involved. Furthermore, the magnitude of the net effect between any two species decays significantly with both spatial distance and with the number of links connecting them, to the point that species connected by paths of five or more links have generally negligible net effects on each other.

TS.05-0-4

Room M6, Thursday 7th Feb. 13.00 h.

Network meso-scale structure and species traits in hummingbird-plant interaction networksMartin Gonzalez, Ana Maria¹; Lee, Sang Hoon²; Rahbek, Carsten³; Dalsgaard, Bo⁴

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Networks describing biotic interactions typically show nested and/or modular meso-scale structures and highly skewed degree distributions, with few highly connected species and long tails of poorly connected ones. Highly connected species show higher closeness and betweenness centralities and are categorized as core species in nested patterns and connector or hubs in modular networks. As network structure has direct implications in community dynamics and robustness, it is vital to characterize properly these structures and the roles species play. For instance, central species have the capacity of affecting directly and strongly most other species in the network, whereas peripherals exert indirect, weaker and localized effects. Furthermore, depending on the structure of the network, the effects of species may span throughout the entire community or be restricted within specific modules. We study whether a core-periphery (nested) or modular partition describes more accurately the structure of 79 quantitative hummingbird-plant networks spanning throughout various biogeographical regions of America, accounting for half of the described hummingbird species and over 1000 flowering plant species. Using complementary data on species traits, we show central species are typically abundant, and have long phenophases, wide range-distributions and generalistic behaviors, including non-restrictive morphologies or feeding habits, i.e. can establish numerous interactions with an ample array of partners. Contrarily, peripherals are rare species, with short phenophases, small range-distributions and specialist behaviors and/or extreme morphologies, limiting their number of potential partners. Such information is valuable to anticipate species role within communities, including potential future interactions or the behavior of invasive species.

TS.05-0-5

Room M6, Thursday 7th Feb. 13.15 h.

Recruitment in forest communities and the Replacement Network conceptAlcántara Gámez, Julio Manuel¹; Garrido Sánchez, José Luis²; Rey Zamora, Pedro José³

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The study of plant communities is one of the oldest and more prolific fields in ecology. However we lack a clear view of the structure of plant-plant interactions in real communities. Indeed, the intensity and outcome, and even the existence, of competitive or facilitative interactions between plants are difficult to measure in the field. Consequently, advances derived from interaction network theory have scarcely pervaded the field of plant community ecology. To fill this gap we are developing the replacement network (RN) concept. It is based on one of the oldest conceptualizations of the processes that drive community dynamics: when a plant dies (which we call the 'canopy' plant), another (the 'recruit' species) takes its place. RNs reflect the set of canopy-recruit interactions realized in a local assemblage. The matrix behind RNs can be used in models of plant community dynamics, providing a direct link between theoretical and empirical studies. We have applied this approach in 10 pine-oak forest assemblages from Southern Spain. We used a likelihood-based approach to explore whether RN structure can be the result of species abundance and phylogenetic distance between interacting species. We found that interaction strength and RN structure show the influences of stochastic, negatively density dependent and evolutionary processes acting on recruitment. Although these processes are known to act in forest communities, our approach allows integrating all of them under a single empirical framework, and paves the way to test complex hypotheses about the combined effects of multiple mechanisms on plant community stability and dynamics.

TS.05-0-6

Room M6, Thursday 7th Feb. 15.00 h.

The architecture of multiplex ecological networksJordano Barbudo, Pedro¹

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Interspecific ecological interactions in nature build up from encounters between individual partners, including variable outcomes from multiple forms of interaction. For example, multiplex ecological networks of plant-animal interactions emerge from the juxtaposition of the different interaction types, e.g., mycorrhizal symbioses, herbivory, pollination and seed dispersal mutualisms, facilitation, competitive interactions for shared partners. In contrast to other multilayer networks, multiplexed networks link a given set of nodes (i.e., plants in a community) through processes where multiple interactions operate (i.e., the sequential stages of reproduction including layers of pollination, herbivory, seed dispersal, and establishment). The result of multiplexed interactions is, ultimately, final effects on fitness of the interacting partners resulting from the coupled mutualistic/antagonistic forms of interaction that each plant species supports. Yet we are far from understanding how these complex networks are intertwined. Characterizing and sampling multiplexed networks means assessing the interaction modes that correspond to each interaction type. I discuss multiple challenges and potential avenues to explore those multifaceted forms of interaction. Species-level multiplex networks are built on individual-based interaction forms for different processes (e.g., pollination, herbivory, seed dispersal). Multi-species, multiplexed interaction networks are just the result of assembling the distinct interaction modes represented across individuals and species in a given community. Multiplexed networks thus allow biologically-realistic representation and analysis of the extraordinary diversity of interactions in real-world assemblages. I review case studies illustrating the use of multiplex networks to assess complex networks of plant-animal mutualisms.

TS.05-0-7

Room M6, Thursday 7th Feb. 15.15 h.

Ecology becomes multilayer: challenges merging interactions and scales in ecological networksSaiz Bustamante, Hugo¹

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In recent years, network theory has experienced a tremendous progress due to the development of multilayer network approaches. Basically, a multilayer network is a network where nodes can belong to different layers, and links are able to connect any possible combination of nodes and layers. Multilayer networks are a perfect tool for ecologists, because organisms (nodes) usually interact with other organisms in different ways that can be identified individually (layers). This presentation will be an introduction about the use of multilayer networks in ecology. First, it will present the first attempts to include different interactions in ecological networks, and the challenges that this implies. Second, it will propose a possible way to identify ecological layers following two criteria: layers including different interactions for the same organisms (horizontal layers); and layers connecting species at different scales (vertical layers). Finally, it will show our ongoing work on real ecological multilayer networks including different horizontal and vertical layers.

TS.05-0-8

Room M6, Thursday 7th Feb. 15.30 h.

The experimental colonization of a plant community by a native species causes changes in plant-pollinator network structure, pollination function and reproductive successHernández-Castellano, Carlos¹; Rodrigo, Anselm²; Gómez, José María³; Stefanescu, Constantí⁴; Calleja, Juan Antonio⁵; Reverté, Sara⁶; Bosch, Jordi⁷

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Plant communities experience changes in species composition mediated by processes of local extinction and colonization. Such changes may affect plant-pollinator interactions and network structure, which in turn may alter pollination function and plant reproductive success. We experimentally introduced a native plant (*Cistus albidus*) to scrubland patches dominated by *Cistus salviifolius*, *Lavandula stoechas* and *Thymus vulgaris* (9 control + 9 treatment patches). Although not present in our study area, *C. albidus* coexists with these three species in other areas. The amount of *C. albidus* floral resources (pollen-nectar) introduced was adjusted to the amount of *C. salviifolius* floral resources in each patch. We measured pollinator composition, visitation rates, pollen deposition, fruit set and seed set of these three species. *C. albidus* attracted the bumblebee *Bombus terrestris*, facilitating visitation by this pollinator to *C. salviifolius* and *L. stoechas*. Network structure was altered by the introduction of *C. albidus*, resulting in the rearrangement of plant species across modules and changes in network roles (the peripheral species *T. vulgaris* became a connector). *C. albidus* acted as a strong connector, promoting heterospecific pollen deposition on *C. salviifolius* and *L. stoechas* stigmas. However, increased heterospecific pollination did not lead to a decrease in reproductive success. In contrast, both fruit set and seed set of *T. vulgaris* increased in treatment patches. Our study demonstrates that changes in plant-pollinator network structure caused by the arrival of a new native species into a plant community may have important consequences on pollination function and plant reproductive success.

TS.05-0-9

Room M6, Thursday 7th Feb. 15.45 h.

Differential effects of local and landscape environmental heterogeneity on properties of bipartite vs. tripartite networks in olive orchardsMartínez Núñez, Carlos¹; Lendinez, Sandra²; Pérez-Milla, Antonio J.³; Manzaneda, Antonio J.⁴; Ruiz Valenzuela, Luis⁵; Rey, Pedro J.⁶

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Bipartite ecological networks (BN) (e.g. plant-pollinator networks) are currently a powerful and widely used tool. Abundant literature explores how species interactions change along environmental gradients. However, some authors argue that BN might be simplistic and miss important information. Several studies discuss how including parasites and parasitoids in networks can fundamentally change or not change the results previously obtained. Nonetheless, we are far from understanding how parasites and parasitoids do affect ecological networks and ecosystem functioning in general. Here, we used 96 bee nest boxes to build networks in 18 paired olive orchards (intensive vs. extensive weed cover management) along a landscape complexity gradient at the regional scale. We built BN accounting for cavity-nester bees and the plants they pollinate. Then, we included macroscopic parasites and parasitoids generating a tripartite food web for each bipartite one. We analyzed the causes and extent of properties change when BN were modified by adding parasites and parasitoids. We also studied how BN and their paired tripartite networks responded differentially to local management (LM), landscape complexity (LC) and their interaction. Our results show general congruencies in the response of bipartite and tripartite networks to LM, LC and their interaction. However, it seems that parasites and parasitoids incorporate a new dimension to the network that fluctuate independently to the others, introducing more variability in simpler bipartite networks. In conclusion, our study shows relative stability between responses of bipartite and tripartite networks to environmental gradients, however, more studies are needed to determine their theoretical differences.

TS.05-0-10

Room M6, Thursday 7th Feb. 16.00 h.

How the interaction network determines the herbivory effects on plant coexistenceR. Granjel, Rodrigo¹; Godoy, Oscar²; Badenhausser, Isabelle³; Gross, Nicolas⁴

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Broadly, herbivores are thought to promote species coexistence through equalizing effects by reducing the competitive ability of the dominant plants, and thus, allowing subordinate species to persist in the community. However, whether herbivores could promote coexistence by increasing stabilizing effects between competitors is less clear. We hypothesized that the prevalence of stabilizing and equalizing effects might be highly dependent on the structure of the interaction network between plants and herbivores. To address this, we focused on a field experiment in a species-rich, calcareous permanent grassland, in which the functional diversity of a community of grasshoppers was manipulated and their impact on the plant community was monitored by changes in coverage for two years. We estimated conspecific and heterospecific competitive interactions between species plus apparent competitive effects of grasshoppers on pairwise plant interactions. With this information at hand, we used recent tools from coexistence theory to estimate the determinants of competitive outcomes in multiple species assemblages (i.e. structural niche and fitness differences), which were then related to three key characteristics of the plant-grasshopper network (i.e. nestedness, strength of the links, and grasshopper abundances). Our results indicate that grasshoppers can either promote or limit plant diversity, and their contrasting effects can be mechanistically understood by how the structure of the plant-herbivore network drives both changes in stabilizing and equalizing effects between subordinate and dominant plant species.

TS.05-0-11

Room M6, Thursday 7th Feb. 16.15 h.

From species to community level: understanding the ecological role of small pelagic fish in the Mediterranean SeaAlbo Puigserver, Marta¹; Navarro, Joan²; Palomera, Isabel³; Coll, Marta⁴

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Mediterranean marine ecosystems are fundamentally driven by their pelagic communities and small and medium-size pelagic fishes play crucial ecological roles. Although fluctuations of their populations have been mainly attributed to environmental variability and overfishing, there is still a lack of understanding on specific mechanisms that drive population changes, impairing the capability to predict future dynamics. Therefore, accurate scientific data at species and community level is needed at inter-annual and seasonal resolution. We used a multidisciplinary approach to advance on our knowledge about the ecological and functional role of several pelagic fish species in the western Mediterranean Sea, including clupeoids, horse mackerels and mackerels. We used energy density, stable isotope (nitrogen and carbon) and stomach content analyses to study seasonal variation in energy content in relation to their breeding strategies, feeding preferences and trophic role in the pelagic food-web. Results showed seasonal differences in energy density highly related with the spawning season and food availability, and differences in energy density and trophic niche between species. To integrate the new findings we developed a qualitative model combining sign directed graphs with an analysis of Bayesian belief networks to test the role of potential pressures on main species. Overall, results provide pivotal information to assist the adaptive management of pelagic fish species in the region.

TS.05-0-12

Room M6, Thursday 7th Feb. 16.30 h.

Understanding predator-prey networks structure from co-occurrence patternsAstarloa, Amaia¹; Louzao, Maite²; Martinez, Udane³; Boyra, Guillermo⁴; Rubio, Anna⁵; Irigoien, Xabier⁶; Chust, Guillem⁷

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Trophic cascades and amplification throughout bottom-up processes make marine prey-predators particularly vulnerable to synergistic effects of exploitation and climate change. Understanding the species interactions in marine ecological networks is hence key for biodiversity conservation and sustainable management of exploited species. The present study aimed at exploring the structure and the key interactions of the pelagic community of the Bay of Biscay by analysing the co-occurrence patterns of top predators (seabirds and cetaceans) and their prey (mainly pelagic fishes) obtained from JUVENA surveys during the 2013-2016 period. To undertake this purpose, a probabilistic model was used to detect positive and negative associations among pair-wise species. To determine the relative contribution of environmental conditions and species interactions (e.g. predators-prey) to these associations, two statistical approaches were used: a null model based on the ecological niche concept and a canonical correspondence analysis. Results showed that interspecific associations of the overall community were mainly positive (65%) and driven by environmental factors, which indicated pair-wise co-occurrence due to sharing habitat conditions according to the null ecological model (based on environmental variables). These positive associations did also indicate predation, mutualism and kleptoparasitism and additionally serve to identify central species in the network, highlighting their importance in structuring communities. The high dependence of these positive associations on abiotic factors, however, make them vulnerable to fluctuations in the environment and calls for attention regarding climate change effects over them.

TS.05-0-13

Room M6, Thursday 7th Feb. 16.45 h.

Diversity and network structure of parasite communities associated to spur-thighed tortoises, *Testudo graeca*, in fragmented habitats of the southeastern Iberian PeninsulaBenítez-Malvido, Julieta¹; Giménez, Andrés²; Graciá, Eva³; Traveset, Anna⁴

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Habitat lost and fragmentation are recognized as major threats to biodiversity maintenance. Besides shifts in population size, species may also experience a higher vulnerability to diseases in disturbed habitats, although we still know rather little about such changes. In this study, we evaluated the effect of different levels of fragmentation (low, intermediate and high) on the structure of interactions between individuals of the spur-thighed tortoise (*Testudo graeca*) and their endoparasites in the Mediterranean scrubland of the southeastern Iberian Peninsula. We also investigated differences in parasite infection between sexes and age classes, and whether the prevalence of infection affected the tortoise body condition according to fragmentation level. The number of parasite species was similar among fragmentation levels but tortoises in low fragmented habitats showed, on average, a lower number of parasite species per individual. The diversity and evenness of interactions were similar across fragmentation levels, but the intermediate level showed the greatest specialization level ($H2'$) indicating that individuals were infested by less abundant parasites in this habitat, whereas in the most fragmented habitat individuals were the most generalized. Parasite richness was positively related with body condition (body length and weight) in low and intermediate fragmented habitats. Overall, adults of all habitat types hold a greater number of parasite species than juvenile and infant tortoises, though no important differences emerged between sexes.

TS.05. Posters

TS.05-P-1

External pavilion, Poster session 2: Wednesday 6th - Thursday 7 th Feb.

The impact of introduced species on pollination networks from well-preserved and disturbed native forest areas of Terceira island (Azores)Boieiro, Mário¹; Ferreira, Mariana²; Santos, Renata³; Pereira, Fernando⁴; Borges, Paulo⁵; Rego, Carla⁶

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Oceanic islands host a high number of endemic species and unique ecological interactions that are being threaten by the direct and indirect effects of human activities, particularly species introductions. Here, we assess the effects of introduced species on plant and insect visitor species richness, flower availability and plant-pollinator interactions in well-preserved and human-disturbed native forest areas of Terceira island (Azores). Native insects were important as flower visitors in both well-preserved and disturbed sites since some species with generalist feeding habits (e.g. hoverflies and the beetle *Anaspis proteus*) can tolerate low to moderate disturbance levels. Nevertheless, the introduced bumblebee *Bombus terrestris* and the honeybee *Apis mellifera* were key interactors at disturbed sites. Curiously, in each study site only a single plant species received most insect visits: the endemics *Hypericum foliosum* and *Tolpis azorica* received most of the visits in the preserved sites while the introduced *Rubus ulmifolius* attracted most visitors in the disturbed sites. The higher flower abundance of introduced plant species in the disturbed sites led to a significant reduction of insect visits to the flowers of native species which may hamper their reproductive success and survival. Efforts need to be addressed to restore plant communities of disturbed sites, assuring the population viability of several Azorean native species and the maintenance of key ecosystem processes. *This work was supported by Fundação para a Ciência e a Tecnologia through project PTDC/BIA-BIC/1013/2014 and grants to MB (SFRH/BPD/86215/2012) and CR (SFRH/BPD/91357/2012).

Thematic Session 06: Ecological restoration

Day: Tuesday 5th February

12:00h 13:30h – 16:00h 17:00h – 18:00h 20:00h

Location: Room M4

Coordinators:

Josep M. Ninot, Universitat de Barcelona, Spain

Margarita Menéndez, Universitat de Barcelona, Spain

Given the ancient and yet increasing land use by human activity, an increasing amount of valuable ecosystems are doomed to be restored. A fair number of restoration actions done during the last decades have grown into fair results, concerning geomorphologic shaping, amelioration of some soil and hydrological aspects, and re-creation of basic plant communities –using a few engineering plant species. Such favored plants, moreover, may incorporate to the restoration actions additional functions, such as soil-water depuration, or habitat creation for targeted biota.

However, in a wide scope of restored areas –from wetlands to forests and to wasted lands– malfunctioning persists in some basic processes. This is the case of altered hydrological dynamics, influential invasive species or generalized pollution, which operate at a much larger scale than that strictly corresponding to the restored areas. In this way, human activity and its legacy, together with climate change, directly affect and drive the functioning, structure and biota of the restored ecosystems.

This proposed session, within the first SIBECOL meeting, may be an excellent crossroad where ecologically connect landscape structure and function; terrestrial and aquatic subsystems; and theoretical with applied frameworks.

TS.06. Oral talks

TS.06-MT-1

Room M4, Tuesday 5th Feb. 12.00 h.

Ecological criteria applied in the restoration of a coastal salt marshQuintana, Xavier¹; Compte, Jordi²; Boix, Dani³; Gascón, Stéphanie⁴; Sala, Jordi⁵; Bas, Maria⁶; Cunillera-Montcusí, David⁷; Tornero, Irene⁸

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We analyse the main ecological criteria applied in the restoration of a coastal saltmarsh ecosystem previously degraded by the construction of an urbanization. By means of this case study, we review the main issues to be taken into account in an ecological restoration project at different scales, from more general aspects, such as the recovery of the main ecological processes and of the ecosystem services provided, to more detailed ones, such as the importance of sediment composition on local hydrology and water salinity. The recovery of the ecological functioning and its durability over time must be the most important restoration objective. Although it should consider the long-term scale, the short-term is also determinant, since local people and visitors have to perceive soon the restoration success. Conservation and recovery of target endangered species, when present, is of course compulsory, but in order to be effective these conservation efforts must be done in the framework of the recovery of ecological processes, so that processes evolution favour and improve endangered species populations. Changes to alternative stable states are of course plausible and managers should assess if the restored habitat may maintain their characteristic ecosystem services under the new stable conditions. The return to the conditions before the degradation has often been used as the main restoration principle. However, this should be applied with caution, considering that the ecological processes are irreversible as are the socio-economical aspects of human population surrounding the restored habitats, including the expected future human use of the restored habitat.

TS.06-O-2

Room M4, Tuesday 5th Feb. 12.30 h.

Spatial associations between an endemic Mediterranean palm and several woody species in Iberian oldfields: implications for restorationGarrote García, Pedro José¹; Castilla Álvarez, Antonio Ramón²; Fedriani Laffitte, José María³

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The understanding of the mechanism underlying the recolonization of old-fields is critical to facilitate the recovery of the ecosystem functioning, particularly in regions where agricultural abandonment has increased in the last 60 years. Because in Mediterranean habitats low seedling survival often limits the recolonization process by woody species, the 'nursing effect' exerted by pioneer species could be paramount. We examined the potential nursing role of an endemic Mediterranean palm (*Chamaerops humilis*) on the recolonization of oldfields in southern Iberian Peninsula. We chose three study sites and, using point pattern analysis, we analyzed the spatial associations between *C. humilis* and other common woody species (e.g. *Olea europaea* var. *sylvestris*, *Asparagus* spp., *Daphne gnidium*, *Rubus ulmifolius*). We detected positive small scale (1-5 m) spatial associations between *C. humilis* and several woody species in the three plots. We found differences among plots in spatial associations between *C. humilis* and woody plants, likely related to variations in succession stage and/or abundance of herbivores. The apparent nurse role of *C. humilis* was greater than could be expected based on its abundance in two plots, suggesting that this endemic palm could act as 'keystone species'. In summary, the spatial aggregation of *C. humilis* with multiple woody species across Iberian old-fields suggests a nursing effect, with potential applications for restoring programs within Mediterranean regions. Further field experiments are indispensable to identify the mechanisms underlying the revealed spatial associations.

TS.06-0-3

Room M4, Tuesday 5th Feb. 12.45 h.

Life the green link: restoring degraded areas with the cocoon ecotechnology

Carabassa, Vicenç¹; Kallen, Sven²; Campo, Julian³; Andreu, Vicente⁴; Gimeno, Eugenia⁵; González, Francisco⁶; Viera, Gustavo⁷; Crescenzo, Valerio⁸; Castro, Antonio⁹; Gutiérrez, Inés¹⁰; Korkoumpas, Dimitrios¹¹; Grammelis, Panagiotis¹²; Alcañiz, Josep Maria¹³

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The impacts of climate change in the Mediterranean area are becoming increasingly perceptible. Many semi-arid regions are suffering significant declines in water availability. Therefore, implementing adaptation and mitigation measures is needed to reduce the vulnerability of these Mediterranean ecosystems and strengthening their resilience. The Green Link is a collaborative LIFE project (LIFE15 CCA/ES/000125) that aims to demonstrate the environmental and economic benefits of an innovative tree growing method. This consists of replacing traditional planting techniques with the "Cocoon", a low-cost and biodegradable device that improves water supply to seedlings during the first months. To prove the viability of the Cocoon technology and demonstrate its potential, the project has planted a variety of woody species on different soil types located in areas on a climate gradient from semi-dry to extremely dry across the Mediterranean basin and the Canary Islands. As a whole, 7 experimental areas located in Italy, Greece and Spain, covering more than 70 ha and 30 plant species (4 subspecies). Results after first summer drought demonstrate that Cocoon ecotechnology is working well, improving survival ratios and physiological state of the seedlings, despite these results are depending on the species and the environmental conditions of the site. Moreover, Cocoon is acting as refuge for some insects and could favor the growing of some commercially interesting fungi. In general, the perception of the agricultural and forestry owners, and the administrations involved is very positive, and the replication actions of the project are exceeding expectations.

TS.06-0-4

Room M4, Tuesday 5th Feb. 13.00 h.

Leaf-litter leachates from helophytes enhance the activity of freshwater biofilms receiving inputs from a wastewater treatment plant effluent

Ribot Bermejo, Miquel¹; Cochero, Joaquín²; Vaessen, Timothy N.³; Bernal Berenguer, Susana⁴; Bastias Álamo, Elliot⁵; Gacia Pasola, Esperança⁶; Sorolla Edo, Albert⁷; Martí Roca, Eugènia⁸

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Bioengineering techniques use aquatic plants (i.e., helophytes) to restore degraded stream habitats. However, helophytes can also contribute to ameliorate stream water quality because they uptake dissolved nutrients and they provide habitat and labile carbon to microbial communities in the rhizosphere. We hypothesize that during plant senescence, leachates from helophyte leaf litter would serve as a labile carbon source to promote growth and microbial activity of biofilms on sediments. We tested the effect of leachates from two common helophytes used in bioengineering techniques (*Iris pseudacorus* and *Phragmites australis*) and compared biofilm biogeochemical responses with those from a brewery by-product rich in sugars. In the laboratory, we exposed biofilms developed on artificial flumes receiving water from a wastewater treatment plant (WWTP) effluent and planted with *Iris* and *Phragmites* to the three different carbon sources (the two leachates and the brewery by-product) and to the water from the WWTP effluent which served as control. The total microbial abundance increased during the incubation experiments with labile carbon compared to the control, regardless of the carbon source considered. The three labile carbon sources clearly enhanced denitrification and aerobic respiration of the biofilms compared to the control. However, the abundance of denitrifying bacteria was not influenced by the treatments considered. Overall, results suggest that leaf litter leachates from helophytes used in stream restoration can promote aerobic respiration as well as denitrification of stream biofilms, which can contribute to enhance the capacity of streams to transform and reduce N excesses from the WWTP effluent inputs.

TS.06-0-5

Room M4, Tuesday 5th Feb. 13.15 h.

The influence of hydro-morphological manipulations on nutrient retention capacity in an eutrophic streamTobella Sanmartí, Marta¹; Nadal, Dani²; Drummond, Jen³; Ribot, Miquel⁴; Sabaté, Santi⁵; Martí, Eugènia⁶; Sabater, Francesc⁷

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Rivers have the capacity to transform and retain nutrient loads coming from their catchments. This capacity is the product of the interaction between chemical reactions, biological uptake and hydrologic retention. Hydrologic retention refers to the retention time of water in transient storage zones (zones with reduced flow, hyporheic zone...), where there is a greater probability of interaction between nutrients in the water column and microorganisms in streambed and hyporheic sediments. Previous studies have proved how hydrologic transport and retention affect nutrient dynamics. This study focuses on assessing how stream channel hydro-morphological manipulations can influence nutrient retention, particularly after wastewater treatment plant inputs. To address this objective, we manipulated the channel morphology, using bioengineering restoration techniques, of three 75-m reaches of Cànoves stream (NE, Barcelona, Catalonia) to modify the hydrologic retention. Manipulations resulted in a reach with a large cross-sectional area and high hydrologic retention, a second reach with a small cross-sectional area and low hydrologic retention and a third reach with a high diversity of habitats. We characterized hydro-morphological features of each reach by measuring morphometric parameters and performing conservative tracer injections. We also measured nutrient (phosphate and ammonium) retention by using bioactive tracer additions. We analysed the breakthrough curves from the tracer injections using an R version of the OTIS model, a 3-D reactive transport model. Our findings demonstrate that hydrologic retention played a contrasting role on the two studied nutrients; while it enhanced phosphate uptake, it decreased ammonium uptake. These results can contribute to improved fluvial restoration practices.

TS.06-0-6

Room M4, Tuesday 5th Feb. 16.00 h.

Mimicking ecological facilitation to establish functionally complementary plant communities in extreme mine soilsNavarro Cano, José Antonio¹; Goberna, Marta²; Verdú, Miguel³

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Traditional techniques for restoration of polluted mine substrates have been traditionally based on extensive treatments as soil amendments or surface sealing. These methods apply a tabula rasa based on the not always assessed inefficacy of natural colonization to phytostabilize these extreme artificial environments. Here we show the role of ecological facilitation as driver of community assembly and promoter of ecosystem functions in metalliferous mine tailings under semiarid Mediterranean conditions. Based on a 12-mine tailing sampling of plants, soil and microbial activities we provide evidences of current passive restoration and reconstruct the assembly of communities and functions along 35 years since mining abandonment. We found 13 local nurse plants actively facilitating the establishment of more than hundred species, among which some strong ecosystem engineers are actively contributing not only to shape patches of biodiversity but also to develop soil fertility, soil microbial productivity and abiotic stress amelioration. We identify the main functional traits that are involved in these ecosystem functions. Based on our results we analyze the ecological applications of facilitation to restoration programs that aim not only the establishment of resilient vegetation through functional complementarity but also the promotion of ecosystem functions to reintegrate mine tailings to the landscape matrix. We show the example of a pilot project recently executed in a mine tailing for restoration of a EU habitat through facilitation-based techniques that combine soft soil preparation methods and the use of artificial microsites mimicking the stress amelioration provided by nurse species.

TS.06-0-7

Room M4, Tuesday 5th Feb. 16.15 h.

LIFE+ RIPISILVANATURA: short-term evaluation of riparian restoration actions across multiple taxaBruno, Daniel¹; Zapata, Víctor²; Guareschi, Simone³; Picazo, Félix⁴; Dettori, Ettore⁵; Millán, Andrés⁶; Velasco, Josefa⁷; Robledano, Francisco⁸

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Invasive species are among the top five causes of biodiversity loss. Particularly, giant reed (*Arundo donax*) has progressively colonized the riparian zones of Mediterranean rivers with detrimental effects on riparian and aquatic biodiversity. Hence, different methods have been traditionally used to control it and restore native riparian vegetation. We assess the effect of a non-evaluated restoration action (i.e. repeated pruning combined with the plantation of native riparian species) on aquatic and terrestrial communities in the context of the project LIFE13BIO/ES/001407 RIPISILVANATURA. Specifically, we evaluate if riparian vegetation, birds and aquatic macroinvertebrates show significant responses to restoration measures through annual biomonitoring (sampling before and after the restoration from 2015 to 2018). Changes in taxa diversity and ecological quality indices for the different biological communities were tested using mixed-effect models (LMEs). LMEs were also applied to assess how riparian variables were related to bird and aquatic macroinvertebrate indices. Non-metric multidimensional scaling (NMDS) and permutational multivariate analysis of variance (PERMANOVA) were performed for each taxonomic group to detect significant differences in taxa composition. Similarity percentage (SIMPER) was applied to identify which taxa led to the observed significant changes in taxonomic composition. During this preliminary assessment, significant changes in riparian and aquatic macroinvertebrate composition patterns were detected. Increases in riparian and aquatic macroinvertebrate richness and quality indices (RQI and IBMWP), and a significant decrease in *Arundo donax* height were observed. Despite the general improvement in biomonitoring indices, restored sites did not reach the values of reference sites after three years of restoration actions.

TS.06-0-8

External pavilion, Poster session 1: Monday 4th - Tuesday 5th Feb.

Ecological restoration of high mountain lakes in the Pyrenees by fish removal or intensive control: provisional results of the Project Life LIMNOPIRINEUSPou-Rovira, Quim¹; Cruset, Eloi²; Font, Blanca³; Jurado, Ismael⁴; Buchaca, Teresa⁵; Sabas, Ibor⁶; Osorio, Víctor⁷; Puig, Mariàngels⁸; Miró, Àlex⁹; Ventura, Marc¹⁰

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Nowadays, more than half of Pyrenean high mountain lakes are occupied by fish, as a result of a historical process that has been accelerated during the last 60 years. In the southern slope of these mountains, the main introduced fish are Brown trout (*Salmo trutta*), Brook trout (*Salvelinus fontinalis*), Rainbow trout (*Oncorhynchus mykiss*) and European minnow (*Phoxinus sp.*). The impacts of the introduction of fish include, among others, the transformation of the ecosystem structure and trophic relationships, and the reduction and extirpation of native species. The project LIFE LimnoPirineus (LIFE13 NAT/ES/001210), started in 2014 and includes among its main objectives the restoration of eight high mountain lakes and the recovery of native species of European interest, either by eradication or intensive control of introduced fish, depending on the size of the lake. Operations started gradually from 2014 to 2017 by means of several capture techniques: mainly gill nets for trout and a combination of gill nets, fyke-nets and electrofishing for Minnows. At present we have already achieved the complete fish removal in two lakes, awaiting for a final certification of this goal along 2018. In other four lakes, this objective is also expected to be achieved in 2018. In the remaining two lakes, we have already obtained a substantial reduction of Minnow density (> 80%). In all eight lakes a clear ecological response has been observed, even before the finalization of fish removal, with the recolonization of species previously extirpated due to fish introductions.

TS.06-0-9

Room M4, Tuesday 5th Feb. 18.00 h.

Genetic diversity and population structure of Pyrenean brook newt (*Calotriton asper*) populations in the Pyrenean rangeLucati, Federica¹; Miró, Alexandre²; Caner, Jenny³; O'Brien, David⁴; Tomàs, Jan⁵; Buchaca, Teresa⁶; Font, Blanca⁷; Cruset, Eloi⁸; Pouvira, Quim⁹; Ventura, Marc¹⁰

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Calotriton asper is an amphibian endemic to the Pyrenees, listed as Near Threatened by the IUCN. We sampled 35 lake and stream populations covering most of the southern Pyrenean range, with the purpose of assessing its genetic variability and understanding the process of migration between nearby ecosystems. Assessment of genetic diversity and population structure was conducted through the analysis of both mitochondrial (cytochrome b) and 17 nuclear microsatellite markers. Variation in cyt b sequences was relatively low, with 8 haplotypes found, of which 3 were unique to the sampled populations. With regard to the variation in nuclear DNA, the mean values of expected (HE) and observed heterozygosity (HO) were 0.46 and 0.41, respectively, and the mean inbreeding coefficient (FIS) was 0.15. Effective population size (N_e) ranged between 17 and 46 (mean $N_e=31$). Population structure analysis revealed the presence of 2 main groups, corresponding to the geographic areas under study. Within each group, a further subdivision into 2 sub-clusters was observed. Mantel test for isolation by distance over all populations showed a significant positive relationship between geographical and genetic distances ($R^2=0.52$). Similar results were found when analysing the 2 clusters separately. We inferred migration patterns at the studied populations, and identified migrants and individuals of admixed ancestry. Furthermore, we detected evidence of gene flow between lakes and streams. Overall, our results indicate that the studied populations are geographically structured, and give insights into the colonisation dynamics of new suitable environments.

TS.06-0-10

Room M4, Tuesday 5th Feb. 18.15 h.

DESEMBALSE project: last days of a dam creating a barrier on community and population structureLarrañaga, Aitor¹; Achurra, Ainara²; Atristain, Miren³; Blanchet, Simon⁴; de Guzman, Ioar⁵; Prunier, Jerome⁶; Velayos, German⁷; von Schiller, Daniel⁸; Elosegui, Arturo⁹

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Reservoirs are one of the most controversial infrastructures in the modern world. Although having a network of reservoirs is a basic requirement for developed countries, they inherently create sociological and environmental repercussions that are difficult to mitigate. Thus, when the lifespan of a reservoir has come to an end it must be dismantled. Enobieta, in the Special Area of Conservation of Artikutza (Navarre/Gipuzkoa), is a 42-m tall dam that will be decommissioned after 3 decades of neglect. Currently, water level is being lowered and a tunnel will be dug in the base of the dam in the summer of 2019. To describe the barrier effect before the dismantlement, we sampled stream macroinvertebrates in a total of 8 reaches above and below the dam, including main tributaries. We expect the dam to isolate populations, thereby increasing the natural level of genetic differentiation among populations and ultimately be surfaced into a distinctive community structure as well. Preliminary genetic simulations suggest that, as expected, genetic differentiation will be largest for the isolated upstream reaches for non-flying macroinvertebrates, such as amphipods or mollusks. On the other hand, simulations predict that genetic differentiation induced by the dam may disappear after 15 to 200 generations of its dismantlement, depending on the species. Case studies like this are highly useful models for informing decisions on where when is worth undertaking this kind of restoration projects.

TS.06-0-11

Room M4, Tuesday 5th Feb. 18.30 h.

Experimental trials as a basis for restoration of high mountain miresPladevall Izard, Eulàlia¹; Espuny, Jaume²; Pérez-Haase, Aaron³; Anadon-Rossell, Alba⁴; Carrillo, Empar⁵; Ninot, Josep Maria⁶

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Wetlands cover small, scattered areas in the Pyrenees. They include habitats vulnerable to disturbance, which have been poorly studied despite being a refuge for rare mire specialists within the Iberian Peninsula. Research about their ecological functioning is needed to create useful restoration protocols after anthropogenic disturbances. In the frame of the LIFE project LimnoPirineus, we are setting restoration protocols for endangered mire habitats, which include active regeneration of plant populations and communities. With this aim, from 2014 to 2018 we have conducted distinct experiments both at short term in controlled conditions, and at mid-term in the field. They were based on a few species of monocots and of Sphagnum mosses, known to perform engineering or structural functions in the natural vegetation. We have analysed their growth and performance under distinct environmental conditions (substrate and depth of the water table), varying densities of the re-created populations and different interspecific occurrences/combinations. The results obtained are a good basis for real restoration procedures, since they provide information on the ability of the study species to establish and develop their structural function in newly created habitats under distinct conditions. Moreover, these experiments enrich the ecological knowledge of mires. For instance, although some results were consistent with the observed vegetation patterns in mire systems, they did not fully correspond to the realized niche of the species studied. This may be evidence of the important role played in mire ecosystems by stochastic events (like drought or flood episodes) and cumulative habitat modification by engineering plant species.

TS.06-0-12

Room M4, Tuesday 5th Feb. 18.45 h.

From sea urchins barrens to well-preserved macroalgal forests: large-scale restoration actions to recover underwater forests in a Marine Protected AreaMedrano, Alba¹; Linares, Cristina²; Cleminson, Maria³; Pagès, Marta⁴; Rovira, Graciela⁵; Solà, Jordi⁶; Hereu, Bernat⁷

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The macroalgal *Cystoseira* species are important habitat-forming species in the Mediterranean Sea, where their dense canopies display a structural role and provide refuge comparable to terrestrial forests. However, over last decades, the decline of several *Cystoseira* species has been occurred due to human-induced stressors, transforming marine forests in simplified communities. Face to the loss of these highly diverse forests, there is an urgent need to combine passive and active restoration techniques in order to maintain their ecological functions. During the spring of 2017 and 2018, we carried out six reforestation actions of *Cystoseira elegans* on degraded shallow areas in the Medes Islands Marine Protected Area and in the nearby unprotected coast (NW Mediterranean Sea), allowing testing for the potential differential success of restoration under different fishing pressure. In contrast to other *Cystoseira* species, *C. elegans* is a relatively fast growing species inhabiting in shallow waters which has expanded their distribution during the recent years, except for those areas dominated by sea urchins barrens as consequence of the overfishing. Taking advantage of the spreading dynamics of this species, we used a combination of different techniques such as fertile apexes transplants, in-situ recruitment enhancement techniques and the complete eradication of sea-urchins in order to enhance the recruitment of *C. elegans* on barren areas and to restore macroalgal forests. The preliminary results obtained in 2017 showed a complete transformation of barren areas into well-preserved forests, however, these results should be confirmed as well as potential differences between different protection regimes.

TS.06-0-13

Room M4, Tuesday 5th Feb. 19.00 h.

Stability recovery of interaction networks in template forests after mining impacts caused since the Middle AgesRodríguez Uña, Asun¹; Moreno Mateos, David²

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Despite the increasing practice of ecological restoration, it does not always guarantee the recovery of the structure, functions and services of ecosystems, at least in the short-term. Most of the studies evaluating ecosystem recovery so far usually use static measures of structure (species richness) or function (carbon concentration). We hypothesize that more complex variables (stability of interaction networks) would be better assessments of the real time required for the recovery of ecosystem complexity. We are studying the interactions between beech trees, ectomycorrhizal fungi, and collembolans feeding on those fungi in an ancient iron mine in Navarra, in use between the XIV and XX centuries. We selected 18 beeches inside and 8 outside the mine where the ectomycorrhizal species have been identified using Sanger sequencing. We have also mass-sequenced gut contents from collembolans collected around the selected trees. We are now building individual interaction networks for each tree with the purpose of comparing different network attributes related to ecosystem stability between the trees grown inside and outside the mine. We expect to find groups of species with stronger interactions (compartments) that play an important role in the process of forest recovery, so that restoration actions can be oriented to benefit them. Furthermore, these results will have applications for restoration strategies and mitigation policies as they will enable to know the real magnitude of degradation and to guide how this lost can be compensated.

TS.06-0-14

Room M4, Tuesday 5th Feb. 19.15 h.

Understanding the long-term assembly of ecosystem complexity to advance a limited restoration**MORENO MATEOS, DAVID¹**

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Growing evidence is showing that ecosystem restoration performance is limited in recovering different metrics of biodiversity and functionality. This pattern spans all kinds of ecosystems and degrading factors, and overall shows that restored ecosystems are one third less diverse, with half of the abundance of plants and animals and have a 40% reduced cycling of carbon and nitrogen. Among other reasons, one that could explain this limitation is our limited understanding of ecosystem recovery. To address this, I propose a three-fold approach: First, we should address the ecosystem complexity issue in restoration by incorporating multilayered interaction networks that allow us to find core species to the network structure. Second, we should use genome-wide sequencing approaches to estimate the recovery of genetic functional variation of those core species that can condition evolution and recovery potential lost by anthropogenic disturbance. And third, given the stochastic nature of ecological interactions and effects of the abiotic environment on ecosystem assembly, we should understand recovery at a long term (>100 years) scale, for example, using space-for-time substitutions. Finding the mechanisms that regulate the assemblage of ecosystem complexity over the long term may help us develop restoration actions that accelerate recovery.

TS.06. Posters

TS.06-P-1

External pavilion, Poster session 1: Monday 4th - Tuesday 5th Feb.

A temporal perspective of facilitation dynamics during forest recovery in Mediterranean old fieldsCruz Alonso, Verónica¹; Villar-Salvador, Pedro²; Ruiz-Benito, Paloma³; Ibáñez, Inés⁴; Bodega, Guillermo⁵; Gómez, Daniel⁶; Rey-Benayas, José María⁷

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Unlike other forest systems, the recovery of Mediterranean oak forests after field abandonment is very slow. This is mainly due to the stressful environmental conditions under which seedling establishment takes place. In these systems nurse shrubs play a critical role by ameliorating the environmental constraints that hinder tree recruitment. Thus, tree successional dynamics is highly dependent on shrub colonization, a temporal pattern that have not yet been quantified. In this study, we investigated the interaction between the colonization of the early-successional nurse shrub *Retama sphaerocarpa* and the recruitment of two late-successional oak species with different ecology (*Quercus ilex* and *Quercus faginea*) in old fields abandoned 30 years ago. We dated the recruitment year of the nurse shrubs and oak individuals and analyzed oak recruitment as a function of shrub colonization and of climatic records. Recruitment followed patterns of high-and-low pulses, with species-specific differences in the number of recruits ($R. sphaerocarpa > Q. ilex > Q. faginea$) with *Q. faginea* having more occasional recruitment events. Unlike in the open areas, *Q. ilex* recruitment under the shrubs remained stable after shrub population developed to a certain size. The climatic condition that negatively affected *Q. ilex* establishment had a lesser effect under the shrub than when recruitment took place in open spaces. Thus, we identified a measurable "nurse-shrub debt" (i.e. the increase in recruitment linked to the nurse shrub presence) across time, and we found that it took 20 years after field abandonment for the shrub population to start catalyzing oak forest recovery.

TS.06-P-2

External pavilion, Poster session 1: Monday 4th - Tuesday 5th Feb.

Evolution of limestone quarries restoration after twelve yearsJorba Peiró, Montserrat¹; Medina, Mercedes²; Edo, Antonio³

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Opencast mining is one of the activities with the greatest environmental impact since it involves the movement and removal of large volumes of soil and vegetation cover with the loss of ecosystem services. The ecological restoration aims to restore ecological services lost during the exploitation of resources and not only attenuate the landscape impact, but to make the new ecosystem functional and self-sustaining. The objective of this work is to evaluate in the medium term the global functioning of the ecosystem generated by the actions and the ecosystem services of soil protection and CO₂ fixation by herbaceous and woody vegetation, in five limestone quarries restorations of twelve years old. For this purpose, the cover and the carbon content of aerial biomass and litter were evaluated in the herbaceous and woody layer. The results indicated that current coverages protect the soil, which predominate spontaneous species characteristic of an intermediate stage in ecological succession, and that store carbon in values consistent with the reference ecosystem. There are significant differences between quarries in most indicators, although there is a tendency towards self-sustainability.

TS.06-P-3

Room M4, Tuesday 5th Feb. 16.30 h.

Recovery of high mountain lake amphibian populations after removing exotic fish (LIFE+ LimnoPirineus)Miró, Alexandre¹; O'Brien, David²; Tomàs, Jan³; Buchaca, Teresa⁴; Sabás, Ibor⁵; Osorio, Víctor⁶; Lucati, Federica⁷; Castrillón, Alba⁸; Solé, Judith⁹; Font, Blanca¹⁰; Jurado, Ismael¹¹; Cases, Meritxell¹²; Cruset, Eloi¹³; Pou-Rovira, Quim¹⁴; Ventura, Marc¹⁵

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Amphibians living in high mountain lakes and ponds are trophic key species within the ecosystem, but are threatened by different causes related to global change, foremost of which is the presence of exotic fish. One of the objectives of the LIFE+ LimnoPirineus project (2014-2019) is the recovery of amphibian populations in eight Pyrenean high mountain lakes by controlling or eradicating exotic fish. During the summer months of 2014 to 2018, we removed between 80% and 100% of the fish present in the eight lakes. We have simultaneously documented changes in amphibian populations by collecting data on their presence and abundance. We have collected the data, both during fish eradication works, and through separate targeted day and night-time surveys. We have found that the different species of autochthonous amphibians present in each catchment have colonized most of the lakes without assistance as the fish eradication work has progressed. The first natural colonization and reproductive event of amphibians was observed, after the first or the second year of eradication works, although there was still a certain proportion of fish in the lakes. This shows the high resilience of the amphibian fauna of high mountain lakes, after reducing or eliminating a perturbation. The lack of colonisation from nearby catchments highlights the crucial role of residual populations not affected by human impacts. The observed recovery of amphibian populations had the same elasticity and rapidity in each of the eight lakes, regardless of when fish had been introduced and regardless of the fish species.

TS.06-P-4

External pavilion, Poster session 1: Monday 4th - Tuesday 5th Feb.

Improvement of water quality and riparian vegetation after the start-up of a constructed wetland in a Mediterranean intermittent stream in the Penedès regionSalvadó, Humbert¹; Granja, Luis²; Gaudes, Ainhoa³; Chamorro, Lourdes⁴

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This project aims to improve the quality of Cantallops intermittent stream, an example of a small mediterranean riparian system in the intensified agrarian region of Penedès (Catalonia). In order to treat the wastewater of the small village of Cantallops a constructed wetland was built in 2017. Up to date, that is the unique public constructed wetland treating urban wastewater in this region. For this reason, we value the municipal government initiative to set up a low environmental impact WWTP process integrated into the landscape. A year before the construction of the WWTP, physico-chemical analysis of water and biotic analysis including flora and fauna were performed in three sampling points located downstream the WWTP. This previous analysis demonstrated a very poor quality of the water spilled into the stream. The riverbed next to the WWT was deforested along 150 m of its natural vegetation. In order to recover and enhance the riparian vegetation we initiated a reforestation pilot test with autochthonous species. After the WWTP construction, water quality showed a remarkable improvement, but not yet significant as it did not reach the expected quality levels. The riverbed vegetation was successfully recovered with more than the 50% of plant cover bush and ruderal spontaneous and transplanted species but also some alien species. Regarding the vertebrate fauna, we emphasize the fact that it has not worsened, because the vertebrate fauna of aquatic environments has expanded in a short time. Finally, only after a year of the WWTP installation the environmental quality was improved.

TS.06-P-5

External pavilion, Poster session 1: Monday 4th - Tuesday 5th Feb.

TERECOVA: Carbon fixation by forest restoration actions in Mediterranean landscapesSauras-Yera, Teresa¹; Alex, Fernandez²; Jaime, Baeza³; Pere, Rovira⁴; Ramon, Vallejo⁵

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According to the strategies developed by the IPCC ARS WG2 (2014) and WG3 draft reports, adaptation and mitigation to climate change includes, among other options, to increase carbon storage in terrestrial ecosystems. In such a context ecological restoration is considered as a management option with multiple benefits (win-win-win), because it helps to improve change adaptation, mitigation and biodiversity. Therefore there are great perspectives for the development of methodologies for ecological restoration taking into account its impact on C budget. Our research aims to analyze how recently developed restoration techniques translate to increases in ecosystem C storage. The specific objective is to evaluate short to medium term organic carbon stocks in two selected restoration projects developed in last decades in Mediterranean forests of Valencia region (E Spain). Restoration techniques included slash brush and planting broadleaved resprouting species in *Pinus pinaster* stands and thinning plus planting with *Quercus faginea* in high density post-fire regenerated *Pinus halepensis* stands. Preliminary results show that restored forests improve the potential for carbon sequestration due to (1) the initial necromass input produced by slash brush that increases C stock on the topsoil, (2) thinning improves forest growth and subsequent carbon fixation by trees. Furthermore, promoting mixed forests by introducing native resprouting species is expected to increase soil organic carbon in the longterm. We thank funding received from the Ministry of Economy, Industry and Competitiveness, project 'Tools for planning ecological restoration in the Region of Valencia' (TERECOVA; CGL2014-52714-C2-2-R).

TS.06-P-6

External pavilion, Poster session 1: Monday 4th - Tuesday 5th Feb.

Enhancing water retention through participatory ecological restorationSilva, Elysa¹; Silva, Elysa²; Naji, Walid³; Moutahir, Hassane⁴; Salvaneschi, Pietro⁵; Bonet, Andreu⁶; López, German⁷; Climent, Emilio⁸; Derack, Mchich⁹; Aledo, Antonio¹⁰; Cortina, Jordi¹¹

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Defining priority areas for ecological restoration is a key step towards effective land use management, due to a large extent of degraded lands and the limited availability of financial resources. The identification of priority areas for restoration based on biodiversity conservation and the optimization of the provision of multiple ecosystem services may have negative effects on the supply of some services. Water is a major limiting resource for ecosystems and human societies worldwide. Global warming and overexploitation threaten water availability in drylands. Eco-hydrological models show that modifying vegetation cover and structure affects water retention. In this study, we aimed at identifying cost-effective restoration scenarios that increase water retention in a semi-arid landscape, taking stakeholder preferences into account. We established a stakeholder platform in Crevillent Management Area (south-east Alicante, Spain), and asked them to identify and rank restoration criteria in eight non-urban landscape units present in the region. Priority areas were then obtained through a weighted sum of these prioritization criteria. Similarly, we asked stakeholders to identify and rank the ecosystem services provided by these landscape units, including water retention. We used the eco-hydrological model HYDROBAL to estimate the impact (effectiveness) of different restoration scenarios on water retention. Finally, we used estimations of the monetary costs of each scenario to calculate their cost:effectiveness.

Thematic Session 07: Evolutionary ecology in terrestrial, aquatic and marine environments

Day: Wednesday, 6th February and Thursday 7th February

Schedule: 12:00h 13:30h - 18:00h 19:30h | 12:00h 13:30h - 15:00h 17:00h

Location: Room M4

Session sponsored by AoB Plants

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Coordinators:

Xavier Picó, Estación Biológica de Doñana (EBD-CSIC), Spain

Mohamed Abdelaziz, Universidad de Granada, Spain

Antonio Castilla, Centro de Ecología Aplicada Prof. Baeta Neves/InBIO, Portugal

All organisms are subject to evolutionary forces that are critically influenced by the local environment in which individuals complete their life cycles. Understanding how such evolutionary forces modulate the populations at different spatial and temporal scales has been a long-term primary research objective in evolutionary biology. Furthermore, such knowledge will be of paramount importance to fully comprehend the evolutionary response of organisms to the rapid environmental changes experienced worldwide. At present, the interaction among various scientific disciplines, including ecology, genetics, genomics and evolution, provides exciting and challenging opportunities to unravel the complexity of evolution in wild environments as well as the evolutionary implications of global climate change on biodiversity. This session attempts to provide insights into the main conceptual advances in the field of the evolutionary ecology of organisms occurring in terrestrial, aquatic and marine environments, whose comparison will be extremely useful to detect common patterns but also the particularities of each environment. We welcome hypothesis-driven theoretical and empirical contributions on evolutionary ecology, population ecology, and/or population genetics and genomics with no bias regarding taxon, biome or biogeographical area.

TS.07. Oral talks

TS.07-MT-1

Room M4, Wednesday 6th Feb. 12.00 h.

Ecological epigenetics: lessons from inter and intra-specific analyses of wild plantsAlonso, Conchita¹; Medrano, Mónica²; Herrera, Carlos M.³

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Understanding the role of epigenetics in organism adaptation and evolution necessarily requires a diverse range of approaches and scales, from experimental manipulation of molecular mechanisms to comparative analysis across taxa. In plants, DNA cytosine methylation is an important and complexly regulated epigenetic mechanism involved in genome stability and the response to multiple environmental factors. Thus, the analysis of natural variation in DNA methylation across species, communities, populations and individuals should help to elucidate the contribution of epigenetics to phenotypic variation of wild plants, and their short-term functional responses to environmental conditions and long-term diversification processes. Our more recent studies adopted a plant community approach to analyze global DNA methylation in plant species from different biogeographic regions and communities associated to environments differing in rainfall. Further comparisons were conducted in congeneric species with different habitat preferences and distribution ranges. Our phylogenetically-encompassing sampling corroborated global cytosine methylation varied widely between angiosperms (range 4.8 - 42.1%; N = 279 spp). Interspecific differences were related to their evolutionary trajectories, as denoted by a strong underlying phylogenetic signal, genome size and some functional plant traits, namely woodiness and leaf perennation. Congeneric comparisons supported some of these findings. Intraspecific analyses highlighted that variation across individual plants within populations was a major source of natural variation in DNA methylation. Altogether, these findings suggest that micro and macro-environmental conditions could influence on plants' epigenome allowing for interesting avenues for experimentation aiming to relate plant phenotypic diversity and epigenetics at different scales.

TS.07-O-2

Room M4, Wednesday 6th Feb. 12.30 h.

Differences in phenotypic plasticity among plant populations: implications of the G × E interaction to forecast responses to climate changeMATESANZ GARCIA, SILVIA¹; Ramírez-Valiente, José Alberto²

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Many studies use differences among plant populations in key functional traits as a tool to infer future responses to environmental change. However, these predictions will only provide meaningful insights when differences assessed in the environment where they are measured reflect differences in future, unmeasured environments, i.e. when plasticity patterns among populations are similar. Conversely, when there is among-population divergence in plasticity (Population-by-Environment, P × E), population differences in one environment may not equally manifest in another environment. We revised climate change studies assessing population differentiation to quantify the occurrence of the P × E. We identified 309 studies (from 172 species), of which 64 % tested P × E. In 77 % of these studies, P × E was significant for at least one functional trait, and 52% showed significant P × E in >50% of traits. Results were consistent across life forms, biogeographical regions and type of experiment, indicating a high prevalence of among-population differences in plasticity. This, together with the fact that one third of studies were performed in just one environment or did not estimate the P × E interaction points to a potentially critical limitation to our current inference on population responses to climate change. Future studies should assess population differentiation in multiple test environments that realistically reflect future conditions (e.g. multifactor experimental treatments that incorporate higher CO₂ levels). Our revision also revealed the predominant focus on trees from temperate climates, identifying underexplored life forms and biogeographical regions that should receive more attention.

TS.07-0-3

Room M4, Wednesday 6th Feb. 12.45 h.

Population differentiation in vegetative and reproductive trait plasticity in response to water availability in the annual forb *Lupinus angustifolius* L.Moncalvillo, Belén¹; Muñoz-Ramos, Marina²; Romero, Jorge³; García de Dionisio, Sandra⁴; Rubio Teso, María Luisa⁵; Iriondo, José M^{a6}; Matesanz, Silvia⁷

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Populations of widely-distributed plant species usually display different levels of phenotypic plasticity. The study of this variation can be relevant for crop wild relatives, especially from a climate change perspective. *Lupinus angustifolius* L. is an annual wild forb with cultivated varieties worldwide and a phenology highly conditioned by summer drought. We assessed the norms of reaction of a wide range of functional traits (SLA, relative water content, SPAD, among others) in response to water availability in four natural populations from two sites with contrasting latitude and climate. We performed a water limitation experiment in semi-natural conditions under a water exclusion structure established outdoors. This characterization of phenotypic plasticity is the first step of a three-generation transgenerational phenotypic plasticity experiment. Thus, we kept track of each mother plant and its seeds to give our data a family structure. Preliminary results evidence marked differences between treatments, i.e. high phenotypic plasticity, with plants in drought conditions being generally smaller, having smaller and thicker leaves and producing lighter and fewer seeds. Populations' response to each treatment also differed. For instance, in the water-stress treatment, southern populations produced thicker leaves than northern populations while that latitudinal difference was not found in the control treatment. As, climate change foreseen scenario in Southern Europe predicts an increase of temperatures and drought events, the identification of populations with higher growth and fitness under water limitation has direct implications in conservation, restoration and agriculture and thus could be of interest for wild and cultivated managing agents.

TS.07-0-4

Room M4, Wednesday 6th Feb. 13.00 h.

Sex-blocking effect in populations of the rotifer *Brachionus plicatilis* in relation to environmental predictabilityColinas Vallejo, Noemí¹; Carmona, María José²; Serra, Manuel³; García-Roger, Eduardo Moisés⁴

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Environmental fluctuations are increasing their frequency and unpredictability as a result of global change. Therefore, understanding the adaptive response of organisms to unpredictable environments is a major challenge to evolutionary ecology. Facultatively sexual rotifers that inhabit small water bodies in eastern Spain are a good model of study. Sex is necessary in their cyclical parthenogenetic life cycle for the production of diapausing eggs that are resistant to adverse conditions. These eggs allow survival in the sediment of ponds between planktonic growing seasons, when the water column is unsuitable for population growth. However, in several rotifer species has been shown a reduction in sexual reproduction investment in the early generations after diapausing egg hatching. This sex-blocking effect has been considered adaptive because it will promote parthenogenetic proliferation in an environment already colonized by conspecifics. Nevertheless, because the blocking effect puts diapausing-egg production at risk, its lasting and intensity are expected to diminish with the unpredictability of the growing season length. We tested these predictions in populations of rotifer *Brachionus plicatilis* inhabiting ponds with different degree of environmental predictability. Results demonstrated the existence of a sex-blocking effect in *B. plicatilis*, the investment in sexual reproduction significantly increased with the number of generations after leaving diapause. Moreover, this investment was dependent on the environmental unpredictability experienced by the population.

TS.07-0-5

Room M4, Wednesday 6th Feb. 13.15 h.

Adaptive divergence of *Pinus sylvestris* populations across Europe: implications in a changing worldRamirez-Valiente, Jose Alberto¹; Solé, Aida²; Benavides, Raquel³; Danusevicius, Darius⁴; Heer, Katrin⁵; Notivol, Eduardo⁶; Opgenoorth, Lars⁷; Pyhäjärvi, Tanja⁸; Savolainen, Outi⁹; Cervantes Arango, Sandra¹⁰; Robledo-Arnuncio, Juan José¹¹

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How species will respond to climate change is yet uncertain. Common gardens, reciprocal transplants and provenance trials have been used to assess adaptive divergence and potential response of forest tree species to environmental change. However, such studies usually focus on juvenile or adult responses with little consideration on the early stages of development, which are critical determinants of the regeneration niche. In this study, we explored the adaptive divergence and phenotypic plasticity in early fitness traits in *Pinus sylvestris* and examined the potential for adaptation to the predicted future conditions of climate. We conducted a continent-wide series of experiments where 24 000 seeds from eighteen populations were established in common garden trials along a latitudinal gradient in Europe. We monitored germination, survival, growth, phenology and ontogenic development over two years. Our results showed that populations differed in all studied traits and fitness components. Specifically, we observed a clinal variation in drought resistance across the species range, such that populations from mesic sites exhibited the highest mortality, lowest growth rates and slowest ontogenic development in the driest site of the series. Importantly, the length and severity of the dry season in the driest site mirrored conditions predicted for central populations by the end of the century by climate change scenarios, suggesting compromised recruitment in those populations. Overall, our study suggests that climate has exerted strong selective pressures on *Pinus sylvestris*, driving the genetic differentiation of populations in traits important for fitness during the first stages of seedling development.

TS.07-0-6

Room M4, Wednesday 6th Feb. 18.00 h.

Fitted for long life? Survival and longevity of the Neotropical damselfly *Polythore mutata* (Odonata: Polythoridae)Cordero Rivera, Adolfo¹; Rivas-Torres, Anais²; Sanmartín-Villar, Iago³; Sánchez-Herrera, Melissa⁴; Encalada, Andrea⁵

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Most forest damselflies of tropical regions live at low population densities and are almost never observed in reproductive behaviour. We hypothesized that under these circumstances selection will favour very high survival rate and hence high lifespan, allowing the animals to be ready for the occasional events that favour reproduction. To test this idea, we studied two populations of *Polythore mutata* by mark-recapture methods. In spite of the low population density in both localities, our estimates of recapture rates suggest population differences in lifespan and body size selection. Females were less often resighted at Tiputini, whereas at Jatun Sacha about 20% of individuals were resighted, irrespective of sex. We also found that daily survival probabilities were not affected by sex at Tiputini, but were higher for females at Jatun Sacha, and were in the interval 0.816-0.974. These values translate into longevities of 5 to 38 days, similar to the longevity observed in other damselflies from temperate regions. Adding body length as a covariate, increases the fit of the models. At Tiputini we found evidence for stabilizing selection for body size, whereas at Jatun Sacha, larger body size was apparently under positive selection. Some specimens had algae growing over the abdomen, suggesting high longevity, but the maximum observed lifespan was between 54 and 63 days. Therefore, we have not found evidence for long pre-reproductive periods and high survival, contrary to our expectations. We conclude that survival rate of damselflies in tropical forests is similar to temperate zones.

TS.07-0-7

Room M4, Wednesday 6th Feb. 18.15 h.

Lifetime patterns of brood parasitism and egg rejection in Magpies (*Pica pica*)Martínez Suárez, Juan Gabriel¹; Martínez, Juan Gabriel²; Molina-Morales, Mercedes³; Precioso, Marta⁴; Avilés, Jesús Miguel⁵

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There is considerable intra and interpopulation variation in both the probability of avian brood parasitism and parasite egg rejection (one of the main defences of hosts against parasitism). Although both topics have been extensively addressed, there are few longitudinal studies of host lifetime patterns of parasitism and egg rejection; this is particularly important in long lived hosts, because factors determining parasitism and rejection may vary along the life of individuals, as it has been suggested for Magpies, the main European host of the great spotted cuckoo (*Clamator glandarius*). Here we present data of 70 female magpies of known age monitored through their lives (between 2005 and 2015). Each season their status of parasitism was recorded and their ability to reject foreign eggs tested using experimental model eggs. Magpies lived on average 3,67 years (range 1-7), and most of them (67,5%) died before 5 years. Females 5 or more years old were less parasitized than those aged 1 to 4 years (25,54% versus 46,32% respectively, $p=0,02$). Age significantly affected the probability of model egg rejection, being less frequent in females younger than 5 (24,24% of females) than in females 5 or more years old (63,33%). Since most females don't reach 5 or more years of age, only a small proportion of them (36,36%) succeeded in rejecting foreign eggs along their lives. We discuss the implications of these results in the evolution of the interactions between brood parasites and hosts.

TS.07-0-8

Room M4, Wednesday 6th Feb. 18.30 h.

Stress, fruit symmetry, seedling morphology and seedling survival: alternative adaptive developmental pathways in a Mediterranean oakDíaz Esteban, Mario¹; Arroyo, Luis²

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Stress experienced by oak trees increases leaf asymmetry, the proportion of asymmetric acorns and acorn abortion rate in the following year. Acorn asymmetry increases abortion rate, and surviving asymmetric acorns gave rise to seedlings with more and smaller leaves, a morphology that is associated with higher mortality under mild conditions (shadowed during the summer drought). This asymmetry-mediated acorn abortion is then adaptive since it saves resources otherwise invested in seedlings of low viability. Under this scenario, survival of asymmetric acorns will be maladaptive. By means of a common garden field experiment we found that acorn asymmetry influenced seedling morphology as found before. However, the effect of asymmetry on morphology was stronger in open (stressful) microhabitats, and this deviant morphology enhanced survival under stressful conditions. The opposite was true under mild (shadowed) conditions. Consistent adaptive association between stress (or lack thereof) during fruit development, fruit symmetry, seedling morphology and seedling survival followed two extreme developmental pathways: the canalized pathway leading to symmetric fruits and seedling phenotypes adapted to survive under normal conditions, and the unstable pathway leading to asymmetric fruits and seedling phenotypes adapted to survive under stressful conditions. Epigenetic processes during fruit development may be a potential mechanism for the maintenance of the proposed alternative developmental pathway worth to be explored.

TS.07-0-9

Room M4, Wednesday 6th Feb. 18.45 h.

Disperser loss and partner switch from native to alien lead to demographic, genetic and evolutionary consequences for *Cneorum tricoccon*Escribano Ávila, Gema¹; Traveset, Anna²

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The disappearance of native species may have complex effects for interacting partners, such as plants dispersed by animals. Yet, this loss may go accompanied with the introduction of alien species that in turn may replace the service provided by the extinct natives. Both, the absolute loss of dispersers and switch from native to alien partners may entail changes in plant demography, genetic diversity and selective pressures leading to evolutionary change. Here we document the changes in seed size of a plant species occurring after its only native disperser (a lizard species) disappeared and those induced by an alien vertebrate predator (the pine marten) that acts as an effective seed disperser of *C. tricoccon*. We further study the demo-genetic consequences for a population where the native dispersers have gone extinct and there is not a functional replacement. Native and alien dispersers exert conflictive selection on seed size (negative and positive, respectively). This selective regime is mediated by dispersers' gape width and it is robust to the possible confounding climatic factors, i.e. precipitation. The conflictive selection is not further reinforced at the germination stage. Overall, seed germination of dispersed seeds was not affected by seed size, and thereby the selection patterns found for the seed dispersal stage may be diluted at subsequent stages of plant recruitment. Disperser loss without replacement led to a drastic reduction in population size, poor regeneration and genetic diversity decrease that seems to further impact plants' vegetative and reproductive performance.

TS.07-0-10

Room M4, Wednesday 6th Feb. 19.00 h.

Temperature modulates sexual conflict intensity through female harm in *Drosophila melanogaster*García Roa, Roberto¹; Carazo, Pau²; Chirinos, Valeria³

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Increasing evidence shows that the fitness of one sex frequently raises at the expense of the other, so that male and female evolutionary interests cannot be simultaneously maximized. This is termed 'sexual conflict' and is currently acknowledged as a key evolutionary process driving male/female adaptations and population viability. Nevertheless, the causes why this process varies so much in strength across taxa are still unclear, particularly in relation to the ecological context where sexual conflict operates. Here, we explore whether temperature may modulate sexual conflict. Using *Drosophila melanogaster* as a model, we measured the impact of sexual conflict on female fitness (i.e. lifespan, lifetime reproductive success and reproductive senescence) by studying females in a high (i.e. 3 males one female) vs. low (i.e. one male and one female) sexual conflict context, at three different thermal environments: 21°C, 25°C (rearing temperature in the lab) and 29°C. Female fitness suffered the highest decrease (i.e. greater sexual conflict levels) at 25°C. Furthermore, mating frequency and female rejections increased relatively more in the high sexual conflict context at 25°C, which altogether indicates that sexual conflict is greater at this temperature. Our results show that female harm levels can be strongly modulated by thermal shifts in the environment during social interactions, and hence that considering the ecological context of reproductive interactions, and more specifically the thermal environment, is potentially critical to understand sexual conflict in wild populations, and its consequences in terms of population viability.

TS.07-0-11

Room M4, Wednesday 6th Feb. 19.15 h.

The effects of chronic exposure to low-dose radiation in Chernobyl's amphibiansOrizaola, Germán¹; Burraco, Pablo²

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All organisms are naturally exposed to background levels of ionizing radiation. However, human activity has caused the accidental release of vast amounts of radiation to the environment, as in the accidents in the nuclear power plants of Chernobyl (1986) and Fukushima (2011). Although the negative impact of the acute exposure to radionuclides right after the accidents is clear, there is still no scientific consensus about the long-term effects of chronic low-dose radiation for organisms living in contaminated areas. Furthermore, the chronic exposure to radiation may also induce fast adaptive responses in some organisms. Here, we present the results of our work examining the effects that living in areas contaminated by radioactive fallout from the Chernobyl accident has on amphibians, by using the Eastern treefrog (*Hyla orientalis*) as study model. We have conducted an intensive sampling across a gradient of radioactive contamination in Ukraine in order to examine changes in the coloration, immune level, general physiology, age structure, cellular damage, sperm viability, as well as the identity and diversity of the skin microbiome. Evaluating how amphibians cope with the chronic exposure to low-dose ionizing radiation will give us a better understanding of the biological effects of radioactive substances on natural environments, as well as provide us with information about possible fast adaptation processes occurring in the system.

TS.07-0-12

Room M4, Thursday 7th Feb. 12.00 h.

Fine-scale spatial genetic structure in a temperate octocoral: insights into the eco-evolutionary processes underlying the population dynamics in the threatened Mediterranean red coralLedoux, Jean-Baptiste¹; Stipoljev, Suncica²; Ruiz, Carlota³; Lopez-Sendino, Paula⁴; Montero-Serra, Ignasi⁵; Antunes, Agostinho⁶; Linares, Cristina⁷; Stipoljev, Suncica⁸; Ruiz, Carlota⁹; Lopez-Sendino, Paula¹⁰; Montero-Serra, Ignasi¹¹; Antunes, Agostinho¹²; Linares, Cristina¹³; Royer, Jean-Philip¹⁴; Drap, Pierre¹⁵; Garrabou, Joaquim¹⁶

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Characterizing the eco-evolutionary processes underlying population dynamics is a crucial task for evolutionary ecologists because of its conservation implications. The study of fine-scale spatial genetic structure (SGS), the nonrandom spatial distribution of genotypes within a population, is particularly relevant in this context because it allows inferring the interaction among demographic and evolutionary processes acting within populations. *Corallium rubrum*, is a habitat-forming precious octocoral from the coralligenous, one of the most diverse but also most threatened Mediterranean habitats. This long-lived species, showing low population dynamics and restricted dispersal capacity, is affected by overfishing (for its use in jewelry) and warming-induced mortality events. While these two pressures lead to dramatic shifts in population demographic structure, little is known regarding their impact on red coral population dynamics. Here, we combined population genetics (14 microsatellites), demographic surveys and photogrammetric methods to further our understanding of red coral population dynamics and to test how it may be impacted by population decline. First, focusing on a pristine-like population, we showed a decrease of SGS from recruits to adults as expected when recruits thin. Then, we compared the patterns of SGS in three populations with contrasted conservation status to characterize the interaction among demographic structure and eco-evolutionary processes (effective dispersal and genetic drift). We showed that demographic erosion induced a simplification of the network of relationships among colonies impacting the underlying processes. This study sheds new light on the dynamics of the red coral with implications for the restoration of similar species.

TS.07-0-13

Room M4, Thursday 7th Feb. 12.15 h.

Evolutionary dynamics of natural plant populations during range expansion: combining phenotypic and genomic approaches.De Pedro, Manuel¹; Mayol, Maria²; González-Martínez, Santiago C.³; Pannell, John R.⁴; Regalado, Ingrid⁵; Riba, Miquel⁶

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Understanding and predicting the consequences of global change on species persistence and distribution requires considering the extent and potential for local adaptation. Local adaptation is common in plants and animals, but could be compromised in those species that have experienced recent range expansion due to demographic and genetic processes leading to the loss of genetic diversity and the accumulation deleterious mutations (expansion load). Here we present new experimental evidence of the evolutionary consequences of range expansion processes in two non-model plant species: *Thrinchia hispida* (Asteraceae) and *Mercurialis annua* (Euphorbiaceae). Both species are outcrossing and short-lived, distributed along natural climatic gradients, and probably followed distinct range expansions after Quaternary glaciations. We use a number of populations from contrasting environments and covering the whole range of both species to analyze phenotypic and genotypic variation. Our results show that, despite both species have undergone recent range expansions, local adaptation and selection are evident at the phenotypic and genetic levels. Moreover, we found that the accumulation of deleterious mutations (expansion load) in range-front populations of *M. annua* has no negative effect on plant performance (fitness). This study highlights the benefits of integrating both phenotyping and genotyping data to understand the evolutionary mechanisms of local adaptation, which can differ from those of model species.

TS.07-0-14

Room M4, Thursday 7th Feb. 12.30 h.

Phenotypic and genomic data reveal adaptive genetic variation in flowering phenology in a Mediterranean alpine plantLara Romero, Carlos¹; Tabarés Sibille, Pablo²; Sacristán, Sandra³; Prieto, Samuel⁴; Checa, Raquel⁵; Morente López, Javier⁶; Rubio Teso, María Luisa⁷; Torres, Elna⁸; García Fernández, Alfredo⁹; Iriondo, José M.¹⁰

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Mediterranean alpine plants are among the organisms most vulnerable to climate change. Given the importance of flowering onset as a determinant of fitness in the new climate change scenarios, its study is of vital importance for future applications in conservation management. Focusing on *Silene ciliata* as a representative of Mediterranean alpine pastures, in three mountain ranges of the Spanish Central System, we observed that the populations located at the lowest elevation edge (more thermic and drier) bloomed earlier than the populations of the summits (colder and more humid). However, when the same plants were grown in a common garden experiment, plants from the summits bloomed earlier. Plants from the summit populations may be under greater selective pressure to flower earlier and optimize flowering duration, due to the short vegetative period and the positive relationship between flowering duration and reproductive success. These findings were corroborated using quantitative genetic approach (Pst-Fst) in which past selection towards early flowering was found. Results were similar in a subsequent common garden experiment involving populations from Northern and Central Spain in which Northern populations bloomed earlier than populations from Central Spain. To elucidate the genetic basis of these responses we performed an exome capture approach relying on a previously studied *S. ciliata* transcriptome. Results suggested that genes involved in flowering and flower development might play an important role in adaptation to elevation. The combination of both genomic and phenotypic data revealed the existence of adaptive potential for an adjustment to environmental change.

TS.07-0-15

Room M4, Thursday 7th Feb. 12.45 h.

Climate and genetic structure contributes to explain intraspecific genetic variation in defensive anatomical traits of a Mediterranean pine.Vázquez-González, Carla¹; López-Goldar, Xosé²; Zas, Rafael³; Sampedro, Luis⁴

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The ability of trees to overcome the new environmental conditions will depend on the extant intraspecific variation in traits with adaptive value. Although genetic variation in life history traits related to productivity and abiotic stress has been better studied, little is still known about defensive traits. Resin ducts are the structures that store and produce the oleoresin in conifers, and because their role in resistance against biotic stress, they are a valuable proxy to study the defensive investment. In the current study, we explored the inducibility and the genetic variation of resin ducts among populations in *Pinus pinaster* and evaluated whether this variation is explained by the abiotic environment from the origin of populations. To meet our objectives, we used a clonal genetic collection of *P. pinaster* in a greenhouse experiment, including 79 clonally-replicated genotypes from 10 populations covering the species distribution range. We measured resin duct features in phloem and xylem in one clonal replicate and their inducibility in the other. Genetic variation among populations was explored by fitting mixed models, and correlation analysis were performed between resin duct features and climatic variables at the site of origin of populations after accounting for the population relatedness, which was quantified by genotyping 126 SNPs in the experimental material. We found that intraspecific genetic variation in the phenotypic expression of resin ducts was explained by the climate at origin. Moreover, we found that the differentiation of resin ducts in the xylem was inducible, although inducibility did not varied among populations.

TS.07-0-16

Room M4, Thursday 7th Feb. 13.00 h.

Comparing adaptive responses to fire in fire-prone vs. non-fire-prone habitats: *Cistus salviifolius* as a study caseGómez-González, Susana¹; Durán, Mario²; Picó, Sergio³; Ojeda, Fernando⁴

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The importance of fire in the evolutionary history of Mediterranean floras is widely acknowledged. However, within Mediterranean-type ecosystems, there are particular types of habitats that seem to have been more intensely associated with fire than others. When a species occurs in two types of habitats with marked differences in their fire regime, this provides a natural experiment to explore fire selection hypotheses. This is the case of the rockrose *Cistus salviifolius* (Cistaceae), which occurs in fire-prone, Mediterranean heathland (herriza) patches and non-fire-prone, coastal shrubland communities from southwestern Spain. Here, we used this species to identify between-habitat differences in adaptive responses to fire, comparing nine populations from herriza habitats (high-fire) and six populations from close Mediterranean coastal communities (low-fire). We performed a seed germination experiment where seeds of 15 individuals of each population were subjected the following treatments: a) 5 min heat-shock (120°C), and b) no heat-shock (control). After 90 days in a growth chamber under controlled conditions, we measured final seed germination and survival. We found that herriza (high-fire) populations were more dependent on heat shock for germination than populations from coastal shrublands (low-fire), in which seed dormancy was somewhat relaxed (i.e. more seeds were capable of germinate without heat shock treatment). Our results highlight the prominent role of fire in selecting for seed germination cues. Together with previous evidence, they also suggest that the herriza outstands among Mediterranean plant communities by its tight relationship with recurrent fire.

TS.07-0-17

Room M4, Thursday 7th Feb. 13.15 h.

Rotifers and environmental unpredictability: a genotype-phenotype-environment mapping approachSerra, Manuel¹; Franch-Gras, Lluís²; Tarazona, Eva³; García-Roger, Eduardo M.⁴; Carmona, María José⁵; Africa, Gómez⁶

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Bet hedging is a predicted adaptation to unpredictability that needs testing. Most rotifers are aquatic invertebrates that proliferate asexually and produce sexually diapausing eggs able to survive adverse conditions, which occur in their habitats after a period of fluctuating length. We use bet-hedging theory to propose and test predictions on traits related to rotifer diapause (e.g., propensity for sex, investment in sex, hatching fraction of diapausing eggs) in relation to unpredictability of the length of the growing season. We studied both field and experimentally-evolving populations of the rotifer *Brachionus plicatilis* from ponds in Eastern Spain and performed (1) a quantification of the environmental unpredictability for field populations, after satellite-acquired time series of water cover, (2) diapause-related traits measured after controlling for genetic variation, and (3) genomic analysis. We found that these rotifers adaptively diverge in relation to the unpredictability in their localities, evolution being fast. Early sex is associated to environmental unpredictability. However, in contrast to experimental populations, in field populations diapausing-egg hatching fraction –being always intermediate– is not lower in environments with higher unpredictability. In field populations bet hedging in diapause-related traits occurs via selection of optimal genotypes for the focal traits, rather than by the production of genetic variance. Our data suggest that adaptive tracking and low heritability in the field should be considered when interpreting departures from expectations. Finally, we found that environmental features and diapause-related traits relate to suites of specific genes, even if the molecular mechanisms linking these genes with life history are still unknown.

TS.07-0-18

Room M4, Thursday 7th Feb. 15.00 h.

Temperature as a modulator of sexual selectionCarazo, Pau¹; García-Roa, Roberto²; Garcia-Gonzalez, Francisco³

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Sexual selection is a fundamental engine of biodiversity and adaptation, as well as a keystone determinant of population viability. A central question in ecology and evolution is thus to disentangle the causes why sexual selection varies so much in strength across taxa. Here we examine the role of temperature, a crucial abiotic ecological factor at a global taxonomic scale, as a modulator of sexual selection and sexual conflict. We outline pathways by which temperature can affect the opportunity for and strength of sexual selection. Our aim is to lay out a framework for future studies that can significantly advance our understanding of how ecology modulates sexual selection and sexual conflict, and foster insight into the impact of global warming on biodiversity loss.

TS.07-0-19

Room M4, Thursday 7th Feb. 15.15 h.

Premating isolation in rapidly evolving organisms: The case of rotifer *Brachionus plicatilis*Jezkova, Ivana¹; Ortells, Raquel²; Serra, Manuel³

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Studying reproductive isolation among populations is one of the main keys to understand the stability of local adaptation, speciation, and further to understand the origin of biodiversity. Following population differentiation that can arise as a result of adaptation to the local environment or genetic drift, speciation is described as associated to the reproductive isolation among populations. Post-zygotic reproductive isolation often precedes the appearance of the pre-zygotic one, but because the cost of sexual reproduction is not negligible, pre-zygotic (especially premating) isolation is also crucial for to stabilize genetic divergence. The zooplanktonic, fast-growing, facultatively sexual rotifer *Brachionus plicatilis*, inhabiting saline water bodies, is a perfect model to study the phenomena mentioned above. Its populations show a strong phylogeographic structure in Spain, as well as local adaptation patterns. Additionally, this species shows a discriminating mating behaviour in relation to its sibling species. However, little is known about the divergence in mating behaviour within this species. Here we use *B. plicatilis* clones from the Spanish ponds to reveal the pattern of premating isolation among the different populations. We measured mating preferences by performing behavioural assays. The hypothesis tested is that premating reproductive isolation increases with phylogenetic distances and the divergent adaptation to the environmental unpredictability in their localities. As *B. plicatilis* does not release any sexual hormones, male-female encounter is random, and the recognition male-female is contact mediated, we also expect that the level of reproductive isolation will be related to the differences among the mate recognition protein responsible for such recognition.

TS.07-0-20

Room M4, Thursday 7th Feb. 15.30 h.

Reduced diversity and chemical divergence after invasion: random events or rapid evolution?Castells, Eva¹

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Predictive models of climate change anticipate a higher water stress on terrestrial ecosystems that will increase plant mortality, community composition and species distribution. Climate change may also induce a rapid evolutionary responses that mitigate the adverse effects of climate change on plants. Biological invasions offer unique strategies to evaluate rapid evolutionary changes to novel environmental conditions. *Senecio pterophorus* is a shrub native from Eastern South African recently introduced into the Western Cape, Australia and Europe in multiple and independent invasions. Individual plant traits (e.g. biomass, SLA) from the invasive areas have rapidly evolved to cope with an increased water stress. Here I aimed to determine i) whether plant chemical composition have changed after invasion and ii) whether these changes are driven by random events related to the colonization history or by selective pressures due to changes in the abiotic and biotic environment. Chemical diversity was higher at the native range and decreased in the non-native areas. Moreover, the chemical profiles diverged across distinct invasive areas. The broad positive correlation between the genetic and chemical distance suggests that the biogeographical differences in plant chemistry were primarily caused by the idiosyncrasy of the invasion. However, one chemotype unique of the native area could have been negatively selected in all the invaded areas. The decrease in plant chemical diversity and divergence associated to biological invasions can have consequences on the ecosystem functioning.

TS.07-0-21

Room M4, Thursday 7th Feb. 15.45 h.

Phenotypic anomalies assessment in a population affected by genetic surfingRodríguez Caro, Roberto Carlos¹; Moreno, Marina²; Jiménez-Franco, María Victoria³; Botella, Francisco⁴; Giménez, Andrés⁵; Graciá, Eva⁶

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Genetic and environmental factors can affect the formation of phenotypic anomalies in wildlife species, so it is important to study anomalies in order to preserve and manage animal populations. In tortoises, carapace anomalies are easily detected and can be a proxy of the fitness of the individuals. The aim of the present study is to analyse the morphological anomalies in spur-thighed tortoise (*Testudo graeca*) at individual level (e.g. sex and age) and at population level (genetic diversity and environmental variables). We monitored 20 samples sites in the southeast of Spain from 2005 to 2017. The species originated in North Africa between 10.000 - 20.000 years ago and was affected by genetic surfing (strong genetic drift). This process resulted in a progressive loss of genetic diversity, individual quality and fitness from the starting point of the expansion to the edge of the distribution. The results of this study showed that anomalies are not significantly related to sex or age. Lastly, at population level, the proportion of animals with phenotypic anomalies was negatively correlated with the geographical distance to the starting point of the population expansion. The progressive loss of fitness related to the expansion of the population can be an evidence of genetic surfing and load expansion theories, which predict that expanding populations incur a mutation burden and may reduce genetic diversity and fitness in the edge of expansion. Consequently, these processes may slow down population expansions and limit the species' distributions.

TS.07-0-22

Room M4, Thursday 7th Feb. 16.00 h.

Using a niche and trait-based approach to disentangle the radiation process of the Aeonium alliance in Macaronesiados Santos, Patrícia¹; Serrano, Helena²; Pinho, Pedro³; Matos, Paula⁴; de Vos, Jurriaan⁵; Branquinho, Cristina⁶

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Adaptive radiation is a process of rapid speciation based on adaptations to new environmental niches and resources. It leads to spectacular arrays of morphologically and ecologically diverse species, such as the Darwin finches from the Galapagos or the Caribbean Anolis lizards. In plants, adaptive radiation is also frequently invoked to explain many enigmatic radiations, but in a strict sense, it has never been conclusively demonstrated. Demonstrating adaptive radiation requires establishing that closely related species co-occur due to divergence in ecological traits critical for survival. We empirically test the adaptive radiation hypothesis in the Aeonium alliance from the Canary Islands, the most speciose plant radiation in Macaronesia, which evolved from a single ancestor. Most species are single-island endemics, local in occurrence, and restricted to specific habitats. Aeonium displays great morphological variation, but it remains unclear whether species radiated due to ecological specialization (adaptive radiation) or an event of explosive diversification without diverse ecological roles among closely related species (e.g. due to among-island allopatric speciation). Currently we are testing if putatively important species traits (such as leaf succulence, thickness, inflorescence architecture, arrangement and number of floral organs, flowering season, habit) are uniquely associated with particular bioclimatic niches, and whether such traits and niches differ among closely related species. The relationship between morphology, niche, and relatedness in this iconic group could reveal fundamental insights into the eco-evolutionary processes that explain enigmatic radiations.

TS.07-0-23

Room M4, Thursday 7th Feb. 16.15 h.

Intra-specific genetic variation at early fitness traits across different spatial scales in European *Pinus pinaster* populationsSolé, Aida¹; Hurel, Agathe²; Robledo-Arnuncio, Juan José³; González-Martínez, Santiago C.⁴; Notivol, Eduardo⁵; Vendramin, Giovanni Giuseppe⁶; Piotti, Andrea⁷; Ramírez-Valiente, Jose Alberto⁸

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Pinus pinaster is a Mediterranean conifer distributed across Western Europe and Northern Africa, from sea level up to 2000 m in elevation. Differential selective pressures caused by environmental heterogeneity can drive the evolution of adaptive divergence even at small spatial scales. In this study, we examined patterns of intraspecific variation in early fitness traits (germination, initial ontogenetic stages and survival) in two contrasting common garden trials. Seeds for the trials were collected from 14 populations: 8 from Spain, 4 from France and 2 from Italy. Sampled populations were distributed in pairs, with paired populations spatially close but ecologically distant (as determined by steep gradients in elevation and/or water availability). All the traits studied showed differences among populations, and a few within population pairs. Germination date was correlated with climatic and geographic variables of the site of origin and with the population mean seed weight. The germination date influenced most of the traits studied, with populations germinating earlier showing greater survival and slower development. The two populations of the Baetic Range were the earliest to germinate and exhibited high germination and survival rates. By contrast, 5 out of the 6 populations with lowest survival rate were also from Spain. Our results indicate strong intra-specific variation in early fitness traits underlying the regeneration niche of the species, mostly at broad spatial scales but even at over few hundreds of meters. This knowledge could help in decision making for adaptive forest management and conservation in the face of climate change.

TS.07-0-24

Room M4, Thursday 7th Feb. 16.30 h.

Relationship between genetic variation in resistance to a key insect herbivore and inducible plant secondary metabolites in maritime pineLópez-Goldar, Xosé¹; Villari, Caterina²; Grivet, Delphine³; Bonello, Pierluigi Enrico⁴; Borg-Karlson, Anna Karin⁵; Zas, Rafael⁶; Sampedro, Luís⁷

(1) Misión Biológica de Galicia (MBG-CSIC); (2) Daniel B. Warnell School of Forestry, University of Georgia; (3) CIFOR-INIA; (4) The Ohio State University; (5) Royal Institute of Technology, Stockholm; (6) Misión Biológica de Galicia (MBG-CSIC); (7) Misión Biológica de Galicia (MBG-CSIC)

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Plant secondary metabolites (PSM) have been widely recognized as relevant traits with strong adaptive value in resistance to herbivores, although the coevolution between PSM and plant enemies is not completely understood, particularly in long-lived plants. We aimed to explore whether the intraspecific variation in resistance to a key herbivore may be explained by the variation in PSM. We used (i) maritime pine clonal genotypes from populations along its distribution range, and (ii) the large pine weevil as an herbivore model, a chewing insect that causes severe damage and decreases survival of conifer seedlings. We exposed constitutive (control) and methyl-jasmonate induced clonal copies of the same genotypes to the pine weevil to measure effective resistance, and, simultaneously, we sampled clonal copies non exposed to herbivory for PSM characterization. We explored the structure of the genetic variation in both constitutive and induced resistance, and looked for relationships between PSM and resistance in both defensive modes, accounting for genetic relatedness among plant genotypes. Resistance largely varied among –but not within– populations. MJ-induction strongly increased resistance, reducing the damage to half compared to non-induced plants. The increase of resistance varied among genetic groups of populations but not among populations themselves, indicating that closely related populations were more similar than distantly related ones for the trait. Specific PSM largely predicted variation in resistance but, whereas constitutive did not show a particular trend towards greater or reduced resistance, induced changes in PSM profile and concentration revealed a pattern of increased resistance to herbivory.

TS.07-0-25

Room M4, Thursday 7th Feb. 16.45 h.

Vegetative anthocyanins are needed to generate stable petal colour polymorphism in an annual plant

del Valle García, José Carlos¹; Alcalde Eon, Cristina²; Escribano Bailón, María Teresa³; Buide del Real, María Luisa⁴; Whittall, Justen Bryan⁵; Narbona Fernández, Eduardo⁶

(1) Universidad Pablo de Olavide; (2) Universidad de Salamanca; (3) Universidad de Salamanca; (4) Universidad Pablo de Olavide; (5) Santa Clara University; (6) Universidad Pablo de Olavide

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Anthocyanins are the major source of colour in flowers and may be also accumulated in vegetative tissues, where perform multiple protective roles traditionally attributed to other flavonoids (flavonols, flavones, etc.). Loss of anthocyanin pigmentation in petals is common across angiosperms but these mutants generally disappear and relatively few cases lead to stable flower colour polymorphism. Theory predicts that localized loss of anthocyanins in petals allows plants to escape from their negative pleiotropic effects in vegetative organs. We study the frequency and biochemical profile of three phenotypes of *Silene littorea*: anthocyanic wild-type, loss of anthocyanins in petals and loss of anthocyanins in the whole plant. Phenotypes lacking anthocyanins only in petals represent stable polymorphism in two populations of the northwest distribution area (mean frequency 8-17%), whereas the phenotype lacking anthocyanins in the whole plant was found across the species range at very low frequency (<1%). *Silene littorea* plants produced anthocyanins and flavones. Loss of anthocyanin pigmentation, either in petals or in the whole plant, does not influence the ability of these phenotypes to synthesize flavones, and this pattern was congruent among populations. Our results suggest that presence of anthocyanins in vegetative tissues seems necessary to generate stable petal colour polymorphisms.

TS.07. Posters

TS.07-P-1

External pavilion, Poster session 2: Wednesday 6th - Thursday 7 th Feb.

How do lizards survive wildfires?Álvarez Ruiz, Lola¹; Belliure, Josabel²; Pausas, Juli G.³

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The role of fire as an important selective pressure shaping plant traits has been well demonstrated in many ecosystems, including Mediterranean ones. However, the evolutionary role of fire on animals has been poorly explored. Wildfires have strong effects on reptile communities. However, after a wildfire, no significant mortality has been found in lizards. Due to their body size, some lizards are likely to survive sheltering in crevices or under rocks. Reptiles use the smell (chemical communication) to detect threats and flee. A threat faced by reptiles in Mediterranean ecosystems is fire, and a stimulus of this threat is the smoke. We aimed to evaluate the response of the lizard *Psammotriton auratus* to the smoke, and whether this reaction is adaptive in fire-prone ecosystems. To test this, we evaluated the response to smoke of lizards from populations inhabiting fire-prone ecosystems, compared to those living in non-fire prone ecosystems. We predicted different behavioral responses between fire regimes, in such a way that populations living in fire-prone ecosystems will be more sensitive to fire stimulus than those living in an ecosystem that rarely burn. In agreement to this hypothesis, we found that lizards from high fire regimes showed a faster reaction to the smoke. This study provides evidence that fire is an important evolutionary driver for animals shaping fire adaptations. Understanding how animals respond to fire is important to fully comprehend ecological and evolutionary processes, as well as for species conservation in a changing fire regime world.

TS.07-P-2

External pavilion, Poster session 2: Wednesday 6th - Thursday 7 th Feb.

Are marine life history strategies different from terrestrial ones?Capdevila, Pol¹; Begger, Maria²; Blomberg, Simon P.³; Hereu, Bernat⁴; Linares, Cristina⁵; Salguero-Gómez, Roberto⁶

(1) Universitat de Barcelona; (2) University of Leeds; (3) The University of Queensland; (4) Universitat de Barcelona; (5) Universitat de Barcelona; (6) Oxford University

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Life history theory seeks to understand the principles shaping the different demographic schedules (combinations of survival, development, and reproduction) that can be observed across the tree of life. However, most fundamental works developing the principles of life history theory have been based on charismatic, terrestrial taxa, being especially neglectful of marine species. A critical consequence of such biases is the lack of a validated generalisation of life history principles. Using an unprecedented amount of demographic information for terrestrial and marine species worldwide, we found a striking differentiation of marine life histories compared to terrestrial species. Globally, trade-offs structured species along two axes of variation: the first described the species' pace of life, while the second described their reproductive strategies. Contrary to life history theory predictions of greater longevity and lower reproduction in more constant environments, marine life histories were constrained to intermediate paces of life, and more reproductive than terrestrial ones. Terrestrial life history strategies were also more diverse than marine species', in line with higher speciation rates and biomass of land species. These results will be discussed in the light of their implications for conservation, focusing on the differences in the demographic rates that confer resilience to both marine and terrestrial species. Our findings have wide-reaching implications and beg for a more holistic re-evaluation of life histories across the tree of life and of species management, particularly in the marine environment.

TS.07-P-3

External pavilion, Poster session 2: Wednesday 6th - Thursday 7 th Feb.

Being in better body condition allows tolerating higher parasite infectionComas, Mar¹

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Parasites are one of the main selective force in nature, affecting fitness and body condition of individuals. Still, we poorly know how parasite prevalence and intensity vary depending of the body condition of the individuals. Here, I study how the prevalence and intensity of blood-sucking mites on the Atlas day gecko (*Quedenfeldtia trachlyblepharus*) vary along an elevational gradient in the High Atlas (Morocco). These geckos are alpine specialist and are more abundant and show higher body condition at higher altitudes. Prevalence did not vary with altitude or sex. However, I found a negative relationship between prevalence and body condition (when statistically controlling for sex and altitude; Estimate = -3.86, Wald Statistic = 5.18, $p = 0.023$). The intensity of infection ranged from 0 to 16 mites per host, with a mean intensity of 3.0 ± 2.6 ($n = 46$). I found a positive relationship between intensity and body condition, considering sex and altitude ($F_{1,42} = 6.2$, $p = 0.017$). However, I found no significant differences in intensity with altitude or sex. In conclusion, geckos in better body condition harboured higher parasite loads, but animals with the highest values of body condition were not infected. These findings suggest that animals with a good body condition may tolerate higher mite infections; however, only animals with the highest values of body condition may resist infection.

TS.07-P-4

External pavilion, Poster session 2: Wednesday 6th - Thursday 7 th Feb.

Improving the ecological knowledge of Eurasian otter in the Segura river basin (SE Iberian Peninsula)Dettori, Ettore Emanuele¹; Zapata-Perez, Victor Manuel²; Bruno, Daniel³; Soto-Otón, Inmaculada Concepción⁴; Rubio-Saura, Nuria⁵; Millan, Andrés⁶; Velasco, Josefa⁷; Balestrieri, Alessandro⁸; Robledano-Aymerich, Francisco⁹

(1) Universidad de Murcia; (2) Universidad de Murcia; (3) Instituto Pirenaico de Ecología (IPE-CSIC); (4) Universidad de Murcia; (5) Universidad de Murcia; (6) Universidad de Murcia; (7) Universidad de Murcia; (8) University of Pavia; (9) Universidad de Murcia

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We evaluated the distribution, habitat use and diet of otter (*Lutra lutra*) in the Segura River and its tributaries from Murcia Region within the project LIFE13BIO/ES/001407 RIPISILVANATURA. In the last 30 years, *Lutra lutra* has expanded its range associated to the improvement of water quality in the Segura river basin. We surveyed (1-10 times) 30 stretches (mean length \pm SD = 0.5 ± 0.3 km) between April 2016 and June 2018, recording the visible spraints of the otter, covering a 109.78 km long section of the river. Habitat suitability and quality was assessed by measuring environmental parameters (speed, turbidity and width of the water sheet, river backdrop, water regime, percentage of riparian vegetation on each river side and of aquatic vegetation, dominant vegetation, presence of human waste, use of the waterbody, geographic coordinates). The relationship between the environmental variables and presence / absence of the otter was evaluated by Logistic Regression Analysis (LRA), testing the statistical significance of each coefficient in the model through the Wald test. Otter presence was detected in 27 stretches (90%), while the percentage of positive surveys was 35%. A total of 585 spraints were collected with more of 12 types of prey determined. Mean number of spraints per 100 m was 3.72. Fish and Crustaceans formed the bulk of otter diet (frequency of occurrence > 50% each), with invasive crayfish *Procambarus clarkii* as the dominant invertebrate prey.

TS.07-P-5

External pavilion, Poster session 2: Wednesday 6th - Thursday 7 th Feb.

Does fire select for sexual precocity in *Pinus halepensis*?Guiote, Carmen¹; García Pausas, Juli²

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Due to the close and ancient relationship between plants and fire in Mediterranean ecosystems, forest fires have exerted a strong selective pressure on plants and, as a consequence, they have acquired a series of features that allow them to resist and regenerate in an environment with repeated fires. For post-fire regeneration, *Pinus halepensis* populations depend on the degree of serotiny (that is, the number of cones that are closed and have not dispersed their seeds previously) and the age at which they begin to produce seeds (if it is higher than the fire interval, pine populations will not be able to regenerate). The present study examines the factors that determine the variability in these traits associated with fire, in order to understand and predict the potential of post-fire regeneration of the populations of this species in a world with increasing fire activity. For this purpose, we have selected 14 plots with contrasted fire regimes on the Valencian Community and we evaluated for each population the age of first reproduction, the degree of serotiny (percentage of cones closed in relation to the total) and the amount of cones produced during the first years of life. Our results show a significant effect of fire regime in these traits, indicating a selective process towards early seed production (precocity) and an accumulation of a larger canopy seed bank with increasing fire recurrence.

TS.07-P-6

External pavilion, Poster session 2: Wednesday 6th - Thursday 7 th Feb.

Experimental test of the trade-off between immune response and growth in blue tit nestlingsMoreno-Rueda, Gregorio¹

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Life-history theory predicts that the different traits related to fitness cannot be maximized, as resources invested in one trait cannot be used in another trait. Consequently, trade-offs between different traits emerge, giving an optimal level of investment in each trait. The immune system is key in fighting pathogens. However, investment in the immune system typically should be traded with other fitness-related components, such as growth. Growth rate, by another hand, is an important component of fitness, especially in growing organisms. Accordingly, some studies give support for a trade-off between immune system and growth in bird nestlings, but those studies did not control for food consumed by nestlings, which casts doubts on their conclusions. Here, I tested the existence of a trade-off between immune response and growth rate in blue tit (*Cyanistes caeruleus*) nestlings, controlling for food received by each nestling. Nestlings inoculated with an antigen (LPS) grew 45% less than control nestlings, in spite of to eat only 9% less food than control nestlings. In conclusion, this study provides convincing evidence that nestlings combating pathogens may show impaired growth.

TS.07-P-7

External pavilion, Poster session 2: Wednesday 6th - Thursday 7 th Feb.

Genomic and phenotypic differentiation of *Arabidopsis thaliana* across the south-western Mediterranean hotspotPicó Mercader, Xavier¹; Marcer, Arnald²; Alonso-Blanco, Carlos³

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Arabidopsis thaliana is an outstanding model plant to conduct evolutionary studies dealing with adaptation and differentiation. The reason is the powerful combination of dense regional collections of natural populations from diverse environments across the distribution range, detailed phenotypic characterisation of life-history traits, and the availability of complete genome sequences. We present some major findings from a long-term research conducted on *A. thaliana* from SW Mediterranean Basin (Spain, Portugal and Morocco) to unravel the evolutionary ecology and the genetic basis of adaptation to environmental variation. For example, a relict genetic lineage has been found to occur across the region, which represents the deepest history in the differentiation process of *A. thaliana*. The species exhibits a strong isolation-by-distance pattern indicating limited geographic seed dispersal. This is important as it partially accounts for the spatially explicit variation in fitness-related life-history traits shown by *A. thaliana* in greenhouse and field conditions. We recently found that the minimum temperature-driven relationship between seed dormancy and flowering time probably underlie local adaptation in *A. thaliana*. In particular, *A. thaliana* from warmer environments exhibited deep seed dormancy coupled with early flowering time. Experimental data from transplant experiments clearly showed that selection mostly acts on flowering time. Interestingly, selection is heterogeneous, favouring early and late flowering phenotypes depending on the effects of the environment on survivorship and fecundity. Finally, we also show how environmental and phenotypic genome-wide associations represent powerful approaches to detect known and new genes as candidates for adaptation to temperature variation by adjusting flowering time.

TS.07-P-8

External pavilion, Poster session 2: Wednesday 6th - Thursday 7 th Feb.

Population differentiation and plasticity to drought in populations of a gypsophile along an environmental gradientRamos Muñoz, Marina¹; Blanco-Sánchez, Mario²; Matesanz, Silvia³; Escudero, Adrián⁴

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To understand the role of phenotypic plasticity as response of plants to climate change is one of the main challenges in evolutionary ecology. This is particularly true in species that have limited migration capacity, such as plants that only grow in gypsum. In this study, we have evaluated phenotypic plasticity patterns for a wide range of functional traits (phenological, morphological, growth, fitness, etc.) in four populations of *Lepidium subulatum*, one of the dominant species of gypsum environments in the centre of the Iberian Peninsula. Populations were sampled along an environmental gradient of rainfall and temperature. We assessed plasticity to drought because water is the most limiting environmental factor in the Mediterranean. We used a common garden approach in seminatural conditions, with the plants growing outdoors in gypsum substrate. To evaluate phenotypic plasticity, we conducted a drought experiment with water exclusion structures. We observed that all populations showed plasticity to water stress adjusting their functional traits to tolerate resource scarcity: reducing its size, producing smaller leaves and advancing its flowering date. Moreover, we found clear differences among populations in both treatments. Our results suggest that these populations can tolerate variable degrees of stress conditions, and point out that plant populations from extreme environments may use plasticity to cope with environmental severity. We discuss the implications of these differences for climate change responses.

TS.07-P-9

External pavilion, Poster session 2: Wednesday 6th - Thursday 7 th Feb.

Flower colour polymorphism and reproductive isolation in *Lysimachia monelli*Sánchez Cabrera, Mercedes¹; Narbona, Eduardo²; Ortiz Ballesteros, Pedro³; Arista, Montserrat⁴

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Flower colour plays an important role in pollinator attraction, but pigments accounting for that colour also provide protection against both biotic and abiotic stresses, thus affecting reproductive success and survival of plants. Some plant species have flower colour polymorphism, presenting two or more colour morphs, what could cause reproductive isolation and species divergence in long-term. Reproductive isolation evolution represents an essential component for species formation and maintenance, and it usually depends on numerous reproductive barriers. *Lysimachia monelli* (Primulaceae) is a flower-colour polymorphic species with two morphs (blue and orange) totally isolated by pre-zygotic geographic barriers. Our aim is to know what degree of reproductive isolation would exist between both morphs if there were a secondary contact, and thus to assess where they are in the process of evolutionary divergence. We collected plants of both morphs along their geographical ranges (Spain, Portugal, Morocco and Italy). In glasshouse, we made 1414 hand pollinations within and between morphs resulting in 776 fruits of which 427 were from crosses between morphs. We germinated seeds from these fruits and measured vigour of the resulting seedlings. We also measured flower colour of parents and F1 progeny with spectrophotometer. In the F1, orange was the predominant colour and blue only appeared when mother was blue. Our results suggest that post-zygotic barriers between blue and orange *L. monelli* seem to be very weak in the first generation. In order to be more conclusive, we will have to wait for the results provided by the second generation.

Thematic Session 08: Extreme events ecology

Day: Thursday 7th February

Schedule: 12:00h 13:30h - 15:00h 17:00h

Location: Room A4

Coordinators:

Julia Chacón Labella, INIA, Spain

Enric Batllori Presas, CREAF; UB, Spain

Cristina García, CIBIO/InBIO, Portugal

Francisco Lloret Maya, CREAF; UAB, Spain

Extreme ecological events (EEEs) are highly infrequent events with a very large or very low magnitude compared to the historical bounds of systems' variation that can trigger disproportionate –positive or negative– consequences for any given aquatic or terrestrial ecosystem. From an ecosystem point of view, EEEs can be classified as extrinsic or intrinsic forcings of the structure, composition and functioning of ecosystems. For instance, climate extremes and their physical impacts –extrinsic forcings such as heat waves, floods, extreme drought, mega-fires– are key drivers of ecological dynamics that are forecasted to increase in frequency, magnitude, and duration in the following decades. Similarly, species-dependent drivers of community assembly and dynamics such as long distance dispersal events –intrinsic forcing– may be paramount in determining range shifts, shaping the scale of genetic and demographic spatial patterns, and driving the advance of invasive species under changing environments.

The session intends to provide a broad, cross-scale perspective of the effects of EEEs and their regime on ecosystems, including terrestrial and aquatic environments, to better understand their impacts in shaping ecological and evolutionary dynamics and the response of ecosystems to ongoing climate change. Results from experiments, targeted field studies, modelling approaches, long-term monitoring programs or sensor networks are welcomed. This session is organized in parallel and complemented by a proposed workshop that will provide the basic knowledge to apply statistics of extremes to ecological data.

TS.08. Oral talks**TS.08-O-1**

Room A4, Thursday 7th Feb. 12.00 h.

Perturbations and non-linear population dynamics in social animalsOro de Rivas, Daniel¹

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Perturbations, as extremes of the environmental variability, may trigger non-linear responses in populations. Non-linearities can be of different nature, from regime shift through abrupt transitions and collapses to tipping points and critical transitions. Below the level of populations, responses to perturbations occur at individual level (e.g. physiological, behavioural, demographic), but in social animals, some of these responses are affected by the social environment. For instance, a potential response to perturbations is dispersing to alternative patches. In social species, dispersal decisions are made depending on what conspecifics do following a feedback mechanism that may either accelerate or hamper non-linearities in population dynamics. Theoretical models, such as the logistic growth, do not consider shifts to negative growth rates from an unstable state of carrying capacity to a stable state of extinction. I explore here some of these models (logistic growth and Allee, density-independent models and models in which growth rate is an allometric power of population density) taking into account the role played by dispersal runaway between patches. I also give an example of a community of social species affected by the same perturbation regime at large spatio-temporal scale and some of the non-linearities observed. The density-independent model does not fit well with the dynamics observed, whereas the logistic and particularly the negative exponential model with dispersal runaway predict much better these dynamics. The mechanistic explanation is related to a behavioural trade-off between two opposite positive social feedbacks (philopatry and dispersal) with fitness consequences.

TS.08-O-2

Room A4, Thursday 7th Feb. 12.15 h.

Threshold responses in bird mortality driven by extreme wind eventsLouzao Arsuaga, Maite¹; Gallagher, Ruairi²; García-Barón, Isabel³; Chust, Guillem⁴; Intxausti, Iñaki⁵; Albisu, Joxan⁶; Brereton, Tom⁷; Fontán, Almudena⁸

(1) AZTI; (2) AZTI; (3) AZTI; (4) AZTI; (5) Centro de Recuperación de Fauna Silvestre de Bizkaia; (6) Centro de Recuperación de Fauna Silvestre Arrano Etxea; (7) Marine Life; (8) AZTI

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Changing environmental conditions can have non-linear effects from populations to ecosystems, which could increase following the strengthening of human activities. Investigating the potential role of threshold responses to increasing extreme events could help elucidate the mechanisms conferring resilience to populations and ecosystems. Among the potential impacts of extreme weather events, the assessment of mortality deserves particular attention for long-lived species. The aim of the present work is to uncover the link between extreme wind events and bird mortality for the 2004-2014 in southern European waters, to detect potential threshold responses. We employed a multi threshold wind speed approach to identify the criteria yielding the strongest predictions. By focusing on a highly vulnerable species, the common guillemot *Uria aalge*, we hypothesized that bird mortality would be related to a cumulative effect of extreme wind events. At the weekly scale, cumulative patterns of extreme wind events and bird mortality were correlated which followed similar sigmoidal temporal patterns, reaching an asymptote especially during heavier winters. The period of maximum mortality fell within the time-frame of maximum extreme events during winter (beginning of December-end of February). We identified a threshold in extreme wind events above which birds experience consistently increased mortality, which was especially evident in the winter 2013/2014. Our methodological approach provides insights on the definition of the number of extreme wind events that should serve as a warning signal to activate the coordination of local administrations and volunteers to anticipate the occurrence of bird mass-mortality events.

TS.08-0-3

Room A4, Thursday 7th Feb. 12.30 h.

Individual and collective behaviors of ecological communities: The example of biological invasionsZelnik, Yuval¹; Arnoldi, Jean-Francois²; Loreau, Michel³

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A longstanding debate in community ecology is whether community patterns are a result of individual species traits or a collective behavior of the entire community. This can be traced back to the work of Clements on community succession as a collective phenomenon and that of Gleason on individualistic plant associations. We propose tackling this dichotomy by considering how a community responds to an introduction of a novel species (e.g. species invasion). We consider two specific questions: whether the introduced species will survive, and if it will lead to a regime shift (given that it survives). We show that the first issue relates directly to individualistic traits, while the second one is determined by the interplay of individual and collective properties. We then propose that indirect effects reflect the degree of collective integration of a community and deduce a methodology to quantify collective integration. To demonstrate the relevance of our definition of collective integration we look at a community's response to perturbations, and in particular the possibility of a far-reaching regime shift due to invasions, along an axis of collective integration. We can thus think of different ways for detecting this property using response to perturbations as a method of probing such complex systems. By considering the property of collective integration, tied to explicit examples such as the community's response to novel species, we hope to bring a dialectical resolution to the question of whether communities behave as a collective or as a loose set of species.

TS.08-0-4

Room A4, Thursday 7th Feb. 12.45 h.

A novel procedure to assess post-disturbance ecosystem dynamics from compositional and structural changesSánchez-Pinillos, Martina¹; Leduc, Alain²; Ameztegui, Aitor³; Kneeshaw, Daniel⁴; Coll, Lluís⁵

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Understanding and measuring post-disturbance ecosystem dynamics have emerged as key priorities in ecology and management. The increasing incidence of extreme ecological events may exceed the capacity of ecosystems to respond, leading to new undesired states, and affecting the functioning and provision of services. Identifying the principal dynamic patterns resulting from disturbances and the environmental factors involved in ecosystem responses to the disturbances are key for detecting ecosystem vulnerability to collapse. We introduce a procedure based on combining pathway analysis of composition and structure of ecological communities affected by disturbances with quantitative indices of resistance and resilience. The goal of this procedure is to answer three relevant questions on the impacts of disturbances in ecosystem dynamics: Which are the most resistant and resilient communities? What environmental factors are involved in post-disturbance community responses? How prone is a community to losing its resilience and collapse? To do this, we propose multivariate similitude indices based on changes in the composition and structure of communities to compare their resistance and resilience to past disturbances. Further, these indices can be used in statistical models to assess the effect of environmental factors on such responses. Descriptive analyses of post-disturbance successional pathways also provide qualitative information on the changes caused by disturbances. Finally, early identification of ecosystem collapse can be determined by understanding pathways towards abrupt, long-lasting, and widespread changes in ecosystem state and dynamics.

TS.08-0-5

Room A4, Thursday 7th Feb. 13.00 h.

Do newly established forests respond differently to extreme climatic events than pre-existing ones?Alfaro Sánchez, Raquel¹; Diez Nogales, Oihane²; Diez, Oihane³; Pino, Joan⁴; Palmero-Iniesta, Marina⁵; Jump, Alistair⁶; Espelta, Josep⁷

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Although deforestation is still considered a major threat for biodiversity conservation at a global scale, in Europe the abandonment of marginal agricultural lands has promoted a steady establishment of “new forests” during the XX century. In Spain almost 22% of current forests were established after 1950 and they account for 25% of the total carbon pools. This trend of expansion is expected to continue alongside predicted increases in the magnitude, frequency and duration of extreme climatic events. It is, therefore, highly important to determine how these new forests will face extreme events, particularly those located at the already hot and dry ‘xeric limit’ of a species’ distribution. Beech (*Fagus sylvatica*) is one of Europe’s most abundant broadleaf trees. Beech forests in Catalonia (NE Spain) are located at the southern edge of this species’ distribution in Europe and offer a unique opportunity to compare the growth patterns, climate response and resilience to extreme events for new and pre-existing forests. We established 19 monitoring plots in 2017 (6 plots in pre-existing forests and 13 plots in new forests). From these plots we collected forest inventory and dendroecological data. Our preliminary analyses indicate that new beech forests are growing faster than pre-existing ones yet they are less sensitive to extreme drought events than established forest when comparing similar age classes. We hypothesise that the more scatter establishment of trees in the new forests coupled with their development in areas with deeper and more fertile soils could have driven the observed higher growth rates.

TS.08-0-6

Room A4, Thursday 7th Feb. 13.15 h.

Identification of “stress memory” from tree ringsLi, Yan¹; Zhang, Qi-Bin²

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Juniper trees on the Tibetan Plateau (TP) could live several hundred years during which there were recurrent climate extreme events. Given that the TP forests are widely considered vulnerable to climate extremes, one question arose is how do trees maintain high resilience to the extreme events. We hypothesize that the trees develop “stress memory” following climate extremes and such “memory” enhances tree resilience to subsequent events. Previous studies of “stress memory” have been mostly restricted to herbs for short time spans, few is about trees for longer term. Here we use ring-width data from 409 trees in 14 sites of juniper forests on the TP to examine whether or not there is signals of “stress memory” in growth response of trees to recurrent extreme events. The tree rings showed 20 extreme events occurring in the past five centuries. We calculated tree resilience to each extreme event for each tree by computing the ratio of tree-ring indices averaged three years after and before the event. We found that the tree resilience had similar increasing trend in series of recurrent events, and such trend could last for 70 years. Our results support the “stress memory” hypothesis in trees, and are of significance in anticipating the capacity of forest resilience in face of future changes in climate extremes and disturbances.

TS.08-0-7

Room A4, Thursday 7th Feb. 15.00 h.

Biotic and abiotic stresses involved in dry and semiarid Mediterranean forest decay processes

Vilagrosa Carmona, Alberto¹; Morcillo, Luna²; Muñoz, Julio Cesar³; Gallego, Diego⁴; Torres, José Manuel⁵; González, Eudaldo⁶; Delzon, Sylvain⁷

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Tree mortality and decay phenomena is increasing in relevance and in number of affected species. Therefore, plant decay and mortality relate extreme droughts or hot waves with other organisms, e.g., insects or microorganisms acting as pests, but their role needs to be elucidated. In this work, we studied three different scenarios of decay processes in several forests. All three were drought-related processes, but the relevance of water scarcity depended on specific factors. They were: 1) *Pinus halepensis* forests under semiarid conditions with decay processes triggered by a severe drought event and successive bark beetle attacks, 2) *P. halepensis* forests under dry conditions with decay processes triggered by a biotic factor (phytoplasma infection) and late bark beetle attacks, and 3) *Q. coccifera* decay associated to the interaction between drought and fire effects, mimic by an intense thinning treatment. We studied several physiological parameters related to the drought intensity suffered by the plants, the impact of these stressful conditions on some plant morphological and physiological traits and the recovery capacity. The results showed that drought always played a relevant role in the decay processes, pushing the plants until stress conditions, but also other biotic factors as phytoplasma disease or bark beetles took advantage of the weakened plant conditions to increase their damaging effect. About the interactions between drought and fire, our results pointed out that fire can be a key factor for resetting differences in the impact of drought in resprouter plants as found in the case of kermes oaks.

TS.08-0-8

Room A4, Thursday 7th Feb. 15.15 h.

New insights at the mesoscale for defining temperate forest responses to climate and disturbance

Martín Benito, Dario¹; Druckenbrod, Daniel²; Pederson, Neil³; Orwig, David⁴; Poulter, Benjamin⁵; Renwick, Kate⁶; Shugart, Herman⁷

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Climate and disturbance alter forest dynamics at different spatiotemporal scales and may leave legacies at local, meso, and macroscales that last centuries to millennia. Here, we revisit ecological concepts related to spatial and temporal scales and present approaches that will likely improve our understanding of climate-forest dynamics across scales. Particularly, we focus on characterizing mesoscale forest dynamics as they bridge fine-scale (local) and continental-scale (macrosystems) processes in ways that are highly relevant for climate change science and ecosystem management. We chose the temperate, broadleaf-dominated forests of the eastern United States as a case study because of their high tree species diversity, variety of disturbance regimes, and an abundance of data or observations. Through a literature review of climate-related tree mortality events and model simulations informed by this review, we show that synchronous patterns of drought-driven mortality at mesoscales may have been overlooked within these forests and that such disturbances can greatly impact terrestrial carbon dynamics. Focusing on temporal and spatial extents equivalent to those of the underlying drivers will be necessary to both characterize forest dynamics across different scales and provide insight into long-term forest changes. Broad scale studies should also have a long temporal scale to provide insight into pathways for forest change, evaluate predictions from dynamic forest models, and inform development of global vegetation models. Integrating data collected from spatially well-replicated networks (e.g. paleoecological data) consisting of centuries-long, high-resolution records with models may provide a better understanding of mesoscale response of forests to climate changes.

TS.08-0-9

Room A4, Thursday 7th Feb. 15.30 h.

Species niche as explanation of extreme event induced die-off. How much are we missing without accounting climatic variability?Pérez Navarro, María Ángeles¹; Broennimann, Olivier²; Esteve, Miguel Ángel³; Guisan, Antoine⁴; Lloret, Francisco⁵

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Extreme climatic events are currently emerging as one of the most important facets of climate change, since they have been shown that can produce stronger impacts on species distributions and community composition than climatic trends. While species distribution models and niche quantification have been widely used to assess future changes in species distributions, they have been poorly applied to explain community dynamics under extreme climatic conditions. In addition, they are usually derived from long-term climate means, not capturing temporal climatic variability in their predictions. Here we characterize species' climatic niches in a rich shrubland community, recently exposed to its driest hydrological year on records, to assess differences in species' response to drought. Particularly we analyzed the relationship between the populations' measured defoliation and mortality and the respective population distance to species niche centroid and edge. In addition, in order to elucidate the effect of temporal climatic variability on niche characterization, we estimated two different niches per species, one built with long term climatic means (1979-2012) and the other using the yearly information from this same time period. We found that population distances to the niche centroid and edge properly portray differences in species die-off. Concurrently, those species with higher increases in niche space when including climatic variability showed lower mortality rates, suggesting lower vulnerability in species living under more variable conditions. These results highlight the importance of adding temporal variability when studying demographic responses to extreme climatic events.

TS.08-0-10

Room A4, Thursday 7th Feb. 15.45 h.

Does phylogenetic diversity of the community determine plant species fitness under environmental stress? A common garden experiment manipulating phylogenetic scenarios of annual plant species on gypsum soilsChaves Jiménez, Rocío¹; Ferrandis, Pablo²; Ortiz Díaz, María Laura³; Escudero, Adrián⁴; Luzuriaga, Arantza⁵

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Previous studies have shown that phylogenetic diversity can be used as a valuable predictor of the effect of biodiversity on ecosystem functioning. High values promote plant productivity and ecosystem stability, probably because evolutionarily distant species are less prone to compete for the same resources. The aim of this study was to evaluate to which extent the phylogenetic diversity determines plant response to different water availability conditions, and its effect on nutrient cycling through enzymatic activity analyses. We experimentally manipulated the phylogenetic diversity of each specific assembly (n= 134), each one containing a combination of 7 species with 10 individuals. Five species combinations were established, three of them with high phylogenetic diversity (Phylogenetic Species Variability, PSV = 0.8) and the other two with low phylogenetic diversity (PSV = 0.3). Each species combination was subjected to two water availability treatments. The control treatment simulated the monthly average rainfall recorded in the last 30 years in the study area. The drought treatment consisted in the reduction of the 66 % in water amount. Each experimental scenario was replicated 10 to 15 times. We registered survival, flower phenology, fruit production, fruit set and seed set of each plant (n= 9140) in each experimental assembly. After fruit ripening, we collected every plant to measure vegetative dry mass per plant. To evaluate the effects on nutrient cycles we will analyse enzymatic activity in each plot (β -Glucosidase, phosphatase and arylsulfatase) when every plant is collected. Results on plant survival, flower phenology and fruit production will be shown.

TS.08-0-11

Room A4, Thursday 7th Feb. 16.00 h.

Does fire regulate fire? Insights on the ecosystem attributes that drive the fire paradoxDuane, Andrea¹; Brotons, Lluís²

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It has been suggested that fire suppression might be actually promoting wildfires through the fire paradox: a high suppression effort can eliminate natural fire breaks and low fuel loads, which hold back large wildfires under extreme weather conditions. However, the fire paradox does not necessarily apply in all ecosystems. Past fires might not always pose a limitation for future fire activity, so fire suppression effects on future fires are unclear. The capability of past fires to remain a barrier for subsequent fires has been suggested to depend on ecosystem attributes such as 1) the fire frequency, 2) vegetation recovery rate and 3) landscape fuel cover. Here, we tested the capability of past fires to negatively influence future fires in a gradient of fuel-fragmentation landscapes in a Mediterranean ecosystem (Catalonia, NE Spain). We found that in fuel-fragmented regions, past fires do not impose a limit to future fires, in contrast to continuous-forest landscapes. In ecosystems with scarce vegetation, new fires are restricted by low fuel areas rather than by past fires. We propose the existence of a spectrum within the aridity-productivity gradient (fuel- vs. moisture-limited fire regimes) in which fire constitutes a feedback itself, specifically in biomes located in intermediate productivity levels. Ecosystems with high fuel loads and high fire frequency will be those more likely to display the fire paradox.

TS.08-0-12

Room A4, Thursday 7th Feb. 16.15 h.

Changes in the timing of the fire season and extreme fire events in SpainRodríguez Urbieto, Teresa Itziar¹; Sánchez, Laura²; Arellano, Gozalo³; Viedma, Olga⁴; Moreno, José Manuel⁵

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Fires exhibit a strong seasonal cycle driven by the dynamic of meteorological conditions and ignition sources throughout the year. The occurrence of fires is very variable in Mediterranean countries; yet, there have been few studies that monitor long-term trends in the seasonality of fires identifying peak or extreme fire events. The present study aims to determine the changes occurred in the seasonality of forest fires in Spain based on official forest statistics in the last four decades. We modeled the weekly peak fire activity as well as the start, end and duration of the fire season each year. We also explored deviations from the general seasonal pattern, referring to periods during which there are more fires reported than usual as extreme behavior. Results showed that the fire season in Spain has been very variable in the study period, being mainly unimodal (summer peak). Our results suggest that the end of the summer fire season is occurring earlier, which has shortened the average duration of the summer fire season, probably due to a combination of social factors and suppression capabilities. Nonetheless, out of season autumn fires have been reported. Furthermore, since 1995 it has been more frequent to find a bimodal fire season, with both summer and spring peaks, being the latter more important in terms of burned area in some years.

TS.08-O-13

Room A4, Thursday 7th Feb. 16.30 h.

Post-fire management in Aleppo pine habitats of SE Iberian Peninsula: plant diversity and pine recruitment related to burn severity and salvage loggingMoya, Daniel¹; Sagra, Javier²; Plaza-Alvarez, Pedro Antonio³; Lucas-Borja, Manuel Esteban⁴; De las Heras, Jorge⁵; Ferrandis, Pablo⁶

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After wildfires, emergency actions and post-fire management are implemented, being salvage logging one of the commonest but showed unclear ecological effects. In Mediterranean Basin, where scenarios predicted more drought periods and changes in fire regimes, forest management should be adapted to maintain and promote ecosystems in vulnerable areas. In July 2012, a mid-high severity fire burned almost 7000 ha of *Pinus halepensis* Mill. forests in southeast Spain. In late spring 2017, we randomly set 15 plots in each situation: unburned mature stands (UB), Low burn severity (LS), High burn severity without post-fire treatment (HS) and High burn severity with salvage logging (HS-SL). The size of circular plots varied depending on the pine tree canopy influence. We sampled vegetation presence following the linear transect method (3 transects per plot) and pine recruitment (1m side squares located on the half). In addition, we surveyed all plant species following the Braun-Blanquet method. Our results showed higher floristic richness, pine seedling density and size in HS. However, Shannon index was similar for HS and HS-SL but higher than UB and LS and Simpson index was lower in HS plots than HS-SL but both lower than UB and LS. The litter and vegetation cover was approximately double on HS than HS-SL.

TS.08-O-14

Room A4, Thursday 7th Feb. 16.45 h.

Evapotranspiration patterns in a Mediterranean coastal valleyLarsen, Elisabeth¹; Chirino, Esteban²; Palau, José Luis³; Moutahir, Hassane⁴; Bellot, Juan⁵

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Actual evapotranspiration (η_a) is a key parameter to understand the soil-water balance in wild-vegetation ecosystems. Estimating the η_a is therefore becoming increasingly important for sustainable water-and land use management, particularly in water-limited areas. This study analyses the temporal-spatial variability of η_a in pine forests in a dry Mediterranean climate in the Túria valley, Eastern Spain. Sap flow measurements were obtained at different altitudes and distances from the coast. Rates of η_a were determined in six pine plots using the eco-hydrological model HYDROBAL. Input parameters included on-site meteorological measurements, vegetation and soil characteristics, and reference evapotranspiration (η_o). The outputs of the model were calibrated with the measured sap flow values. As a seasonal average, results show that the inland sites had 26% less η_a than the coastal sites during spring, and 35% less during fall. During summer however, η_a values were 24% higher inland than at the coast. Looking at precipitation received, values were 34% higher inland than at the coast in spring, 32% higher during fall and without differences during summer. This indicates that even with overall similar values of precipitation and η_a during ten months of measurements; the temporal-spatial outputs are highly variable. The higher temperature at the coast has a leading role in the higher rates of η_a , except for in the warm summer season, when inland η_a values surpass that of the coast. This demonstrates how increased temperatures combined with less precipitation can have a negative effect on η_a values, due to increased direct evaporation versus transpiration.

TS.08. Posters

TS.08-P-1

External pavilion, Poster session 2: Wednesday 6th - Thursday 7 th Feb.

Disentangling the contribution of deterministic and stochastic processes to local species assembly: the case of annual plant communities in gypsum systems

Ortiz Díaz, María Laura¹; Ferrandis, Pablo²; Chaves, Rocío³; Luzuriaga, Arantzazu⁴

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Assembly of plant communities is explained as a conceptual gradient defined by two opposing postulates; the deterministic view (Clements 1916), which interprets the community as a closed conformed superorganism strongly defined by environmental filters, and the stochastic approach (Gleason 1926), which sees the community as an open, coincidental combination of species, subordinated to ecological-drift processes. Although both approaches have received attention of community ecologists, there is still a lack of information concerning processes that act during the assemblage of plant communities. In this study we aim to evaluate, through a field experiment in a semi-arid gypsum system of southeastern Madrid, the contribution of stochastic processes (arrival of propagules) simultaneously with that of abiotic (water availability) and biotic (presence of biological soil crust and perennials) environmental filtering to the assemblage of annual species.. The experiment consists of two scenarios of presence of propagules (sterile soil vs. homogenized seed bank), five scenarios of biotic filters (presence of complete *Macrochloa tenacissima* plants, only aerial or underground perennial plant part, , presence of biological soil crust, and bare soil), and two scenarios of water availability (natural precipitation vs. experimentally duplicated). The result is a complete factorial design with 20 experimental treatments 10-fold replicated, (i.e., 200 plots). This experiment will be run for three years, during which species assembly rules should manifest. We hypothesise that changes in the intensity of the environmental filters may promote or inhibit the expression of stochastic processes in the assembly of species. Preliminary results will be shown.

Thematic Session 09: Growth footprints: the challenge of time in plant and animal ecology

Day: Tuesday 5th February

Schedule: 12:00h 13:30h – 16:00h 17:00h

Location: Room A3

Coordinators:

Joaquim Garrabou Vancells, Institut de Ciències del Mar CSIC, Spain

Beatriz Morales Nin, IB-CSIC IMEDEA, Spain

Igor Gutiérrez Zugasti, Instituto Internacional de Investigaciones Prehistóricas de Cantabria (IIIPC), Spain

Gabriel Sangüesa Barreda, iuFOR-Universidad Valladolid, Spain / Instituto Pirenaico de Ecología (IPE-CSIC), Spain

Jesús Julio Camarero, Instituto Pirenaico de Ecología (IPE-CSIC), Spain

Isabel Dorado-Liñán, E.T.S.I. Montes, Forestal y Medio Natural, UPM / Forest Research Centre (INIA-CIFOR), Spain

Mar Génova, Escuela Universitaria de Ingeniería Técnica Forestal, UPM, Spain

Emilia Gutiérrez, University of Barcelona, Spain

Andrea Hevia, University of Huelva, Spain

Raúl Sánchez-Salguero, Univ. Pablo de Olavide, Spain

The dichotomy between time scale and resolution is a key factor in ecology. If time scales are inappropriate or the temporal resolution is insufficient, the mechanisms and drivers of ecological processes may not be fully understood. Growth records are studied by many scientific disciplines in ecology and, represent a mid- to long-term time perspective after precise dating processes and dictated by species life span. Some of them show a high temporal resolution (from annual to even daily), and an interesting spatial resolution within aquatic and terrestrial ecosystems. These strengths have turned these disciplines into a powerful approach to address complex ecological processes and, contextualize environmental change throughout time. The variety of these disciplines includes: annual-rings formed by perennial plants, horns growth in mountain goats, growth banding in coral skeletons, fish otoliths, or shells in bivalve molluscs, among many others. Despite growth footprints show important methodological resemblances, weaknesses, and future challenges, the different scientists have been uniquely focused on specific taxonomic groups with scarce transdisciplinary feedbacks. This session is an opportunity to break these barriers, and to be a meeting point for those scientists from many different fields united by the use of retrospective growth proxies in plant and animal ecology.

TS.09. Oral talks**TS.09-MT-1**

Room A3, Tuesday 5th Feb. 12.00 h.

Tree-rings: environmental issues and tree factsGutiérrez Merino, Emilia¹

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It is well known that no growth process is continuous and that no organism grows uninterrupted because at some point growth is limited by some internal and / or external factor. Growth involves an increase in size, mass or volume and takes place at time intervals that we quantify through measurements. The fluctuations in growth can be irregular or they can correspond to regular cycles, days or years, so that the growth structures can be cross-dated. The largest and oldest organisms with growth structures (growth footprints) are the trees of the temperate and cold zones that form annual bands of wood, which appear as concentric rings in a cross section of the trunk, branches and roots xylem. Trees growth processes are very sensitive to environmental factors, which determine annual tree growth rate and tree-ring traits recording a large amount of information from the environment. Much of this information can be retrieved from tree-rings to study environmental (e.g. carbon footprint) and ecological processes. Furthermore, structural and functional traits of the wood rings determine tree performance. For instance, trees with high growth rates have higher hydraulic conductivity but also higher hydraulic vulnerability to cavitation. All these points are highly relevant to ascertain trees responses and forests function under the ongoing climate change.

TS.09-O-2

Room A3, Tuesday 5th Feb. 12.30 h.

Does drought sensitivity rely on competition and tree age? Elevation mattersCasas Gómez, Pablo¹; Sánchez-Salguero, Raúl²; Sangüesa-Barreda, Gabriel³; Camarero, Jesús Julio⁴; Linares, Juan Carlos⁵

(1) Universidad Pablo de Olavide; (2) Universidad Pablo de Olavide; (3) Instituto Pirenaico de Ecología (IPE-CSIC); (4) Instituto Pirenaico de Ecología (IPE-CSIC); (5) Universidad Pablo de Olavide

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The relative effect of tree age, size, and competition as regards tree growth responses to climate remains still poorly understood. Here, we seek to investigate drought sensitivity at the individual tree level, accounting for inherent tree traits and extrinsic factors, in the drought-sensitive Mediterranean fir *Abies pinsapo*. Tree-rings of half thousand cored trees were crossdated and total age was estimated. Dendrochronological methods were applied to quantify climate-growth relationships using tree-ring width indices (TRWi) calculated for firs of contrasting age- and size-groups, between 1000-1800 m elevation. Competition was investigated in trees growing at the lower elevation limit, by a distance/size-dependent competition index. TRWi-climate relationships showed significant rising sensitivity to spring temperature and precipitation in the young-age groups, unrelated to competition. Besides, sensitivity to summer and autumn temperatures recorded in the year prior to growth was higher in the old-age groups growing at low competition intensity. As regard elevation, sensitivity to spring temperature and precipitation was higher in those younger ages located at lower elevation, while prior autumn temperature sensitivity increases with elevation and age. Our results support that tree age and elevation modulates drought sensitivity, while competition intensity seems to be linked to size-effects, with mayor relevance regarding carbon storage, but not so significant effects regarding climate-growth sensitivity.

TS.09-0-3

Room A3, Tuesday 5th Feb. 12.45 h.

Long-term resilience and tree growth responses to drought in old-growth rear edge Mediterranean pine forestsHevia Cabal, Andrea¹; Sánchez Salguero, Raúl²; Vázquez Piqué, Javier³; Camarero, Jesus Julio⁴; Linares, Juan Carlos⁵; Alejano, Reyes⁶

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In southern Europe, old-growth conifer forests are scarce and increasing aridity may negatively impact them at the rear edge or in the most xeric sites. A better understanding of contrasting growth responses to climate and extreme droughts would provide insight into the long-term vulnerability of those old-growth forests. Here, we investigate how tree age and climate trends drive growth resilience and recovery to droughts in three *Pinus nigra* subsp. *salzmannii* old-growth, rear-edge forests (Sierra de Cazorla, Sierra María and La Sagra) in southeastern Spain. We used dendrochronology to assess growth in three age classes (young, age < 150 years; mature, 150 < age < 300 years; and old age > 300 years). Tree-ring width chronologies were built for each age class and site and then related to monthly temperatures, precipitation and drought during the 20th century. We evaluated long-term growth resilience to severe droughts occurring in 1983, 1994-1995, 1999, 2005, and 2012. We found that drought is a main driver of growth of *P. nigra*, with differences between sites (aridity conditions) and tree age groups. Mature and young trees responded more to drought severity than old trees. Old trees from dry sites showed a low resistance to drought but also recovered less rapidly than trees of similar age from wet sites. If droughts become more severe and frequent as predicted in the Mediterranean region, old and mature trees from stands in the driest regions will be increasingly more sensitive to intense dry spells.

TS.09-0-4

Room A3, Tuesday 5th Feb. 13.00 h.

Calibrating the age of red deer (*Cervus elaphus hispanicus*) with lines of arrested growth in long bonesGort Esteve, Araceli¹; Köhler, Meike²; Gutiérrez Merino, Emilia³

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Our main objective was to test the reliability of long-bone skeletochronology in an endotherm species, the red deer. Skeletochronology can be used to determine individual age at death by counting lines of arrested growth (LAG) in ectotherms long bones, due to temperature and metabolism decrease during winter and in endotherms teeth. This methodology has been successfully applied to ectothermic species, where bone remodeling is limited. In contrast, endotherms experience substantial long bone remodeling throughout their life. Red deer reach reproductive maturity soon and do not experience a decrease in body temperature or in their basal metabolic rate in winter as pronounced as ectotherms do. Therefore, the utility of this technique in red deer, and in endotherms in general, still needs validation, which can be accomplished by calibrating bone age with teeth age. To pursue our main objective, we counted the number of LAGs in long bones (femora and tibiae), then compared that number with the number of rings counted in teeth (molar histology) of the same individuals to validate the estimated ages. We collected the long bones (6 femora and 8 tibiae) and teeth from individuals hunted in 2013 - 2014, in a red deer population established in the National Hunt Park of Boumort (pre-Pyrenees). Our calibration allowed us to date the exact year of death of males and females. We are still obtaining more data to improve our knowledge of the life history traits and demographic structure of this population to aid in their management and conservation.

TS.09-0-5

Room A3, Tuesday 5th Feb. 13.15 h.

Contrasting effects of fog frequency on the radial growth of two tree species in a Mediterranean-temperate ecotoneBarbeta, Adrià¹; Camarero, Jesús Julio²; Sangüesa-Barreda, Gabriel³; Muffler, Lena⁴; Peñuelas, Josep⁵

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Rear-edge tree populations are relevant for conservation because they harbor high intraspecific biodiversity and play a key role during periods of climate change. The occurrence of these populations is influenced by heterogeneous topography that creates regionally rare microenvironments. Climate is changing at a global-scale, but little is known about the long-term impact on local climatic singularities. We analyzed tree-ring growth chronologies of the two species (*Fagus sylvatica* and *Quercus ilex*) forming the evergreen-deciduous forest ecotone at the rear-edge of *F. sylvatica*'s distribution. The study area is a coastal range with frequent fog immersion, which has been hypothesized to favor the persistence of *F. sylvatica*. We analyzed the effect of fog on tree growth along a topographical gradient and the sensitivity of growth to rainfall and temperature. Foggy days decreased by 62% over the last four decades, concomitant with increasing temperatures. Summer fog had positive effects on *F. sylvatica*'s growth through a temperature buffering effect. The positive effect of fog on the growth of *Q. ilex*, however, was likely caused by a collinearity with rainfall. *Q. ilex*'s growth was less sensitive to climate than *F. sylvatica*'s, but both were mostly determined by early-summer water balance. Our results indicate that a decrease in fog frequency and an increase in temperature may generally benefit *Q. ilex*. Rainfall and temperature changes matter most for the fate of rear-edge tree populations, but local climatic singularities such as fog should also be considered, as those can swing the balance in climate-sensitive ecotones.

TS.09-0-6

Room A3, Tuesday 5th Feb. 16.00 h.

Assessing wood traits to reconstruct late frost defoliations in Iberian beech forestsSangüesa Barreda, Gabriel¹; Olano, José Miguel²; García-Pedrero, Ángel³; García-Cervigón, Ana Isabel⁴; Rozas, Vicente⁵

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Rapid climate warming is altering the species-environment relationships, being particularly important for plants at the beginning of the growing season. Warmer springs induce an early leaf unfolding, consequently extending the growing period but also increasing the vulnerability to frost risk. Spring late frosts can cause the total loss of emerging leaves and the need for their replacement, concluding in a very narrow growth ring. The expected increasing frequency of late frosts might limit population dynamics of deciduous forests, and thus their capacity of altitudinal ascent to compensate for increasing drought levels. The incidence of these events is, however, understudied owing to the lack of accurate long-term data of their impact and frequency. Since reconstructing the occurrence of these episodes is key to pinpoint the forests' response to climate change, we need robust criteria to retrospectively discern late frost episodes from other frequent extreme events such as droughts. Here, we assess the reliability of different tree-ring traits, such as growth rate, microdensitometry, quantitative anatomy, carbon isotopes or dendrochemistry, for reconstructing past late frost defoliations along altitudinal gradients in 6 Iberian beech locations (*Fagus sylvatica*). Additionally, we use growth series of evergreen cohabitant conifers (mainly *Pinus sylvestris*) as a non-sensitive record to spring late frosts, but susceptible to drought. The reconstructed events are also verified with NDVI series from Sentinel and daily meteorological data. Our previous results reinforce the need of using multiple independent methods to accurately detect late frost defoliations.

TS.09-0-7

Room A3, Tuesday 5th Feb. 16.15 h.

Wood anatomical adjustments of *Alnus glutinosa* to waterlogged conditionsAnadon Rosell, Alba¹; Scharnweber, Tobias²; Smiljanic, Marko³; Wilmking, Martin⁴

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For centuries, peatlands have been drained for anthropogenic use such as agriculture, forestry or peat mining, which has caused habitat degradation and large amounts of CO₂ emissions. In the last decades, there has been an increase in the European policies aimed at restoring these habitats through rewetting. Little is known about wood anatomical adjustments of alder (*Alnus glutinosa* L.), a widespread tree species in temperate peatlands, to these artificial alterations of the water table. In this study, we focus on two neighbouring alder carrs in northern Germany. One of them underwent a rewetting process in 2005 and is under waterlogged conditions most part of the year, whereas the other one is a drained alder carr in which the water table remains below the soil surface year-round. In April 2017, we took increment cores from three trees at each site, cut them with a rotary microtome, stained them and fixed them in permanent microslides. We took high resolution images under the microscope and proceeded to quantitatively analyse alder xylem anatomy with the specialized software ROXAS. We measured vessel lumen area and density, vessel grouping, theoretical hydraulic conductivity and ray parenchyma abundance. In addition, we took bark samples of the same trees and analysed their bark anatomical structure. We discuss the xylem and bark anatomical adjustments of alder trees to waterlogging conditions and its implications for the ability of these trees to cope with such conditions.

TS.09-0-8

Room A3, Tuesday 5th Feb. 16.30 h.

Hydraulic control of tracheid expansion and final diameter in Scots pine at its dry distribution limitCabon, Antoine¹; Fernández-de-Uña, Laura²; Gea-Izquierdo, Guillermo³; Meinzer, Frederick⁴; Woodruff, David⁵; Martínez-Vilalta, Jordi⁶; De Cáceres, Miquel⁷

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Xylem conduits diameter exhibits large variability at various levels: from within-ring variations such as xylem tapering or the early-wood-latewood transition, to variations between rings and across populations or species. Water availability affects conduit diameter at several of these levels, with conduits being narrower when formed during drier years or under drier climates. However, it is still not clear which mechanisms are implied in the control of conduit expansion and final diameter. Here we seek to (1) characterize the patterns of tracheid expansion at an infra-annual scale; (2) formulate a hydraulic-based mechanistic model replicating the behaviour of observed tracheid expansion; (3) test the hypothesis that tracheid expansion and final diameter are under passive hydraulic control. For this purpose, we estimated weekly tracheid expansion by repeated measurements of cell radial diameter on microcores sampled weekly during 2013 and 2014 in a *Pinus sylvestris* population of central Spain. On the other hand, we formulated a mechanistic tracheid expansion model based on Lockhart's cell growth equations where all variables but water potential are fixed. Tracheids expansion followed a saturation-shaped curve, which slope and duration decreased during the growing season. The model successfully reproduced observed tracheid expansion dynamics for both 2013 and 2014 ($R^2 = 0.94; 0.93$), rising an excellent fit to the observed tracheid diameter variations within the rings ($R^2 = 0.99; 0.99$). These results are consistent with the hypothesis that intra-annual tracheid diameter variations are under passive hydraulic control and suggest that hydraulics could also drive other patterns of tracheid diameter variations.

TS.09. Posters

TS.09-P-1

External pavilion, Poster session 1: Monday 4th - Tuesday 5th Feb.

Temporal shifts in the climatic signal of *Pinus nigra* subsp. *salzmannii* in natural stands across its Iberian distributionCaetano Sánchez, Cristina¹; García-Cervigón, Ana Isabel²; Olano, José Miguel³; Rozas, Vicente⁴; Sangüesa-Barreda, Gabriel⁵; Rozenberg, Philippe⁶; Sánchez-Salguero, Raúl⁷

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Understanding the link between climate and tree growth is a critical step to face global warming. This is an urgent need in Mediterranean basin, where higher than average increments on drought intensity and frequency are expected together with raising temperatures. Drought tolerant species like junipers are responding to this change through an earlier initiation of cambial initiation and longer summer drought arrest. However, it is not clear whether more mesic species like some pines will be able to adjust to this drier environment. In this study, we explore the impact of climatic conditions on secondary growth of black pine (*Pinus nigra* subsp. *salzmannii*) inhabiting Mediterranean mountains. To this end, we cored adult trees in six populations comprising the Iberian range of the species. We generated ring-width and earlywood chronologies and assessed xylem quality by measuring microdensity (minimum and maximum), that reflect xylem anatomy and functional traits. Warmer springs are expected to favor an earlier initiation of cambial activity that will be appreciated through a shift in the timing of temperature signal in spring to earlier months. Simultaneously, increased drought stress would be appreciated through a tighter control of tree growth by precipitation, with differences in the timing from north to south. Preliminary results support the control of ring width by precipitation. Growth in wet edge populations is mainly responsive to spring-summer rainfall, whereas this signal is displaced in dry edge populations to winter-spring. Minimum density would show a similar pattern as earlywood width but with an earlier temporal signal.

TS.09-P-2

External pavilion, Poster session 1: Monday 4th - Tuesday 5th Feb.

Tree-rings improve forest site productivity estimations in Atlantic Iberian *Pinus pinaster* forestsMolina Valero, Juan Alberto¹; Sánchez Salguero, Raúl²; Pérez Cruzado, César³; Álvarez González, Juan Gabriel⁴; Camarero, Jesús Julio⁵; Hevia, Andrea⁶

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Accurate information on the site quality estimations for Atlantic maritime pine (*Pinus pinaster* Ait.) stands in the Iberian Peninsula have been deeply evaluated using forest inventories data. However, site quality information on the individual tree, wood-quality or above-ground biomass changes of standing timber are also needed to improve forest management and optimize timber growth and production. In addition, climate sensitivity across its distribution range is of key importance to understand species' responses to climate and therefore to assess the effects of climate variability on forest productivity. We used dendrochronology combined with forest inventory data in 36 sites of mature and undisturbed *P. pinaster* stands to analyse the effects of climate on annual tree growth across a broad gradient of site productivity and stand structure in northern Spain. Basal area increment (BAI) was positively related to site quality with some influence of local topographical conditions (e.g., slope, aspect). BAI was enhanced by spring precipitation but decreased as summer temperature warmed. BAI also increased as site productivity increased and as stand density decreased. Trees growing in lower quality sites were more sensitive to warmer and drier conditions during droughts or heat waves. Results suggest that site quality estimations should consider individual tree growth and climate-growth relationships to improve silvicultural prescriptions focused on wood production and resilience to climate change.

TS.09-P-3

External pavilion, Poster session 1: Monday 4th - Tuesday 5th Feb.

Combining satellite and tree ring data to monitor late frost defoliation risk in Iberian beech forestsOlano Mendoza, Jose Miguel¹; García-Pedrero, Angel²; Sanguesa, Gabriel³; Rozas, Vicente⁴

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Under the current context of global warming, rising temperatures are driving longer growth seasons for temperate trees due earlier leaf unfolding. Extended active seasons have been related to higher photosynthetic gains and larger secondary growth. However, the observed warming is associated with an increase in temperature variability, including a higher frequency of extreme events like spring late frost episodes, which might curtail the hypothetical positive response of tree growth to climate warming. Late frost defoliation is conspicuously appreciated in the field by a rapid loss of the emerging leaf canopy, with a later formation of a second leaf canopy or even the absence of leaf canopy for the whole growing season. Moreover, these episodes are registered in tree secondary xylem by the presence of very narrow or missing annual growth rings. To improve our understanding of this phenomenon, we develop a tool to monitor the spatio-temporal dynamics of late frost defoliation in Iberian beech forests (*Fagus sylvatica*). These forests usually inhabit mountain areas where fogs and topographic precipitation may compensate for regional summer drought, thus being especially sensitive to these events. The proposed methodology exploits satellite data from the Sentinel-2 Image Time Series (NDVI index) and in situ information of beech wood growth obtained by dendrochronology to automatically find the pattern describing late frost occurrence in beech forests both spatially and temporally. We use this tool to analyze 2016 to 2018 growing seasons in the Iberian beech distribution ranges and determine the factors associated to higher late frost damage risk.

TS.09-P-4

External pavilion, Poster session 1: Monday 4th - Tuesday 5th Feb.

Development of forest management tools for sweet chestnut coppice in the north of SpainPrada Monteagudo, Marta¹; Martínez-Alonso, Celia²; González-García, Marta³; Majada, Juan⁴

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The sweet chestnut coppice (*Castanea sativa* Mill.) is a species of great importance in the northwest of Spain due to its potential in construction as a structural material. However, many coppices have been abandoned, resulting in unstable and degraded stands. Thus there is a need of improving forest management, even more in a climate change scenario. The aim of this study was to develop different silvicultural tools in order to improve forest management in chestnut forests under a global change scenario. For this purpose, a dynamic growth model was developed with three projection functions: density, basal area and dominant height. The data came from two separate inventories over time (2009 and 2018) on a permanent plots network without forest management located in Asturias. Plots represent all the variability available in the region for the study species. Additionally, a network of permanent plots with new forest management alternatives were used to: (1) evaluate the effect of forest management over time, comparing two different silvicultural treatments: intensive thinning and superintensive thinning, leaving a density of 800 stems ha⁻¹ and 400 stems ha⁻¹, respectively, (2) analyze dendrochronologically the effect of forest management, and (3) evaluate the health status of the sweet chestnut stand and the relationship with forest management. The study of all these aspects of sweet chestnut coppice will provide valuable information for forest managers and forest-wood sector industries by providing tools to optimize production through sustainable forest management.

TS.09-P-5

External pavilion, Poster session 1: Monday 4th - Tuesday 5th Feb.

Xylem plasticity of *Pinus halepensis* to climate change and droughts in the southeast of Spain. Acclimatize or die?Valeriano, Cristina¹; del Río, Miren²; Cañellas, Isabel³; Gutiérrez, Emilia⁴

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The southeast of Spain is a region where climate change is more pronounced. The increase in temperatures has been one of the highest in Spain; from 1972 summer and spring temperatures have increased more than 3°C and summer rainfall has decreased significantly. In this context, how the forests are responding is a relevant question. We have studied growth trends of tree-ring width (RW), basal area increment (BAI) and earlywood-latewood proportion, and described the characteristic rings (narrow, missing, and brown) of six *Pinus halepensis* forest stands in Sierra Espuña. Raw data of tree-ring growth series (mm/year) do not show a negative trend and basal area increments (mm²/year) do show a significant decreasing trend only in one stand. Aleppo pine adjusts its growing period to annual climate variations; tree-growth begins earlier due to spring temperature increase. Frequent drought episodes lasting several years limit tree growth: tree-rings are narrower, and earlywood-latewood proportions change to preserve the hydraulic system. Acclimation of these populations is significant during extreme droughts, generating only latewood ("brown rings") or missing rings; however, mortality episodes have not been triggered. The mechanism involved in these populations response is the high plasticity of Aleppo pine, an isohydric species able to adjust its phenology, thus one of the most resistant species to the ongoing climate change. Nevertheless, there are some evidences indicating that these populations may be at the limit of their resistance and resilience to the new conditions, as basal area is slowly decreasing and synchrony among growth series is increasing.

Thematic Session 10: Linking functional traits and fitness in a changing world

Day: Wednesday 6th February and Thursday 7th February

Schedule: 12:00h 13:30h - 18:00h 19:30h | 12:00h 13:30h - 15:00h 17:00h

Location: Room M5

Coordinators:

Jesus Vilellas, Trinity College Dublin, Ireland

Nuria Pistón Caballero, Federal University of Rio de Janeiro, Brazil

María Begoña García, Instituto Pirenaico de Ecología (IPE-CSIC), Spain

Roberto Salguero-Gómez, University of Oxford, UK

Functional traits and vital rates inform on some of species' most relevant ecological processes, such as the use of available resources, life history strategies, or responses to the environment. While many trait-based studies implicitly assume a relationship between traits and fitness, we have surprisingly little evidence from empirical data. In addition, a combination of multiple traits can affect fitness simultaneously. In this session, we will showcase cutting-edge researcher analysing the links and trade-offs between functional traits, vital rates, and their effects on fitness. The session will also include studies of patterns and/or correlations in functional and demographic traits in response to agents of global change, such as warming, drought or land use changes. We will accept presentations with either intraspecific (individual- or population-oriented) or interspecific (community-oriented) approaches, and we especially welcome large-scale or integrative studies. We propose to address this timely topic by developing a series of overview talks and closing up with a synthetic framework to integrate plant shape, function and strategies. The topic of the proposed session aligns well with the theme of the SIBECOL 2019 meeting because most ecosystem services and biodiversity at large rely on plant traits, which are at the core of this session.

TS.10. Oral talks

TS.10-MT-1

Room M5, Wednesday 6th Feb. 12.00 h.

When Wright met Hutchinson: combining adaptive landscapes and probabilistic hypervolumes to understand trait patterns across environmentsPérez Carmona, Carlos¹

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In the context of accelerated global environmental change, approaches based on functional traits have a great potential to predict the effect of these changes on ecosystems. However, the evidence supporting one of the main assumptions for these approaches - that the performance of species in a given environment is given by its traits - is extremely scarce. Adaptive landscapes represent fitness in a trait space, revealing the adaptive value of different trait combinations in a given environment. Mapping adaptive landscapes across a wide range of conditions would be a major advance for ecology as a predictive science, since it is one of the key pieces missing to predict species abundances across environmental gradients from their traits, considered the 'Holy Grail' of ecology. This is because, if not all trait combinations confer equal fitness, trait values within a species, community, region, or even at the global scale should not be equally represented across the whole range of possible values. However, despite indirect evidence, it is unclear if, and to what extent, adaptive landscapes translate into the relative abundance of trait values in real communities. In this key-note talk, I will present some of the reasons that have hampered uncovering the link between fitness, traits, and species abundances. Then, I will show how the current development of suitable methods and the growing availability of large plant trait and demography databases allows tackling this question at a global scale. Finally, I will present the first results of a coordinated initiative to do so.

TS.10-O-2

Room M5, Wednesday 6th Feb. 12.30 h.

Evolution of functional traits and growth dynamics in crops, and its impact on plant fitnessGómez Fernández, Alicia¹; Milla, Rubén²

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Plant domestication has profoundly modified morphological and physiological traits of crop species. Among other traits, domestication has generally increased plant size, a key functional trait associated with competitive ability, vital rates, plant performance under changing environments and, ultimately, with plant fitness and crop yields. Surprisingly, growth and other vital rates have changed little after domestication, suggesting that other relevant traits, such as seed size or ontogenetic effects, could drive the evolution of increased plant sizes. We have conducted growth experiments to test the influence of varying seed sizes on body size throughout ontogeny, and on fitness, both at an inter- and intraspecific scales. Combining growth modelling with structural equation models, our results show that seed size not only affects seedling emergence and early growth rates, but also plant size and fitness later on, via cascading effects over time. In this contribution, we will show and discuss the role of ontogenetic allometry as a relevant driver of plant size evolution, and its implications for adapting agriculture to the challenges of global change.

TS.10-0-3

Room M5, Wednesday 6th Feb. 12.45 h.

The importance of symmetric and asymmetric competition in Iberian forests: a functional trait approachRuiz-Benito, Paloma¹; Cruz-Alonso, Verónica²; Zavala, Miguel A.³; Ratcliffe, Sophia⁴; Gómez-Aparicio, Lorena⁵

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Plants compete for multiple resources such as light, water and nutrients. Asymmetric and symmetric competition indices have been related to tree responses to light versus water or nutrient availability, respectively. Although competition for light has been used as a good proxy of overall competition we might expect a high intensity of symmetric competition in water-limited forests, particularly for those functional traits related to water uptake and control (e.g. water potential loss). However, the absolute importance of symmetric and asymmetric competition in Iberian forests and how functional traits determine individual response and their effect on competition and complementarity mechanisms is not well understood. Here, we used tree growth data from the Spanish Forest Inventory spanning temperate to Mediterranean climates. We applied spatially-explicit trait-based growth neighbour analyses to quantify how traits control the intensity of symmetric and asymmetric competition between species. We found both symmetric and asymmetric competition indices were important determinants of plant-plant interactions, but the effect of symmetric competition was generally stronger than asymmetric competition. Traits controlled the same way symmetric and asymmetric competition effects on growth, although the absolute effect of competition on growth was different for each trait. Our results suggest that in water-limited forests belowground effects are important determinants of competitive effects on tree growth.

TS.10-0-4

Room M5, Wednesday 6th Feb. 13.00 h.

What determines fitness on gypsum environments?: natural selection on ecophysiological traits of dominant gypsophiles in contrasting field conditionsBlanco Sánchez, Mario¹; Ramos-Muñoz, Marina²; Díaz-Guerra, Laura³; Pías, Beatriz⁴; Ramírez-Valiente, José Alberto⁵; Escudero, Adrián⁶; Matesanz, Silvia⁷

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In gypsum habitats, the main selection pressure is temporal and spatial water availability. One of the most relevant sources of environmental variation in these habitats is slope aspect in the gypsum outcrops. In the northern hemisphere, north-facing slopes receive lower solar radiation, which results in lower evapotranspiration rates and lower temperatures, which is key during summer drought. In these two contrasting scenarios (north and south slopes), the optimum phenotype (including phenological, morphological and physiological traits) may differ significantly. Therefore, we hypothesize that different traits (and trait values) may be under selection across slopes. To address this question, we performed a field experiment on gypsum outcrops in central Spain, with two dominant gypsophiles, *Helianthemum squamatum* and *Centaurea hyssopifolia*, across two different years, to test if traits under selection vary between slopes, species and years. We randomly selected 120 plants per slope and species (480 plants). In each plant, we measured a wide range of functional traits that are highly affected by environmental conditions and are known to have a strong impact on fitness (e.g. SLA, flowering phenology, photosynthetic efficiency, etc.), and also characterized the microhabitat (abiotic and biotic) because of its potential effect on plant phenotype and fitness. We finally quantified reproductive fitness of each plant (e.g. number of inflorescences, seed set...), and used phenotypic selection analyses to identify traits under selection. Our results show that traits with adaptive value vary between slopes and species. Overall, our results contribute to improve our understanding of adaptive traits and processes in gypsum environments.

TS.10-0-5

Room M5, Wednesday 6th Feb. 13.15 h.

Species traits modulate the decline of Mediterranean butterfliesMelero Cavero, Yolanda¹; Stefanescu, Constanti²; Pino, Joan³

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Understanding the pressures affecting species population dynamics is a central issue in ecology and management. Several studies have suggested that certain intrinsic ecological (i.e. those that define species ecological niches) and life-history traits predispose a species to be more susceptible to environmental pressures. However, little empirical evidence exists regarding the relationship between these traits and the species' demographic responses. Using data of 66 butterfly species representing five ecological and two life-history traits we studied how/if these traits were related to the species' population growth rates and to their variations. Our results revealed declines in 70% and increases in 23% of the studied species, evidencing stronger declines than those previously detected. Population declines were associated with species' degree of habitat specialisation and with the number of generations (Estimates = -0.001, p-values < 0.03). For all species, fluctuations in abundances were greater within than between years, although the mean value of the inter-annual variation was 1.5 times higher than within years. Our results evidenced that habitat specialists and multivoltine species are more likely to suffer severe annual fluctuations; and that multivoltine species and extreme larval specialists had the most marked seasonal fluctuations. We also found higher resilience in generalist species, in concordance with biotic homogenisation in disturbed communities. However, many generalists were also in decline, indicating a potential general reduction in this group that goes beyond faunal homogenisation. Given butterflies are biodiversity indicators, these patterns are a possible reflection of an overall impoverishment in biodiversity.

TS.10-0-6

Room M5, Wednesday 6th Feb. 18.00 h.

Testing the effect of species-level functional traits on structuring subarctic versus subtropical communitiesGarcía-Comas, Carmen¹

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Classic niche theory assumes that species-level functional traits affect species relative fitness and thus community structuring, but empirical tests for this assumption are scarce. Moreover, recent evidence of increasing functional over-redundancy towards the tropics suggests that traits affect community structuring differently across regions. To tackle these issues, we develop a new method: comparing the frequencies of trait categories in the species-rank abundance distributions of local communities versus their frequencies in the regional average species pool. We unveil different patterns for six traits in subarctic versus subtropical copepod communities, the main component of large zooplankton in the ocean. In subarctic communities, medium-sized and cold-water species are selected to dominate, indicating that traits affect relative fitness as predicted by classic niche theory. In subtropical communities, most species are small and warm-water, but small and warm-water are not selected to dominate, suggesting that greater species diversity towards the tropics may be due to lesser trait-based fitness difference, which allows more species to coexist. We conclude that those species-level functional traits have a stronger role in structuring subarctic than subtropical communities. Combining species and functional trait information may contribute to understanding mechanisms behind patterns of diversity change such as the latitudinal gradient of biodiversity.

TS.10-0-7

Room M5, Wednesday 6th Feb. 18.15 h.

Contribution of inter- and intraspecific competition on tree functional traitsÁlvarez-Garrido, Lucía¹; Lechuga, Víctor²; Carreira, José A.³; Viñepla, Benjamin⁴

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Community assembly in forest ecosystems is the result of biotic and abiotic factors interacting and giving shape to the community composition along time and space. Both kind of factors are responsible for tree functional traits present in the snapshot of a forest. Nowadays, the advances in functional trait-based community ecology have highlighted the importance of combining inter- and intra-specific variability to understand and predict the structure and dynamics, as well as the sustainability, of forest ecosystems. However, studies accounting for inter- and intra-specific competition contribution on tree functional traits are scarce. In order to assess the role of intra- and interspecific competition on functional traits, we measured tree growth, leaf mass per area (LMA), wood density (WD), photosynthetic (AN), stomatal conductance (gs) and respiration (R) rates of within and among *Abies pinsapo*, *Pinus nigra* and *Cedrus atlantica* stands in the Talassemtane National Park, northern Morocco. Our results indicate different competition indexes between homogeneous and heterogeneous forest stands, because of the different contribution of the spatial structure and the tree sizes in mono- or multi-specific stands. It's remarkable that *P. nigra* and *A. pinsapo* mono-specific stands showed differences in stomatal conductance, with 45% gs higher in homogeneous stands of *P. nigra* and *A. pinsapo* than in mixed stands with all the other species present. Moreover, as shown by an ordination analysis, the functional traits studied of *P. nigra* and *C. atlantica* showed differences depending on mono-specific and multi-specific stands, while *A. pinsapo* appeared to be less influenced by inter- and intra-specific competition.

TS.10-0-8

Room M5, Wednesday 6th Feb. 18.30 h.

Unpredictable environments change plants' functional strategy what enhances their fitness: similarities and differences between *Papaver rhoeas* and *Onobrychis viciifolia*March Salas, Martí¹; Fitze, Patrick S.²; van Kleunen, Mark³

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As a consequence of climate change, organisms are facing more variable and unpredictable environments. Plants may cope with these new circumstances by changing their strategies, e.g. by investing in some functional traits instead of others, to maintain or improve their fitness. With regard to changes in precipitation predictability, immediate plastic and long-term evolutionary changes in root functional traits are likely to affect fitness, but few experiments have tested this hypothesis. In a four-year experiment, we tested how more and less predictable precipitation regimes affect root functional traits and strategies, and selective regimes of the *Onobrychis viciifolia* and *Papaver rhoeas*. We also assessed transgenerational responses by maintaining the same treatments for four years and by comparing plants of three generations of descendants with ancestor generation. More predictable precipitation led to higher relative investment in secondary roots by *P. rhoeas* and to higher relative investment in root biomass (root weight ratio; RWR) by *O. viciifolia*. Selection differential showed that both strategies led to reduced fitness. Moreover, both species increased their number of secondary roots under more predictable precipitation, which was also associated with a fitness decrease. In *P. rhoeas*, descendants reduced their RWR in the less predictable treatment what leads to increased fitness. Our findings reveal that 1) changes in roots functional traits and strategies are key to reduce potential impacts of increasing climatic unpredictability, 2) plants can immediately increase their fitness through phenotypic plasticity in roots, and 3) plants would be able to conduct some adaptations through changes in root tactics.

TS.10-0-9

Room M5, Wednesday 6th Feb. 18.45 h.

Moving forward in community ecology: integrating phenotypic plasticity and population dynamicsEscudero Alcántara, Adrián¹; Matesanz, Silvia²; de la Cruz, Marcelino³

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Although the number of papers in what has been called plant trait-based ecology grows exponentially and new insights are emerging, from our perspective, several issues should be integrated to build a novel coexistence theory. Here we present a novel conceptual framework in which the functional perspective is moved to a phenotypic-based community ecology and, in parallel, we also propose to leave the static perspective of the most of the studies in the field to consider the realized communities as a shifting pattern in which different populations are dynamically changing. We present examples of fully mapped communities and new summary functions where the so-called plant's eye perspective leads us to exemplify these new concepts.

TS.10-0-10

Room M5, Wednesday 6th Feb. 19.00 h.

Seed dispersal and fine scale spatial heterogeneity determine annual plant assemblies in semi-arid gypsum systems: a spatial point pattern approach.López Peralta, Ana María¹; Luzuriaga, Arantzazu López²; Sánchez, Ana María³; de la Cruz, Marcelino⁴; Escudero, Adrián⁵

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In these study we try to understand the importance of stochasticity versus ecological rules determining species coexistence. For this aim, we use fully mapped annual plant communities under an experimental setting using spatial point pattern techniques. We set replicates in space (six 1 m² plots) and time (seedlings vs. reproductive community, two consecutive years). We submitted the half of plots to an experimental BSC perturbation treatment. We compared results with four null models to discern between stochastic processes, habitat heterogeneity, dispersal processes and joint effects of habitat heterogeneity and dispersal. The 64% of patterns were clustered and so related to primary dispersal nearly the mother plant. These patterns were associated to more opportunistic species with smaller seeds, lower height and higher SLA and reproductive ratios. Patterns associated to spatial heterogeneity supposed the 31% and were related to more conservative species, with heavier seed, and lower SLA, reproductive ratios. Nevertheless, this spatial heterogeneity were not associated to physical structure of BSC. Stochastic processes had a lower representation in the system and were determinant of only the 4% of the patterns. Finally, joint effects of habitat heterogeneity and seed dispersal were very rare (1%). Therefore, primary seed dispersal together with fine scale environmental variability were the main drivers of annual species assemblage in semi-arid gypsum systems. Probably, chemical compounds of BSC are more determinant of this spatial heterogeneity than its physical structure.

TS.10-0-11

Room M5, Wednesday 6th Feb. 19.15 h.

Linking network parameters to species traits and fitnessLazaro Castillo, Amparo¹; Gómez-Martínez, Carmelo²; Alomar, David³; González-Estévez, Miguel Ángel⁴; Traveset, Anna⁵

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The structure of plant-pollinator networks has important implications for community persistence against perturbations. However, the mechanisms underlying such structure and especially the functional consequences of changes in it are still largely unknown. In the case of plants, species specialization, selectiveness and species roles in pollination networks might be related to traits such as flower attractiveness, availability, and dependence on pollinators and, in turn, both network parameters and species traits might influence plant fitness. In a two-year study, we collected data of the 23 most representative plant species from a rich coastal community to understand the association between floral traits (abundance, phenology, pollinator dependence, insect visitation rates, nectar volume, and flower shape and size), network parameters (linkage level, strength, d' , species roles) and plant fitness (estimated as seeds/flower). Actinomorphic flowers and those more dependent on pollinators showed higher linkage levels than the others. Traits associated to availability and attractiveness (abundance, flower size) and the accessibility to resources (corolla tube length) influenced species strength. Regarding species roles in the networks, they were mostly affected by flower size, although the strength of the relationship varied between years. Despite different effects of traits on network parameters, plant fitness was mostly determined by flower abundance and their generalization level. Our study, therefore, contributes to the understanding of the relationships between network structure, ecological processes and function.

TS.10-MT-12

Room M5, Thursday 7th Feb. 12.00 h.

Are we measuring the right traits to forecast vegetation responses to drought?Martínez Vilalta, Jordi¹

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The promise of functional traits is that they will inform us about important ecological and demographic processes, eventually having an impact on plant performance and fitness. This key assumption, however, has rarely been tested, and in the cases in which it has been, the results indicate that many widely used, 'functional' traits are not associated to performance in terms of growth or survival. Here I will address some of the issues we face when using functional traits to forecast plant responses to stress, focusing on water availability and drought-induced mortality. In particular, I will capitalize on several recent studies to provide some insights into: (i) how do traits vary along gradients of water availability and what traits are more plastic? (ii) How stable are trait correlation networks across ecological levels of organization and what are the implications? And (iii) what is the minimum set of mechanistic traits that can be used to characterize plant drought responses? I will end by discussing the prospects in improving our ability to forecast drought-induced mortality risk and the implications of using relative constant functional traits vs. dynamic state variables in monitoring and modelling contexts.

TS.10-O-13

Room M5, Thursday 7th Feb. 12.30 h.

Functional space of tree species varies with the canopy species richness and this relation is context-dependantBenavides, Raquel¹; Valladares, Fernando²; Valladares, Fernando³; Scherer-Lorenzen, Michael⁴

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Disentangling changes in species trait expression along a diversity gradient brings insight into the relevance that intraspecific variability may exert on species interactions (competition or complementarity). In this study, we evaluated the functional space of nine tree species dominant in three forest types in Europe (a continental-Mediterranean, a mountainous mixed temperate and a boreal) growing in communities with different canopy species richness, including pure stands. We measured whole-plant and leaf traits in 1,403 individuals, and used them to quantify species functional hypervolumes for each diversity level. We investigated changes along the species richness gradient in terms of hypervolume size (trait variance) and centroid translation (shifts of average trait values) using null models, seeking species responses to the neighbouring species richness. Our main results showed differences in trait variance and shifts of mean values along the gradient, with shorter trees but larger crowns in mixed stands. We found trait convergence (constrained functional spaces) in pure stands, suggesting an important competition among conspecifics, and trait divergence (expanded functional spaces) in two-species mixtures, suggesting competition release due to interspecific complementarity. Our results show that tree species phenotypes respond to the species richness in the canopy tree layer, favouring species complementarity at low level of canopy diversity in European forests; while further response to increasing species richness were context-dependant, waning species complementarity in sites with liming conditions for growth.

TS.10-O-14

Room M5, Thursday 7th Feb. 12.45 h.

Contributions of functional traits and climatic variables shaping tree species distributionsSaura Mas, Sandra¹; Martinez-Vilalta, Jordi²; Shipley, Bill³

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The functional trait concept in community ecology has been based mainly on the use of average functional trait values at the species level. However, the use of average trait values is known to hide much functional variation at different ecological scales, including variability within populations and particularly among populations along environmental gradients. How important are differences in functional trait values within and between tree species in determining forest assembly along environmental gradients? We studied this question using CATS regression in shaping tree species distributions in Catalonia, NE Spain using plot-level trait values instead of species' means, and including information on trait variation. The traits were leaf nitrogen content, maximum height, wood density and specific leaf area. Species abundances, radial growth and functional trait data were obtained from the Ecological and Forest Inventory of Catalonia (IEFC), which sampled 10,638 plots distributed randomly with a density of ~1 plot • km². The most abundant species in the region, dominating ~90% of the total forested area, belong to the Pinaceae (7 species) and the Fagaceae (6 species) families. Climatic data and presence of management in each plot were also considered. Our results indicate a significant relationship between functional traits and tree species distributions and, moreover, this relationship depend on temperature, climatic water availability, and presence/absence of management. Our findings reveal the importance of the interaction between environmental variables and functional traits to interpret the distribution of tree species, and open avenues to model changes in species distribution under climate change.

TS.10-0-15

Room M5, Thursday 7th Feb. 13.00 h.

Intraspecific trait variation and abiotic factors as predictors of biomass production in *Quercus ilex* forest along an aridity gradientVillar Montero, Rafael¹; Olmo, Manuel²; Sánchez, Manuel³; Arenas, Salvador⁴; Ruiz-Benito, Paloma⁵

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Forest ecosystems provide important ecosystem functions and services, and occupy a large area in the world (in Spain ~ 35% of the total area). Tree diversity is a key factor underlining the forest functioning and the provision of ecosystem services. The study of the role of trait-based diversity effects on forest functioning has often missed intraspecific trait variability, at least across large spatial scales. Therefore, it is not well-known how intraspecific trait variability might affect to forest growth. In recent decades, an enormous effort has been made to characterize the structure, density and composition of Spanish forests through the National Forest Inventories (IFN). Since the IFN is carried out every decade in the same plots, it is possible to estimate the growth of the trees. However, there are very few studies that have estimated the growth (based on biomass) of forests and what are the factors that limit their growth. Some of the missing aspects are those related to intraspecific trait variability and soil nutrient availability. In this study, 30 *Quercus ilex* forests are studied along a gradient of aridity in Spain to know how the growth of these is determined by abiotic factors and intraspecific trait variability. Our results shows that growth was very variable, due to differences in abiotic factors, tree size and tree density. Surprisingly, the variation explained by temperature or precipitation was very poor (less than 7% of total variation in growth) which could be associated to the intraespecific variability and other abiotic and biotic factors.

TS.10-0-16

Room M5, Thursday 7th Feb. 13.15 h.

Resource availability and herbivory may alter maritime pine reproductive output and masting patternRodríguez Larrinaga, Asier¹; Sampedro, Luis²; Zas, Rafa³

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Masting is a common reproductive strategy of wind-dispersed trees, but its ultimate drivers and proximate mechanisms are still poorly understood. Resource allocation and seed predation are thought to play a key role, with predation being highlighted as one of its evolutionary drivers. Resistance to herbivores and granivores is a costly trait. Most chemical defences of pine trees are indeed carbonate compounds and might hence alter the carbon balance in trees, and ultimately its annual reproductive output. To explore the role of resource availability and herbivory on maritime pine reproduction and its interannual variability we set up two parallel experiments with replicate ramets of three different genotypes. In the resource availability experiment we applied an annual fertilizer supplement for 4 years, while on the herbivory experiment ramets were subjected to five herbivory simulation treatments (control, clipping, induction by methyl-jasmonate, and low and high intensity mechanical wounding). Our results show resource availability and defensive responses to herbivory seem to alter the reproductive effort of maritime pine in differing ways: while increasing available resources increased the number of flowers produced without affecting subsequent seed production, herbivory simulation did not alter the number of flowers produced but reduced healthy seed output in following years. Seed weight was not affected by any of the treatments. The implications for long term seed output of maritime pines are complex, but are probably related to the long ripening period of cones and seeds in this species.

TS.10-O-17

Room M5, Thursday 7th Feb. 15.00 h.

Reproductive fitness of herbaceous species in a drier and warmer world: Influence of the flowering phenologyHidalgo Gálvez, María Dolores¹; Hidalgo-Galvez, María Dolores²; Rodríguez-Carrasco, Teresa³; Herrador, María Belén⁴; Matías, Luís⁵; Cambrollé, Jesús⁶; Pérez-Ramos, Ignacio Manuel⁷

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Dehesas are agroforestry ecosystems resulting from the selective thinning of trees in natural oak forests. However, the structure and functioning of dehesas are being threatened in the last decades by the registered rise in temperature and drought intensity. Climatic models predict the continuity of these warning trends. To analyze the effects of these environmental changes on the herbaceous community, an experiment of rainfall exclusion and temperature increase was set up simulating the predicted changes in climate. The main objective of this study was to analyze the impact of climate change on the reproductive fitness of herbaceous species. Thirty-six experimental plots were installed at three dehesas (differing in grazing intensity) located in southern Spain. They were distributed equally between grassland and under tree canopy. Four climatic scenarios in each of them were simulated (control, warming, drought and warming + drought), and quantified the total number and weight of viable seeds in the most abundant species. From the 40 species analyzed, those with an earlier flowering phenology were more negatively affected by the temperature increase and aridity than species with a later phenology, likely due to their lower tolerance to water stress. Although each species responded differently to the different climatic treatments, the double abiotic stress had the overall most negative impact on the reproductive fitness of the studied species. Our community-level approach constitutes a useful tool on functional attributes of plant communities, predicting their responses to biotic and abiotic changes as well as inferring ecosystem properties of ecological and agricultural importance.

TS.10-O-18

Room M5, Thursday 7th Feb. 15.15 h.

Fitness, warming and species interactions at the northern and southern limits of a nurse plantVillemas Ariño, Jesus¹; García, María B.²; Morris, William F.³

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Predictions of plant responses to global warming frequently ignore biotic interactions and intraspecific variation across geographical ranges. Nurse species play an important role in plant communities by protecting other taxa from harsh environments, but the combined effects of warming and beneficiary species on their fitness components have been largely unexamined. We analyzed the joint effects of elevated temperature and neighbor removal on the nurse plant *Silene acaulis*, in factorial experiments near its northern and southern range limits in Europe. We recorded growth, probability of reproduction and fruit set during three years. The effects of enhanced temperature were positive near the northern limit and negative in the south for some fitness components. This pattern was stronger in the presence of neighbors, possibly due to differential thermal tolerances between *S. acaulis* and beneficiary species in each location. Neighbors generally had a negative or null impact, although small individuals of *S. acaulis* in the north showed higher growth when surrounded by other taxa. Finally, the local habitat within each location influenced some effects of experimental treatments. Our results highlight the need to consider geographic location, biotic interactions and local-scale environmental variation to predict the effects of global warming on plant fitness components.

TS.10-0-19

Room M5, Thursday 7th Feb. 15.30 h.

Plant functional traits explain spatial intraspecific variation in a Groundwater Dependent Ecosystem of arid regionsTorres García, María Trinidad¹; Salinas, María J.²; Cabello, Javier³

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Groundwater Dependent Ecosystems (GDEs) are endangered in the Anthropocene, especially in arid and semi-arid regions where plants and humans compete for water. Here, we investigate functional traits of a deciduous and phreatophytic species in the South-east of Spain that constitutes a GDE: *Ziziphus lotus* (Rhamnaceae). *Z. lotus* shrubs are protected as priority habitat by the European Habitats Directive and their decline might be on account of underground reasons. In the eolic coastal plain of Cabo de Gata-Níjar Natural Park (Spain), we hypothesized that the spatial variability in *Z. lotus* functioning is related to the spatial variation of groundwater availability and quality. Multivariate analyses were applied to a set of morpho-functional (e.g. Maximum growth stems length), leaf economic (e.g. Specific Leaf Area, Water Use Efficiency), and hydraulic traits (e.g. Water potential, stomatal conductance) to explore spatial patterns and to know what and to what extent plant functional traits describe those patterns. The results showed differences between individuals located at the inner part of the plain, those located closer to the litoral, and individuals growing in the seasonal stream that goes across the plain. Further, hydraulic functional traits had much to contribute to explain the observed variability. This has important implications for monitoring groundwater by functional traits of phreatophytic species and for their application in the management of this valuable resource in arid and semi-arid regions.

TS.10-0-20

Room M5, Thursday 7th Feb. 15.45 h.

Can hydraulic, leaf and stems traits predict performance along a water availability gradient?Rosas, Teresa¹; Mencuccini, Maurizio²; Saura-Mas, Sandra³; Sterck, Frank⁴; Martínez-Vilalta, Jordi⁵

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Foundational to trait-based ecology is the assumption that functional traits have an impact on plant performance. However, a lot of studies have failed to find associations between traits and demographic rates and have often ignored intraspecific trait variation (ITV). Here, we studied the variability of a set of hydraulic, leaf and stem traits along a water availability gradient for the six dominant tree species in Catalonia, NE Spain (*Fagus sylvatica*, *Quercus ilex*, *Q. pubescens*, *Pinus halepensis*, *P. nigra* and *P. sylvestris*). Our main objectives were to: (1) assess trait variability and its distribution among levels of organization; (2) study trait responses to water availability and (3) evaluate the effects of environment and traits on demographic rates. We sampled 15 populations per species along a water availability gradient (in terms of the precipitation to potential evapotranspiration ratio, P/PET). The traits studied included leaf mass per area (LMA), leaf nitrogen concentration (N), wood density (WD), the Huber value (Hv, the ratio of cross-sectional sapwood area to leaf area), sapwood-specific and leaf-specific stem hydraulic conductivity (KS and KL, respectively), vulnerability to xylem embolism (P50) and the turgor loss point (Ptlp). Our results showed that ITV contributed to a substantial amount of the total variance (from 6 to 42%) depending on the trait and that most traits responded to P/PET across species. However, only Hv and Ptlp responded to increasing water availability within species (negatively in both cases). We will also show how traits relate to growth and mortality rates at the stand level.

TS.10-0-21

Room M5, Thursday 7th Feb. 16.00 h.

How climate change can drive ant functional structure and diversityFrasconi Wendt, Clara¹; Verble-Pearson, Robin²; Almeida Aleixo, Cristiana³; Nunes, Alice⁴; Boieiro, Mario⁵; Branquinho, Cristina⁶

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Mediterranean drylands are particularly vulnerable to climate change, and the increase in aridity threatens key groups and ecosystem functions, as revealed by many long-term studies. To anticipate effects of climate changes on biodiversity and overcome issues related to long-temporal studies, a space-for-time approach is often preferred. Whereas a functional perspective, rather than a taxonomical, is implemented to detect responses of biodiversity and ecosystem processes to climatic changes. Ants are particularly sensitive to environmental changes and, besides been responsible for many ecosystem functions, have been successfully used to predict effects of climatic change. We aimed to evaluate ant functional traits response to climate along a spatial gradient. We chose an aridity gradient stretching from semi-arid to dry sub-humid in a typical Mediterranean ecosystem in the south-west of the Iberian Peninsula. Continuous and categorical functional traits were selected, and ant functional structure and diversity, using the community-weighted-mean and Rao's quadratic entropy indices respectively, were correlated to aridity. Results showed that the community-weighted-mean, rather than the functional diversity metric, significantly correlates with the climatic variables. A total of six functional traits changed along the aridity gradient, reflecting changes in habitat complexity, resource availability and microclimatic conditions. Furthermore, we intend to evaluate changes in functional beta diversity along the gradient. The measurement of the functional beta diversity could reveal compositional differences, in terms of functional traits, along the climate gradient, and may forecast changes in ecosystem functions at increasing aridity.

TS.10-0-22

Room M5, Thursday 7th Feb. 16.15 h.

Searching for the perfect mesophyll: a trade-off between productivity and stress resistance?Flexas, Jaume¹; Carriquí, Marc²; Clemente, María José³; Coopman, Rafael⁴; Gago, Jorge⁵; Gulías, Javier⁶

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Photosynthesis is a key factor underlying species responses to climate change and resource availability. Over the past two decades, our research group has shown ample evidence that mesophyll conductance to CO₂ (g_m) is as much limiting for photosynthesis as stomatal conductance is and, in some organisms, even more. While g_m is a dynamic trait, the maximum g_m of a given species is determined by the specific anatomical arrangements of the mesophyll, with a dominant role of cell wall thickness (CWT) and the fraction of mesophyll cells covered by chloroplasts (Sc/S). Significant and important differences in g_m exist between phylogenetically distant plant groups. Specifically, a decreasing trend for CWT and an increasing trend for Sc/S is observed from bryophytes to vascular plants and, among these, from ferns to angiosperms. Such trends correspond well with scaling maximum photosynthesis rates in each group. We hypothesize that this trend reflects a trade-off between photosynthetic capacity and desiccation tolerance, the latter being generalized in bryophytes, common in ferns and rare in higher plants. To test this hypothesis, we have conducted field campaigns in extreme environments of the world, including hot and cold deserts, like Atacama, salty planes in Los Andes, the Arctic and Antarctica, among others. Preliminary results confirm the hypothesized trade-off; and a few outliers to this trade-off were found in particular environments, which are promising candidates for 'high fitness species' in a climate change situation. The findings are discussed in terms of evolution and adaptation, highlighting their potential effects in plant fitness.

TS.10-0-23

Room M5, Thursday 7th Feb. 16.30 h.

Disentangling above and belowground drivers of stomatal response to drought stress on a temperate deciduous treeGimeno Chocarro, Teresa Efigenia¹; Barbeta, Adrià²; Clavé, Laura³; Delvigne, Camille⁴; Wingate, Lisa⁵; Ogée, Jérôme⁶

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Ever since the formulation of the stomatal optimization theory four decades ago, plant physiologists have been searching for a unified formulation to model the response of plant stomata to environmental and endogenous drivers. In the meantime, most Dynamic Global Vegetation Models (DGVM) incorporate some form of Leuning's empirical formulation (Leuning 1995 Plant Cell and Environment 18:339) that enables to predict the coupling of carbon uptake and water use under a gradient of temperature, air moisture and atmospheric CO₂ concentration. However, there is still great diversity in the way DGVM represent carbon and water trade-offs in response to soil water availability. Theoretical and semi-empirical formulations arising from optimization theory in combination with hydraulic modelling provide a novel framework for predicting stomatal response in the face of climate and global change. Here, we tested for the ability to predict stomatal behavior of two recently proposed formulations where stomata are hypothesized to maximize carbon gain instantaneously, irrespective of water availability. We measured leaf water potential, photosynthesis and stomatal conductance under a vapor pressure deficit gradient (VPD) in European beech (*Fagus sylvatica*) saplings subjected to three levels of water availability. The conductivity of the soil-plant-atmosphere continuum was manipulated by potting plant in three different types of soil with contrasting texture. Our results allow to disentangle the effect of atmospheric (VPD) and soil drought on stomatal behavior. Our findings support that a unified theoretical approach combining optimization and hydraulic modelling allows to predict stomatal behavior irrespective of the temporal scale considered.

TS.10-0-24

Room M5, Thursday 7th Feb. 16.45 h.

What if riparian tree species are confronted to drought periods? Linking foliar traits and foliar dynamics to water availability in a Mediterranean riparian forestPoblador Ibáñez, Sílvia¹; Sperlich, Dominik²; Nadal-Sala, Daniel³; Sabater, Francesc⁴; Sabaté, Santiago⁵

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Climate change is already affecting tree species performance around the world. However, little is known about climate change effects on riparian forests. Riparian trees inhabit the wettest areas of a catchment, and thus they might not present ecophysiological mechanisms to cope with the ongoing aridity increase. This work aims to evaluate tree species sensitivity to water availability in a mixed Mediterranean riparian forest. We evaluated tree canopy dynamics, and foliar chemical and morphological traits, during two vegetative years with contrasting environmental conditions (wet and dry). Moreover, we conducted isotopic analyses to determine water sources for riparian trees transpiration. Our results showed that soil water is the main source for transpiration (~80%) in all riparian tree species, particularly in summer. Autochthonous tree species (*Alnus glutinosa*, *Populus nigra* and *Fraxinus excelsior*) reduced their leaf production during the dry year. Yet, only *P. nigra* was able to increase its intrinsic Water Use Efficiency (iWUE) during that year. In contrast, the invasive species *Robinia pseudoacacia* showed a high plasticity to adapt to the environmental conditions variability. This species modified its water sources depending on the environmental conditions and its location on the riparian area. Moreover, *R. pseudoacacia* was able to produce more leaf biomass during the dry year, as well as increase its iWUE. Overall, our results highlight the extreme sensitivity of riparian tree species to water availability, and indicate the risk of these autochthonous species to be substituted by invasive species, more plastic and better adapted to drought periods such as *R. pseudoacacia*.

TS.10. Posters

TS.10-P-1

External pavilion, Poster session 2: Wednesday 6th - Thursday 7 th Feb.

Size does matter: morphology, sexual expression and sex ratios in *Pseudoscleropodium purum* across Europe

Boquete Seoane, María Teresa¹; Aboal, Jesús R²; Branquinho, Cristina³; Calleja, Juancho⁴; chila, antonina⁵; Cronberg, Nils⁶; cruz de carvalho, Ricardo⁷; estébanez-Pérez, Belén⁸; Fernández, Jose Ángel⁹; González-Mancebo, Juana María¹⁰; Leblond, Sebastien¹¹; Martínez-Abaigar, Javier¹²; Medina, Nagore¹³; Núñez-Olivera, Encarnación¹⁴; Patiño, Jairo¹⁵; Retuerto, Rubén¹⁶; Vanderpoorten, Alain¹⁷; Zechmeister, Harald¹⁸; Varela, Zulema¹⁹

(1) Estación Biológica de Doñana (EBD-CSIC); (2) Universidade de Santiago de Compostela; (3) Universidade de Lisboa; (4) Universidade de Santiago de Compostela; (5) Universidad Autónoma de Barcelona; (6) Lund University; (7) ce3c, Faculdade de Ciências, Universidade de Lisboa (8) Universidad Autónoma de Madrid; (9) Universidade de Santiago de Compostela; (10) Universidad de la Laguna; (11) Muséum National d'Histoire Naturelle; (12) Universidad de la Rioja; (13) South Bohemia University; (14) Universidad de la Rioja; (15) Universidad de la Laguna; (16) Universidade de Santiago de Compostela; (17) University of Liège; (18) University of Vienna; (19) Universidade de Santiago de Compostela

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Sex-specific traits determine ecological performance of individual sexes within species. Bryophytes are unique in that respect because more than 60% of species present separate sexes (i.e. dioecy), and females often outnumber males in natural populations, as opposed to seed plants (4 – 6% dioecy, male-biased populations). However, the causes that determine these characteristics in bryophytes have not been elucidated yet. Here we select *Pseudoscleropodium purum*, a dioecious pleurocarpous moss, as a model and conduct a study aiming at identifying spatial patterns of variation of sexual expression levels, sex ratios, morphology, and the potential environmental factors driving this presumable variation. Moss samples were collected at 161 locations in seven European countries spanning its distributional range along a latitudinal gradient (from Canary Islands to Sweden). Sexual and morphological traits were measured in ca. 100 gametophores per population. We found high levels of sexual expression (average 54%), and sex ratio was strongly female-biased in most sites (~85%). Unexpectedly, we found a few strongly male-biased populations (57-100% males) clustered in very specific areas in the Iberian Peninsula. Sex expressed shoots were significantly larger than non-expressed ones in terms of weight and length, but differences were non-significant when comparing males and females. We also found significant differences in morphological traits across sites between expressed and non-expressed, and male and female plants. We hypothesize that there may be sex-specific differences in tolerance to some environmental variables that could be driving these patterns and so, further work will focus on the study of these potential selective forces.

TS.10-P-2

External pavilion, Poster session 2: Wednesday 6th - Thursday 7 th Feb.

Tree competition effects on secondary growth of Scot pines in a Mediterranean altitudinal limit

Carvalho, Bárbara¹; Heres, Ana-Maria²; Martín Cacheda, Lucía³; Ledo Lançao, Verónica⁴; Castro, Pablo⁵; C. Bastias, Cristina⁶; Benavides Calvo, Raquel⁷; Valladares, Fernando⁸; Escudero, Adrián⁹; Escudero, Adrian¹⁰

(1) w/o; (2) Transilvania University of Brasov; (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); (9) Universidad Rey Juan Carlos; (10) Universidad Rey Juan Carlos

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Competition among individual trees is a fundamental ecological process that plays a major role in population dynamics, survival, growth and species replacement. Moreover, under highly stressed environments it may exacerbate the external limiting conditions. The main aim of this study is to model the secondary tree growth of *Pinus sylvestris* as function of three different components: plant size, neighbor competition and site environmental conditions. In this study, we used a final 5-year measurement of tree growth in a Mediterranean montane monospecific coniferous forest at 1700m of altitude, in Sierra de Guadarrama, Madrid. We aimed at investigating the effects of tree size, neighborhood competition, and environmental condition on tree growth and spatial variation of the growth patterns of individuals of this boreal species close to the rear edge of its geographical distribution, using a spatially explicit neighborhood scale approach. Our analysis of tree growth is being performed in 900 individuals of *P. sylvestris* distributed in a 2-hectare area. All individuals with diameter at breast height (DBH) > 7.5 cm are measured and georeferenced. The main advantage of the neighborhood approach is that it captures the local nature of plant interactions and acknowledges that the frequency with which individuals interact with other conspecific neighbors may depend less on their relative abundance than on their particular spatial pattern.

TS.10-P-3

External pavilion, Poster session 2: Wednesday 6th - Thursday 7 th Feb.

Understanding plant community assembly under water limitation: an experimental test with long-lived speciesCrespo Bastias, Cristina¹; Carvalho, Bárbara²; Matesanz, Silvia³; Valladares, Fernando⁴; de la Cruz, Lydia⁵; Benavides, Raquel⁶

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Climate change alters the environmental conditions key to plant performance and fitness, with potential consequences for species interactions and community dynamics. Therefore, it seems critical to investigate the capacity of plants to cope with these novel environmental conditions. In this context, phenotypic plasticity is a key mean, allowing plants to deal with these changes by adjusting their phenotypes to new conditions. The main goal of this work is to analyze phenotypic shifts as well as the magnitude and direction of response of different tree species co-occurring in communities under biotic and abiotic environments based on global change predictions. We are currently performing a greenhouse experiment with a full-factorial design, where plants from four different tree species (*Quercus ilex*, *Quercus faginea*, *Pinus nigra* and *Pinus sylvestris*) co-occur in environments with contrasting water availability [control vs. low water supply] and different community richness and composition. We expect a shift in key traits related to water acquisition as species richness increases, to diminish competitive interactions and favor resources complementary among different species. The phenotypic shift and plasticity will be more intense in monospecific communities (i.e. individuals with similar ecological requirements) than in mixed and between species sharing functional group. In mixed communities with water limitation, we expect that those species following anisohydric strategies, such as *Q. ilex*, would have a competitive advantage reflected in their fitness. While those species with isohydric strategies such as *Pinus* genus would present higher plasticity to compensate their low drought tolerance.

TS.10-P-4

External pavilion, Poster session 2: Wednesday 6th - Thursday 7 th Feb.

Intraspecific variation in fruits of *Fraxinus angustifolia* and *Ailanthus altissima* in riparian and roadside habitatsHernández Pazmiño, Nathalia¹; Jiménez Escobar, María Dolores²; Delgado Sáez, Juan Antonio³

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Fraxinus angustifolia is a common species of riparian vegetation but is flexible enough to be found along roadsides in many places of the Iberian Peninsula. However, since a century ago, *Ailanthus altissima*, an invasive species, is spreading into these habitats. The aim of this work was to compare the diaspores morphology of these two species to test the degree of variation of different functional traits related to their dispersal capability and seedling establishment. For this study we considered samara fall speed and wing loading as estimates of dispersal potential; and samara weight as an estimate of seedling establishment potential. A General Linear Model (GLM) was performed, combining a fixed factor: habitat; and two random factors: individual tree; and plot. Results reflected a large proportion of samara trait variation between habitats and plots for *A. altissima* whereas intraindividual variation was the main source of variation for *F. angustifolia*. In addition, there were significant differences in samara weight between the two sampled habitats for *A. altissima*, whereas no differences were observed for *F. angustifolia*. These results suggest that *A. altissima* is able to increase the weight of the samaras without affecting its dispersal potential, likely due to their pronounced three-dimensional structure. In contrast, *F. angustifolia* samaras present a bi-dimensional arrangement and so the weight of the samara could be a determinant component of its dispersal performance.

TS.10-P-5

External pavilion, Poster session 2: Wednesday 6th - Thursday 7 th Feb.

A matter of place: Local and broad-scale variables determine the functional structure of bryophytes in headwater streamsMonteiro, Juliana¹; Aguiar, Francisca C.²; Matos, Paula³; Vieira, Cristiana⁴; Branquinho, Cristina⁵

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Bryophytes are a key group of freshwaters providing multiple ecological functions, especially in headwaters. Worldwide, recent efforts were directed at characterizing the functional composition of vascular aquatic communities, but few studies have addressed bryophyte functional responses to environmental conditions. Our study was conducted in headwaters within Natura 2000 Sites in the NW and CW Portugal, where we collected data on bryophyte species and environmental variables from 165 locations. We hypothesized that functional traits related to growth, life-form, reproduction, autecology, and life-strategy mediate the responses to the environmental conditions. We used hierarchical clustering and indicator species analyses to obtain groups of sites with similar functional structure, and Non-Metric Multidimensional Scaling to understand the relations between these groups and the main environmental gradients. The analyses revealed six groups of sites, dominated by distinct functional groups, namely: i) saxicolous, typical from frequently submerged rocky substrates, ii) truly aquatic, found in submerged conditions, iii) highly dynamic, which colonize unstable microhabitats, iv) streamside, at or just above the water level, v) high-altitude, typical of acidic mountain streams, and vi) basophilic, found in limestone streams. These groups were primarily defined by local-scale variables, followed by broad-scale gradients of climate. Particularly, the annual precipitation, a surrogate for streamflow regime, largely contributed to the segregation of these functional groups. Our results highlight the importance of hydrology as a major driver of the functional structure of bryophyte communities. Further research is needed to enlarge our knowledge on the use of these functional groups as ecological indicators of climate change.

TS.10-P-6

External pavilion, Poster session 2: Wednesday 6th - Thursday 7 th Feb.

The role of fire and aridity in the structure of plant communities in Mediterranean ecosystemsMoreira, Bruno Ricardo¹; Pausas, Juli Garcia²

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Fires and drought (aridity) are important environmental pressures in Mediterranean ecosystems worldwide. The predictions of current climate change scenarios suggest a greater severity of climatic conditions in the future with a trend towards an increase in warming and droughts (frequency and / or intensity) in the next decades. This may imply a greater and a change in the regime (frequency and/or intensity) of fires, with important consequences on biodiversity. Therefore, it is essential to advance our understanding of the role of fire and aridity in the assembly of Mediterranean plant communities. The goal of this study was to ascertain the different processes determining community assembly in fire-prone communities of the Mediterranean Basin and the changes in the relative importance of these processes along the successional dynamics. For this, we sampled sites along a temporal gradient of succession after wildfire using a chronosequence representing time since last fire and captured differentiated climatic conditions by conduction the study in two different regions with contrasted aridity, in the Iberian Peninsula. We used a trait-based approach that lies in the integration of the interplay between abiotic filters such as fire and climate, but also considering species interactions. For this, we sampled species co-occurrence patterns and quantified relevant trait values, considering their intra- and inter-specific variability. Our results suggest that abiotic filtering and species interactions determine plant traits, driving the community structure in fire prone shrublands. Our results also suggest the interplay between fire and aridity has an important role determining this structure.

TS.10-P-7

External pavilion, Poster session 2: Wednesday 6th - Thursday 7 th Feb.

Functional variability in lichen epiphytic communities in *Nothofagus pumilio* forests along an environmental gradient in ChileRodríguez Arribas, Clara¹; Aragón, Gregorio²; Hurtado, Pilar³; Zamorano-Elgueta, Carlos⁴; Cavieres, Lohengrin⁵; Prieto, María⁶; Martínez, Isabel⁷

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The temperate forests of *Nothofagus* in the American continent are characterized by a high diversity and biomass of lichen species. Understanding how environmental filters modulate the functional diversity of epiphytic lichen communities can help us to understand the responses of these communities to changes in climatic and topographic variables. We hypothesized that more adverse environmental conditions (e.g. drier or illuminated places, or situated at lower altitudes) will decrease the functional diversity of epiphytic communities. In this study we sampled a total of 27 forests of *Nothofagus pumilio* located in 10 different localities across a latitudinal gradient in Chile. In each forest, we chose 5 plots of 200x200 m and 10 trees in each plot. We used sampling squares at breast height and base in North and South orientations of each tree and we counted the relative abundance of each species. We analyzed different functional traits of lichens as the growth form or the type of photobiont. So far, our results show clear patterns of relation with the different environmental variables considered, especially of the growth forms. Thus, foliose lichens were more abundant at higher altitudes, while crustose and fruticose lichens reduced their abundances with altitude. Latitude significantly affected foliose species, reducing their abundance in Southern latitudes. In relation with the climatic variables, we observed that annual precipitation increased the abundance of crustose and fruticose lichens but decreased foliose species. This study shows that environmental filtering is affecting functional diversity of epiphytic lichen communities and determines their assemblage.

TS.10-P-8

External pavilion, Poster session 2: Wednesday 6th - Thursday 7 th Feb.

Hairiness: an essential functional trait in pollinator ecologyRoquer-Beni, Laura¹; Rodrigo, Anselm²; Boreux, Virginie³; Klein, Alexandra-Maria⁴; Arnan, Xavier⁵; Fornoff, Felix⁶; Bosch, Jordi⁷

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Pollinator functional diversity is increasingly being incorporated into pollination ecology studies. Commonly used pollinator functional traits include mouthparts length, body size, nesting habits, pollen specialization and sociality. Hairiness (pilosity) is another important pollinator trait, which has been shown to play an important role in thermoregulation, as well as pollen collection, transportation and pollination effectiveness. However, there are few studies using this trait, probably due to the lack of efficient methodologies. In this study we present a new method to quantitatively measure pollinator hairiness and propose an index of pilosity. We measured hair density and length in three body areas (face, dorsal surface of the mesothorax and ventral surface of the mesothorax) of different pollinator species from various taxonomic groups. Hair length was positively correlated to body size, but hair density and body size were not correlated. In bees, hair density and hair length were negatively correlated, suggesting a trade-off between these two components. We used this information to create an index of pilosity (product of hair density and hair length). According to this index, butterflies and bee-flies (Bombyliidae) are the hairiest pollinator groups, followed by bees, hover-flies (Syrphidae), beetles and other flies. Among bees, *Bombus* and *Osmia* were the hairiest genera, followed by *Anthophora*, *Andrena*, *Lasioglossum* and *Nomada*.

TS.10-P-9

External pavilion, Poster session 2: Wednesday 6th - Thursday 7 th Feb.

Water shortage in a water rich environment: how are photosynthesis, respiration and foliar morphology of riparian trees affected by a severe summer drought?Sperlich, Dominik¹; Chang, Chaoting²; Poblador, Sílvia³; Sabaté, Santi⁴

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Riparian forests in arid and semi-arid regions are biodiversity hotspots and highly dynamic ecosystems providing important exchange processes of water, carbon and nutrient cycle with the entire catchment. Rapid growth rates of the Mediterranean riparian tree species are strongly linked to these dynamic biogeochemical processes benefiting from both high solar energy- and water availability. Not much is known, however, how seasonal drought affects the ecophysiology of riparian tree species, which can benefit from stream water independent of precipitation events. In this work, we studied the effect of a drought year on key ecophysiological variables such as the photosynthetic capacity, foliar respiration, and leaf traits in a Mediterranean, mixed, riparian forest. Net assimilation (Anet), stomatal conductance (gs) were significantly reduced in the drought year in *Fraxinus excelsior*, *Populus nigra*, and *Alnus glutinosa* but not in *R. pseudoacacia* where they were significantly increased. *F. excelsior* was the most affected of all species by drought showing signs of dehydration and foliar wilting in the drought period. The water-use efficiency was significantly increased in the drought year. We found that the photosynthetic potentials (Vc,max and Jmax) were not affected by the drought conditions. Foliar respiration decreased under summer drought except for *A. glutinosa* where it increased. All in all, the highly competitive photosynthetic traits of the invasive tree *R. pseudoacacia* help to explain its dominance and wide distribution from near- to far-stream sites.

TS.10-P-10

External pavilion, Poster session 2: Wednesday 6th - Thursday 7 th Feb.

Facilitation in Mediterranean grasslands: integrating the three (i.e. taxonomic, functional, and phylogenetic) biodiversity dimensionsVega Álvarez, Julia¹; Cayuela, Luis²; García Rodríguez, José Antonio³; Cayuela, Luis⁴; García Rodríguez, Jose Antonio⁵

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Positive plant-plant interactions are key to understand community assembly. Facilitation research has recently focused on functional and phylogenetic aspects to unravel if assemblages are shaped by species' functional traits and/or their evolutionary histories. In 2014, Chao, Chiu, and Jost, proposed a methodology consistent in transforming taxonomic, functional and phylogenetic diversity indices into comparable units using generalized Hill numbers, establishing an integrated framework called "attribute diversity". By jointly considering the three dimensions of biodiversity we can address the effects of facilitation on overall biodiversity and potentially disentangle its role in ecosystem functioning. In this study we apply this comprehensive approach to facilitation, analysing how shrubs affect taxonomic, functional and phylogenetic diversity of a Mediterranean grassland. Besides, we build a water stress gradient to analyse how positive effects of shrub cover change with water availability depending on the biodiversity dimension considered.

Thematic Session 11: Marine and terrestrial ecosystem responses to climate change: from genes to populations and ecosystems

Day: Wednesday 6th February and Thursday 7th February

Schedule: 12:00h 13:30h - 18:00h 19:30h | 12:00h 13:30h - 15:00h 17:00h

Location: Room M2

Coordinators:

Daniel von Schiller, University of the Basque Country (UPV/EHU), Spain

María Almagro, Basque Centre for Climate Change (BC3), Spain

Cristina Romera-Castillo, Institute of Marine Sciences (ICM-CSIC), Spain

Rafael Marcé, Catalan Institute for Water Research (ICRA), Spain

Biel Obrador, University of Barcelona (UB), Spain

One of the most apparent signals of humans' impact on the biosphere is climate change, causing alterations in the average climate and, in the intensity and frequency of extreme climatic events such as droughts, storms or heat waves. Evidence of environmental alterations has transgressed almost all levels of organization in biological systems and has extended to a wide range of spatial and temporal scales. Both marine and terrestrial ecosystems play a critical role in the global carbon cycle, in biodiversity maintenance and in the provision of ecosystem services. Changes in climate overlap with human-induced modifications in the structure of ecosystems and their interactive effects can ultimately lead to non-linear responses and tipping points. Understanding those processes that are essential to guarantee the structure and function of ecosystems, as well as the long-term provision of services, has become a key priority in conservation science.

This session welcomes contributions to increase our knowledge and predictions about the responses of species (from individuals to communities), and their underlying mechanisms, to climate change. Attendees will benefit from different study systems, approaches, methodologies and scales for the evaluation of ecosystem responses and the special focus on management strategies aimed at enhancing ecosystem stability and resilience.

TS.11. Oral talks**TS.11-MT-1**

Room M2, Wednesday 6th Feb. 12.00 h.

Climate refugia as hotspots of genetic diversity for marine forestsSerrao, Ester¹; Neiva, Joao²; Assis, Jorge³; Paulino, Cristina⁴; Pearson, Gareth⁵; Pearson, Gareth⁶

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Climate-driven range shifts that shape the geographical distribution of genetic diversity can drive different modes of speciation such as through divergence in allopatry or via recombination at contact zones through allopolyploidy. Here we report case examples of these predictions for ecosystem structuring species such as those forming algal forests. These were discovered by analysing the geographical distribution of genetic variability and modelling species ranges. We found high and unique genetic diversity at estimated long-term persistence zones (refugia during both warmer and colder extremes), which are presently located at the lower latitude range edges, in shrinking climatic refugia, which impoverish global genetic diversity. We also discovered diversity and reticulation within lineages including endangered, modern climatic relicts and the identification of stable allopolyploid species with clearly discernable ancestry and geographical distribution. This allopolyploid speciation along a transitional coastline represents a hotspot of diversity and evolution at sympatric range contact zones. Furthermore, in some complexes, shifting habitat suitability under variable climate conditions created divergent lineages with limited range overlap and limited genetic admixture, representing a complex of incipient species. Phylogroup distributions compared with models of habitat suitability further demonstrate a role of cycles of glacial isolation in disjunct persistence areas intercalated with ephemeral interglacial expansions and admixture at high-latitude contact zones. Multi-glacial cycles thus acted as a speciation pump for marine organisms otherwise exhibiting cosmopolite amphiboreal distributions.

TS.11-O-2

Room M2, Wednesday 6th Feb. 12.30 h.

Warming oceans, changing habitats: coupling thermal performance with ecosystem shiftsBoada, Jordi¹; Alcoverro, Teresa²; Arthur, Rohan³; Alonso, David⁴

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Environmental regimes shape the distribution of marine habitats across the globe. Global changes in temperature regimes and the increased occurrence of extreme events have so far caused critical environmental shifts in such habitats. Foundation species of temperate reefs such as kelps and other macroalgae are good examples shifting habitats in a tropicalisation scenario. More importantly, changes in the ecosystem structure are sometimes governed by non-linear dynamics making the effects of warming oceans more challenging. This is particularly relevant when the ecosystem structure drops to critical levels that do not guarantee the sustainability of the natural resources and services that they offer; collapses. In this study we revise the state of the art of ecological shifts related to warming seas worldwide, with a special attention on ecosystem collapses. We propose to focus our attention on the relationship between i) the thermal performance of foundation species and ii) the thermal-related strength of ecological interactions in which they are involved to disentangle the effects of global warming in shifting ecosystems. Specifically, we demonstrate how simple trophic mathematical models have a good capacity of predicting ecosystem shifts in a changing thermal regime scenario. This becomes critical to preserve the sustainability of natural resources and prevent them from undesired, climate-related shifts.

TS.11-0-3

Room M2, Wednesday 6th Feb. 12.45 h.

The hidden feedbacks of global change: unveiling complexityMagro Ruíz, Sandra¹

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Global change is the sign of identity of the Anthropocene. Human activities have affected ecological functions to the point that we have alter and transform not only all terrestrial and aquatic ecosystem, but also the processes that maintain life on Earth. Although it is well known that all ecosystems are connected through energy and matter fluxes, and feedbacks usually occurs in biological systems, there is a lack of integrated approaches that address the existence of reciprocal relationships between global change drivers. In the present study, we aim to identify feedbacks between 10 key global change processes based on the planetary boundaries defined by Röckstrom. We have review around 3000 papers in which we identify all interactions between drivers and we have categorized them depending on the amplifying, attenuating or neutral effect. Then we identify the reciprocal interactions between pairs of drivers (feedbacks) and we have calculated their environmental impact (the effect of the feedback multiplied by the scale of influence) and their research intensity (the number of single interactions supporting the existence of each feedback). Our results showed that there are evidences of 32 reciprocal interactions among global change drivers in the scientific literature but only 3 has been studied explicitly as feedbacks. Then, there are 29 feedbacks that remain hidden. From them, more than 75% have a reinforcing effect. Feedbacks with the highest environmental effect are also the worst represented in scientific literature. Although further research is needed, our results shed light upon the complexity of global change.

TS.11-0-4

Room M2, Wednesday 6th Feb. 13.00 h.

Temporal changes in Iberian forest structure, dynamics and composition in the last 35 yearsAstigarraga, Julen¹; Andivia, Enrique²; Cruz-Alonso, Verónica³; Zavala, Miguel Ángel⁴; Ruiz-Benito, Paloma⁵

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Climate change is leading to increased temperature, altered precipitation and more intense and frequent extreme events such as droughts or spring frosts in Mediterranean areas. Moreover, there is a generalised abandonment of agricultural and forest uses such as grazing or firewood production. These changes are impacting forest composition (e.g. structure and species composition) and functioning (e.g. growth and mortality). However, the evaluation of global change impacts on forests at large spatial and long temporal scales remains challenging, because of the lack of detailed data. Here, we analysed the temporal trends of forest structure (mean diameter at breast height, basal area, tree density and heterogeneity), demography (growth and mortality) and composition (percentage of gymnosperms) in the last c. 35 years across the Iberian Peninsula using permanent plots of the second, third and fourth Spanish Forest Inventory. Then, we evaluated the effect of recent global change (i.e. climate and forest structure) underlining shifts in forest demography and composition. Iberian forests increased in tree size and basal area, while reducing their density and heterogeneity. In addition, forest stand experienced a reduction in growth, an increment in tree mortality and increased proportion of angiosperms. Both recent climate change and forest structure interacted shaping forest demography and compositional trends. Our results contribute to understand forest responses to global change and provide practical implications to prioritise the implementation of conservation and management practices in those forest types more vulnerable to global change.

TS.11-0-5

Room M2, Wednesday 6th Feb. 13.15 h.

Effects of climate change on a freshwater food chain: how does temperature affect primary producers and consumersAlmeida, Salomé FP¹; Oliveira, Ricardo²; Mortágua, Andreia³; Figueira, Etelvina⁴; Feio, Maria João⁵

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Mean global air temperature is predicted to increase between 1 and almost 5 °C by 2100 which will be closely followed by an increase in stream water temperature. Diatoms are the dominant group of primary producers in rivers and streams. *Nitzschia palea* (NPAL) is a tolerant species to organic and nutrient contamination. Nevertheless, little is known about its tolerance to temperature. *Theodoxus fluviatilis*, a freshwater snail feeds mainly on biofilms, and therefore, on diatoms. The aims of this work were to determine the effects of temperature on the growth and physiological state of NPAL and how it would affect the growth of *T. fluviatilis*. NPAL was grown at 4 temperatures (20, 30, 33 and 35°C) and attained maximum growth on the 7th day at 30°C. After the 7th day of culture growth declined rapidly. At 33°C cell damage increased (higher values for lipid peroxidation and protein carbonylation); at 35°C it didn't grow at all. Lipid content increased significantly at culture days 11 and 14 for 30 and 33°C coinciding with the decline phase of the growth curve. Taking into account the previous results, *T. fluviatilis* was fed with biofilm of NPAL at 20 and 30°C for 15 days and growth inferred by measurement of the shell length difference; stress on the grazer was inferred by respiration measurement. Contrary to expected growth of *T. fluviatilis* wasn't affected by the food provided; stress was significantly higher at 20°C. The period of feeding should be increased and optimum temperature determined for the snail.

TS.11-0-6

Room M2, Wednesday 6th Feb. 18.00 h.

Benthic diversity in the future ocean: metabarcoding assessment of littoral communities from a volcanic CO₂ vent in La Palma, Canary IslandsWangensteen, Owen¹; González-Delgado, Sara²; Soto, Ana Zaida³; Alfonso, Beatriz⁴; Sangil, Carlos⁵; Mariani, Stefano⁶; Hernández, Jose Carlos⁷

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Volcanic CO₂ vents are excellent natural laboratories to study the effects of ocean acidification (OA). Recently, several such vents were discovered in shallow waters by La Palma (Canary Islands) with some exceptional features resembling the pH conditions of future oceans (7.6 average pH). We report biodiversity variation in benthic communities along the natural pH gradient, assessed by a metabarcoding method using universal mitochondrial cytochrome c oxidase (COI) primers. We sampled benthic assemblages at different distances from the vent, which were separated into two size fractions (macrofaunal and meiofaunal). A metabarcoding procedure using Leray-XT primers (a highly degenerate set which allows detailed characterisation of most Eukaryotic diversity) was used to sequence a 313-bp COI fragment. ANOSIM tests revealed significant changes in MOTU (Molecular Operational Taxonomic Unit) composition between sites, associated to the close presence of the vent. We observed an increase in non-calcified Rhodophyta and turf-like communities closer to the vent, where calcified species were very rare. Some Phaeophyceae such as *Halopteris* sp. thrived in the vent, while others such as *Canistocarpus* sp. (abundant elsewhere) disappeared. Regarding Metazoans, we observed that species living closer to the vent tend to have smaller body-size and brooding reproduction. Interestingly, total diversity of the smaller fraction increased near the vent, while diversity of the bigger fraction decreased. We demonstrate that OA can alter taxonomic composition, structure and biodiversity of benthic ecosystems, and we present a novel, versatile, and affordable molecular tool, without the requirement of taxonomic expertise availability, to monitor such changes.

TS.11-0-7

Room M2, Wednesday 6th Feb. 18.15 h.

Leaf microbes and nitrification in the canopies of European forests: evidence from stable isotopes, meta-barcoding and qPCR

Guerrieri, Rossella¹; Barceló, Anna²; Mattana, Stefania³; Calíz, Joan⁴; Elustondo, David⁵; Hellstein, Sofie⁶; Matteucci, Giorgio⁷; Merilä, Päivi⁸; Michalski, Greg⁹; Nicolas, Manuel¹⁰; Vanguelova, Elena¹¹; Verstraeten, Arne¹²; Waldner, Peter¹³; Watanabe, Mirai¹⁴; Peñuelas, Josep¹⁵; Mencuccini, Maurizio¹⁶

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Forest canopies influence our climate through carbon, water and energy exchanges with the atmosphere. However, less investigated is whether and how tree canopies change the chemical composition of precipitation, with important implications on forest nutrient cycling. Recently, we provided for the first time isotopic evidence that biological nitrification in tree canopies was responsible for significant changes in the amount of NO₃ from rainfall to throughfall across two UK forests at high nitrogen (N) deposition. This finding strongly suggested that bacteria and/or Archaea species of the phyllosphere are responsible for transforming atmospheric N before it reaches the soil. This study aims to 1) characterize microbial communities harboured in tree canopies for two of the most dominant species in Europe (*Fagus sylvatica* L. and *Pinus sylvestris* L.) using meta-barcoding techniques, 2) quantify the functional genes related to nitrification, and 3) estimate the relative contribution of NO₃ derived from biological canopy nitrification vs. atmospheric deposition by using d18O and d17O of NO₃ in forest water. We considered twelve sites included in the European ICP forests monitoring network, chosen along climate and N deposition gradients, spanning from Fennoscandia to the Mediterranean. Preliminary results indicate differences in bacterial structure and composition across phyllosphere (and between the two species considered), water and soil samples. Moreover, presence of nitrifying bacteria and Archea (as assessed through qPCR) and their activity (as derived from d18O and d17O) were detected across all the samples, regardless the level of N deposition.

TS.11-0-8

Room M2, Wednesday 6th Feb. 18.30 h.

Severe drought alters flowering and reduce production and decomposition processes as early response in Mediterranean shrublands

Maturano Ruiz, Adrián¹; Fuentes, David²; Llorens, Ismael³; Bausà, Marta⁴; Valdecantos, Alejandro⁵

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Changes in soil use and wildfire regime have deeply altered plant communities in the Mediterranean Basin in the second half of the 20th century. Furthermore, the increase in temperature and drought forecasted for the coming years will aggravate that situation, especially in drylands. Although the current research effort in the topic, it is needed to delve into an adaptative approach to the response of vegetation, improving our knowledge in the processes and properties of plant communities under future scenarios. In this study we established a manipulative drought experiment in post-fire mature seeder-dominated shrubland, a common alternative stable state of burned Mediterranean pine woodlands. We analyzed vegetation response to a gradient of water availability created through experimental treatments, from rainfall exclusion (79% exclusion) to artificial watering (22% annual precipitation increase), assessing their impacts on individual traits of the most common shrub species and on community properties and processes. Two years after the experiment started, community properties and processes showed earlier response to the implemented drought gradient than the shrub individual traits. Litter production, root production and litter decomposition were 75%, 124% and 170% higher in the watered than in the droughted plots, respectively. Within the individual traits, flowering is the most sensitive process to drought, increasing and overlapping the flowering peaks between the main shrub species in the driest plots. Despite the main differences in these experiments are expected after the fourth year of study, our results point to the potential effects of an extreme drought period over that rising communities.

TS.11-0-9

Room M2, Wednesday 6th Feb. 18.45 h.

Complementarity of food web and Bayesian hierarchical modelling approaches to predict marine species distributions under climate changeColl, Marta¹; Pennino, Maria Grazia²; Steenbeek, Jeroen³; Sole, Jordi⁴; Bellido, Jose María⁵

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The spatial prediction of species distributions from survey data is a significant component of spatial planning and the ecosystem-based approach. Frequently, statistical analysis of species occurrences and their relationships with associated environmental factors is used to predict the likelihood of a species to occur in unsampled locations, and to forecast species distributions under climate change projections. However, it is known that environmental factors alone are rarely sufficient to account for species distributions; other ecological processes including species interactions (such as competition and predation), and the impact of human activities, may affect the spatial arrangement of a species. Here, we use the Bayesian Hierarchical Species Distribution model and the mechanistic food web Ecospace Habitat Foraging Capacity model to predict the presence and biomass distribution of iconic commercial species in an exploited marine ecosystem of the Northwestern Mediterranean Sea: European hake, anglerfishes and red mullets. We explore the complementarity of both approaches, aside from their applicability as independent techniques. We assess how to use Bayesian models to incorporate uncertainty into the food web modelling, and we discuss advantages, limitations and future developments of both spatial-temporal modelling techniques under the context of future scenarios of climate change and adaptive management of marine resources.

TS.11-0-10

Room M2, Wednesday 6th Feb. 19.00 h.

Key environmental factors for modelling high mountain lake summer water temperatures: a future climate change prediction in Pyrenean water bodiesSaludas, Ibor¹; Miró, Alexandre²; Miró, Alexandre³; Catalan, Jordi⁴; Ventura, Marc⁵

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Water temperature is a key environmental variable for ecological and biological processes. In the current context of existing climate change, it is of paramount importance knowing the variables that can be used for modelling and predicting thermic variables in water bodies, especially those of high altitudes such as Pyrenean mountain range. We have described the regional and interannual variability in Pyrenean lakes and ponds and used mixed models to identify the key environmental variables for modelling different water temperatures: mean and maximum summer temperature, accumulated degree-days, diel temperature ranges and oscillation. We used a decade of data from 59 temperature series of Pyrenean lakes and ponds covering most of the mountain range. We run the models for predicting actual and future temperatures under different warming scenarios for 2267 water bodies of the Pyrenees. We have found that altitude is the main explicative variable for accumulated degree-days, mean and maximum temperature, whereas lake area had the most important effect on diel temperature range and temperature oscillation, with a lesser effect of altitude. Altitude, lake area, catchment morphology and solar radiation together were more explanative than interannual variability in air temperature. Accumulated degree-days are expected to increase more in smaller lakes and ponds and at higher altitudes. Predicted mean summer water temperatures in Pyrenean water bodies can increase 0.96 °C from the present mean 11.08 °C by 2090.

TS.11-MT-11

Room M2, Thursday 7th Feb. 12.00 h.

Understanding and predicting drought-linked tree growth decline from local to regional scalesJump, Alistair¹; Vilà-Cabrera, Albert²; Ruiz-Benito, Paloma³

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Increased temperatures and altered precipitation regimes amplify drought frequency and intensity, elevating plant stress and mortality. Drought-linked growth decline and large-scale forest mortality events will have far-reaching impacts on carbon and hydrological cycling, biodiversity, and ecosystem services. It is typically assumed that range-edge populations are most at risk. However, biogeographical theory and global vegetation models poorly represent impacts on forest systems witnessed recently. Since trees are sessile and long-lived, their responses to climate extremes are substantially dependent on historical factors in addition to suitability of current climate and other environmental factors. We argue that periods of favourable climatic and management conditions that facilitate abundant tree growth can lead to structural overshoot of aboveground tree biomass due to a subsequent temporal mismatch between water demand and availability. When environmental favourability declines, consequent increases in water and temperature stress drive a gradient of tree structural responses ranging from premature leaf senescence and partial canopy dieback to whole-tree mortality. While this risk will increase with large predicted fluctuations in both wet and dry conditions, interactions between climate and landscape heterogeneity can lead to significant population retention even in areas that are deemed highly vulnerable to dieback at the landscape scale. We will present ongoing research demonstrating how we can refine our predictive capacity to better forecast population retention and loss from local to regional scales.

TS.11-O-12

Room M2, Thursday 7th Feb. 12.30 h.

Vulnerability to climate change of an endangered dioecious tree species: growth responses to climate and competition across environmental gradientsHerrero Méndez, Asier¹; Laskurain, Nere Amaia²

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Warming and increased frequency and intensity of climate extremes can alter forest ecosystems functions and trigger biodiversity loss. Resilience capacity to extreme events, quantified as the ratio of averaged performance before and after an extreme event, could be critical to assess the ability of organisms to withstand climate change. Further, competition commonly interact with climate limiting tree growth in the southern distribution of species. In this context, dioecious tree species could be especially vulnerable since its populations depend on the performance of both male and female individuals, and an imbalance in the sex ratio could affect population viability. Different growth responses to climate can be expected between sexes, given that females invest more resources in reproduction. We assessed growth responses to climate in European yew (*Taxus baccata* L.), a relict dioecious tree species endangered at its southern distribution. Specifically, we evaluate: i) resilience capacity to extreme droughts, ii) growth responses to long-term climate and iii) relative importance of climate and competition in growth in recent years. Eight yew populations were sampled along a gradient of increasing Mediterranean influence in southern Europe (northern Iberian Peninsula and Sardinia). In each population 15 healthy trees of each sex were cored. Resilience capacity to extreme droughts and growth responses to climate and competition significantly differ between sexes and climatic areas, which can influence the dynamics of the species across its southern distribution. Our results could be used to design adaptation actions to minimize the impact of climate change in the most vulnerable populations.

TS.11-0-13

Room M2, Thursday 7th Feb. 12.45 h.

Seagrass Thermal Limits and Vulnerability to Future WarmingMarbà, Núria¹; Jordà, Gabriel²; Bennett, Scott³; Duarte, Carlos M.⁴

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Seagrass rank among the most threatened habitats in the biosphere. The bulk of losses are attributable to the wasting disease, eutrophication and mechanical damage. However, there are growing reports of seagrass mortality events associated to heat waves. Here we test the hypothesis that seagrass thermal limits decline with increasing latitude, and assess the proximity of extant seagrass meadows to their upper thermal limits as well as the time required for these thermal limits to be met under the business as usual emission scenario (RCP8.5), which is that more closely reflecting realized emission trajectories. We do so by combining a synthesis of reported empirically- or experimentally-determined thermal limits for seagrass and current, derived from reanalyses of ocean surface temperature data and future, derived from projections using global circulation models forced by greenhouse emissions, thermal regimes.

TS.11-0-14

Room M2, Thursday 7th Feb. 13.00 h.

Greater growth stability of trees in marginal habitats suggests a patchy pattern of population loss and retention in response to increased drought at the rear range edgeVilà-Cabrera, Albert¹; Jump, Alistair²

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Climate change is pushing species to decline across rear-edge populations, but evidence on population persistence is also accumulating. Refining our predictive understanding of species rear range-edges is essential to advance our ability to monitor and plan for the impacts of increased drought and sudden species range retractions. Taking the European beech tree as model species, we tested the hypothesis that individual growth across the most 'marginal' rear-edge populations (i.e. geographically isolated populations that inhabit marginal habitats) is declining in response to increased drought. We sampled 40 rear-edge populations according to a crossed factor design of geographical and ecological marginality, and assessed tree growth resilience and trends in response to increased drought over recent decades. Tree growth resilience and stability were higher than expected across geographically isolated populations occurring in marginal habitats, while drought impacts and growth decline were higher in the range-core, and across better-quality habitats. We predict regional-scale species loss but local population retention, rather than abrupt species range retractions.

TS.11-0-15

Room M2, Thursday 7th Feb. 13.15 h.

Climate change as a driver of Mediterranean marine forest declineVerdura, Jana¹; Vergés, Alba²; Santamaria, Jorge³; de Caralt, Sònia⁴; Ballesteros, Enric⁵; Cebrian, Emma⁶

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Canopy-forming macroalgae are the main habitat-engineering species in the intertidal and upper subtidal zones on most temperate rocky shores. These forests have gone missing in several temperate coasts during the last decades, triggering important changes in the seascape. *Cystoseira* species are the main habitat-forming species on shallow water Mediterranean rocky bottoms and they follow the same tendency, which has been mainly related to habitat destruction, pollution and overgrazing. Linked to global warming, extreme climatic events, such as heat waves, are also affecting marine ecosystems worldwide, but no evidences of their effect and their possible interactions with other stressors on *Cystoseira* populations have been reported yet. Here we show how an abnormal positive thermal event affects the density and size structure distribution of a relict population of *C. crinita*. Additionally, we experimentally show that, although *C. crinita* was able to resist punctual high temperature peaks, exceptional and maintained periods of high temperatures (28°C) lead to the death of all individuals. Additionally, recruits' growth and survival were severely affected by UV radiation. Thus, climate change may seriously compromise the viability of *C. crinita* populations already faced to other stressors.

TS.11-0-16

Room M2, Thursday 7th Feb. 15.00 h.

Can climate warming be a limiting factor for the *Caulerpa cylindracea* invasion?Santamaría Pérez, Jorge¹; Golo, Raúl²; García, María³; Azzurro, Ernesto⁴; Verges, Alba⁵; Cebrian, Emma⁶

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Invasive species are one of the main threats to marine biodiversity worldwide and under rapid environmental change they have been predicted to enhance their expansion. In fact, once they arrive to a new place, environmental conditions suitability will determine their establishment and invasive success. Therefore, knowledge on how environmental change may determine invasive spread is of capital interest. Specifically, the Mediterranean Sea has become a hotspot for marine invasions and it is especially prone to climate change. Among alien species, *Caulerpa cylindracea* has been identified as one of the main invasive algae species since 1991. From then, it has expanded all along the Mediterranean and Atlantic coastal areas, displaying a great tolerance to a broad range of temperature conditions. However, no experimental study has assessed whether populations from different places can adapt to different seawater temperatures, which might be essential to determine the future invasibility of *C. cylindracea* under climate change. In the present study, we cultured *C. cylindracea* individuals, from Eastern and Western Mediterranean populations, for 35 days at 5 temperature treatments. Our results suggest that there might be some local adaptation to climatic conditions, as the individuals from warmer areas showed a greater survival. Furthermore, although really high temperatures affected the survival of this species, those temperatures are beyond what is expected as the maximum SST in the Mediterranean Sea for the next decades; so future conditions might not be enough to hinder the *C. cylindracea* invasion.

TS.11-0-17

Room M2, Thursday 7th Feb. 15.15 h.

Phenotypic biomarkers of extreme climatic impacts on declining insect populations

Vives Ingla, Maria¹; Carnicer, Jofre²; Stefanescu, Constanti³; Vila, Roger⁴; Peñuelas, Josep⁵; Carnicer, Jofre⁶; Cortizas, Sofia⁷; Lopez, Carlos⁸; LLusia, Joan⁹; Vidal, Meritxell¹⁰; Casado, A¹¹; Peñuelas, Josep¹²

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Widespread population declines have been reported for diverse Mediterranean butterflies over the last three decades, and have been significantly associated to increased global change impacts. Here we analyse whether plastic phenotypic traits of a model butterfly species (*Pieris napi*) perform as reliable biomarkers of vulnerability to extreme temperature impacts in natural populations, showing contrasting trends in declining and non-declining populations. We also examine whether increased temperature, drought impacts and landscape changes are robust candidates explaining long-term population declines. The results show that plastic phenotypic traits (body mass and wing size) are reliable biomarkers of population vulnerability to extreme thermal conditions. Wing size is strongly reduced only in declining populations during summer drought periods. Lab rearing of these populations documented reduced wing size due to significant negative effects of increased temperatures affecting larval growth. Thermal effects in host plant microsites significantly differ between declining and non-declining populations, with stressful thermal conditions only effectively ameliorated in non-declining populations. In declining populations we observe limited vegetation thermal buffering effects, and larval growth occurs in these populations at significantly higher temperatures. We conclude that these thermal biomarkers are indicative of the population vulnerability to increasing global warming impacts, showing contrasting trends in declining and demographically stable populations. Our results also identify multi-annual summer droughts affecting larval growing periods as a key driver of the recently reported butterfly population declines in the Mediterranean biome.

TS.11-0-18

Room M2, Thursday 7th Feb. 15.30 h.

Global warming effects on Mediterranean macrophytes metabolic rates

Vaquer-Sunyer, Raquel¹; Forteza, Marina²; Bennett, Scott³; Marbà, Núria⁴

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Global warming is affecting coastal areas around the world. The Mediterranean Sea is warming three times faster than global average and its coastal ecosystems are vulnerable to this warming. Coastal areas dominated by benthic macrophytes are key ecosystems that maintain biodiversity, act as carbon sinks and regulate biogeochemical cycles. Metabolic rates of marine macrophytes regulate oxygen, carbon and pH dynamics in coastal systems. Here we examine the responses of metabolic rates of four different macrophyte species in the Mediterranean Sea over a range of temperatures, two macroalgae (*Padina pavonica* and *Cystoseira compressa*) and two seagrasses (*Posidonia oceanica* and *Cymodocea nodosa*) from 4 different areas across the Mediterranean Sea: Crete, Cyprus, Catalonia and Balearic Islands. These four areas represent a natural temperature gradient, with warmer waters in the Eastern Mediterranean and decreasing temperatures when moving westwards. Elucidating how coastal ecosystems will respond to warming is essential to predict future changes associated to climate change and to establish management strategies to protect marine biodiversity and ecosystems functioning.

TS.11-0-19

Room M2, Thursday 7th Feb. 15.45 h.

Interdisciplinary long-term monitoring of a "living fossil": ecology, paleontology and geochemistry meet to assess climate change in the Mediterranean SeaKersting, Diego Kurt¹; Linares, Cristina²; Brachert, Thomas³; Hathorne, Ed C.⁴; Leinfelder, Reinhold⁵; Montagna, Paolo⁶; Pretus, Joan Ll.⁷; Reuning, Lars⁸; Spreter, Philipp⁹; Zinke, Jens¹⁰

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Despite shallow coral reefs are mainly restricted to tropical and subtropical marine environments, relict reef-builder corals can be also found in temperate seas like the Mediterranean Sea. The aim of this presentation is to show the preliminary results of an ongoing interdisciplinary project studying the Mediterranean endemic coral *Cladocora caespitosa* as both, bioindicator of climate change, and archive of past environmental conditions and biological responses. Extensive *Cladocora* reefs flourished in Mediterranean coasts as early as the Pliocene and the occurrence of this species' reefs shows continuity until present, linked however to changes in distribution, size and environmental conditions. *Cladocora* reefs are rare nowadays and are notably impacted by climate warming. The long-term monitoring (17 yr.) of a permanent coral transect in the Columbretes Islands Marine Reserve (NW Mediterranean), together with high-resolution water temperature data, has allowed to describe the link between warming and coral mortality events, as well as to assess the species' responses and recovery potential. Although this information is crucial, longer data series, spanning beyond instrumental and monitoring data, are needed to better contextualize and understand current environmental changes and their impacts. To fill this knowledge gap, we studied modern and fossil *C. caespitosa* skeletons using X-rays, CT-Scans and geochemistry analyses, to obtain information on environmental variables (e.g. temperature, seasonality), as well as on the ecological and biological responses (e.g. growth, stress and recovery markers) over wide temporal ranges. Our results show the great potential of *C. caespitosa* as an indicator and archive of current and past changes.

TS.11-0-20

Room M2, Thursday 7th Feb. 16.00 h.

Are the holm oak forests fossils? An example of the Iberian mountain rangeGarcía-Fayos Poveda, Patricio¹; Bochet, Esther²; Espigares, Tíscar³; Nicolau, José Manuel⁴; Monleon, Vicente⁵

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In this study, we analyze the recruitment of *Q. ilex* in the Iberian Range, where this species still forms extensive forests, is recovering from the intense past human use (mainly coal and grazing with sheep and goats) and where the average temperature has increased over the last century. To unravel the effect of climate and changes in use, we searched for recruits aged 50 years or less in several plots of 5.3 ha along a gradient of intensity of deforestation, from the maximum forest cover to areas without trees, in two contrasting climates within the range of the species; one in the lower limit (450 mm, semi-arid) and the other in the optimum of that range (750 mm, sub-humid). The age of the recruits was established from models relating the diameter of the root-collar and the number of tree rings. A great difference was found in the recruitment between the semi-arid and sub-humid populations. In semi-arid populations, less than 50 plants.ha⁻¹ were found, even when the cover of adult *Q. ilex* trees and the coverage of nurse plants were similar to that of nearby populations that received a greater amount of precipitation and exhibited a very high recruitment, about 1000 plants.ha⁻¹. Despite the great longevity and capacity to regrowth after disturbances or stress, the recruitment of *Q. ilex* in semi-arid areas was too low to ensure long-term replacement of populations, suggesting that the forests dominated by this species in the semi-arid should be considered as fossil forests.

TS.11-0-21

Room M2, Thursday 7th Feb. 16.15 h.

Can life history traits divergences between the extremes of *Molva* sp distribution tell us something about their vulnerability to sea warming?

Serrat, Alba¹; Lloret, Josep²; Muñoz, Marta³; Lloret, Josep - this is an error of the online submission process (he is already the second author)⁴

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The effects of climate change may vary across the distributional range of the species. In relation to sea warming, populations of cold-water fish inhabiting temperate and nearly closed areas as the Mediterranean Sea are in a particularly vulnerable situation since they face physiological stress and a reduction in their optimal habitat. Meanwhile, in the Atlantic upper limit of their distribution the opposite processes may be taking place due to an increase in the suitability of water temperature. Generally, relevant environment-mediated trade-offs occur between condition status and reproductive output, consequently affecting species abundance and distribution. *Molva* is a genus of commercially exploited cold-water marine fish that comprises 3 species. While *M. molva* is found in both water masses, *M. dypterygia* is restricted to the NE Atlantic and *M. macrophthalma* to the Mediterranean. Here we selected two oppositely extreme populations of this genus as a case study: *M. dypterygia* in Iceland and *M. macrophthalma* in the Gulf of Lion. We analysed and contrasted the condition and reproductive status of the populations between these two study areas. Both, condition, estimated from stored energy and considered a proxy of fitness, and reproduction, taking into account annual cycle and spawning strategy, showed differences which confer them a different degree of vulnerability to climate change. These findings reinforce the idea of the role of the environment in shaping reproductive strategy and condition status, and indicate that changing environmental conditions may impose critical changes ultimately affecting population key aspects.

TS.11-0-22

Room M2, Thursday 7th Feb. 16.30 h.

Tolerance to high temperatures and recovery after damage in six *Pinus* species: trade-off between resilience and resistance

Uscola Fernandez, Mercedes¹; Villar-Salvador, Pedro²; villar salvador, Pedro³; Jacobs, douglass⁴

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The main drivers of plant species distribution are temperature and precipitation. While drought and frost tolerance in plants have been widely studied, information on resistance to high temperatures is scarce. However, seedlings, that are especially critical for the viability of plant populations, would be highly susceptible to heat events. High temperature events are increasing in both frequency and magnitude. Therefore, study the heat tolerance of the species would help to predict future changes of distribution due to climate change. The objective was to compare the tolerance to high temperatures and the capacity to recover after heat damage in six European *Pinus* species, under the hypothesis that the response of the species would be driven by the environmental characteristics of their respective distribution areas. Preliminary results show that survival to heat events was similar across species. However, the strategies of the species were markedly different. While *P. uncinata* and *P. sylvestris* (with coldest distribution) showed high resistance to damage at high temperatures but low recovery capacity once the damage occurs; *P. pinaster* and *P. pinea* showed a high recovery after heat events, although heat damage occurred at low temperatures. These results suggest the existence of a trade-off between resistance and resilience to high temperatures. Likewise, the temperature of non-recovery of each species strongly correlated with the maximum summer temperature of their distribution area. This study shows that tolerance to high temperatures drives the distribution of species, however, both tolerance to high temperatures and recovery after heat damage should be considered.

TS.11-0-23

Room M2, Thursday 7th Feb. 16.45 h.

Are Mediterranean forest replacing tree species by more drought tolerant ones at the expense of growing less?García Valdés, Raúl¹; Flores Ruiz, Lorena²; Martínez-Vilalta, Jordi³

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Forests are key ecosystems because they provide important services such as carbon uptake, wood production and hydrological regulation. The ecosystem services of a specific forest depend on the abundance of its species, which indicates that changes in community composition would lead to changes in forest services. A previous study reported that from the year 1986 to 2008 Fagaceae species had been increasing their abundance in Iberian forest at the expense of Pinaceae species. The possible causes are climate change, the reduction in forest management and the abandonment of crops. Since these two families are characterized by very different functional properties, this change raises questions regarding the consequences in terms of forests services (e.g. wood productivity) and vulnerability to ongoing climate change (e.g. drought tolerance). In addition, these two elements may interact due to the trade-off between growth rate and drought tolerance, as recently reported in Eastern US where forest communities have been increasing in drought tolerant species at the expenses of productivity. In our study we used three consecutive forest inventories across Catalonia, from year 1989 to 2016, to study species replacement and its consequences for the community drought tolerance and wood productivity. We expected that if replacement of Pinaceae by Fagaceae continues, it would lead to an increase in productivity and a reduction in drought tolerance, in contradiction with Eastern US observations. Preliminary results show indeed that Fagaceae species continue replacing Pinaceae species, but also that forests that are increasing in drought tolerant species are growing less.

TS.11. Posters

TS.11-P-1

External pavilion, Poster session 2: Wednesday 6th - Thursday 7 th Feb.

Ontogeny determines inter-specific differences in resilience to recurrent drought events in pine forestsAndivia, Enrique¹; Ruiz-Benito, Paloma²; Díaz-Martínez, Paloma³; Carro-Martínez, Noelia⁴; Zavala, Miguel A⁵; Madrigal-González, Jaime⁶

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Increased temperatures and more frequent extreme droughts are inducing alterations in forest functioning and composition, especially in Mediterranean forests. Understanding coexistence and how tree species respond to drought events along the ontogeny is essential to evaluate forest dynamics under climate change. Here, we evaluated growth resilience to drought events in adults and juveniles of three coexistence pine species (*Pinus pinaster*, *P. nigra* and *P. sylvestris*) growing in a Mediterranean continental forest. Basal area increment was evaluated from 1951 to 2015 in adult trees using standard dendrochronological methods, while height growth index was evaluated in juveniles for the period 2001-2015 by measuring annual stem elongation. We calculated resilience to the drought events of 2005 and 2012 in juveniles and adults. We did not find inter-specific differences in the resilience of adults to drought events. However, inter-specific differences in juveniles were apparent after the drought event of 2012 leading to growth decoupling between the three pine species. *P. pinaster* was the most resilient followed by *P. nigra* and *P. sylvestris*. Our results suggest that pine species are more vulnerable to droughts at the earlier ontogenetic stages. Thus, juvenile survival to recurrent drought events may suppose a bottleneck for forest regeneration. In addition, the lower performance of mountain pines (*P. nigra* and *P. sylvestris*) compared to *P. pinaster* could lead to shifts in the vegetation structure of this forest ecosystem, especially under a scenario of hotter drought events.

TS.11-P-2

External pavilion, Poster session 2: Wednesday 6th - Thursday 7 th Feb.

Allochthon sediment trapped by flexible canopies under oscillatory flowsBarcelona, Aina¹; Colomer, Jordi²; Serra, Teresa³

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Seagrass beds are known as ecosystems engineers for their ability to modify the local hydrodynamic conditions and their important role protecting the shorelines. They reduce sediment resuspension and increase sediment retention stabilizing the bed absorbing the kinetic energy. In consequence, they play a critical role improving the water quality. Although the sediment resuspension was found to decrease as a flexible canopy density increase, the effect of the flexible canopy density on trapping allochthon sediment is still poorly understood. A total of 40 experiments were designed to determine the trapping of allochthon sediment depending on the density of the flexible canopy on an oscillatory flow. The aims of this work are (1) determining the variations of suspended sediment concentration within a canopy for different canopy densities, and (2) determining the sediment trapped by plants. Laboratory experiments were carried out in a flume using five different flexible canopy densities (955, 637, 318, 127 and 0 plants·m⁻²), eight waves amplitudes (1.2, 1.5, 2.0, 2.2, 4.5, 4.7, 5.0, 5.6 cm) and two different frequencies (0.7 and 1.2 Hz). This work shows that allochthon sediment within a canopy increases linearly with the TKE. Whereas, the suspended sediment above the canopy was constant in all the cases. In addition, slight differences were observed by the sediment trapped by each individual plant in canopies with different densities, therefore the canopy density does not influence the trapping by each individual plant.

TS.11-P-3

External pavilion, Poster session 2: Wednesday 6th - Thursday 7 th Feb.

Local temperature regimes may determine *Cystoseira* thermal tolerance to future warmingCebrian, Emma¹; Verdura, Jana²; de Caralt, Sònia³; Santamaria, Jorge⁴; Vergés, Alba⁵; Mangialagio, Luisa⁶; Ivesa, Lijliana⁷; Farina, Simone⁸; Cefali, Maria Elena⁹; Frascchetti, Simonetta¹⁰; Ballesteros, Enric¹¹

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Cystoseira species are important habitat-forming species on shallow rocky bottoms that have gone missing from many coastal areas, impairing essential ecosystem services. Although contamination, habitat destruction and overgrazing have been pointed out as main sources of regression, recent studies have shown that climate change may drastically compromise viability of some populations. In the actual scenario of ocean warming it is essential to determine the adaptation of these populations to thermal stress in order to design future conservation actions. Since the response of *Cystoseira* to thermal stress may be modeled by local conditions, here we compared the thermal tolerance of populations dwelling in the coldest and warmest areas of the Mediterranean Sea. We show that *C. crinita* populations from warmer areas had a temperature tolerance threshold 2°C higher than those from the North-western Mediterranean, whereas those influenced by cold waters of the Gulf of Lions were the most vulnerable. There is a strong correlation between the observed differential phenotypic responses and the local temperature regimes experienced by each population. This is the first evidence of the role of thermal history in shaping the thermo-tolerance response of marine habitat-forming macroalgae under contrasting temperature environments.

TS.11-P-4

External pavilion, Poster session 2: Wednesday 6th - Thursday 7 th Feb.

A phytometer of standardized herbaceous plant communities growing across Europe unravels climate and soil controls on biomass productionEstiarte Garrofe, Marc¹; Wilfahrt, Peter²; Jentsch, Anke³; Berauer, Bernd⁴; Peñuelas, Josep⁵; Kröel-Dulay, György⁶; Orbán, Iló⁷; Schmidt, Inger Kappel⁸; Larsen, Klaus Steenberg⁹; Djukic, Ika¹⁰; Mänd, Pile¹¹; Löhmus, Krista¹²; Radujkovic, Dajana¹³; Vicca, Sara¹⁴; Abrantes, Nelson¹⁵; Tietema, Albert¹⁶; Van Dusseldorp, Marleen¹⁷; Stojnic, Srdjan¹⁸; Orlovic, Sasa¹⁹; Holub, Petr²⁰; Urban, Otmar²¹; Karel Klem, Karel Klem²²; Bahn, Michael²³; Reinthaler, David²⁴

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The production of biomass by plant communities is controlled by the climate and by soil characteristics. The interference among climate and soil effects hampers the identification of the controlling factors in studies across climatic gradients. To overcome the difficulty of disentangling climate and soil effects, we designed a phytometer conformed by an herbaceous standardized plant community with three plant species. Phytometers assembled on a standard substrate were distributed across eighteen European locations and, at every location, phytometers were also assembled on local soil. The wide distribution of the experiments, located from 51°N to 48°N latitude and from 8°W to 27°E longitude provided a gradient of climatic and local soil conditions. Results show that after 50 days of growth in the field under local climates, phytometers on standard substrates reacted only to climate and showed that, across locations, aridity is the strongest determinant of biomass production. Phytometers on local soil reflected additive effects of climate and soil, and the effects of the local soil could be isolated after relativizing to phytometers on standard soil. The relativized local soil effect correlated most strongly to P availability and showed only a weak negative relationship with N availability. Overall we show that the phytometer acts as an integrative proxy for the multitude of drivers of plant productivity and that combining standard and local substrates allows for the separation among climatic and edaphic effects.

TS.11-P-5

External pavilion, Poster session 2: Wednesday 6th - Thursday 7 th Feb.

Effects of UVB radiation on net productivity of marine plankton communities in the Eastern Indian Ocean coastGarcia Corral, Lara Silvia¹; Gonzalez, Natalia²; Comesaña, Maria³; Vigoya, Lorena⁴; Duarte, Carlos⁵; Agusti, Susana⁶

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The reduction of the stratospheric ozone layer decreased towards the poles more strongly in the Southern Hemisphere and led to an increase in ultraviolet B radiation (UVBR) incident on the ocean surface. The Eastern Indian Ocean Coast (EIOC) considered as oligotrophic and with clean transparent waters, is exposed to high levels of UVBR. The impact of UVBR on planktonic primary producers and heterotrophs as well as its influence in the global carbon cycle and its feedbacks in climate regulation is uncertain. Here we test the null hypothesis that net community production (NCP) of plankton communities in surface waters of the EIOC is not affected by ambient UVBR. We used quartz and borosilicate glass materials (transparent and opaque to most UVBR, respectively) to assess 82 surface communities sampled along the EIOC, allowing the comparison of NCP between communities where UVBR is excluded and those receiving natural UVBR. Our results showed that NCP of plankton communities in surface waters of the EIOC is influenced by UVBR. The impact of UVBR on NCP depends on the metabolic status of the system (autotrophic vs heterotrophic), as well as on the UVB doses received by the communities. We also find a temporal effects being the strongest effects in spring when extremely high UVBR doses are registered. Previous NCP rates reported are likely to be biased, underestimating or overestimating NCP depending on the metabolic status of the communities as most of the published rates were obtained with UVBR opaque materials, therefore needing to be re-interpreted.

TS.11-P-6

External pavilion, Poster session 2: Wednesday 6th - Thursday 7 th Feb.

Carbon fluxes in *Posidonia oceanica* and *Cymodocea nodosa* meadows in Pollença Bay, MallorcaHendriks, Iris¹; Vaquer-Sunyer, Raquel²; Flecha, Susana³; Morell, Carlos⁴

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The Mediterranean Sea is among the regions of the planet that are heating up most rapidly, with a rate of three times that of the global ocean. There is evidence that *Posidonia oceanica* seagrass meadows, an endemic and dominant ecosystem in the coastal zone of the Mediterranean Sea, are vulnerable to climate change since extreme thermal conditions stress the plant physiologically. Another common species of seagrass, *Cymodocea nodosa* is thought to be more resistant to warming. Changes in the structure and species of seagrass meadows and metabolic activity are reflected in the characteristics and biogeochemical processes of the coastal zone. For instance, the change in seagrass meadows will affect the ability to buffer the effects of acidification on coastal ecosystems. Meadows of macrophytes are important coastal ecosystems and are probably the only reservoir of Blue Carbon in the Mediterranean. The loss (or change in composition) of marine vegetation will not only alter the carbon sink capacity and risk of release of historically stored carbon, but also will impact the metabolism and organic and inorganic carbon flux in the meadows. In this presentation we report an assessment of metabolic status, organic and inorganic carbon fluxes during spring and summer in an area with high nutrient charge in *Posidonia oceanica* and *Cymodocea nodosa* meadows.

TS.11-P-7

External pavilion, Poster session 2: Wednesday 6th - Thursday 7 th Feb.

Effects of UV radiation and rainfall reduction on the vegetation structure and biomass of a Mediterranean shrubland before and after a controlled fireLlorens Guasch, Laura¹; Díaz-Guerra, Laura²; Font, Joan³; González, Josep-Abel⁴; Verdaguer, Dolors⁵

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Climatic models predict near future decreases in cloudiness in the Mediterranean basin, which might increase UV radiation and decrease precipitation levels reaching plant communities. Since drier conditions are expected to favour an increase in fire frequency, these changes might affect species composition and resilience of Mediterranean shrublands. The aim of this study was to elucidate the role of UV and precipitation in the modulation of plant species composition and biomass of a Mediterranean shrubland before and after a fire. Throughout a three-year field experiment, naturally growing vegetation was subjected to three UV conditions (UVB exclusion, UVA+UVB exclusion or near-ambient UV levels) in combination with two precipitation regimes (natural and reduced rainfall), along with a controlled fire towards the middle of the study period. The pint-point method was used to evaluate once per year plant cover and biomass, species relative abundance, species richness and evenness, and Shannon diversity. The dominant species were: *Erica scoparia*, *Phillyrea angustifolia* and *Arbutus unedo* as shrubs, and *Brachypodium retusum* and *Carex oedipostyla* as herbs. Treatment effects were few and sporadic. The most sensitive parameter was the ratio leaf/total number of plant contacts, which was reduced by both, UV exposure and drier conditions. UVA exposure enhanced plant cover few months after the fire, increasing the relative abundance of herbs at the end of the study. Conversely, UVB slowed down the recovery of plant cover after the fire, partly due to a lower growth of *A. unedo*. No overall interactive effects between UV radiation and precipitation were found.

TS.11-P-8

External pavilion, Poster session 2: Wednesday 6th - Thursday 7 th Feb.

Ecological drivers of seasonal change in commercial species distributions of the Northwestern Mediterranean SeaLloret Lloret, Elena¹; Pennino, Maria Grazia²; Vilas, Daniel³; Bellido, Jose Maria⁴; Navarro, Joan⁵; Coll, Marta⁶

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Despite the multiple studies that focus on the Mediterranean ecosystems, there is a lack of information considering seasonality on those ecosystems, particularly related to their spatial structure and functioning. This is key to predict how ecosystems can react to adverse effects or in last case, climate change. Here we study the distribution of eight commercial species; including fish, crustaceans and cephalopods, in a highly exploited area of the Northwestern Mediterranean Sea during two different seasons (winter and summer). We hypothesise that the seasonal differences in the water column (with a marked thermocline in summer and absence of it in winter) as well as the spatial heterogeneity of oceanographic conditions, can result on a seasonal variation of species distributions, with impacts on the spatial and functional traits of the ecosystems. We employ a Bayesian hierarchical species distribution model with data from two oceanographic surveys (winter and summer). Our model includes seven explanatory variables; depth, type of substrate, temperature (surface and bottom), surface salinity, primary production, and changes in fishing effort as the drivers of species distributions during both seasons. We search for significant drivers in each season and if they are specific or common to all the studied species. Then, we investigate whether the functional relationships between the predicted and explanatory variables vary from winter to summer. Our results provide a more solid knowledge about the species distributions and seasonality in the Mediterranean Sea, with important management implications in a context of increasing climate change.

TS.11-P-9

External pavilion, Poster session 2: Wednesday 6th - Thursday 7 th Feb.

Recurrent extreme droughts increase synchrony of individual-level growth patterns regardless of species identity in Iberian pinewoodsMadrigal González, Jaime¹; Andivia, Enrique²; Calatayud, Joaquín³; Herrero, Asier⁴; Ruiz-Benito, Paloma⁵; Laskurain, Nere Amaia⁶; Zavalá, Miguel A.⁷

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Increased aridity imposes serious limitations to forest productivity worldwide. As a result, warming and increasing intensity of climate extremes are enhancing synchrony of tree growth patterns in diverse climatic regions. However, the individual variability in synchronic growth responses has not been assessed previously, even when individual-level information can reveal patterns not obvious from aggregated data at population level. In fact, individual-scale inference seems to be critical to anticipate species vulnerability to climate change. In this study, we analyze changes in tree growth patterns synchronicity after two extreme droughts (2005 and 2012) in three representative tree species (*P. sylvestris*, *P. nigra* and *P. pinaster*) in the Iberian Peninsula. A total of 30 healthy tree individuals were cored with an increment borer. We evaluate the synchronicity of negative responses in growth to climate attending to temporal variations in the structure of individual based co-response networks (considering all the individuals irrespective of the species). After 2005, a large proportion of individuals showed negative responses to climate, increasing the synchrony of growth patterns. Our results indicate that extreme drought events can synchronize growth responses across species and locations, highlighting the influence of individual tree characteristics in vulnerability to climate change.

TS.11-P-10

External pavilion, Poster session 2: Wednesday 6th - Thursday 7 th Feb.

The role of epigenetic regulation as a mechanism of plant acclimation to climate change: the case of *Hordeum murinum*Pérez Ramos, Ignacio Manuel¹; Hidalgo-Galvez, María Dolores²; Rodríguez-Calcerrada, Jesús³; Chano, Víctor Manuel⁴

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Understanding how plant species will respond to the new environmental conditions predicted by climate change models is nowadays one of the main challenges of ecologists. The adaptability of a plant species to environmental changes is mainly driven by the genetic variability of its populations. In addition, a plant species can also acclimate to new abiotic conditions through epigenetic mechanisms (e.g. structural and/or chemical changes in the genome not affecting the nucleotide sequence). However, the role of the epigenetic regulation as a potential mechanism of plant acclimation to climate change remains largely unknown, particularly in plant species of agronomic interest. In this study, we experimentally evaluated the impact of the drier and warmer conditions forecasted by climate change models on the genetic and epigenetic variability of an annual species that dominate savanna-like ecosystems in south Spain ("Valle de los Pedroches", Córdoba, Spain): *Hordeum murinum*. For this purpose, we collected vegetal samples for a total of 120 individuals subjected to four different climatic treatments ('control', 'warming', 'drought' and 'warming+drought'), that were used to identify genetic markers sensitive to methylation and to analyze its genetic variability (using AFLP techniques). *Hordeum murinum* exhibited an overall large phenotypic variability in response to the different climatic treatments, due to an underlying great genetic variability. In addition, a great epigenetic variability may lead to a great phenotypic plasticity, conferring the species a strong ability to adapt and acclimate to the new environmental conditions.

TS.11-P-11

External pavilion, Poster session 2: Wednesday 6th - Thursday 7 th Feb.

Mechanisms of litter decomposition of *Arbutus unedo* and *Phillyrea angustifolia* under different UV radiation levels and water availabilityRodríguez Hidaglo, Claudia Marina¹; Verdaguer, Dolors²; Satorres, Marta³; Romaní, Anna⁴; Llorens, Laura⁵

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According to recent global models, lower soil water availability and increased UV radiation are expected over the next decades in the Mediterranean basin. Reductions in rainfall might result in reduced soil microbial activity, while increased UV radiation might accelerate photodegradation of senescent plant material. To elucidate whether UV radiation and reduced water availability changes can alter litter decomposition dynamics of *Arbutus unedo* and *Phillyrea angustifolia*, two common species in Mediterranean shrublands, a field experiment was performed. Eighteen plots were subjected to the combination of three UV conditions (UVA+UVB exclusion, UVB exclusion and ambient UV) and two rainfall levels (natural and reduced rainfall). Preliminary results suggest that leaf growth under the different water availability conditions entails changes in the microbial biomass just after abscission. Indeed, in the case of *P. angustifolia*, bacteria preferred to colonize leaves grown under reduced rainfall, while fungi rather colonized leaves of *A. unedo* under natural rainfall conditions. Results from the initial steps of litter decomposition process (4 months) indicated a greater weight loss and fungal colonization in *P. angustifolia* than in *A. unedo*. As expected, low water availability reduced microbial colonization during litter decomposition of both species. The effect of radiation was mainly observed on *A. unedo* where the exposure to UVB reduced fungal colonization and decreased the weight loss during decomposition, especially in dry conditions, while UVA enhanced microbial colonization and weight loss. These preliminary results suggest greater effects of UV under reduced rainfall, and distinct effects of UVA and UVB on microbial litter decomposition.

TS.11-P-12

External pavilion, Poster session 2: Wednesday 6th - Thursday 7 th Feb.

Artificial selection on flowering onset as a conservation tool in *Lupinus angustifolius* L. (Fabaceae)Sacristán Bajo, Sandra¹; Tabarés, Pablo²; Prieto, Samuel³; Ruiz, Raquel⁴; Lara, Carlos⁵; Morente, Javier⁶; Rubio, Maria Luisa⁷; Torres, Elena⁸; García, Alfredo⁹; Iriando, José María¹⁰

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The threats that climate change represent for the persistence of biodiversity make necessary the consideration of new conservation strategies. Facilitated adaptation by artificial selection consists of the selection of individuals carrying alleles of greater adaptive value to increase their frequency in the population. Given that flowering onset is one of the key phenological aspects for angiosperm plants in response to climate change, this work aims to evaluate the effects of assisted selection on *Lupinus angustifolius*. For this purpose, seeds were collected from four populations located in Spain (two belonging to a cold environment and two belonging to a warm environment). In November 2016 seeds were sown in a common garden environment, and in spring 2017 we observed that individuals from warm populations flowered earlier. From this common garden, seeds of the 25% of individuals of each population that started flowering earlier were chosen, thus creating an early flowering selection line, and seeds of another 25% of each population were randomly chosen to create a control line. In the 2017-2018 season, the plants from the early flowering line flowered significantly earlier, confirming the heritability of this trait. Furthermore, significant differences in flowering onset were found again between populations. In parallel, we evaluated several functional traits, finding significant correlations between flowering onset and some of these functional traits. The present results will be useful to assess the viability of this kind of approach as an adaptive response to climate change.

Thematic Session 12: New opportunities in ecological studies using new tools and sensors, from satellites to ROVs

Day: Tuesday 5th February

Schedule: 18:00h 20:00h

Location: Room M1

Coordinators:

Juan Miguel Soria García, Institut Cavanilles de Biodiversitat i Biologia Evolutiva. Universitat de València, Spain

Although remote sensing on landscapes has traditionally been limited by the spatial and radiometric resolution of the sensors, its use for the study of the properties and processes of marine, freshwater and terrestrial ecosystems has seen an increase in the last years. This increase in the use of remote sensing has also been observed everywhere, where in recent years several studies have been carried out with low and high resolution sensors, both spatial and radiometric. The European Space Agency (ESA) currently has deployed a new Earth Observation Satellite, the Sentinel-2 (S2). The mission started in 2015 and is composed of two satellites, called S2A and S2B, making it an exceptional tool for intensifying studies on agriculture and forest areas, water bodies and oceans with a spatial resolution (10 m) and a temporary frequency (5 days) unthinkable so far in free and open-access data. Also, Remote Operated Vehicles give more detailed information in small areas with new miniature cameras and mobile applications.

TS.12. Oral talks

TS.12-MT-1

Room M1, Tuesday 5th Feb. 18.00 h.

Multi-scale remote sensing complementing long-term monitoring for conservation in Doñana LTSER platformDíaz-Delgado Hernández, Ricardo¹

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One of the major challenges of remote sensing is the upscaling of natural processes. Although there is a huge availability of sensors, the nature of the process to be monitored constrains the upscaling possibilities. This is especially evident for phenological processes such as flowering, fruiting, leaf emergence or fall as well as for defoliation processes. This work will show several solutions entailed in the Doñana long-term monitoring program in order to scale up the collected information in the field to drone-borne and satellite images.

TS.12-O-3

Room M1, Tuesday 5th Feb. 18.45 h.

Ecological study of the jellyfish *Pelagia noctiluca* in the Balearic Sea using state-of-the-art technologiesPrieto, Laura¹; Navarro, Gabriel²; Navarro, Gabriel³; Makovec, Tihomir⁴; Vodopovic, Martin⁵; Fernández-Montblanc, Tomás⁶; Mourre, Baptiste⁷; Grau, Antoni⁸; Tintoré, Joaquín⁹

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Given the magnitude of ecological and socio-economic consequences of jellyfish outbreaks in the Iberian shorelines, the understanding of mechanisms driving them is of great importance for the prediction of future scenarios. The identification and location of the target species as well as the gathering of relevant data seems a first valuable step through population dynamics and ecological modeling. The aim of this study is to combine the abundance variability of these organisms with the physical and oceanographic forcing at different spatial and temporal scales in the Balearic Sea. The most abundant and frequent species in this area but also in the whole Mediterranean Basin is *Pelagia noctiluca*. This species is totally pelagic during its entire life cycle as it lacks of the polyp stage. Another peculiarity of *P. noctiluca* is that does dial vertical migration: surface at night and 80-100m during the day. For this ecology study of *P. noctiluca* multi diverse technologies were employed: plankton nets, ROVs, CTDs, cameras equipped with laser (to study jellyfish abundance day and night), lagrangian buoys, drones, several remote sensing images and hydrodinamical models, together with a new jellyfish observation system implemented in the shoreline and continental shelf. The complete study demanded the use of both, an oceanography vessel with 24 h operability and also a big data assimilation facility. The combination of all these sources of data was analyzed to characterize this jellyfish variability and its connection with the physical environment at a resolution never achieved before.

TS.12-0-4

Room M1, Tuesday 5th Feb. 19.00 h.

New mapping tools and different sensor resolution for vegetation mapping: what actually matters?

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A current challenge of biodiversity and conservation is to estimate the spatial extent and conservation status of habitat types across landscape continuum. In absence of fine-resolution maps at large scale, which is the common case, predictive models can represent a valuable tool for the assessment of the area of occurrence and relevant functional traits of habitat types. However, the implementation of these tools is hampered by the complexity of natural systems due to environmental or successional gradients, plant traits and human disturbances occurring from large to local scales. Recent developments in data availability (from satellites to ROCs in a continuous enhance of spatial, spectral and temporal resolutions) and image processing (data mining approaches ranging from traditional machine learning to recent artificial intelligence algorithms) is unleashing new challenges in this field of research. In this study, we combined an exhaustive field sampling of complex vegetation patterns at a EUNIS level across the Cantabrian Mountains of Northern Spain with a high spatial resolution database including remotely sensed products and environmental limiting factors (10-meters pixel size) to assess the role of decision-making in the modeling process. We specifically compared the predictive performance and mapping capabilities of typical machine learning approaches and recent artificial intelligence algorithms. We calculated omission-commission errors and overall accuracy scores of the AOO of 80 habitat types encountered across the study areaby using independent field data and previous detailed maps. The results of this study represent an important step for improving the monitoring of vegetation patterns and processes in complex landscape mosaics under the effects of Global Change.

TS.12-0-5

Room M1, Tuesday 5th Feb. 19.15 h.

Assessing the effectiveness of Protected Areas in promoting forest stability – a methodological approach based on satellite time-series data and multi-model inference

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The establishment of Protected Areas (PAs) is a fundamental strategy for promoting the conservation of natural heritage as well as ecosystem stability in face of global change. However, a systematic evaluation of PAs effectiveness for maintaining stable forest ecosystems applicable at the country level is still lacking. For tackling this, we developed an approach supported by Satellite Earth Observations from the MODIS/Terra platform. A time-series for the Enhanced Vegetation Index (EVI) was used to calculate several stability metrics, supported by the concept of Ecosystem Functioning Attributes, for capturing inter-annual changes in land-surface seasonal dynamics of productivity and phenology. Using these metrics, a statistical resampling approach was employed to compare the distributions of stability metrics between PA and non-PA locations, while maintaining similar environmental conditions. Statistical models were ranked through a multi-model-inference framework to investigate the drivers of stability performance. Results showed that most PAs effectively promoted higher relative forest stability in comparison to non-PAs. However, we found strongly different performances across PAs and widely heterogeneous stability patterns inside them. Model results showed a positive effect on the stability of PA size and amount of broadleaf forest, and a negative effect of the interaction between forest fires and PA average altitude. Moreover, PAs with taller forests, higher vertical heterogeneity, mean forest patch size and connectivity presented higher relative stability. We argue that multitemporal-metrics derived from EVI time-series can be used to measure conservation efficiency and ecosystem dynamics. We also discuss the advantages, pitfalls and potential sources of uncertainty in our approach.

TS.12. Posters

TS.12-P-1

External pavilion, Poster session 1: Monday 4th - Tuesday 5th Feb.

A new tool to visualize and analyze National Forest Inventory dataGranda, Víctor¹; Banqué, Mireia²; De Cáceres, Miquel³; Martínez-Vilalta, Jordi⁴; Vayreda, Jordi⁵

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National Forestry Inventories (NFI) are long-term projects aimed at monitoring forest resources at regional/national levels and their changes over time using a representative sample of forest plots. This data can be used to address many relevant ecological questions related to forest composition, structure and dynamics at large spatial scales. Moreover, NFI have become invaluable tools for model calibration/validation and to study the impact of environmental changes on forests and the services they provide to society. In Spain the NFI is carried out by the Ministry of Agriculture, Fishing and Food, and consists in a database of field data from more than 90,000 plots, obtained every ~10 years. In order to use NFI data as a research tool, an extensive data cleaning and preparation process must be performed. This process is time-consuming and error-prone, which makes the current situation in which it is typically performed every time by different research groups very inefficient and frequently inconsistent. We present here a new tool that allows for interactive visualization, analysis and download of processed NFI data. This tool offers easy and quick access to the processed data from all inventories, from the NFI2 (1986-1996) to the NFI4 (2006-2016), which should improve the use of this data in different ecological contexts. This first version covers Catalonia (a climatically heterogeneous region in NE Spain), but can be easily expanded to cover the whole of Spain (as IFN4 becomes progressively available) and will be freely available for managers, technicians, students and researchers worldwide.

TS.12-P-2

External pavilion, Poster session 1: Monday 4th - Tuesday 5th Feb.

Use of satellite images to characterize the spatio-temporal dynamics of primary productivity in hotspots of endemic Iberian butterfliesSánchez Fernández, David¹; Aragón, Pedro²; Hernando, Carlos³

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The Iberian Peninsula is one of the European regions with the highest number of endemic species. Therefore, it is imperative to detect species populations potentially affected by variations in ecosystem functioning. Since the emergence of data processed from satellites, the possibility of carrying out studies covering both a spatial and temporal dimension has increased, which gives more comprehensive information of the species population dynamics and ecosystems. Primary productivity is a crucial parameter in understanding ecosystem function and services since it is the basis of the trophic chain. This study examines the spatiotemporal variation of primary productivity over a 14-year temporal series (2000-2013) through the enhanced vegetation index (EVI). We focused on the hotspots of endemic diurnal butterflies of the Iberian Peninsula to obtain primary productivity dynamics as an indicator to optimize further conservation efforts. Statistically significant, yet spatially irregular, trends were found in localized places mostly in mountain systems (Cantabrian Mountains, Iberian System, Sierra de Guadarrama and Sierra Nevada). In 60% of these places, primary productivity decreased. Two of these endemic species, the Sierra Nevada blue (*Polyommatus golgus*) and the Puerto del Lobo butterfly (*Agriades zullichi*), which are classified by the International Union for Nature Conservation (IUCN) as "Vulnerable" and "Endangered", respectively, are present in localities where primary productivity showed a marked decline despite being within the Natura 2000 Network. The procedures developed here can serve as a tool to detect biodiversity hotspots where further monitoring is needed, based on consistent temporal trends of primary productivity.

TS.12-P-3

External pavilion, Poster session 1: Monday 4th - Tuesday 5th Feb.

Evaluación mediante imágenes de Sentinel-2 de la calidad del agua en lagunas de alta montaña pirenaicasSoria Garcia, Juan Miguel¹; Soria, Xavi²; Urrego, Patricia³; Pereira-Sandoval, Marcela⁴; Ruíz-Verdú, Antonio⁵; Peña, Ramón⁶; Delegido, Jesús⁷; Vicente, Eduardo⁸

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La teledetección es una herramienta óptima para el seguimiento en continuo de la calidad de una masa de agua utilizando variables ópticamente activas como la transparencia, la materia orgánica cromofórica (CDOM) o la concentración de clorofila a y así conocer mejor su variación espacial y temporal. Los lagos oligotróficos pirenaicos son masas de agua aisladas de pequeño tamaño con una gran dificultad en el acceso para trabajos de toma de datos de campo. En este sentido, Sentinel-2, el nuevo satélite de observación de la tierra de la agencia espacial europea (ESA), con una resolución espacial de 10 m y una frecuencia temporal de 5 días (impensables hasta ahora en imágenes de acceso libre) permite la realización de estudios de calidad que no son posibles con los métodos convencionales sin un gran esfuerzo material y económico. El estudio se realizó con imágenes de la zona pirenaica del verano de 2015 a 20177 recogidas en julio, agosto o septiembre. Se descargaron ya procesadas con la corrección geométrica y atmosférica a nivel 2A desde el hub de la ESA Copernicus. Se procesaron para la extracción de los datos de reflectividad y se pudo estimar la concentración de clorofila a de cada lago mediante aplicación del algoritmo de cuatro bandas (ND4) de Sentinel-2, la transparencia y el CDOM (ratio verde/rojo). La interpretación de los modelos nos muestra su utilidad como indicadores de pérdida de calidad en las masas de agua, de forma que se pueden supervisar remotamente sus condiciones.

TS.12-P-4

Room M1, Tuesday 5th Feb. 18.30 h.

Remote sensing techniques as a tool to study the multitemporal change detection of water quality parameters and hydrological variations in Mediterranean lakesDoña, Carolina¹; Morant, Daniel²; Picazo, Antonio³; Rochera, Carlos⁴; Sánchez, Juan Manuel⁵; Camacho, Antonio⁶

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Wetlands contribute to a wealth of ecosystem services, such as being wildlife refuges, the regulation of the hydrological cycle for flood and drought control, and providing water supply, among others. Although these areas have a critical value to sustainable development, they are detrimentally impacted by urban growth, agricultural land reclamation and derived pollution. The ecological status of these aquatic ecosystems can deteriorate due to eutrophication, challenging ecosystem conservation. On the other hand, the water balance and hydrological variations are intimately tied to potential changes in a lentic ecosystem. Then, understanding the dynamics of water in lakes helps the goal of conservation and recovery of these valuable ecosystems. In this work we show how remote sensing technologies facilitate the content-based mapping over space and time, leading to multitemporal change detection of the water quality parameters and hydrological variations in wetlands, this being especially relevant under the current climate change scenario. Several lakes located in the Biosphere Reserve of La Mancha Húmeda, currently the main wetland area inland the Iberian Peninsula, were selected to show some examples of the application of this kind of techniques. Our advancements show an operational and cost-effective way for monitoring water quality and hydrological patterns of wetlands so as to accomplish the requirements of the Habitats and the Water Framework Directives. This work was supported by the project CLIMAWET (GL2015-69557-R) funded by MINECO and FEDER-EU Funds.

Thematic Session 13: Nutrient cycling in soils and dry riverbeds under increasing dryness - physical and biological drives

Day: Tuesday 5th February

Schedule: 18:00h 20:00h

Location: Room A2

Coordinators:

Marisa Arce, Center for Edafology and Apply Biology of Segura (CEBAS-CSIC), Murcia, Spain

Clara Mendoza-Lera, BTU Cottbus-Senftenberg Freshwater Conservation Department, Germany

María Almagro, BC3-Basque Centre for Climate Change, Spain

Anna M. Romaní, Institute of Aquatic Ecology, University of Girona, Spain

Rosa Gómez, University of Murcia, Spain

Expanding drought due to climate change might affect nutrient cycling in dry soils and sediments from dry river beds..., especially in mediterranean, arid and semiarid watersheds. Key biogeochemical processes driving nutrient cycling may be compromised due to increasing dryness (reduction of water availability). However, the drivers and constraints and their interactions that end up determining the biogeochemical responses to dryness still remain unclear. Drivers and constraints include physical factors such as irradiance, with its potential effect on organic matter decomposition, and soil/sediment structural parameters (i.e. texture, granulometry, origin, organic matter content) that may interact with the microbial community composition (bacteria, archaea, fungi) and its functional capabilities.

The objective of this session is to get together soil, plant, and freshwater ecologists working in ecosystems under different dryness (deserts, intermittent freshwaters, mediterranean watersheds...) to decipher the biogeochemical, microbial and physical mechanisms driving responses of nutrient cycling in soils and sediments to increasing dryness. We believe that this necessary link between disciplines will bring relevant key mechanisms and interactions as well as distinct methodological approaches. This will help improve our understanding of the biogeochemical implications of dryness and to anticipate to potential effects of water scarcity on temperate areas.

TS.13. Oral talks

TS.13-0-1

Room A2, Tuesday 5th Feb. 18.00 h.

The sediment of semi-arid wetlands responds to alterations in macrophyte meadows due to Global Change factorsPuche, Eric¹; Rojo, Carmen²; Rodrigo, Maria A.³; Sánchez, Ester⁴; Sánchez-Carrillo, Salvador⁵; Álvarez-Cobelas, Miguel⁶

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The changes undergone by charophytes (freshwater macrophytes) due to Global Change factors could alter ecosystem processes such as the nitrogen cycle or carbon fixation, and finally the sediment chemical and biological composition. Our objective was to verify that mechanisms used by the charophytes to counterbalance the harmful effects of UV-radiation can affect the associated communities inhabiting their meadows, such as the microbial communities in surficial and subsurficial sediments, responsible for carbon fixation and inorganic nitrogen release. We know that charophyte responses to Global Change (e.g. changes in UV-radiation), which is more severe in semi-arid regions such as the Mediterranean, can alter their morphology, growth, stoichiometric and molecular composition (allelopathic concentrations, protectors against UV-radiation -UVACs-, pigments, etc.). For this reason, we performed an experiment based on mesocosms located in a protected Mediterranean coastal wetland. We assessed the charophyte "health" and their associated benthic community growing on the sediment with unaltered sunlight and with filtered UV-radiation. Moreover, we compared the effects that the charophyte meadows, under both radiation conditions, exert on the sediment processes thanks to treatments without charophyte meadows. The meadow response variables analysed were: charophyte fresh weight, pigment and UVACs concentrations, polyphenols, periphyton, zoobenthos and stoichiometry). In the sediment, the abundance and diversity of the surficial and subsurficial communities (bacteria, microalgae) were determined, along with its stoichiometry and nutrient content. This experiment allows confirm our hypothesis: meadows promote sediment carbon sinking and nitrogen loss and the mechanisms used by charophytes in front to UV-radiation reduce these beneficial systemic effects.

TS.13-0-2

Room A2, Tuesday 5th Feb. 18.15 h.

Drought modifies plant root traits and their interaction with fungal communitiesLozano Bernal, Yudi Mirley¹; Aguilar-Trigueros, Carlos²; Rillig, Matthias C.³

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Drought events are recurrent phenomena, which are predicted to increase both in frequency and in severity over the next few decades. The response of grasslands to drought seems to be determined by species diversity and community composition. However, how drought modifies root traits and soil fungal communities is poorly known. To address this gap, we grew 25 different grasslands species under drought (30 % WHC) and non-drought (70 % WHC) conditions. The plants used included all major functional types (grasses, legumes and forbs). At the end of the experiment, we measured soil properties, root traits and fungal community structure. Plant trait responses to drought depended on plant functional type. For example, grasses and herbs had increased root diameters but decreased specific root length and root tissue density. On the other hand, legumes showed a smaller diameter under drought. These different trait responses seem to correspond to different strategies to reduce embolism under drought: the greater diameter of grasses and herbs is more favorable for water and nutrient transportation, while the reduced specific root length might be due to the reduction in fine roots diminishing the risk of hydraulic rupture. Fungal composition also changed under drought, and in particular, the abundance of fungal pathogens, saprotrophs and AMF decreased with drought. In summary, drought modifies plant root traits, fungal composition and abundance. We also uncovered correlations among these parameters, for example a decrease in specific root length was correlated with a decrease in abundance and richness of AMF.

TS.13-0-3

Room A2, Tuesday 5th Feb. 18.30 h.

How soil microbes respond to droughtLeizeaga, Ainara¹; Hicks, Lettice C.²; Rouks, Johannes³

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Climate change will intensify droughts and precipitation events which will induce enormous dynamics in microbial activity and soil biogeochemistry. Thus, understanding the response of microbial processes to moisture fluctuations will help achieve a predictive understanding of responses to future global change. We investigated whether repeated drying-rewetting (DRW) cycles would induce faster recovery of bacterial growth ('resilience') during a DRW event in the laboratory. We also tested if this could be scaled up to an ecosystem level and investigated if communities derived from environments with different exposures to drought would respond differently. We used soils from an 18-year drought experiment in Northern Europe to test if long-term summer drought would induce a higher resilience in bacteria, and subjected the soils from the field-experiment to repeated DRW cycles to elucidate the interaction between exposure to long term drought and DRW cycles. Repeated DRW cycles in the laboratory increased the speed of bacterial growth recovery in each cycle. This suggested that repeated DRW cycles selected for a more DRW-competent community. Field drought also selected for bacteria with a faster growth recovery and when these soils were subjected to repeated DRW cycles, bacteria with a history of drought exposure responded faster to the perturbations. Thus, (i) both repeated DRW cycles and experimental field-drought selected for a bacterial community with a faster growth-recovery following DRW and (ii) an interaction between exposure to long term drought and DRW cycles was observed. Taken together, microbes responded to drought by acquiring a high resilience to rewetting after drought.

TS.13-0-4

Room A2, Tuesday 5th Feb. 18.45 h.

On the effects of tree canopy, rainfall and sunlight on river sediment microbial activity during drying and after flow resumptionSchreckinger, Jose¹; Mendoza-Lera, Clara²; Mutz, Michael³

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Increased frequency and duration of drought periods progressively cause drying of shore and bed sediments with implications for the metabolic performance of rivers. Our objective was to understand the effect of drying scenarios on microbial activity (i.e. community respiration) of lowland river sediments during drying and after flow resumption. In 56 outdoor mesocosms we exposed sandy sediments to drying scenarios: i) no shade and no rain, ii) no shade plus rain, iii) shade plus rain. Rain was applied following a natural summer regime. We enriched half of the mesocosms with 65 % allochthonous organic matter. Respiration during drying is measured weekly assessing CO₂ production with emission chambers. The short-term response of respiration to flow resumption was determined for 4 days after 10, 30 and 90 days of drying as O₂ consumption of the sediment perfused with river water. First results showed a decrease in respiration under drying affected by the drying intensity (shade plus rain > no shade plus rain > no shade no rain) and level of organic matter content (low < high). We expect the respiration after flow resumption to be affected by the drying scenarios, the duration of drying and the organic matter content. Duration of expected lag phase and the rate of recovery after flow resumption will give insight to the regulation of functional resistance and resilience of stream ecosystems. All results will be available at the end of the summer 2018 and presented at the conference.

TS.13-0-5

Room A2, Tuesday 5th Feb. 19.00 h.

Dynamic of organic matter in ephemeral rivers shapes nutrient, microbial activity and biota diversity distribution in riverbedsGómez, Rosa¹; Sánchez-Montoya, María del Mar²; Guerrero, María Mercedes³; Miñano, Jesús⁴; Tockner, Klement⁵

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In ephemeral streams and rivers occasional flood events transport organic matter which is accumulated in river beds and floodplains in form of debris piles, contributing to the retention of both the organic and inorganic loads. In addition, the presence of shallow dry pools, as depressed and depositional areas of silt and clay, are also frequent along the dry riverbeds. These two types of geomorphological structures could potentially enhance primary and secondary production in ephemeral rivers, especially where water and nutrients are limiting factors, by providing moisture and nutrient-rich habitats. We examined the effect of debris piles and dry pools on sediment nutrient concentration, microbial activity and ground-dwelling arthropod community in the Ugab river, one of the ephemeral rivers that drain the Namib desert. For this purpose, we sampled the sandy channel, debris piles and pools and adjacent terrestrial habitats during the dry phase. In summary, a spatial domain of influence of debris piles and pools on organic matter, nutrient content and sediment microbial activity was observed in approximately four meters to the center of geomorphic structures, with higher values in debris piles than dry pools and sandy channels. The terrestrial arthropod composition significantly differed between the five habitats, with Formicidae, Blattoidea and Coleoptera explaining most of the differences found. Debris piles, apart from riparian zone, emerged as important habitats harboring the highest number of morphospecies. Our results emphasize the importance of debris piles along dry riverbeds as hotspots of nutrients, microbial activity and ground-dwelling arthropod biodiversity in ephemeral rivers.

TS.13-0-6

Room A2, Tuesday 5th Feb. 19.15 h.

Factors driving net nitrification in riparian soils across biomesLupon, Anna¹; Gerber, Stefan²; Bernal, Susana³

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Riparian areas are considered natural filters of nitrogen (N) within catchments because they can substantially diminish nitrate loads from terrestrial to aquatic ecosystems mostly via denitrification (the microbial transformation of nitrate to N gas under anoxic conditions). However, this N removal capacity depends not only on denitrification, but also on gross nitrification (the nitrate production under aerobic conditions). These two microbial processes respond differently to environmental conditions, and hence, the N removal capacity of riparian soils may vary across biomes. We compiled 48 published studies reporting net nitrification rates, soil moisture, and soil temperature in 56 riparian soils across the globe to explore the role of riparian zones as hotspots of N removal within different biomes. We used in situ net nitrification as a proxy of the balance between gross nitrification (production) and denitrification (removal). In total, we compiled 508 measurements of net nitrification rates that ranged from -0.2 to 3.2 mg N kg⁻¹ d⁻¹. The highest net nitrification rates were observed in Mediterranean riparian soils, while the lowest were reported in alpine and boreal riparian soils. A simple process-based model suggests that this pattern could be mostly explained by changes in soil moisture and temperature across biomes, and that the weakest N removal rates occur in the riparian soils with intermediate soil moisture conditions. Overall, these results highlight that regional differences in riparian soil N cycle and future projections of climate should be considered to understand the potential of riparian zones as green N filters within landscapes.

TS.13-0-7

Room A2, Tuesday 5th Feb. 19.30 h.

Effects of desiccation on the self-purification capacity of headwater streamsWeigelhofer, Gabriele¹; Von Schiller, Daniel²; Mutz, Michael³; Tritthart, Michael⁴

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Over the past thirty years, the frequency and duration of droughts has increased across Europe, causing perennial streams to shift to intermittency even in temperate regions such as Austria. Our study aims to investigate the medium- and long-term effects of drought on the biogeochemical processes in temperate streams and compare them to Mediterranean or arid streams with a long history of intermittency. In the frame of the project PURIFY (2018-21), we studied 6 intermittent streams in Austria located across a land use gradient. Water and sediments from intermittent and perennial reaches were sampled before, during, and after the dry phase and were analysed as to surface and hyporheic water and sediment quality (nutrients, DOM, POM) and the biomass and activity of surface and hyporheic biofilms (bacterial and algal abundances, respiration, extracellular enzymes). In addition, we determined SRP and ammonium uptake kinetics via slug addition experiments before and after the dry phase. To extend these results, we are analysing the effects of desiccation on the uptake of nutrients and organic matter at the sediment surface and in the hyporheic zone via experimental flumes and sediment perfusion cores under controlled lab conditions using stable isotopes. Preliminary results show decreased algal and bacterial abundances and enzymatic activities in intermittent reaches, especially in the surface sediments, regardless of the dominant land use.

TS.13. Posters

TS.13-P-1

External pavilion, Poster session 1: Monday 4th - Tuesday 5th Feb.

Effects of drought length on nutrient and DOM processes in the hyporheic zone of temperate streamsCoulson, Laura¹; Weigelhofer, Gabriele²; Schelker, Jakob³

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Intermittent streams as well as extreme events are expected to become more common as the climate changes. Therefore it is important to understand how drought affects nutrient and DOM processing within streams. Previous work has focused largely on Mediterranean streams. This project proposes to evaluate how drought affects the nutrient and DOM processes in the hyporheic zone of temperate streams. We will use experimental hyporheic flumes (5 m long, 0.6 m wide, 1.2 m deep) to examine how drought duration affects the biogeochemical processes within stream biofilms and how these impact nutrient and DOM dynamics. Drought duration will last from 3 days to 8 weeks. The flumes will be allowed to fall dry in the upper sediments layers (0-60 cm depth) while retaining subsurface flow in the deepest layer (60-80 cm depth). Nutrients, DOC, DOM quality, extracellular enzymatic activities, and sediment bacterial abundance will be analyzed throughout the dry and rewetting periods.

TS.13-P-2

External pavilion, Poster session 1: Monday 4th - Tuesday 5th Feb.

The leaf economic spectrum drives leaf litter decomposition in Mediterranean forestsGarcía de la Riva, Enrique¹; Prieto, Ivan²; Villar, Rafael³

(1) Brandenburg University of Technology; (2) Centro de edafología y biología aplicada del Segura (CEBAS-CSIC); (3) Universidad de Córdoba

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Decomposition is one of the main ecosystem processes that has profound effect on carbon cycling. A myriad of studies have shown that traits of green leaves determine decomposition rates. However, these studies typically ignore the real plant community compositions, intraspecific variability or edaphic conditions. The aim of this study is to understand the factors that govern the process of decomposition in Mediterranean forests. We evaluated the relationships among leaf traits and decomposition rates at different environmental scales and organisational levels (species and community). To this end, we measured morphological (leaf dry matter content -LDMC- and specific leaf area -SLA-) and chemical leaf traits (N, P, K, d13C) in 38 woody species from nine sampling sites distributed along a topographic gradient in south Spain. We also try to assess the relationships at community level among decomposition rates with Leaf Economic Spectrum (LES) and several soil variables. We found positive relationships at species and community level between decomposition rates and SLA, leaf N, K and P and negative with LDMC and d13C. The relationship among LES and decomposition rate showed similar slope regressions when different zones or topographic position were taking into account. In addition, LES was better predictor than soil variables for decomposition rates at community level. In summary, our results support the idea that the suites of leaf traits of woody plants have a strong control on the pace of C cycling, being the best drivers of decomposition processes within the same climatic environments.

Thematic Session 14: Organisms and ecosystem responses to global change in soils and sediments

Day: Tuesday 5th February

Schedule: 12:00h 13:30h – 16:00h 17:00h – 18:00h 20:00h

Location: Room M5

Coordinators:

Pablo García Palacios, Universidad Rey Juan Carlos, Spain

Iván Prieto Aguilar, CEBAS-CSIC, Spain

Irene Cordero, University of Manchester, UK

Global change ecology has traditionally focused on aboveground organisms. In recent years, we have seen an increased interest to understand how global change impacts on soil/sediment biodiversity translate into altered ecosystem functioning. Soil and sediment organisms play a fundamental role in ecosystem processes, e.g. C, N and P cycling, in terrestrial and aquatic systems, and are highly sensitive to global change. Ecosystem responses to global change are thus largely determined by the interactions between plants, physicochemical factors of soils, water and sediments, and their inhabiting organisms. In this session, we would like to invite communications of studies linking the diversity (taxonomic, functional and phylogenetic) of plant, soil and/or sediment communities, with the responses of C, N and P cycling to global change. We propose that a combination of approaches (large-scale observations, long-term field experiments, short-term incubations, and meta-analysis) is needed to gain mechanistic insights on this topic that can be used to inform the assumptions in Earth system models. We will bring together scientists working at the interface between ecosystem, plant and microbial ecology in terrestrial and aquatic systems, to increase our understanding of relevant topics such as carbon-climate change feedbacks, agricultural intensification, litter decomposition, forest dynamics and functional aspects of biotic interactions. This thematic session is sponsored by the AEET Working Group PlanSoil.

TS.14. Oral talks**TS.14-MT-1**

Room M5, Tuesday 5th Feb. 12.00 h.

New insights toward the natural history of soil biodiversityDelgado Baquerizo, Manuel¹

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Microbes are one of the most abundant and diverse life forms on Earth, and play an essential role in maintaining multiple ecosystem functions including litter decomposition, primary production, soil fertility and gas emissions. However, soil microbes are highly vulnerable to global environmental drivers such as land-use change, nitrogen enrichment and climate change. I will present some of my recent work aiming to (1) identify the role of microbial diversity in regulating the rates and stability of multiple ecosystem functions in terrestrial and freshwater ecosystems under global change scenarios; (2) provide insights on the ecological predictors and potential vulnerabilities of dominant taxa on a worldwide scale from the first global atlas of dominant bacterial taxa; and (3) identify the prevalent ecological mechanisms shaping patterns of belowground biodiversity over an evolutionary time scale. Here, I will provide a novel perspective on the knowns and unknowns surrounding microbial ecology, and deliver new insights toward the natural history of soil biodiversity.

TS.14-O-2

Room M5, Tuesday 5th Feb. 12.30 h.

Soil variability below healthy, declining and dead trees: a cause or a consequence of tree mortality in N African Cedar forests?Carreira de la Fuente, José Antonio¹; Lechuga, Víctor²; Linares, Juan Carlos³; Viñeola, Benjamín⁴; Lloret, Francisco⁵

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Tree mortality has become a widespread phenomenon affecting multiple forest species in many areas of the world. To disentangle the causes underlying these forest decline processes, many investigations have focused on direct relationships between exposition to climatic stress and physiological and tree-growth responses. But between-site and intra-site variability in tree mortality cannot often be fully explained by climatic drivers, which in turn led to emphasize the modulating effects of variations in land-use and stand canopy structure. However, little attention has been paid to the role of spatial variability in soil genesis and soil degradation. N Africa *Cedrus atlantica* forests are a paradigmatic case of extensive forest decline, which combines common aridification trends with contrasting differences in land use and soil status. In this work, we collected soil samples from beneath healthy, defoliated and dead trees along replicated transects, in two main *Cedrus atlantica* distribution areas (Mid- and High Atlas, Morocco). Soils samples were analyzed for both, slow turn-over, time-integrative variables (mineralogical properties, isotopic natural abundance), and fast turn-over, time-responsive variables (nutrient availability and transformation rates, enzyme activities). Results globally show a stronger size-effect of tree vigor classes on the soil slow turn-over variables than on the responsive ones. This suggests soil legacy effects (both between-site and intra-site differences in soil development and degradation) play an important modulating role on tree-mortality spatial patterns, which can be distinguished from post-mortality, shorter-term changes in the soil linked to altered litter inputs and plant community composition.

TS.14-0-3

Room M5, Tuesday 5th Feb. 12.45 h.

Above and belowground plant traits shaping taxonomical and functional microbial diversities in ecological restoration: results from TalVeg2, a monospecific experiment with twelve Mediterranean speciesMerino Martín, Luis¹; Fort, Florian²; Shihan, Ammar³; Del Rey Granado, Maria⁴; Zhun, Mao⁵; Boukcim, Hassan⁶; Taugourdeau, Olivier⁷; Bertrand, Isabelle⁸; Le Bissonnais, Yves⁹; Plassard, Claude¹⁰; Stokes, Alexia¹¹; Roumet, Catherine¹²; Fromin, Nathalie¹³

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In TalVeg2, a research project on restoration of slopes and embankments, we study the ecosystem services related to soil processes provided by different species frequently used for restoration in Mediterranean environments. We studied soil characteristics, microbial taxonomical and functional diversities, enzymatic activities and above-ground and below-ground plant traits of 12 species. Each species was grown from seed in a monoculture in 72 inclined steel boxes (0.7 x 0.7 x 0.3 m) and every monoculture was replicated six times with additional six control (bare soil) boxes. Three replicate boxes were used for soil, microbes and vegetation sampling and other three for runoff and erosion measurements. Root physical properties, substrate-induced respiration of soils (SIR), Soil Microbial Community Level Physiological Profiles (CLPP), bacterial (B) and fungal (F) abundance (qPCR 16S and 18S rDNA) and F:B ratios were assessed at 4, 7 and 9 months after sowing. After 9 months, hydrolytic enzymatic activities (β -glucosidase, β -xylosidase, N-acetyl-glucosaminidase and leucine amino-peptidase), oxidative enzymatic activities (phenol oxidase and peroxidase) were also assessed and bacterial (16S) and fungal (ITS) biodiversity was determined using high throughput sequencing. Results showed that species from Fabaceae family stimulated the microbial activity (SIR, catabolic activity) compared to species from the Poaceae family. The functional (catabolic) diversity of the microbial community associated to Fabaceae species was also higher than for Poaceae. These results together with previous results on soil erosion, infiltration rates and soil aggregate formation and stabilization, highlight the importance of species from the Fabaceae family for promoting soil restoration.

TS.14-0-4

Room M5, Tuesday 5th Feb. 13.00 h.

Pathogen-induced tree mortality modifies key components of the C and N cycles with no changes on microbial functional diversityÁvila Castuera, José Manuel¹; Gallardo, Antonio²; Ibáñez, Beatriz³; Gómez-Aparicio, Lorena⁴

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An increase in tree mortality as a consequence of biotic disturbances has been detected in forests worldwide, but little is known about their consequences on soil microbial communities and C and N cycles. We assessed the effects of *Quercus suber* tree mortality on functional properties of the soil microbial community and different components of the C and N pools in two forest types (open woodlands and closed forests) invaded by the exotic soil-borne pathogen *Phytophthora cinnamomi*. We used neighbourhood models to analyse the short-term effects of *Q. suber* mortality on soil variables, by comparing the impact of *Q. suber* trees with different health status. The potential long-term indirect effects were analysed, comparing the impact of healthy *Q. suber* and non-declining coexistent tree species (*Olea europaea* var. *sylvestris* and *Quercus canariensis*). Pathogen-induced tree mortality reduced soil microbial respiration, but did not change microbial functional diversity or biomass but. The direct effects of oak decline on C and N pools depended on soil texture. We found a reduction in total soil C but an increase in the more labile forms of C in sites with low clay content. An increase in NO₃⁻ but a decrease in NH₄⁺ was found in sites with high clay content. Coexistent species differed strongly from *Q. suber* in their effects on the C and N cycle. Overall, our results suggest that pathogen-induced tree mortality might translate into short- and long-term effects on C and N cycles, despite no effects on microbial functional diversity and biomass.

TS.14-0-5

Room M5, Tuesday 5th Feb. 13.15 h.

European forest soil microorganisms in the face of drought: the influence of tree diversityGillespie, Lauren¹; Fromin, Nathalie²; Milcu, Alexandru³; Devidal, Sébastien⁴; Buatois, Bruno⁵; Hättenschwiler, Stephan⁶

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Climate change models predict increased drought frequency and severity for a significant part of Europe, which may affect the activity of forest soil microorganisms who control much of the carbon and nutrient cycling. Tree community diversity and composition may be particularly important in forest microbial responses to drought. We investigated (1) the effects of drying and rewetting events (DRW) on European forest soil functioning along a latitudinal gradient, and (2) the influence of tree species mixtures on soil microbial resistance and resilience during these events. In four European countries, we sampled soil from natural, mature monospecific and mixed forest stands and subjected them to two DRW events. We measured CO₂ and N₂O fluxes before, during, and after each DRW event, as well as microbial biomass and community functional diversity before and after the two-DRW experiment. Our results show that CO₂ flux is reduced under drought and surges after the first rewetting. Yet, CO₂ fluxes return to pre-disturbed levels after the second DRW cycle. N₂O fluxes have less variation. The stability of CO₂ fluxes (but not N₂O) is higher in mixed stands compared to monospecific stands in response to drought. This seems to be uncorrelated to biomass and functional diversity of microbial communities suggesting that the stability of processes in response to drought was rather driven by community composition. These results could help predict changes in forest microbial functioning under climate change based on tree diversity.

TS.14-0-6

Room M5, Tuesday 5th Feb. 16.00 h.

The legacy of recurring extreme drought on soil microbial community structure and functionCordero Herrera, Irene¹; Leizeaga, Ainara²; Hicks, Lettice C.³; Rousk, Johannes⁴; Bardgett, Richard D.⁵

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Soil microbial communities are complex and provide a diversity of functions. It is well established that extreme droughts have strong effects on soils. But these events are expected to be more common, and it remains unclear how drought frequency and intensity will interactively influence soil microbial communities and whether recurrent, intense droughts might trigger transitions to alternative stable states. To test this, we designed a microcosm experiment with grassland soils where we evaluated the stability of microbial community structure and a suite of microbial-mediated functions to drought of different intensities and frequencies. We also tested the adaptation of bacterial and fungal communities, by determining their ability to maintain growth rates during drought ('resistance') and to recover following an additional drying-rewetting cycle ('resilience'). Microbial decomposition capacity, measured as soil enzymes, was reduced by high intensity drought, which was accompanied by a flush of nutrients. High drought frequency and intensity combined to exacerbate these effects. Microbial biomass declined, bacterial and fungal community structure changed, and so did their resistance and resilience to drought. Intense drought increased bacterial resilience, selecting for a bacterial community adapted for fast recolonization, with an enhanced growth during a dry/wet cycle. The fungal community was more resistant to drought than bacteria, and its resistance and resilience were unaffected by drought treatments. However, they showed a reduced growth during a dry/wet cycle. Drought effects mostly persisted 6 months after rewetting. Our results suggest a possible regime shift to an alternative stable state and a change to a bacterial-dominated decomposition.

TS.14-0-7

Room M5, Tuesday 5th Feb. 16.15 h.

Experimental summer drought has long lasting effects on improved grasslands performance across the isle of IrelandLeón-Sánchez, Lupe¹; Caplat, Paul²; Sadikova, Dinara³; White, Hannah⁴; Yearsley, Jonathan⁵; Emmerson, Mark⁶; Caplat, Paul⁷; Sadykova, Dinara⁸; White, Hannah⁹; Yearsley, Jonathan¹⁰; Emmerson, Mark¹¹

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An increased frequency of summer drought is predicted in Europe, with summer rainfall decreasing by up to 30–40% in parts of Europe under a high emissions (RCP8.5) scenario. Grasslands where food is produced cover a large proportion of the land surface and are vitally important to the economy of Ireland and the UK, where droughts are predicted to be more frequent. We have conducted a manipulative field experiment in 20 improved grasslands in four regions all over the island of Ireland in order to quantify the effects of summer drought on plant performance, by exposing them to a (severe) two months' drought in the peak of growing season. We measured biomass production in the drought and control plots and collected continuous data of soil moisture and temperature in the plots. We controlled that our experiment caused a decrease in soil moisture (35% on average) but no significant change in soil temperature. At the end of the experimental drought (DAY 0), plant productivity was decreased on average by a 35% ($p < 0.001$), with the largest reductions in the east centre of the Island (42%) with respect to control plots. After the experimental drought, primary productivity remained significantly lower in drought plots than in control plots, being on average 34% lower ($p < 0.001$) than controls two months after the end of the drought (DAY 64). This large decrease in primary productivity highlights the vulnerability of grasslands to forecasted summer drought, with wide spread social, economic, and animal welfare impacts.

TS.14-0-8

Room M5, Tuesday 5th Feb. 16.30 h.

Interactive effects of climate change and grazing intensity on soil functioning in dehesa ecosystemsDomínguez Nuñez, María Teresa¹; Jimenez, Carlos²; Matías, Luis³; Gutiérrez, Eduardo⁴; Herrador, Belen⁵; Hidalgo, María Dolores⁶; Pérez-Ramos, Ignacio⁷

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Dehesas are agroforestry systems that occupy a significant fraction of the land surface in the Iberian Peninsula, being the main agroforestry system in the region. The sustainability of these systems could be threatened by the increases in grazing intensity that they have experienced over the last decades, and by the changes in abiotic conditions predicted by the different climate change projections. In this work we analyzed the impact that both sources of stress (climate change and increasing grazing intensity) have on some variables related to soil microbial activity in dehesa ecosystems. Thirty-six experimental plots were established in three dehesa farms exposed to different grazing intensities. In these plots, air temperature and rainfall inputs were manipulated over two years, simulating climate conditions in Southern Spain predicted for the end of the century. The plots were located in different microhabitats (under tree canopy and in open areas) to evaluate whether tree cover could attenuate the impact of climate change on soil functioning. Habitat type exerted a significant influence on most of the variables related to soil nutrient contents and microbial activity (microbial biomass, carbon and nitrogen mineralization rates, enzyme activities), the greatest values of these variables being found on soils underneath trees. Grazing intensity influenced those variables related to N cycling, while climate change treatments had a very limited impact on soil functioning and nutrient content. In conclusion, habitat type and grazing intensity have larger effects of soil functioning than air warming and drought in these drought-prone ecosystems.

TS.14-0-9

Room M5, Tuesday 5th Feb. 16.45 h.

Soil warming triggers coupled carbon and nitrogen losses in subarctic soilsMarañón Jiménez, Sara¹; Soong, Jennifer²; Leblans, Niki³; Fuchslueger, Lucia⁴; Bjarni, Sigurdsson⁵; Peñuelas, Josep⁶; Richter, Andreas⁷; Janssens, Ivan⁸

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The biogeochemical coupling between plant and soil microbes is especially tight in northern ecosystems, where low temperatures constrain the rates of soil organic matter mineralization (SOM) and the supply of mineral N for plants. Increasing temperatures can accelerate SOM mineralization throughout the year and cause seasonal asynchronies with plant N uptake, with critical consequences for soil C and N cycling. Geothermally active areas in Iceland provided stable and continuous soil temperature gradients to test this hypothesis, encompassing the full range of warming scenarios projected by the Intergovernmental Panel on Climate Change for northern regions. The incubation of soils from these geothermal gradients revealed a persistent increase in the respiratory costs of microbes living at warmer temperatures for seven years. The increasing energy costs of metabolic maintenance and resource acquisition led to a weaker capacity of C stabilization in microbial biomass, which contributed to substantial soil C losses. However, soils also experienced large and proportional N losses in response to warming. Our results show that a strong C limitation of microbial biomass restricted the capacity of N retention of soil microbes and likely increased the vulnerability of soil to N losses during winter. These findings suggest a strong control of microbial physiology and C:N stoichiometric needs of soil microbes on the retention of soil N and ultimately on the resilience of high-latitude soil C stocks to warming. The integration of these processes will contribute to improve the predictions of climate change-C cycling models.

TS.14-0-10

Room M5, Tuesday 5th Feb. 18.00 h.

Decoupling of nutrient cycling under elevated CO₂Ochoa Hueso, Carlos Raul¹; Piñeiro, Juan²; Power, Sally³

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The notion that all constituents of an ecosystem must remain tightly coupled to ensure stable and sustainable ecosystem functioning has been an implicit assumption of ecosystem scientists since the times of Lindeman and Odum. Climate change and elevated atmospheric [CO₂] (eCO₂) are currently altering nutrient cycling and availability rates in ecosystems worldwide. If the availabilities and turnover rates of macro- and micronutrients are differentially affected, then nutrient cycles may become decoupled, something that few studies have considered to date. Here, we evaluate the impacts of three years of eCO₂ (550 μmol CO₂ mol⁻¹) on the availability and stability of eleven essential macro and micronutrients, in a mature, P-limited Eucalyptus woodland from Eastern Australia (EucFACE). We also assessed how eCO₂ affected the stoichiometry of available nutrients and the biogeochemical coupling of these nutrient cycles. Nutrient availabilities and their stoichiometric ratios were unaffected by eCO₂. In contrast, the stability of nutrients (particularly that of S, Ca and Mg) increased under eCO₂, which was linked to a reduction in the degree of nutrient coupling under eCO₂ conditions. Here, we have shown that macro-nutrient cycles can quickly become decoupled under eCO₂ in a low-nutrient eucalypt woodland from Australia, despite the lack of consistent effects on nutrient availability, which may have unpredicted consequences in terms of ecosystem functioning under the widely assumed paradigm of positive ecosystem coupling-ecosystem functioning relationship.

TS.14-0-11

Room M5, Tuesday 5th Feb. 18.15 h.

Plant life on gypsum soils: deciphering the ionome of Iberian gypsum plants

Palacio Blasco, Sara¹; Cera, Andreu²; Sánchez, Ana María³; Mota, Juan F.⁴; Escudero, Adrián⁵; Serrano Pérez-Serrano, María⁶; Merlo, Encarnación⁷; Pérez-Hernández, F⁸; Salmerón-Sánchez, Esteban⁹; Mendoza-Fernández, Antonia¹⁰; Pérez-García, Francisco Javier¹¹; Montserrat-Martí, Gabriel¹²

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The ionome of plants is a key tool to unravel plant adaptation to the environment, with particular relevance on special substrates. Gypsum soils are amongst the most widespread atypical substrates on Earth, yet little is known about the different mechanisms displayed by plants to survive on them. Previous nutritional studies performed on a handful of plants exclusive to gypsum soils (gypsophiles) and non-exclusive plants (gypsovags) have shown how broadly distributed gypsophiles have different chemical composition to narrowly distributed ones, the latter being more chemically similar to gypsovags. Nevertheless, information on the ionome of a broader group of gypsum plants is lacking. We analyzed the concentration of 26 elements in the leaves of 70 taxa typical of Iberian gypsum soils. The selection included wide and narrow gypsophiles plus gypsovags, the latter collected both in and out of gypsum. Our results indicate that the three groups of plants studied can be separated by their ionic composition, with narrow gypsophiles showing different elemental composition than both gypsovags and widely distributed gypsophiles. Widely distributed gypsophiles stand out by their high S, Ca, Mg and Fe concentrations, while narrow gypsophiles show intermediate S concentrations to the other two groups of plants and gypsovags accumulate more K, Mn and Cu. The segregation among the three groups of plants stands when both perennial and annual plants are studied separately, although the variability is larger in perennial than annual plants. This information can help identify different metabolic strategies to cope with the atypical chemical composition of gypsum soils.

TS.14-0-12

Room M5, Tuesday 5th Feb. 18.30 h.

Influence of global change drivers on fine scale determinants of soil fauna

Homet Gutierrez, Pablo¹; Jimenez Chacón, Alejandro²; Matias, Luis³; Gómez Aparicio, Lorena⁴; Godoy, Oscar⁵

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Soil fauna plays an essential role for nutrient cycling processes, but the drivers promoting changes in its abundance and diversity, particularly within a global change context are largely unknown. In spring 2016, we built a rainfall exclusion experiment (30% rainfall reduction) to explore soil fauna responses to simulated climate change in a mixed oak forest of southern Spain invaded by the exotic soil-borne pathogen *Phytophthora cinnamomi*. We identified soil fauna groups at the suborder taxonomic level and its trophic position at the beginning of the experiment and after one year in both experimental and control plots. We then analysed the effect of the rainfall reduction treatment on temporal changes in the abundance and diversity of soil mesofauna. We also explored statistical correlations with fine-scale biotic and abiotic parameters by means of structural equation models. Primarily, we observed that one year of experimental rainfall reduction strongly decreased predator abundance but not detritivore abundance. Moreover, light availability, tree defoliation and the abundance of *P. cinnamomi* were identified as the main drivers of the changes in the abundance of particular detritivore groups. Our results demonstrate rapid responses of the abundance and composition of the litter mesofauna to climate change-related drought, with the organisms in the higher trophic levels being the more susceptible to increasing dryness. Multiple tree and litter characteristics influenced litter fauna abundance at local scale, suggesting that global change drivers as climate change and invasive exotic species are modifying these complex relationships.

TS.14-O-13

Room M5, Tuesday 5th Feb. 18.45 h.

The Interaction between current and past land use changes affect soil oribatid diversity in holm oak (*Quercus ilex*) forestsDoblas Miranda, Enrique¹; Espelta, Josep Maria²; Pino, Joan³

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In the last decades, agricultural abandonment has resulted in the development of novel forests all over Europe. These forests possess relatively unknown structural and functional attributes, influenced by the long-term effects of past land uses, which might in the end determine soil fertility. In order to disentangle the effects of current forest spatial distribution and the land use legacies on soil diversity, we determined oribatid mite populations in old forests, adjacent new forests and isolated new forest patches in a Mediterranean landscape mosaic. On the one hand, although old forests support higher diversity than new forests patches, spatial distribution (isolation) seems to play a higher role than forest age in affecting oribatid diversity. On the other hand, the existence of differences in community composition between old and new forests, suggest a maintenance of original habitat legacies during long term scales.

TS.14-O-14

Room M5, Tuesday 5th Feb. 19.00 h.

Drought-induced fast contraction of springtail richness across EuropePeguero Gutiérrez, Guille¹; Sol, Daniel²; Arnedo, Miquel³; Petersen, Henning⁴; Salmon, Sandrine⁵; Ponge, Jean-François⁶; Maspons, Joan⁷; Emmett, Bridget⁸; Beier, Claus⁹; Tietema, Albert¹⁰; Deangelis, Paolo¹¹; Kovács-Láng, Edit¹²; Kröel-Dulay, György¹³; Estiarte, Marc¹⁴; Bartrons, Mireia¹⁵; Holmstrup, Martin¹⁶; Janssens, Ivan A.¹⁷; Peñuelas, Josep¹⁸

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Soil fauna plays a fundamental role on key ecosystem functions like organic matter decomposition, although how local assemblages are responding to climate change and whether these changes may have consequences to ecosystem functioning is less clear. Previous studies have revealed that a continued environmental stress may result in poorer communities by filtering out the most sensitive species. However, these experiments have rarely been applied to climate change factors combining multi-year and multi-site standardized field treatments across climatically contrasting regions, which has limited drawing general conclusions. Moreover, other facets of biodiversity beyond taxonomic richness, potentially more closely linked to ecosystem functioning, have been largely neglected. Here, we report that the abundance, number of species, phylogenetic diversity and functional richness of springtail communities (Subclass Collembola), a major group of fungivores and detritivores, decreased within four years of experimental drought across six European shrublands. The loss of phylogenetic and functional richness were higher than expected by the loss of species richness, leading to assemblages of phylogenetically similar species sharing evolutionary conserved traits. Additionally, despite the great large-scale climatic differences among study sites, we found that local taxonomic, phylogenetic and functional richness of springtail communities were able to explain up to 30% of the variation in annual decomposition rates. Altogether, our results suggest that the forecasted reductions in precipitation associated with climate change may erode springtail communities and likely other drought-sensitive soil invertebrates, thereby retarding litter decomposition and nutrient cycling in ecosystems

TS.14-0-15

Room M5, Tuesday 5th Feb. 19.15 h.

Tree species shape the assembly of microbial decomposer communities during oak leaf and pine needle litter decompositionFernández Alonso, María José¹; Díaz-Pinés, Eugenio²; Kitzler, Barbara³; Rubio, Agustín⁴

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Litter decomposition (i.e. the breakdown of organic matter and release of nutrients in the soil) is a complex process dependent on litter intrinsic properties, environmental conditions and soil microbial decomposer communities. We examined how the global-change driven forest succession from Scots pine to Pyrenean oak may influence litter decomposition in a Mediterranean ecotone forest. We performed a reciprocal transplant experiment using litterbags in two neighbouring monospecific stands of pine and oak. The decomposition of litter from pine needles, oak leaves and an admixture 1:1 of both needles and leaves was investigated, along with changes in litter mass loss, C and N contents and microbial community structure by PLFA method over a two-year period. Our results evidence that, litter type is the most important factor affecting mass and N dynamics during the early stages of decay (ca. 1 year). However, the effect of forest type by pre-determining decomposition conditions showed an increasing importance with time. Tree species influenced soil microclimate and the functional assembly of microbial communities, both key drivers of litter decomposition processes. We found different microbial colonisation patterns of decomposing litter between forests, suggesting a microbial functional adjustment to litter stoichiometry. Specific feedbacks between tree species, soil microenvironment and microbial functionality have strong implications for litter decomposition and the biogeochemical cycling of C and N suggesting that the global change-driven forest succession from pine to oak may lead to a decrease of forest floor accumulation.

TS.14-0-16

Room M5, Tuesday 5th Feb. 19.30 h.

Assessing the effect of plant phylogenetic diversity on leaf litter decomposition in stream microcosmsLópez, Naiara¹; Pérez, Javier²; Basaguren, Ana³; Pozo, Jesús⁴; Boyero, Luz⁵

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Plant litter decomposition is a key ecosystem process that plays a significant role in the global carbon cycle and is affected by global drivers such as biodiversity loss. Many experiments have examined the effects of riparian plant biodiversity loss on leaf litter decomposition in streams, but there is no consensus about which measures of biodiversity are more relevant to address this question. Given that species that are closer in the phylogeny tend to share more functional traits than more distant species, we predicted that plant phylogenetic diversity (PD) would be a good proxy for leaf litter functional trait diversity and thus would affect decomposition rates. We tested this hypothesis in a stream microcosm experiment where we manipulated plant PD, using riparian plants from 3 families (Betulaceae, Salicaceae and Fagaceae) in 3 spp-mixtures of low PD (spp within the same family) or high PD (spp from different families), both in the presence and absence of a common leaf-shredding detritivore. Unexpectedly, we found no effect of PD on decomposition rates in microcosms with or without detritivores, and PD was not strongly related to leaf litter trait variability, possibly because some of the relevant traits are not phylogenetically conserved or due to the existence of convergent evolution or phenotypic plasticity. Our results suggest that biodiversity measures other than phylogenetic diversity are more appropriate to explore effects of plant biodiversity loss on leaf litter decomposition.

TS.14-0-17

Room M5, Tuesday 5th Feb. 19.45 h.

Snapshot of structure, functions and diversity of temporary streambed microbes under a range of hydrologic historyGionchetta, Giulia¹; Artigas, Joan²; Oliva, Francesc³; Romaní, Anna⁴

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Microbes inhabiting temporary streambeds manifest achievable adaptations under intermittent flow, but the increasing aridity of freshwater courses could affect their structural and functional responses dynamics. As a consequence, enhanced foresee dryness of Mediterranean streambed may further determine changes in biogeochemical and nutrient processes carried out by these microorganisms. Ultimately, increasing intermittency strength may determine the transition from a freshwater to a soil-like system. The present study investigated the impact of drought duration, frequency and intensity on heterotrophic microbes and their organic matter degradation capabilities in sediments from Mediterranean streams. To this aim, a streams network was selected including the most important river watersheds in Catalunya (SE Spain) and covering perennial and temporary streams. The hydrology history of the 47 sites was monitored over 8 months previous to the intensive field sampling of autumn 2016, the last warmest year. From that sampling we evaluated bacterial biomass, community respiration, a range of extracellular enzyme activities, and the microbial diversity of archaea, bacteria and fungi (Next Generation Sequencing). Preliminary results indicate that microbial structure and functions resisted to the increased dryness and started being drought-affected after a lag-time, in particular bacterial biomass decreased only after more than 3-months of continuous dryness. Interestingly, the temporal continuity of the dry phase impacted more than repeated frequencies of dry moments, especially in terms enzyme activities and microbial diversity. These results suggest a non-linear response of streambed heterotrophs to dryness and that drought "hardness" (including duration, frequency and intensity) would model the communities' functional responses and assemblages.

TS.14. Posters

TS.14-P-1

External pavilion, Poster session 1: Monday 4th - Tuesday 5th Feb.

Short-term effects of N and P deposition on plant and soil communities in four Spanish alpine systemsArmas Kulik, Cristina¹; Rodríguez-Echeverría, Susana²; Rodríguez, Alexandra³; Durán, Jorge⁴; Ochoa-Hueso, Raul⁵; Usero, Francisco M.⁶; Pugnaire, Francisco I.⁷; Manrique, Esteban⁸

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Global environmental change threatens ecosystems biodiversity and functioning, and one of its main drivers is the increasing atmospheric deposition of nitrogen (N). Nitrogen deposition is projected to double by 2050 and understanding how it alters ecosystem processes has become a critical topic. Nitrogen and phosphorus (P) are essential for plant and microbial productivity. Also, ecosystem functioning depends on both the availability and the stoichiometry of these nutrients, as they are tightly linked through biochemical processes that are major controls of key ecosystem processes. We addressed the influence of atmospheric deposition of N and P on the soil and plant communities of four Spanish alpine ecosystems that span along a latitudinal and aridity gradient (Teide, Sierra Nevada, Guadarrama and Picos de Europa National Parks). In 2016, we started an experiment that simulates projected deposition scenarios following a factorial design of N and P addition. We monitored N and P wet deposition and measured in situ inorganic N and P production, plant growth, and the activity and abundance of soil microbiota. Ambient wet deposition levels were low in all sites but we observed a fast fertilization effect on the production of soil inorganic N and P. At the three Iberian sites, plant growth and soil microbial activity were mainly affected by P addition, while in the southernmost arid site (Teide), plants mainly responded to N fertilization, whereas soil activity (i.e. respiration) and bacterial abundance were affected by the addition of both N and P.

TS.14-P-2

External pavilion, Poster session 1: Monday 4th - Tuesday 5th Feb.

Litter decomposition process of three halophytic species at La Pletera salt marsh (NE Iberian Peninsula): litter quality, enzyme efficiencies and fungal biomassCarrasco Barea, Lorena¹; Llorens, Laura²; Romaní, Anna Maria³; Verdagué, Dolors⁴

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Salt marshes are important carbon reservoirs because of the high amount of carbon stored in vegetation and especially in soil. Litter decomposition is a key process, mainly mediated by fungal microorganisms, that allows the incorporation of organic carbon into the soil, favoring its storage at the long-term. Hence, the aim of this study was to compare the litter decomposition process of three halophytic species (*Sarcocornia fruticosa*, *Atriplex portulacoides* and *Elymus pycnanthus*) which dominate two different plant communities in La Pletera salt marsh (NE Iberian Peninsula). For each species, litter quality (carbon, nitrogen, cellulose and lignin content), decomposition rates, extracellular enzyme activities (β -glucosidase, β -xylosidase, leucine-aminopeptidase and phenol oxidase) and fungal biomass were determined throughout the decomposition process. *E. pycnanthus* litter had the highest values of carbon, cellulose and lignin, being more recalcitrant than the litter of the other species, which agrees with its lowest decomposition rates. Besides, *E. pycnanthus* had also the lowest enzyme efficiencies and fungal biomass. The decomposition rate of *A. portulacoides* showed a remarkable variability suggesting that litter decomposition of this species is highly sensitive to edaphic heterogeneity. In fact, differences in decomposition rates, extracellular enzyme activities and fungal biomass were found between litter samples of *A. portulacoides* placed in two different sites within the same plant community. Overall, results indicate that *E. pycnanthus* would favor the incorporation of organic carbon into the soil more than the other two species due to its lower litter decomposition rates and consequently lower mineralization of the organic carbon.

TS.14-P-3

External pavilion, Poster session 1: Monday 4th - Tuesday 5th Feb.

Can gypsophiles grow out of gypsum? A common garden experiment to understand plant adaptation to gypsum soilsCera Rull, Andreu¹; Palacio, Sara²; Montserrat-Martí, Gabriel³; Ferrio, Juan Pedro⁴

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The vegetation of gypsum habitats is formed by gypsophiles, i.e. plants that only appear on gypsum, and gypsovags, which can grow on both gypsum and non-gypsum soils. Plant performance and distribution could be affected by several factors in gypsum ecosystems, such as the depth and hardness of the petrogypsic layer, low water availability, and adverse chemical factors. Gypsum soils are described as alkaline with dominance of calcium, sulphate and magnesium, moderate salinity and reduced fertility. In this regard, gypsophiles show different leaf ionome than gypsovags, which may indicate different strategies to cope with gypsum. In this study, five species of gypsophiles and five of gypsovags were grown in pots with either native gypsum or calcareous soils to evaluate the effects of substrate composition on the survival, performance and leaf ionome. Seeds collected from natural populations were sown directly on target substrata, and a subset of plants was harvested for analyses during the first and second year after germination. We measured growth, phenology, total biomass, seed size, photosynthetic rate, water use efficiency (WUE), and the leaf ionome. Our results indicate that gypsophiles can grow, flower and produce seeds on calcareous pots, and most of them are able to accumulate high S concentrations, irrespective of soil. Some of gypsophiles showed better performance and higher transpiration rate and stomatal conductance in calcareous soil. Owing to our results, gypsophiles seem perfectly able to survive, grow and produce seeds out of gypsum, and they are S-accumulators, even when S availability in soil is low.

TS.14-P-4

External pavilion, Poster session 1: Monday 4th - Tuesday 5th Feb.

Changes in soil microbial utilization pattern in response to plant diversity and precipitation change in a Mediterranean shrublandFromin, Nathalie¹; Shihan, Ammar²; Santonja, Mathieu³; Hättenschwiler, Stephan⁴

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Functional diversity of soil microorganisms and the processes they drive are controlled by environmental conditions and biotic factors, such as the quality and diversity of plant litter entering the soil. Here we aimed at quantifying the consequences of plant diversity and reduced precipitation - two important factors of global change - on soil microbial community functioning in a Mediterranean shrubland of Southern France. Across a natural gradient of shrub species diversity (including all possible combinations of the four dominant species *Quercus coccifera*, *Cistus albidus*, *Ulex parviflorus*, and *Rosmarinus officinalis*), we collected soil samples after 7 and 31 months of rain exclusion and measured the soil microbial community level physiological profiles. We tested the hypothesis that both functional identity and diversity of leaf litter of the plot-specific shrub community would impact the catabolic profiles of the soil microbial community, with more active and more diverse microbial communities under more diverse shrub cover. An average reduction of 12% of annual precipitation was a poor predictor of the functional diversity of microbial communities. In contrast, plant cover, species richness, and litter functional dissimilarity significantly explained the functional parameters of the soil microbial communities. We also identified species-specific effects of the presence of the four species on soil microbial metabolic activity and diversity. Our data suggest that changes in plant community composition and diversity that can occur following climate change will affect soil microbial activities and diversity in this Mediterranean shrub ecosystem.

TS.14-P-5

External pavilion, Poster session 1: Monday 4th - Tuesday 5th Feb.

Phytostabilisation of trace elements with different tree species revealed a species-specific effect on soil functioningGil-Martínez, Marta¹; Domínguez, María Teresa²; Navarro-Fernández, Carmen María³; Tibbett, Mark⁴; Marañón, Teodoro⁵

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Phytostabilisation is the use of plants and associated microorganisms to reduce the mobility of soil contaminants. Its efficiency is highly dependent on plant identity because of species-specific effects on soils, which also affect soil nutrient cycling and microbial growth. In a trace element (As, Cd, Cu, Pb, Zn) contaminated soil in SW Spain, a long-term phytoremediation plan was implemented to reduce the spread of contaminants in the mine-spill affected area. Soils underneath three native tree species: white poplar (*Populus alba*), stone pine (*Pinus pinea*) and wild olive (*Olea europaea*), were sampled 15 years after plantation to evaluate medium-term soil functionality. A significant effect of tree species on soil contamination levels was not found. In relation to soil nutrients, afforested soils presented an increasing soil fertility in comparison to treeless soils. Among species, soils underneath white poplar presented a lower acidification and a higher N content, while soils underneath stone pine were acidified and showed the highest C:N ratio. Regarding soil microbial biomass, a significant effect of stone pine was found indicating a reduction on biomass. Tree species showed different effects depending on specific soil enzyme activities, however, in general, enzyme activities were highly driven by soil acidification and contamination. In conclusion, the medium-term effect of phytostabilisation by the studied tree species was weak in terms of contamination stabilisation, however a marked tree species footprint was found in terms of soil nutrient contents as well as on microbial biomass and enzyme activities. Therefore, a species-specific effect was found with direct consequences on soil functionality.

TS.14-P-6

External pavilion, Poster session 1: Monday 4th - Tuesday 5th Feb.

Host identity and spatial-temporal factors affect the structure and function of fungal communities in Mediterranean mixed pine-oak forestsPrieto Rubio, Jorge¹; Buée, Marc²; Alcántara, Julio Manuel³; Azcón-Aguilar, Concepción⁴; Rincón, Ana⁵

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Fungal communities are key components of forest ecosystems. They are involved in the productivity of trees and the distribution of resources, and can be an important underlying mechanism for the coexistence of plants (i.e. ectomycorrhizas). Fungi facilitate the degradation of complex organic compounds in soils, being directly involved in the cycling of nutrients. However, the biotic and abiotic factors that affect the structure and function of forest fungal communities remain yet to be fully understood. For this purpose, we analyzed the influence of host identity and spatial-temporal factors as drivers of diversity and functionality of their associated fungal communities. We sampled ectomycorrhizas and rhizospheric soils of eight plant species (belonging to *Quercus*, *Pinus* and *Cistus*) from two Mediterranean mixed forests located in Jaén (Spain), in spring and autumn. High-throughput sequencing and enzyme activity measures related to carbon turnover and nutrient mobilization were performed. Our results revealed that the factors host plant identity and site strongly influenced the fungal species composition, whereas the season had a much less pronounced effect. Less than 5% of ectomycorrhizal fungi were shared by all plant species, the 42% was found in both forests and the 64% at both seasons. Additionally, all factors did influence the enzymatic activities in the rhizospheric environment, particularly those related to N and P mobilization. These results contribute to understand the factors governing the structure and function of fungal communities in Mediterranean forests, which is relevant for the resilience and maintenance of these ecosystems in a global change perspective.

TS.14-P-7

External pavilion, Poster session 1: Monday 4th - Tuesday 5th Feb.

Rapid changes in nutrient availability in a Mediterranean forest due to simultaneous effects of simulated climate change and exotic pathogensVilla, Elena¹; Gallardo, Antonio²; Serrano, María Socorro³; Gutiérrez, Eduardo⁴; Gómez-Aparicio, Lorena⁵

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Climate change and exotic pathogens are two key global change factors driving the decline of *Quercus* species in forests worldwide. However, very little is known about the interactive effects of these two factors on biogeochemical cycles. Here, we assessed for the first time the consequences of the simultaneous impact of climate change and soil-borne pathogens on nutrient cycling. We conducted a field experiment in a Mediterranean forest affected by *Quercus suber* decline, evaluating how drought (ambient vs. ~30% reduction in rainfall), warming (ambient vs. ~2.5 °C increase) and the abundance of the oomycete pathogen *Phytophthora cinnamomi* affected nutrient availability in soils (microbial biomass nitrogen, NH₄⁺, NO₃⁻, and urease, phosphatase and β-glucosidase activities). One year after the beginning of the experiment, the drought treatment decreased by 19% the soil phosphatase activity in spring and caused substantial reductions in microbial biomass nitrogen and NH₄⁺ (60% and 33%, respectively) in summer. Warming also caused very rapid changes in nutrient availability, increasing NH₄⁺ concentration in summer by 38%. Moreover, *P. cinnamomi* abundance was positively correlated with urease and β-glucosidase activities. We did not find any short term interaction between the climate treatments and *P. cinnamomi* abundance. Our findings suggest that drought can have a very rapid negative impact on nutrient cycling in Mediterranean forests that could be partially buffered by the effects of warming and *P. cinnamomi* infection. Climate change and soil-borne pathogens can have counteracting effects on nutrient cycling, supporting the need for more studies that analyze their simultaneous effect on ecosystem functioning.

Thematic Session 15: Palaeoecology: using long-term datasets to test ecological questions

Day: Tuesday 5th February

Schedule: 12:00h 13:30h – 16:00h 17:00h

Location: Room A2

Coordinators:

Encarni Montoya, Institute of Earth Sciences “Jaume Almera” (CSIC), Spain

Sandra Nogué, University of Southampton, UK

César Morales del Molino, Swiss Federal Research Institute WSL / IPS & OCCR, University of Bern, Switzerland

Sergi Pla-Rabés, CREAM; UAB, Spain

Ecosystems are dynamic entities under continuous change, in response to both internal processes and changes in the external environment. The disparity in the time span of ecological processes and diverse lifespans mean that ecological dynamics play out over a range of spatial and temporal scales, including those well beyond a human lifetime. Ecologists are increasingly aware of the importance of long-term ecological datasets extending over centuries and millennia. This need has been reflected in the last decades by the accumulation of long-term monitoring data, as well as by the global concern about current climate change. Palaeoecology, literally “old ecology”, is the study of the remains of living organisms preserved in sedimentary archives in order to reconstruct and interrogate ecological processes over time scales from decades to millennia and beyond, yet the research community using these techniques is not well integrated in many cases with modern ecological research, to the detriment of both ecology and palaeoecology. To bridge the gap between ecology and palaeoecology we, therefore, propose a session to discuss a wide range of ecological topics that would be enriched by long-term datasets, including broad disciplines such as biogeography, macroecology, community ecology, and evolutionary biology.

TS.15. Oral talks

TS.15-MT-1

Room A2, Tuesday 5th Feb. 12.00 h.

Treeline and climate in the Pyrenees: current situation, past reconstruction and future projectionsCatalán, Jordi¹; Batalla, Meritxell²; Pérez-Obiol, Ramón³; Ninyerola, Miquel⁴

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The treeline is an essential feature of the mountain landscape. The declining temperature with altitude modulated by local topoclimatic characteristics is the key driver defining the treeline location. This thermal limit has a functional basis that results in little variation among the different species involved around the world. Heuristic models indicate a requirement of a minimum length of the growing season (~94 days) defined as all days above a daily mean temperature threshold (~0.9 °C) and a characteristic average temperature across all these days (~6.4 °C). With the aim to reconstruct the treeline in the past and project it to future climate scenarios, we adapted these requirements to monthly –averaged weather data and applied the model across the Pyrenees using topoclimatic data at 30x30 m resolution based on observations during the period 1981-2015. The performance of the model was evaluated using the minimum distance of the estimated treeline position to the individual tree (*Pinus uncinata*) that was the closest to the ridge of the mountain in the forest inventories available. There was a generally good agreement. The deviations showed a clear geographic pattern that suggested an additional altitudinal limitation by water availability. After modelling this water limitation, the deviations were more regionally random reflecting the local human deforestation. The model built was applied to evaluate future climate scenarios at short and mid-term, and to estimate the past treeline position during different periods of the Holocene according to climate reconstructions based on pollen from lake sediment records.

TS.15-O-2

Room A2, Tuesday 5th Feb. 12.30 h.

Phylogenetic diversity through the Cenozoic in the Iberian florasVerdú Del Campo, Miguel¹; Pausas, Juli²; Postigo-Mijarra, Jose María³; Barrón, Eduardo⁴; Casas-Gallego, Manuel⁵; Arroyo, Juan⁶; Carrión, José Sebastián⁷

(1) CIDE; (2) CIDE; (3) IES Clara Campoamor; (4) Instituto Geológico y Minero de España; (5) CGG Robertson; (6) Universidad de Sevilla; (7) Universidad de Murcia

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Phylogenetic diversity accounts for the historical legacy of the species assembly and integrates the variability of morpho-functional diversity evolved through time. Thus, phylogenetic diversity has helped to understand the assembly mechanisms underlying extant communities. However, changes in phylogenetic diversity through geological times have been seldom studied, being plants one of the less studied groups. The Iberian Peninsula provides an appropriate scenario to track phylogenetic changes through time because of our relatively well-known palaeobotanical record over the Cenozoic, the last 65 Ma. During all this time, a great number of taxa appeared, spread and became extinct due to numerous factors probably related to climate, topography and ecological interactions. We compiled an extensive fossil database of Iberian flora to the level of family or genus that spans from the Paleocene to the Quaternary and assembled the past phylogenies to estimate temporal changes in phylogenetic diversity associated to observed taxon gains and losses. To detect abrupt changes in phylogenetic diversity, we evaluated the departure of the observed phylogenetic diversity from those expected under a null model following an evolutionary birth-death process. The application of this model let us to infer a number of stages of different gains and losses of diversity over the Cenozoic. We discuss putative causes related to these changes of floristic diversity.

TS.15-0-3

Room A2, Tuesday 5th Feb. 12.45 h.

DNA from living edaphic communities in palaeoecological metabarcoding: a drawback of universal primersGarcés Pastor, Sandra¹; Wangenstein, Owen S.²; Pérez-Haase, Aaron³; Pèlachs, Albert⁴; Pérez-Obiol, Ramon⁵; Soriano, Joan-Manuel⁶; Cañellas-Boltà, Núria⁷; Mariani, Stefano⁸; Vegas-Vilarrúbia, Teresa⁹

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We performed a metabarcoding study using universal 18S and COI markers on four modern moss communities and five depths of a sedimentary core from a peat bog system in Central Pyrenees. We compared the palaeoecological communities recovered from ancient DNA to the detected DNA sequences obtained from the modern communities. We also compared the information provided by sedimentary DNA to the environmental reconstruction based on pollen and macroremains from the same record. We successfully amplified ancient DNA with both markers from all the sedimentary samples, including the deepest one (~10000 years old). Even though 18S primers could amplify a broader range of organisms, the taxonomic resolution was lower than that obtained from COI. The results showed that it is crucial to discern between sequences amplified from edaphic living communities and from ancient DNA when interpreting palaeoecological metabarcoding datasets. Data recovered from ancient sedimentary DNA do not entirely overlap with the reconstruction based on pollen and macroremains, and the combination of both approaches reveals more detailed information. This molecular approach brings promising findings about the diversity of modern and past eukaryotic peat bog communities, which can be assessed using universal metabarcoding markers after sequences from living edaphic organisms are removed, and opens the way to more detailed reconstructions of past ecosystems using DNA metabarcoding.

TS.15-0-4

Room A2, Tuesday 5th Feb. 13.00 h.

Tracking past vegetation on silent sites with ancient DNAde Nascimento Reyes, Lea¹; Wood, Jamie²; Fernández-Palacios, José María³; Caujapé-Castells, Juli⁴; Criado, Constantino⁵; Jaén-Molina, Ruth⁶; Naranjo-Cigala, Agustín⁷; Nogué, Sandra⁸; Wilmshurst, Janet⁹

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Reconstructing past vegetation is one of the main aims of palaeoecological studies and is used to describe past ecosystems and their responses to change over decades to millennia. Unlike modern ecological vegetation surveys, the study of past vegetation is restricted to sites where conditions are good enough for plant fossil preservation. Although the information obtained from fossil preserving sites is extremely valuable, the uneven spatial representation of these long-term records can leave some regions devoid of data about the past. The analysis of ancient plant DNA (aDNA) from these 'silent sites' is increasingly being used as a way to reconstruct past vegetation in areas where plant fossils are too degraded for conventional microscopic analyses. Examples of these obscure or 'silent sites' are dry areas of any given region lacking more traditionally studied lakes or wetlands. Here we analysed aDNA from sediments in the dry lowland areas of the Canary Islands. Whereas several fossil pollen records from mid to high elevation sites on the islands show how initial human settlers changed forest composition and cover, nothing is known about their impact in the lowland vegetation. We show how ancient DNA from plants can be retrieved from environmental samples in dry areas and provide new information and ecological insights about otherwise difficult to study areas.

TS.15-0-5

Room A2, Tuesday 5th Feb. 13.15 h.

An ecological status indicator for all time: Are AMBI and M-AMBI effective indicators of change in deep time?Borja, Ángel¹; Caswell, Bryony²; Frid, Chris³

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Increasingly environmental management seeks to limit the impacts of human activities on ecosystems relative to a 'reference' condition, which is often the presumed pre-impact state. To do so requires information on the true 'natural' or pre-human state of ecosystems, however, information on such ecosystem baselines are lacking. We explore how marine ecosystems in deep time (the Late Jurassic, 4 Myr), prior to human activities, are characterised by the AZTI's Marine Biotic Index (AMBI) and M-AMBI indices, and how the indices responded to natural perturbations (increase of organic matter, decrease of oxygen). These two indices are widely used to detect the impacts of human disturbance on present-day marine ecosystems and to set management targets. The response of relatively well-preserved fossil deposits that underwent substantial natural environmental change (from deoxygenation) are compared with present-day benthic communities under pressure from anthropogenic activities. Our results show that these indices detected changes in past seafloor communities that underwent regional deoxygenation in a manner analogous to those in a present-day system experiencing two decades of organic pollution. These findings highlight the potential for palaeoecological data to contribute to reconstructions of pre-human marine ecosystems, and hence provide information to policy makers and environmental regulators with greater temporal context on the nature of 'pristine' marine ecosystems.

TS.15-0-6

Room A2, Tuesday 5th Feb. 16.00 h.

Let's burn it! Simulating fire-vegetation dynamics at millennial timescales in the central PyreneesGil Romera, Graciela¹; Benito, Blas M²; González-Sampériz, Penélope³

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Fire is a strong ecosystem disturbance, reshaping landscapes, acting on patterns and processes, or fostering new community assembling. Understanding long-term ecosystem post-fire response is essential, especially in fire-sensitive ecosystems, as mountain regions. We present a palaeoecological and modelling approach aiming to test to what extent fire is shaping long-term vegetation dynamics and whether biotic interactions amongst tree taxa are more relevant in determining the observed fossil pollen spectra. We compare fossil pollen and charcoal records from El Portalet (EP) at 1830 m asl (Central Pyrenees) with a spatial-explicit agent based model. This model simulates the forest dynamics for the four main arboreal taxa corresponding pollen types in EP (Pinus, Betula, Corylus and Quercus deciduous) producing a pollen record for each of them. The model also simulates the fire regime which is conditioned by the charcoal record. We found that low to intermediate fire frequencies simulated best EP fossil pollen records supporting that non fire-conductive conditions in subalpine areas would have limited fire activity. Intermediate fire frequencies and number of ignitions simulated best the observed birch, hazelnut and oaks dynamics, which present post-fire responses, in contrast with pines whose dynamics was best simulated by low fire frequencies.

TS.15-0-7

Room A2, Tuesday 5th Feb. 16.15 h.

The productivity-diversity relationship at millennial scalePla Rabes, Sergi¹; Catalán, Jordi²

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Over the last 540 million years, the diversity of life on Earth has increased despite the occurrence of five catastrophic mass extinctions events. Today, we know that habitat destruction and the introduction of exotic species are causing the extinction of many species. Globally these extinctions are triggering the sixth mass extinction. However, beyond the global speciation and extinction events, at ecological time scales diversity is currently increasing in many species assemblages by the establishment of regionally new species. Under the current Global Change, this increase could be a transient phenomenon between two ecological states that lead to an extinction debt. However, if communities would not be saturated local and regional diversity would increase with the passage of time. Here we show that after 10.000 years benthic and planktonic protists assemblages still unsaturated. We observed an early establishment of core species (dominant species), and their relative abundances are following lake biogeochemical changes. Hence, the increase in richness is due to the establishment of satellite species driven by centennial climate fluctuations. Protist productivity and the abundance of core species decreased during north hemispheric cold climate fluctuations, which leads to a rapid increase in species richness. Despite the observed turnover and the decrease in satellite species after these cold spells, species gains were always higher than species losses, which results in an increasing trend in richness all through the Holocene.

TS.15-0-8

Room A2, Tuesday 5th Feb. 16.30 h.

The Paleoecology of Cape Verde: Perspectives and challenges of reconstructing paleoenvironments in semi-arid islandsCastilla-Beltran, Alvaro¹; de Nascimento, Lea²; Edwards, Mary³; Fernández-Palacios, José María⁴; Nogué, Sandra⁵

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Due to the scarcity of archaeo-historical information about environmental change, the characterization of Cape Verdean past ecology, its long-term variability, and the identification of human impacts on the landscape need paleoenvironmental reconstructions. However, there are intrinsic challenges in the study of paleoenvironments in arid and semi-arid islands: the absence of stable water bodies decreases the number of potential paleoecological sites, and human activities tend to concentrate in areas with high soil moisture, disturbing soil profiles with steady sediment deposition. This paper sets out to discuss the perspectives and challenges of paleoecological studies of the volcanic calderas in the highlands of Cape Verde, comparing the 2100-year-old Cova de Paúl record (Santo Antão Island, 1200 m AMSL), and the Monte Gordo Records (Sao Nicoláu Island, ~1050 m AMSL). We propose a multi-proxy approach with a focus on relationships between sedimentology, fire history, and a set of bio-proxies, including pollen, NPP, and silica bodies. We discuss issues of the spatial scale of paleoenvironmental reconstructions and their chronology, as well as the differentiation between long-distance and local palynomorphs. While challenging, assessing the long-term natural history of Cape Verdean landscapes and their responses to climatic and human disturbance pulses is key to facing socio-ecological challenges in the near future.

TS.15-0-9

Room A2, Tuesday 5th Feb. 16.45 h.

Colônia crater: Reconstruction of two glacial-interglacial cycles of vegetation and fire dynamics in the Atlantic forestRodríguez-Zorro, Paula¹; Ledru, Marie-Pierre²; Aquino-Alfonso, Olga³; Daniau, Anne-Laure⁴; Camejo, Adriana⁵; Tropical Project Members, Tropical Project Members⁶

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Although paleoecological studies are increasing in South American tropics, very few records encompass deeper scales in time, which means most of the records are not older than 40 kyr BP (Kilo years Before Present). Long-term datasets are very useful to determine the effect of glacial and interglacial periods in continental and marine areas, which can lead to predicting future responses of ecosystems to drastic climatic changes. In the Southeastern part of Brazil, where the Colonia crater is located, the influence of the Atlantic Ocean, polar air masses, and amazon's water circulation make the area a unique place for regional and global paleoclimatic research. Our project covers the study of the long-term climate cycles in the wet tropics during the last 180 kyr, specifically in the Atlantic forest domain. We are aiming to understand the expression of the glacial-interglacial cycles in terms of the floristic composition together with the driving factors in changes in diversity. Two sediment cores (7 and 14m length) were retrieved from a bog in the Colonia crater and were dated and analyzed by pollen, charcoal, and geochemistry. Our results reveal that during the last 2 glacial-interglacial periods, the Atlantic forest persisted with lower frequencies during each glacial-interglacial transition. In general, high frequencies of arboreal vegetation were detected during each interglacial period as well as reduced fire frequencies; on the contrary, cold glacial periods were characterized by the increase of open areas taxa like Poaceae and cold taxa like Araucaria together with more frequent fires.

TS.15. Posters

TS.15-P-1

External pavilion, Poster session 1: Monday 4th - Tuesday 5th Feb.

Unprecedented grazing threatens rear-edge populations of birch in central Iberia (Cabañeros National Park, Spain)Morales del Molino, César¹; Tinner, Willy²; Carrión, José³; Colombaroli, Daniele⁴; Perea, Ramón⁵; Valbuena-Carabaña, María⁶; Zafra, Elena⁷; Gil, Luis⁸

(1) University of Bern; (2) University of Bern; (3) Universidad de Murcia; (4) Royal Holloway University London; (5) Universidad Politécnica de Madrid; (6) Universidad Politécnica de Madrid; (7) Universidad Politécnica de Madrid; (8) Universidad Politécnica de Madrid

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Western Mediterranean rear-edge populations of *Betula* represent unique reservoirs of genetic diversity currently threatened by increasing wild ungulate densities, dryness, and wildfires. A historical perspective on their past responses to changing herbivory, fire occurrence and climate may contribute to assess their future responses to comparable scenarios. We have reconstructed vegetation and disturbance history in the Cabañeros N.P. (central-southern Spain) using palaeoecological tools, focusing on the long-term dynamics of relict *Betula* populations, the historical range of variation of herbivore densities, and their interactions. Changes in water availability and mainly land-use history have been crucial for vegetation shifts. Heathlands and *Quercus* woodlands dominated during dry phases, while *Sphagnum* bogs and *Betula* stands expanded during wet periods. *Betula* survived droughts but could not cope with enhanced land-use, particularly increasing livestock raising since ~1050-1250 CE, and eventually underwent local extinction. High herbivore densities not only contributed to *Betula* demise but also caused the retreat of *Sphagnum* bogs and probably intervened in the regional pine decline. Intensified land-use after the Ecclesiastical Confiscation (~1750-1850 CE) implied a further increase in herbivory, but truly unprecedented values were reached only during the last decades, following rural depopulation. Contrarily, present fire activity lies within the range of variation of the last millennia, with fires (mainly human-set) mostly occurring during dry periods. Our palaeodata highlight the need of controlling the densities of wild ungulates to preserve ecosystem composition and functioning, and the convenience of restoring *Betula* populations in suitable habitats where they disappeared at least partly because of human agency.

TS.15-P-2

External pavilion, Poster session 1: Monday 4th - Tuesday 5th Feb.

Environmental history of Burg lake (1821m): 18,000 years to test ecological questionsPelachs, Albert¹; Pérez-Obiol, Ramon²; Rodríguez, Josep Manel³; Burjachs, Francesc⁴; Expósito-Barea, Isabel⁵; Yll, Errikarta-Imanol⁶; Julià, Ramon⁷; Bal, Marie-Claude⁸; Soriano, Joan Manuel⁹

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The 14 m core depth of Lake Burg provides a detailed environmental history for the last 18,000 yr in the southern slope of the Pyrenees (NE Spain). Bioclimatic proxies such as pollen, LOI, macroremains and sedimentary charcoal indicate significant climatic oscillations and human impacts. This study provides an opportunity to question some basic concepts, for example, shifting baseline, threshold, or resilience. From this it follows a discussion in the framework of the long-term ecological changes, with examples that illustrate the dynamics of five main landscapes: 1) Sparse *Pinus* populations in an open landscape during the Pleni- and Late Glacial, from 18,000 to 10,000 cal yr BP, when the catchment area is a lake with abundance of *Botryococcus*. Human influence is not reflected. 2) *Betula* populations and other deciduous forests from the beginning of the Holocene until the middle Holocene. The sediment marks a transition to palustrine conditions and coincides with the beginning of the Neolithic. 3) High relevance of *Abies alba* between 5500 and 4000 cal BP with increases of *Cyperaceae* at local level. 4) Increase of human evidences and dominance of *Pinus* in the landscape. 5) Open landscape with a strong humane influence (*Poaceae* play an important role) and a hydromorphic soil for the last two thousand years is being established progressively. High-mountain natural systems are sensitive to climate change, but also to the human management that clearly had begun by the Neolithic, became significant over the past three millennia, and were present everywhere starting in the Middle Ages.

Thematic Session 16: Predicting the response of carbon, nutrient and water cycles to global change: where theory, data and models meet

Day: Tuesday 5th February

Schedule: 18:00h 20:00h

Location: Room M3

Coordinators:

Teresa E. Gimeno, Basque Centre for Climate Change (BC3), Spain

Benjamin D. Stocker, CREAM; UAB, Spain

Aude Valade, CREAM; UAB, Spain

Estela Romero, CREAM; UAB, Spain

Global environmental change affects the functioning and structure of terrestrial and aquatic ecosystems. However, fundamental questions regarding underlying mechanisms and future responses remain unresolved and undermine robust predictions under climate change scenarios. Process-based models are commonly used for predicting changes in water, carbon and nutrient fluxes but often rely on theories and hypotheses with limited empirical constraints or purely empirical formulations. The large amount of observational data that have become available in recent years from Earth observations, large field data collections and manipulation experiments open new opportunities. More than ever, solid theoretical foundations and powerful models are needed to make robust predictions with the contribution of this plethora of available data. This session aims at bridging the gap between empirical and theoretical science: using data for testing hypotheses and finding appropriate model formulations to address fundamental questions about the impact of global change on biogeochemical cycles and the functioning of ecosystems. We welcome contributions covering a wide range of spatial and temporal scales and disciplines, including biogeochemistry, ecophysiology, soil science, ecohydrology, marine and aquatic sciences. We particularly encourage contributions from studies that couple experimental and modelling approaches with a focus on linking theory and data.

TS.16. Oral talks

TS.16-MT-1

Room M3, Tuesday 5th Feb. 18.00 h.

Some thoughts for solving the dysfunctional relationship between experiments and modelsResco, Víctor¹

(1)

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In theory we are aware that “all models are wrong, but some are useful”. In practice however reasonable model fit (under some circumstances) becomes theory. In consequence those processes that, according to a widespread model, should be negligible they are not researched any further. The reality is that general laws in ecology are rare (if existing at all) and there are many important and unknown processes that are yet to be captured by any model, regardless of whether or not they are marginal. This is one of the many reasons underlying the dysfunctional relationship between experimentalists and modellers and many important processes discovered by experiments being ignored in models. The opposite phenomenon, whereby key model predictions remain untested experimentally are also not uncommon. How do we bridge these gaps? Here I will first describe some important processes where little research has been conducted because the process is considered marginal by theory (that is, by a widespread model). I will then demonstrate how allowing models to set theory is dangerous for a discipline like ecology, where general laws are yet to be described. Next I will provide some examples of processes underlying land-atmosphere exchange that contradict basic model assumptions. Overall, I will argue that we must recover experiments as a primary tool of advancing ecological science and I will provide some thoughts to improve the experimentalist-modeler relationship.

TS.16-O-2

Room M3, Tuesday 5th Feb. 18.30 h.

Why should phytoplankton ecologists care about turbulence?

Mouriño-Caballido, Beatriz¹; Villamaña, Marina²; Otero-Ferrer, José Luis³; Cermeño, Pedro⁴; Chouciño, Paloma⁵; Estrada, Marta⁶; Fernández-Castro, Bieito⁷; Figueiras, Francisco G.⁸; Gasol, Josep M.⁹; Latasa, Mikel¹⁰; Marañón, Emilio¹¹; G. Morán, Xosé Anxelu¹²; Moreira, Víctor¹³; Reguera, Beatriz¹⁴; Varela, Marta¹⁵

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Drawings by Leonardo da Vinci painted 500 years ago demonstrate that turbulence has been a fascinating topic for centuries. This process dominates the transfer of momentum and heat, and the dispersion of small organic and inorganic substances in the ocean. Only recently we have been able to measure turbulence in the field on a regular basis. One of the fascinating implications of this progress is the possibility to revisit classic models in phytoplankton ecology. In 1978 Margalef proposed in his famous mandala that turbulence and inorganic macronutrients are the two main factors controlling the succession of main microphytoplankton groups. Several limitations were noted when applying this approach to the field. First, the Margalef's mandala describes only the succession of vegetative phases of microphytoplankton. Moreover, due to the difficulties in quantifying mixing in the field, the validation of Margalef's model was traditionally limited to studies where indirect estimates of nutrient supply were used. Here we combined a novel dataset of hydrographic properties, turbulent mixing, nutrient concentration and pico and microplankton community composition collected in tropical and subtropical regions, the Northwestern Mediterranean sea, and the Galician upwelling system to validate, for the first time, the Margalef's mandala in the field.

TS.16-0-3

Room M3, Tuesday 5th Feb. 18.45 h.

Modelling the carbon cycle in lenitic ecosystems to understand their role in climate changeCamacho, Antonio¹; Morant, Daniel²; Picazo, Antonio³; Rochera, Carlos⁴; Miralles, Javier⁵; Doña, Carolina⁶

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Some of the main ecosystem functions, as well as relevant ecosystem services such as climate regulation, are mediated by the carbon cycle in the ecological systems. This biogeochemical cycle is significant when evaluating and quantifying some of the properties that habitats present, as well as possible responses to changes in the environment. This work presents a theoretical and methodological framework for the carbon cycle, focusing on freshwater ecosystems as an example, from which the carbon balance could be estimated. The model is built by several submodels that represent the main processes related to the carbon cycle in wetlands. Environmental features like the hydrological patterns, climatic data, and salinity level on water are included as determining factors that modify the carbon emission or absorption rates through the different processes involved. Finally, the results of each submodel are integrated as C inputs or outputs for the quantification of the carbon budget of the studied system. The model allows to play with the key environmental factors, then estimating the carbon balance in different climate change scenarios. The hydrological model could also be modified to estimate the response of the carbon cycle to different management measures. The model could be used not only as a scientific method to evaluate the functions and ecosystem services but also as a tool for managers and decision-makers in order to integrate a climate outlook in management and conservation plans. This work was supported by the project CLIMAWET (GL2015-69557-R) funded by MINECO and FEDER-EU Funds.

TS.16-0-4

Room M3, Tuesday 5th Feb. 19.00 h.

Disentangling the influence of evaporative demand and soil moisture supply on plant transpirationFlo, Víctor¹; Granda, Víctor²; Martínez-Vilalta, Jordi³; Poyatos, Rafael⁴

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Plant transpiration is one of the main components of the global water cycle and it is tightly associated with plant productivity, growth and survival. Plants regulate transpiration in response to varying soil moisture supply and evaporative demand but we have yet to disentangle the influence of these two factors as drivers of transpiration. Understanding the global patterns of plant transpiration responses to soil moisture and evaporative demand is paramount to anticipate the effects of droughts on vegetation in a warmer planet. Here we analyzed the first global database of plant transpiration derived from sap flow measurements (SAPFLUXNET). This database contains data for 158 tree species, 2270 trees and more than 2.1 M tree-days. We quantified the relative importance of different hydroclimatic factors, representative of evaporative demand (radiation, vapor pressure deficit, wind speed) and soil moisture supply using machine learning algorithms (random forest). We identified substantial differences in the relative importance of these four hydroclimatic factors as transpiration drivers across biomes and climates. Furthermore, the relative importance of evaporative demand and soil moisture was found to be associated to tree size, tree social status, stand structure and soil characteristics. Our results highlight the broad ecological variation in the relative sensitivity to atmospheric and edaphic drought and contribute to a better understanding of plant functional responses to drought worldwide.

TS.16-0-5

Room M3, Tuesday 5th Feb. 19.15 h.

Nutrient stoichiometry in tropical forests; where are the nutrients?

Urbina Barreto, Ifigenia¹; Grau, Oriol²; Sardans, Jordi³; Van Langenhove, Leandro⁴; Verryckt, Lore T.⁵; Soong, Jennifer L.⁶; Janssens, Ivan A.⁷; Peñuelas, Josep⁸

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Nutrients in tropical forests are distributed unevenly between plant and soil systems. Forest soils in French Guiana are old, highly weathered and extremely nutrient poor, while trees have a great amount of aboveground biomass and store large quantities of nutrients. Plant nutrient uptake and recycling is a challenging field of study, and involves complex interactions between plants and soil, where microbes and mycorrhizas play a relevant role. Nutrient resorption from leaves before abscission may be very advantageous in nutrient-limited ecosystems, but it remains poorly explored. In order to better understand the processes that are driving nutrient distribution in tropical forests we analyzed the chemical composition (i.e., C, N, P, K, Ca, Mg and Fe) of tree aboveground organs (leaves, senescent still attached leaves, and leaves-litter at the soil surface) and soil (at two different depths), across a topographic gradient (determining nutrient availability), in two climatic seasons (wet and dry), and in two different forests in the French Guiana. We explored whether these factors shaped nutrient resorption in primary forests that grow on soils that are highly limited in P availability. We found higher nutrient stocks (g/m²) in the leaves and the litter than in the soil except the Fe contents and we hypothesized that nutrient resorption would play a key role in nutrient cycling of these forests.

TS.16-0-6

Room M3, Tuesday 5th Feb. 19.30 h.

Soil structure and fauna are key for modeling organic matter dynamics with soil model KEYLINK

Flores, Omar¹; Deckmyn, Gaby²; Schnepf, Andrea³; Valladares, Fernando⁴; Curiel Yuste, Jorge⁵

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Global change predictions depends on our capacity to predict changes in the carbon (C) biogeochemical cycle. C cycle is the main target of many ecosystem process-based models. These models include key processes such as litter and soil organic matter (SOM) decomposition, but many of them ignore soil structure, which has proven effects on ecohydrology and biotic interactions, neglecting its effect on carbon fluxes. Moreover, the important role of soil fauna controlling soil structure (due to 'engineer' species) or carbon fluxes within the food web is crucial and well documented, but it is also underrepresented in SOM dynamic models. KEYLINK is a new process-based soil model developed to amend these deficiencies while being simple enough to be included into existing ecosystem models. It considers a soil food web by functional groups, a theoretical approach to the matrix of soil structure, and all their interactions and effects on soil hydrology and SOM dynamics. Furthermore, many models underestimate CO₂ emissions from arid and semiarid ecosystems, as they neglect the relevance of processes like photodegradation of litter in drylands. Special emphasis has been placed here in modeling SOM dynamics in Mediterranean-type ecosystems. We have used KEYLINK using theory as well as data from several experiments from different climates (e.g., boreal, temperate, Mediterranean) and for different types of ecosystems (e.g., forests, crops), simulating ecosystem responses to changes in, for instance, food web functional groups and litter quality, changes in C sequestration and CO₂ emissions, and ecosystem resilience to climate change.

TS.16-0-7

Room M3, Tuesday 5th Feb. 19.45 h.

Ecological evolution (eco-evo) modelling and genomics data: mind the gapVallina, Sergio¹

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Modelling ecological evolution of species traits is a challenging goal for numerical ecologists. There is currently the view that there is a lot of hidden potential from genomics data to help models in this quest. However, ecological models and genomics data “need and provide” very different kind of information. Metaphorically speaking, they belong to different scientific universes even if they try to answer similar ecological questions. That means that there is large * gap * between the information that ecological models need and the information that genomics data may be able to provide. By definition a model is a crude simplified version of reality, which means that they do not model “explicitly” many of the processes that take place during ecological dynamics. This implies that some of these non-explicitly resolved processes need to be parameterized by making strong assumptions. Others are just left behind as if they would not exist at all, which is a stronger assumption. Ideally we would like to obtain information on the model parameter values from genomics data – But how? Can we really do that today? I would argue that this gap between ecological models and genomics data is currently too large (unfortunately), and it is still unknown how we will be able to close it in the near future. Yet, merging eco-evo with genomics data is clearly the way forward in numerical ecology. Put Your Seat Belt On.

TS.16. Posters

TS.16-P-1

External pavilion, Poster session 1: Monday 4th - Tuesday 5th Feb.

Ecosystem Functional Types as descriptors of ecosystem functioning at regional scale

P. Cazorla, Beatriz¹; Meijide, Ana²; Cabello, Javier³; Peñas, Julio⁴; Sigut, Ladislav⁵; Pavelka, Marian⁶; Knohl, Alexander⁷; Pilegaard, Kim⁸; Domingo, Francisco⁹; Sánchez-Cañete, Enrique¹⁰; Loubet, Benjamin¹¹; Kruijt, Bart¹²; Alcaraz-Segura, Domingo¹³

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Classification into functional units in ecology aims to reduce the diversity of biological entities (e.g. genes, species or ecosystems) on the basis of processes. Classifications allow for the identification of homogeneous groups that show a specific and coordinated response to environmental factors. To classify biodiversity functional dimension at ecosystem level, we use Ecosystem Functional Types (EFTs): groups of ecosystems or patches of the land surface that share similar dynamics of matter and energy exchanges remotely-sensed measured. Here, we hypothesize that EFTs are good descriptors of matter and energy fluxes. So, our aim was to test whether EFTs differ in matter and energy exchange dynamics. We validated our remotely-sensed EFTs with direct field measurements obtained from Eddy Covariance Towers. We identified EFTs from 2001-2014 time-series of satellite images of the Enhanced Vegetation Index (EVI) obtained by the MODIS-Terra sensor, MOD13Q1 product. Further, we calculated the annual curve of carbon dynamics using data from 50 Eddy covariance towers obtained from FLUXNET2015 dataset, and located throughout the study area with data over the period 2001-2014. To test if EFTs differ in the fluxes of matter and energy exchange we made a discriminant analysis between our EFTs data and Eddy Towers data. Our results showed that EFTs discriminated these fluxes with 84% of accuracy. We conclude that EFTs derived from satellite images are good descriptors of matter and energy fluxes between the biota and physical environment.

TS.16-P-2

External pavilion, Poster session 1: Monday 4th - Tuesday 5th Feb.

Recent forest increase in Europe (1992-2015): implications for ecosystem functions and services

Palmero Iniesta, Marina¹; Espelta, Josep Maria²; Alfaro, Raquel³; Pino, Joan⁴

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Europe has experienced a steady increase in forest area over recent decades, determining strong effects on the provision of ecosystem functions, services and disservices. However, these effects might be strongly modulated by regional gradients and local socioecological conditions driving forest recovery. We have used the CCI Land Cover (LC) map (300-m pixel resolution) provided by the ESA to assess recent forest dynamics across Europe. Then, we have combined the oldest (1992) and the most recent (2015) maps to assess forest relative net change (i.e. the difference between gains and losses) the amount of new forests (i.e. forest gain) and their main origin (i.e. land cover category in 1992) across biogeographical European regions. Socioecological correlates of forest net change and gain were explored using European and Global geoportals provided by GEOSS and the OGC, among other. While forest has increased by almost 237,096 km², forest net gain is one fourth of this total, thus showing the extreme dynamism of current European forests. Relevance of forest expansion is especially important in the northern ones - the Boreal and Continental - in both absolute and relative terms. Most part of gains corresponds to forest expansion into former agricultural mosaics in southern and central Europe and wetland areas in the Boreal region. In contrast, less than 2% correspond to forest regrowth after disturbance, mostly in the Mediterranean region. The importance of the main socioecological drivers and the consequences for C sequestration at a continental scale are discussed on the light of climate change predictions.

TS.16-P-3

External pavilion, Poster session 1: Monday 4th - Tuesday 5th Feb.

Coastal phytoplankton in a global changing world, oceanic and terrestrial factorsPeters, Francesc¹; Domènech, Ginebra²; Carrillo, Laura³; Fornós, Pau⁴; Arin, Laura⁵; Romero, Estela⁶

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Phytoplankton production is largely determined by the availability of nutrients. In the open ocean, nutrient availability is largely determined by the mechanical energy needed to bring nutrient-rich deep water mixed with upper ocean surface water, marking a clear seasonal cycle, at least in temperate and subtropical seas. As the surface waters increase their temperature with climate change, stratification becomes stronger and mixing is reduced, theoretically reducing phytoplankton production. In the coastal ocean, terrestrial sources of nutrients, with their own dynamics, blur the seasonal cycle to varying degrees depending on the importance of these sources. Riverine sources, with discharge dynamics heavily modified by water use, especially around large urban areas, may alter the plankton community composition in coastal waters. Other sources of nutrients, such as atmospheric deposition, are increasingly being recognized as important, especially in the desertification scenario of the Mediterranean area (Sahara dust), but also owing to anthropogenic aerosols in an increasingly industrialized area. We will make extensive use of time series analysis of both satellite data and coastal in-situ monitoring stations to derive both seasonal signal alterations and well as long time changes, especially in chlorophyll data, and discern between open water (mostly climate related) and coastal tendencies. Chlorophyll concentration shows marginal long-time tendencies for the last 20 years but is significantly decreasing in the last few years (2013-2017), both in open waters and the coastal ocean.

Thematic Session 17: Quantitative Behavioural and Movement Ecology

Day: Tuesday 5th February

Schedule: 12:00h 13:30h – 16:00h 17:00h

Location: Aula Magna

Coordinators:

Frederic Bartumeus, CEAB; CSIC & CREAM; UAB, Spain

Daniel Campos, UAB, Spain

Daniel Sol, CREAM; UAB, Spain

Meritxell Genovart, IMEDEA & CEAB; CSIC, Spain

Disentangling the behavioral variability, organization, and dynamics of living organisms (from 'simple' animals to humans) is fundamental to understand ecological interactions and ecosystem functioning. Despite the centrality of this concept the task of providing quantitative descriptions of such behaviours and untangling the generative mechanisms from the observed patterns, is challenging. Only recently have been developed quantitative frameworks to measure, visualize and analyze 'big' (highly-resolved, diverse and fast) behavioural and movement data. The latter comes concomitantly with the accelerating advances in technology to measure behaviour, both in the lab and in the field, but also to boosted statistical modelling. In the recent future, the rise of 'Big behavioural data' will keep on revolutionizing the field, magnifying the applicability of behavioural data across species and ecosystems, and beyond ecological sciences. In this session, we hope to take the pulse of such a revolution, focusing on the modelling of movement and behavioural variability, at the individual and population level, and their impact in the functioning of ecosystems. We aim to foster a revitalized quantitative look to the field that we think will be instrumental in the next decade of research.

TS.17. Oral talks**TS.17-MT-1**

Room Aula Magna, Tuesday 5th Feb. 12.00 h.

Coping with novelty in opportunistic-generalist lifestylesLefebvre, Louis¹

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One of the major problems in ecology today is the way high rates of anthropogenic change affect biodiversity. Change, usually at lower rates than that of the present, has always been a feature of ecosystems, and animals differ in the way they cope with it. Some animals are opportunistic and able to colonize modified habitats quickly, while others are more conservative and can suffer when their habitats change. Birds offer a unique taxonomic group to study divergent responses to change because of their phylogenetic, ecological and behavioural diversity, as well as the vast amount of data available on them. One way to quantify behavioural response to change is to count feeding innovations, the incorporation of new foods or new feeding techniques in the diet. Innovation rate is currently available for over 1200 species of birds worldwide and can be used in comparative analyses to test for ecological, life history and evolutionary correlates. By focusing on a few species that are closely related, but widely divergent in their opportunism, we can also pinpoint the cognitive and neural mechanisms that accompany responses to change.

TS.17-O-2

Room Aula Magna, Tuesday 5th Feb. 12.30 h.

Natural selection on behavior shapes the trophic ecology of brown anoles facing rapid environmental change: a field experimentLapiedra, Oriol¹; Morales, Nina²

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Recent work on inter-individual variation in behavior has revealed that individuals that consistently differ in behavior commonly interact with the environment in different ways. It follows that different individuals could have different chances to cope with rapid environmental challenges. The ecological and evolutionary implications of this variation remain unclear due to the lack of manipulative field studies in natural conditions. We designed a field experiment in which we first documented consistent inter-individual variation in ecologically relevant risk-taking behavior in brown anoles (*Anolis sagrei*). Then, we translocated them onto a replicated set of small, experimental islands in the Bahamas. On these islands, we manipulated the presence or absence of the curly tailed lizard (*Leiocephalus carinatus*), a well-known ground anole predator. Due to differences in natural selection on risk-taking behavior, habitat use of anoles that survived on islands with predators differed from that on predator-free islands. By using stable isotope analyses, we then asked if these predator-induced habitat shifts led to differences in the foraging ecology of anoles between experimental treatments. Our results reveal trait-mediated dietary shifts on islands with predators as compared with predator-free islands. Specifically, anoles obtained lower proportions of marine-derived food resources on islands with predators present; these resources are found on the ground, where anoles are more vulnerable to ground predators. Our results reveal that, when animal populations face rapid environmental changes, natural selection on behavior can have cascading trophic effects at the ecosystem-level that can potentially pave the way for mid-term changes in eco-evolutionary dynamics.

TS.17-0-3

Room Aula Magna, Tuesday 5th Feb. 12.45 h.

Factors determining the use of livestock carcasses in farms by endangered vulturesGarcía Alfonso, Marina¹; van Overveld, Thijs²; Gangoso, Laura³; Bouten, Willem⁴; Serrano, David⁵; Donázar, José A.⁶

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During the last centuries, the bulk of the diet of European vultures has relied on livestock carcasses. Nevertheless, modernization of livestock husbandry practices and sanitary regulations have resulted in a lower number of carcasses available for vultures. Although new European rules are allowing the farmers to abandon livestock carcasses, this process is taking place without further planning, so a detailed knowledge of how vultures use these resources is needed. We studied individual selection of goat farms by Canarian Egyptian vultures (*Neophron percnopterus majorensis*) in Fuerteventura, using 16.847.635 locations provided for 4 years by 45 GPS-tagged birds and information from 318 farms concentrating 95% of livestock. We modelled these data by means of GLMMs and following Akaike information criterion. GPS-marked vultures preferred farms with larger numbers of livestock and where carcasses were abandoned in the field. Farms away from roads and closer to largely predictable feeding places (muladares and refuse dumps) were also selected. Territorial vultures were more prone to visit farms close to their nests, and farms were used more by males, younger birds, and unsuccessful breeders. Non-territorial vultures preferred feeding on farms away from human populations and during the non-breeding season. From our results, it can be predicted that changes in farming practices could have asymmetric effects on individual Egyptian vultures. Its influence also will differ depending on farm locations. These findings highlight how sanitary conservation schemes cannot be applied uniformly to avian scavenger populations.

TS.17-0-4

Room Aula Magna, Tuesday 5th Feb. 13.00 h.

Size-specific shoaling behaviour of the key Mediterranean herbivore fish *Sarpa salpa* and its importance for their feeding strategyBuñuel Moreno, Xavi¹; Alcoverro Pedrola, Teresa²; Arthur, Rohan³; Romero, Javier⁴

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Several species show a wide flexibility in grouping behaviour as individuals attempt to optimise the relative costs and benefits of solitary and group living. When the grouping species is also an important ecosystem modifier, its decisions can have serious implications for how and where its function is distributed. We examined shoaling choices and foraging behaviour in *Sarpa salpa*, the most important fish herbivore in nearshore Mediterranean systems. Shoals were strongly size assorted, with individuals choosing to group with conspecifics of a similar body length. This was most likely to reduce the conspicuousness of odd-sized individuals to potential predators. In addition, there was a significant positive relationship between body length and shoal size – as individuals grew larger they tended to aggregate in larger shoals. Finally, feeding behaviour was highly influenced by shoal size. Individuals within smaller shoals all fed simultaneously, whereas in larger shoals, individuals participated in partial and rotational feeding, with individuals taking turns to feed in seagrass patches. These behaviours were unique to the largest shoals. Rotational feeding strategies probably allow larger individuals to access the most nutritional basal leaves and ensured that large shoals foraged voraciously at the same spot until most of the seagrass canopy was consumed before moving to another location. These individual shoaling strategies have important consequences for how herbivory is distributed across the landscape. Meadows dominated by smaller shoals are likely to be more homogeneously grazed while large shoals create a more patchy, intense mosaic of herbivory.

TS.17-0-5

Room Aula Magna, Tuesday 5th Feb. 13.15 h.

A new perspective of the social population networks in a reproductive contextPlaza Cusiné, Mireia¹; Lattore, Martina²; Flynn-Carroll, Alex³; Schroeder, Julia⁴; Moreno Klemming, Juan⁵

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The understanding of social decisions and their fitness consequences in animal populations has become a topic of recent interest for behavioral ecologists. The social structure inside the population network shapes key processes including foraging, information flow or reproduction. Mate choice is a crucial factor for the individual reproductive success in monogamous species, although most of them engage in copulas outside the social pair-bond resulting in a variable percentage of extra-pair offspring. The reasons for the wide variation in the frequency of this phenomenon between species and populations have been intensely studied over the last two decades but they are not yet completely understood. The opportunity hypothesis (Krause J et al. 2015) suggests that social network dynamics are related with the reproductive ones, and that the time an individual spends with others in social activities like feeding or communicating is positively correlated with the intensity of its mating behavior in order to obtain the social benefits those potential mates give her/him. In the present study we test the opportunity hypothesis in a captive population of common sparrows *Passer domesticus* by analyzing the relation between the extra-pair behavior measured by direct observation and the individual social variables measured by automated systems. Our results indicate that extra-pair mating and reproductive activities are associated with the number and intensity of social interactions inside the population network, allowing females (and males) to be better socially connected.

TS.17-0-6

Room Aula Magna, Tuesday 5th Feb. 16.00 h.

An individual behavioural-bioenergetic framework connecting within and between individual variability in movement behaviour and life historyCampos Candela, Andrea¹; Palmer, Miquel²; Alós, Josep³

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Consistent between-individual differences in movement and spatial behavioural traits are widely recognized across taxa, moreover, may co-vary with fast-slow life history strategies in adaptive contexts leading to Spatial Behavioural Syndromes across a continuum ranging from resident to mobile behavioural types. The ways in which behavioural variation at the within-species level is translated to the wide range of observed life histories remains a cornerstone for understanding a number of ecological processes, but yet an unresolved question, mainly due to the lack of a proper theoretical framework that mechanistically and non-linearly links individual life histories with between-individual differences in behavioural traits. Focusing on Home Range behaviour, we propose to link mechanistically behaviour, physiology/metabolism and life history, by providing links between two well-founded theories, the movement ecology paradigm and the Dynamic Energetic Budget theory, in order to explain how animals move across dynamic energetic landscapes. This framework hosts the mechanisms explaining i) how behavioural between- and within-individual variability connects explicitly with internal state-variable dynamics, ii) how physiology and behaviour are inter-connected by energy/mass fluxes, and iii) how different life-histories arise from both behavioural and physiological variability. Overall, it provides support for both mobile-behavioural and fast-physiological/metabolic types leading to faster growth and earlier sexual maturation, and that the ecological environment shapes the expected outcomes through plasticity. This novel behavioural-bioenergetics framework reveals encouraging opportunities to deepen in the field of movement ecology, by providing a novel route-guide to explore the generative mechanisms explaining the observed movement patterns and the eco-evolutionary processes generating Spatial Behavioural Syndromes.

TS.17-0-7

Room Aula Magna, Tuesday 5th Feb. 16.15 h.

A simple rule connects mechanistic and evolutionary models of foraging behavior in *Caenorhabditis elegans*Pérez Escudero, Alfonso¹; Madirolas Pérez, Gabriel²; Gore, Jeff³

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An integrative view of behavioral ecology requires connecting different levels of description, from the genetic and neural underpinnings of behavior to its evolutionary consequences. The nematode *C. elegans* offers an opportunity to achieve this aim, being well studied at the level of genetics, development and neuroscience, as well as at the level of its elementary behaviors (i.e. its immediate response to a chemical gradient). Comparatively, we know less about how these elementary behaviors combine to produce the complex outcomes that determine fitness (i.e. finding a profitable food patch in a complex environment). As a first step to fill this gap, we have characterized *C. elegans* distribution across food patches of different qualities. We find a strikingly simple result: the ratio of the number of worms in any two food patches is equal to the ratio of the densities of the two patches. This result holds regardless of the absolute density of the food patches (across two orders of magnitude) and of the number of patches present in the environment—a robustness that suggests simple underlying principles. From the evolutionary viewpoint, our results match the Ideal Free Distribution (predicted by game theory as the evolutionary stable strategy when animals compete for food). From the mechanistic viewpoint, we find that patch-leaving behavior is the dominant factor, with other factors such as chemotaxis and memory having an almost negligible impact on the observed distribution. These results therefore connect large-scale patterns predicted by evolutionary theory with the behavioral mechanisms leading to them.

TS.17-0-8

Room Aula Magna, Tuesday 5th Feb. 16.30 h.

GPS monitoring reveals how large scavenger survival rates and health status are determined by foraging differences at individual and population scaleArrondo, Eneko¹; Sanchez-Zapata, José Antonio²; Sanchez-Zapata, José Antonio³; Donazar, José Antonio⁴

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Griffon vulture is the main Circumediterranean avian scavenger species with 90% of the population located at the Iberian Peninsula. Despite its high abundance and key ecological and conservation roles, this species is still largely unknown mainly due to lack of information on movement and foraging ecology. In this study we aimed at exploring differences in the foraging behavior and its ecological consequences both at individual and population scales. To study the foraging behavior we used GPS and accelerometer data of 65 adult individuals from two vulture populations at the upper Ebro Valley (northern Spain) and the Baetic Mountains (southern Spain) between 2015 and 2017. Moreover, we measured corticosterone metabolites in feathers and lead concentrations in blood in each individual and monitored mortality rates of both populations. Furthermore, we visited 11,463 feeding locations around the Iberian Peninsula to check the type of carcass the vultures were feeding on. Our results showed that northern vultures consumed mainly intensive or semi extensive livestock carcasses (pig and sheep) while southern vultures mostly relied on wild ungulates (mainly from hunting) and semi-extensive livestock. Moreover, the results from the physiological analyses suggested that northern population showed poorer health status (higher stress, lower vitamin levels) while southern population had higher blood lead concentration. In addition, we observed that northern population had lower survival rates due to higher frequency of accidents when foraging in highly anthropized areas. Despite the large size of Iberian griffon population, these results raise questions about the species conservation in a metapopulation scenario.

TS.17-0-9

Room Aula Magna, Tuesday 5th Feb. 16.45 h.

Consequences of animal-human intra-specific movement variation in exploited social-ecological systemsAlos, Josep¹

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Intra-specific spatial behavioural diversity facilitates persistence of predator-prey systems. In social-ecological systems like fisheries, spatial behavioural diversity emerges from both fish and human levels. Here we hypothesized that the general movement characteristics and variation adopted by both fish and human predict encounters among them. Accordingly, we have developed a coupled, social-ecological, spatially-explicit individual based model where fish and fishers move and interact according to a variety of empirically-based random walks (RW). Ecologically, fish behavioural diversity is integrated in the model using a mechanistic movement model of home range behaviour. Socially, by considering that human's searches use different level of social information to maximize profit, fishers' behavioural diversity is integrated in the model using composite RWs. We have developed a series of simulations and explored the performance of the system across exploitation time. We have found that encounters between fish and humans are strongly dependent on the behavioural diversity in the space use, and both animal movement and human searching behaviour are equally relevant. The model predictions were confronted with real-data where a swarm of fish and fishers are tracked simultaneously facilitated by the recent developments of the tracking technology and the sophistication of statistical tools applied to movement data.

TS.17. Posters

TS.17-P-2

External pavilion, Poster session 1: Monday 4th - Tuesday 5th Feb.

C. elegans improves multi scale search and dimensionality through looping behaviourLloret-Cabot, Roger¹; Panlilio, Maria²; S Ryu, William³; Garriga, Joan⁴; Campos, Daniel⁵; Bartumeus, Frederic⁶

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The movement pattern of *C. elegans* is poorly described by run-and-tumble models used in statistical physics to understand biological searches. This is so because worms are capable of controlling the curvature between reorientation events, producing both directional persistence and looping behaviour to intensify local search. Loops maybe considered large discrete steps of constant curvature that brings the animal back to its previous position; the smaller the curvature the larger the time taken to this position. Previous research on *C. elegans* search behaviour has been largely undertaken in short spatiotemporal scales and mainly focused on stereotyped turning behaviour. However, the structural organization of *C. elegans* search trajectories is more complex, and their generative mechanisms and patterning are poorly understood. Here we expanded classic experimental scales up to 90 min and 24.5 mm² in an effort to capture high-order trajectory motifs and patterning. Our results show that *C. elegans* unfolds looping behaviour by covering a wide range of scales and in a time-ordered manner. The average size of the loops and its variability grows as the animal explores the environment until reaching a maximum, and then decreases to almost disappear as the worm decides to leave out the area. Based on a simple model we analyze to what extent the observed variability departs from an elementary stochastic generative process, suggesting some type of neuromotor control on loops sizes and variability. Finally, we also explore the impact of the observed looping patterns on search efficiency and its role as a sampling strategy.

TS.17-P-3

External pavilion, Poster session 1: Monday 4th - Tuesday 5th Feb.

Individual specialization of an opportunistic predator living in human landscapesNavarro, Joan¹; Grémillet, David²; Ramirez, Francisco³; Afán, Isabel⁴; Bouten, Willem⁵; Forero, Manuela⁶

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Population expansions of successful species have gained importance as a major conservation and management concern. The success of these 'winner species' is widely attributed to their high adaptability and behavioural plasticity, which allow them to efficiently use opportunities provided by human-modified habitats. However, most of these studies consider conspecifics as ecological equivalents, without considering the individual components within populations. This is critical for a better understanding of the main ecological mechanisms related to the success of winning species. In this study, we investigated the spatial movements of the opportunistic yellow-legged gull *Larus michahellis*, a clear example of a winning species, to examine its degree of individual specialization in habitat use. To test for such individual strategies, we applied specialization metrics to spatial data obtained from 18 yellow-legged gulls that were GPS-tracked simultaneously during the breeding season. The results revealed that population-level generalism in habitat use in the yellow-legged gull arises through varying levels of individual specialization, and individual spatial segregation within each habitat. Importantly, we found that the combination of individual specialization and individual spatial segregation may reduce intra-specific competition, with these 2 important mechanisms driving the success of this winning species.

TS.17-P-4

External pavilion, Poster session 1: Monday 4th - Tuesday 5th Feb.

The Movement Ecology of Seabirds revealed with Unsupervised Behavioural ClusteringZajková, Zuzana¹; Reyes-González, José Manuel²; González-Solís, Jacob³; Bartumeus, Frederic⁴

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Recent advances in technology and machine learning enable to delve into movement and behaviour of wild animals with unprecedented details. Biologging allows for automatically recording of huge amount of data over long periods and provides essential information to understand how internal state of individuals relates to the environment, and how this relation is expressed through behaviour. Among widely used devices, geolocation-immersion loggers (GLS) provide high-resolution (3s) wet-dry conductivity data together with positional data, enabling to infer year-round behaviour of seabirds at sea. Here we present a new methodological approach where wet-dry data is used as the key segmentation variable to identify behaviours. The approach is grounded on a machine learning algorithm recently used for unsupervised behavioural clustering. As a proof of concept, we applied our approach on data from Cory's shearwater, a highly mobile pelagic seabird species. We tracked the individuals simultaneously with GLS and GPS loggers during the breeding period and with GLS alone year-round. This analysis allowed us to identify elementary behavioural modes (movement clusters) and further on dissect, among other aspects, how changes in movement patterns can relate to different contexts. We also show that geolocation-immersion loggers alone (without any GPS data association) collect relevant enough information to depict most of the behavioural landscape. This result may provide the required step for extending segmentation analyses and unsupervised clustering to year-round trips, opening new avenues to understand behavioural patterns over the entire annual cycle of marine species spending most of their lives out of the human's sight.

Thematic Session 18: Ramon Margalef legacy

Day: Tuesday 5th February

Schedule: 18:00h – 20:00h

Location: Room M6

Coordinators:

Narcís Prat Fornells, Universitat de Barcelona, Spain

In the year of the 100 anniversary of Ramon Margalef birth: which has been its legacy? Margalef has produced hundreds of papers in many relevant fields of the Ecology, like diversity and biodiversity, community and population ecology, environmental issues, plankton taxonomy and ecology, and many others. Margalef was in the 60's and 70's a world reference in Ecology together with the Odum's. In the Latin-Americans countries, many of his students are now professors. Margalef's legacy in Latino America is comparable to Hutchinson's legacy in the rest of the world (even he probably Margalef will not agree with this assumption). He holds a long list of prizes and honors. However, his figure seems to disappear from the front of the ecology issues since the 80's. Which is the actuality of his ideas and work today? Why many people working in Ecology didn't recognize the importance of Margalef in the introduction of the Shannon formula in ecology? Despite a nearly constant or even increasing number of papers of Margalef being cited every year, why his latest book "Our biosphere" (and many other papers) are absent from books and textbooks in Ecology? We call for presentations that may explain or add information to understand why Margalef has not the same recognition from worldwide ecologist than other classical authors in Ecology. An analysis of his prolife in <https://scholar.google.com/citations?user=d3w4mPIAAAAJ&hl=en> will be used as introductory lecture.

TS.18. Oral talks

TS.18-0-1

Room M6, Tuesday 5th Feb. 18.00 h.

Microbial plankton community in a semi-enclosed bay affected by upwelling: seasonal evolution and the role of the nutrient trapFigueiras, Francisco G¹; Teixeira, Isabel G²; Froján, María³; Arbones, Belén⁴; Castro, Carmen G.⁵

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The Ría de Vigo is a semi-enclosed bay on the NW Iberia that is affected by seasonal upwelling (spring to autumn) and where fisheries and aquaculture coexists with other human activities such as ship building and tourism. The microbial plankton community in this system was studied with a sampling frequency of twice a week during a year with the aim of knowing how this community structures and reacts to environmental variability. Autotrophic biomass (AB) dominated from spring to autumn when upwelling prevailed, while AB and heterotrophic biomass (HB) covaried over the year according to $HB:AB = 0.26 \pm 0.04$ ($r^2 = 0.7$) pointing to the link of the two communities. Diatoms and autotrophic nanoflagellates accounted for $80 \pm 18\%$ of the AB, whereas the HB was mainly composed of heterotrophic bacteria ($36 \pm 11\%$) and heterotrophic nanoflagellates ($30 \pm 12\%$). AB and HB, as well as their main components, showed a continuous increase during the upwelling season that was attributed to growth. However, a sudden increase occurred in autumn when downwelling caused the accumulation of biomass before leading to the low values of winter. As upwelling promotes the export of material to the open ocean, the increase in biomass was possible by the existence of a nutrient trap that fuels phytoplankton growth through recycling at the sediment-water interface a substantial part of organic matter previously synthesized in the water column. The reorganization of the community that follows the winter depletion began with the proliferation of small plankton forms.

TS.18-0-2

Room M6, Tuesday 5th Feb. 18.15 h.

Benthic communities: the ocean's last boundary?Gili, Josep-Maria¹; Vendrell, Begoña²; Sabater, Francesc³; Ros, Joandomènec⁴; Arntz, Wolf E.⁵

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Benthic communities depend on receiving much of their food from water column-produced materials. During sinking, particles are transformed in a discontinuous process and temporally retained in transitional physical structures, which act as boundaries, and contribute to their further transformation. Motile organisms are well-acquainted with boundaries. The number, width and placement of boundaries should be related to the degree of particle degradation or transformation. Finally, particles reach the seafloor and are the main food source for benthic organisms; the quality and quantity of this food determine the development of benthic communities. However, benthic communities do not only play the role of a sink: they act as an active boundary -a concept comparable to other oceanic boundaries-, in accordance with Margalef's boundary concept.

TS.18-0-3

Room M6, Tuesday 5th Feb. 18.30 h.

The Margalef mandala: a key tool to progress in the understanding of microplankton dynamics and harmful algal bloomsBerdalet, Elisa¹; Marrasé, Cèlia²; Abós-Herràndiz, Rafael³; Blasco, Dolors⁴; Estrada, Marta⁵

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In 1978, Margalef published one of his most cited papers "Life-form of phytoplankton as survival alternatives in an unstable environment". There, he illustrated as a "tentative plot" an ecological space defined by nutrient availability and turbulence that structured the succession of the principal phytoplankton life-forms. This conceptual model, the later so-called "Margalef mandala", has inspired generations of scientists in their aim to understand not only phytoplankton, but also microplankton communities dynamics in the ocean and coastal waters. The particular inclusion of the "red tide dinoflagellates" in the mandala attracted in particular the harmful algal bloom researchers. The mandala has been modified, expanded, rotated and reinterpreted; it has incorporated new concepts, fostering positive feed-back of ideas and research. This presentation will illustrate some of the mandalas defined in the context of harmful algal blooms research, and will be devoted to Margalef and many of the researchers that, inspired by his mandala have contributed to the progresses of understanding the events and also prevent their impacts on human health and the ecosystems.

TS.18-0-4

Room M6, Tuesday 5th Feb. 18.45 h.

Revision of phytoplankton succession in the light of mixotrophic and heterotrophic linksReguera, Beatriz¹; Velasco, Esther²; Ramilo, Isabel³; Hernández-Urcera, Jorge⁴; Mouriño-Carballido, Beatriz⁵; Nogueira, Enrique⁶

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Early studies by Margalef et al. (1955) and Durán et al. (1956) in the Ría de Vigo established the basic features of successional phenomena in marine phytoplankton communities and the relationship of characteristic phytoplankton assemblages with environmental factors. Thirty years later, the control of phytoplankton dominance by upwelling forcing (Figueiras et al., 1994) and the effect of upwelling pulses in the reset of microplankton succession (Tilstone et al; Nogueira et al. 2000, Tilstone et al. 2000) were well established. Growing evidence on mixotrophy within phytoplankton species, and the observations of diverse modes of phagotrophy questioned the old paradigms on succession based on the predominant role of abiotic drivers and a size gradient in trophic flows. From March 2017 to March 2018, a fixed station in Ría de Vigo was weekly sampled as part of the RETOS project REMEDIOS (The RolE of Mixing on phytoplankton bloom initiation, maintEnance and DIssipatiOn in the galician rías). Plankton net-hauls were observed live on arrival in the laboratory and water samples at multiple depths were collected for quantitative analyses by conventional microscopy methods and by flow imaging microscopy (FlowCAM®), in addition to measurements of physical properties (temperature, salinity and microscale turbulence) of the water column. This work focuses on biological interactions and emphasizes the importance of predation by facultative mixotrophs (e.g. *Fragilidium* on *Dinophysis* spp) and heterotrophs (*Protoperidinium divergens* on *Tripos fusus*) in the control of the seasonal succession of microplankton species.

TS.18-0-5

Room M6, Tuesday 5th Feb. 19.00 h.

How butterflies increase in size: wing surface and scales in a discontinuous scenarioMasó, Albert¹; Baixeras, Joaquín²; Oller, Josep Maria³; Romero, Javier⁴

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The contribution of continuous vs. discontinuous mechanisms in evolution has been a long-lasting debate. Butterflies (Lepidoptera Papilionoidea) is a highly diverse group of insects. The wings represent most of their morphological surface and, with few exceptions, they are invariably covered by scales. We present here an example based on wing size of butterflies as a potential evidence of a discontinuous macroevolutionary mechanism. Based on a seminal idea by Prof. Margalef, we hypothesized that the evolution of wing size in butterflies is partially based on wing surface duplication events. To test this hypothesis, we gathered data from Western Palearctic Papilionoidea species (263), and experimentally determined an average wing length for each one of them. These values were analysed for eleven monophyletic subfamilies, showing a clear aggregation around values arranged in a progression of ratio $\sqrt{2}$. We also examined our dataset using a simulation model of wing length evolution, which again indicated the existence of surface duplication events. Although our results are not fully conclusive, they suggest that the duplication of the wing surface (probably caused by generalized duplication of the wing cells) is a relevant process in the evolutionary changes in wing size of the Papilionoidea. Such duplications, no doubt occurring with low frequency, generate discontinuities in the distribution of wing sizes, with later speciation events only causing small variations around the original wing size. Our exploration suggests that the evolution of wing size would be the result of two overlapping mechanisms, one discontinuous (macroevolutionary) and another gradual (microevolutionary).

TS.18-0-6

Room M6, Tuesday 5th Feb. 19.15 h.

Environment, ecology and society in Spain and Portugal: 1918-2019García Novo, Francisco¹

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The earliest National Parks of Spain, Montaña de Covadonga and Valle de Ordesa, have been established in 1918. Half a century later, in 1969, Doñana National Park was created supporting a new approach to conservation and nature management. N Park Peneda-Gerês, in Portugal, was set up in 1971. 1918-2019 interval witnessed the emergence of Ecology, conservation and environment in our society which underwent profound changes in values and demands. Population increased showing a steady concentration in urban centres and coastal strips and a decline of rural areas. Forestry, husbandry and agriculture have intensified while less productive surfaces were neglected. One thousand new dams allowed the spread of irrigation and urban supply. However, dams interrupted rivers controlling flows, reducing sediment transport and creating reservoirs. Growing consumption of fertilizers and pesticides reduced local diversity in cultivated lands and rivers. Industrial development improved population income, but also caused atmospheric, riverine and soil contamination. Urban spreading and infrastructure building fragmented landscapes. Environmental changes were perceived by society with a growing interest for landscapes, native species, water and air quality levels. Universities and CSIC funded new chairs and research groups on Ecology, Limnology, and related sciences. SIBECOL evidences the mature state of ecological science in our peninsula.

TS.18-0-7

Room M6, Tuesday 5th Feb. 19.30 h.

Land or sea, an example of how to use Margalef's way of thinking in order to enhance Ocean LiteracyVendrell-Simón, Begoña¹; Gili, Josep-Maria²; Peral, Laura³; Salazar, Janire⁴; Grinyó, Jordi⁵; Ambroso, Stefano⁶; Zapata, Rebeca⁷; Corbera, Jordi⁸; Marcé, Magi⁹

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Ramon Margalef had the ability of asking open questions which always fostered further thinking and making "mental experiments". Margalef, who had a profound and detailed knowledge of ecosystems, thought in a very holistic way, and this allowed him to see similar processes and mechanisms in those very diverse ecosystems. Therefore, it is not uncommon to see in his texts comparisons between terrestrial and aquatic ecosystems, or even comparisons of the functioning of our technological human society and the functioning of natural ecosystems. These comparisons allow for a quick and efficient way of getting the general picture of how Nature works in different ecosystems and therefore allow for a better approach to unknown ecosystems, as they facilitate their knowledge and thus their comprehension and further conservation. Taking from Ramon Margalef his holistic and creative way of thinking we have developed different didactic materials meant for approaching students to knowing the Ocean. Why the Ocean? Because despite its utmost importance for life and our planet, it still remains quite unknown and it is alarmingly underrepresented in text books and in the examples provided in schools. This causes an enormous gap in the knowledge of the Ocean, which might imply a scarce or non-existent comprehension of the impact of human activities on the Ocean and its further impact, in turn, on humankind. Following Margalef, we have chosen analogies and similarities as educational tools in order to attain a better Ocean Literacy in society, while stimulating creativity.

Thematic Session 19: The Potential of Biodiversity in Agriculture

Day: Thursday 7th February

Schedule: 12:00h 13:30h – 15:00h – 17:00h

Location: Room A2

Coordinators:

Christian Schöb, ETH Zurich, Switzerland

Rubén Milla, Universidad Rey Juan Carlos, Spain

Several decades of ecological research have demonstrated the benefits of biodiversity for ecosystem functioning, services and stability. Nevertheless, the vast majority of plant production is still based on monoculture cropping, with significant negative impacts on the environment and a failure to meet current demands on increasing yields. Large quantities of chemical input and mechanical interventions are needed to keep the monoculture-cultivated ecosystems functioning and to maintain their services over time. More sustainable ways of plant production are needed and ecology and evolution may hold key answers to the questions of how this could be achieved. In particular, the diversification of cropping systems and the use of biodiversity has been proposed as a promising way for a more sustainable development of agriculture. In this session, we would like to bring together experts in the field of agricultural ecology, the evolution of crops and biodiversity research and provide an update on the current challenges in the study of the potential of biodiversity for agriculture.

TS.19. Oral talks**TS.19-MT-1**

Room A2, Thursday 7th Feb. 12.00 h.

Using biodiversity strategies to improve agricultureBernhard, Schmid¹

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In the past, huge increases in production were made possible by an improved understanding of plant growth and biomass allocation. A central question in this context was how resources and light can best be converted to plant biomass while at the same time minimizing losses to consumers. The answer was sought in developing production systems of great uniformity in agriculture and forestry. However, concerns about the sustainability of such systems have led to requests for the conservation of biodiversity. It is assumed that this leads to a tradeoff of choice between monocultures (to maximize production) versus mixtures (to maximize conservation benefits). I will show that this tradeoff does not exist and that in fact plant diversity usually increases productivity and at the same time can maintain healthy ecosystems. The reasons for this are 1) a better conversion of resources and light into biomass and 2) fewer losses to consumers, in particular pathogens, in diverse as compared with uniform plant stands. Diversity plantations can be easily used for production of hay or biofuels. We were able to select forage species for increased combining ability and mixture yield within less than 10 years based on the natural variation found in these species without any previous breeding. But biodiversity also holds potentials for food crops. For example, using breeding and biotechnology it would be possible to develop highly resistant mixed-genotype crops with uniform management and harvest requirements.

TS.19-O-2

Room A2, Thursday 7th Feb. 12.30 h.

Plant domestication disrupts biodiversity effects across major crop typesChacón Labella, Julia Maria¹; Milla, Ruben²; García Palacios, Pablo³; Matesanz, Silvia⁴; Schöb, Christian⁵; Milla, Ruben⁶; García Palacios, Pablo⁷; Matesanz, Silvia⁸; Schöb, Christian⁹

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Increasing plant diversity as a means to foster productivity over time is solidly supported by research in natural and semi-natural ecosystems. However, the ability of crop assemblages, in comparison to wild stands, to benefit from the effects of diversity is unclear. We argue that the evolution under domestication might have decreased the ability of crops to over-yield in mixtures. We tested this idea comparing the performance of major crop types, and that of their wild progenitors. We grew individuals of 8 crop species and its 8 wild progenitors separately, in monocultures and in mixtures with three increasing levels of diversity, and measured aboveground biomass as a proxy of productivity. We found positive biodiversity effects for crops and their wild relatives, but loweroveryielding in crops compared to their wild relatives. Interestingly, the stronger biodiversity effects shown by wild relatives were caused by stronger selection effects, which in turn were primarily associated to larger differences in leaf size in the mixtures of wild relatives. These results suggest a disruption of positive biodiversity effects on productivity after plant domestication, and show that the delivery of biodiversity effects in mixtures of crops and wild relatives is mediated by trait diversity within assemblages. Therefore, the fact that a number of key traits have converged during evolution under domestication might have decreased the ability of crops to perform in polyculture.

TS.19-0-3

Room A2, Thursday 7th Feb. 12.45 h.

Changes in partial resistance to aboveground and belowground pests in wild and traditional tomato accessionsFerrero Vaquero, Victoria¹; Blanco, Lidia²; Díaz-Pendón, Juan Antonio³; Herrero, Óscar⁴; Planelló, Rosario⁵; Fernández-Muñoz, Rafael⁶; de la Peña, Eduardo⁷

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Understanding how plant defences mediate the interaction of insect herbivores is essential in community ecology and in the development of biological control strategies. A commonly invoked hypothesis explaining the high susceptibility of many crops to invertebrate pests and diseases is that crop evolution under domestication has selected plant traits that result in a decreased resistance to these pests. Moreover, ecological theory, based on the molecular pathways regulating defensive responses of plants towards insect pests and diseases, predicts the occurrence of resistance trade-offs. In order to test these two hypotheses, we conducted a combination of field and greenhouse experiments using 23 genotypes of tomato. We used wild tomato accessions, traditional varieties and introgressed cultivars from different geographic origins representing different stages in tomato domestication. We compared the performance of these accessions to three different pest species, the aphid *Macrosiphum euphorbiae*, the cotton leafworm, *Spodoptera littoralis*, and the root-knot nematode *Meloidogyne incognita*. The results of the experiments show differences in tomatoes fitness depending on the pest and also in performance of pests according to tomato provenance. The implications of these findings to understand plant-insect interactions during the domestication process are further discussed.

TS.19-0-4

Room A2, Thursday 7th Feb. 13.00 h.

Enhancing plant biodiversity and ecosystem services after ten years of organic farming in the PEIN of Gallecs (Catalonia)Chamorro, Lourdes¹; Blanco-Moreno, José Manuel²; Rotchés-Ribalta, Roser³; Sans, Xavier⁴

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In 2005, an agroecological transition project was initiated at the Parc de l'Espai d'Interès Natural de Gallecs (PEING) with the aim of promoting the economic, ecological and social values of this periurban rural area located 15 km NE of Barcelona. The objective of the transition to organic farming is to assure the productivity and the sustainability of the farms in a long term. The Gallecs Consortium, the Gallecs Agroecological Farmers Association, and the Agroecosystems Research Group (ARG) of the UB collaborated in a holistic overview of the transition. Nowadays, the PEING is one of the largest areas of organically managed arable land in Catalonia. From 2006 to 2016, the ARG periodically surveyed 20 pilot fields (ca. 46 ha) for plant richness and cover, and recorded crop varieties in organic arable crops. The number of crops was increased from 1 to 21, including ancient and local varieties of cereal and legumes. Plant species richness present in these fields increased from 65 to 144. At field scale, richness increased over time, from 14.7 to 19.4 species/field, but plant cover did not changed (24%). Of these 134 species, 94% were interesting as food resource for birds, 75% for pollinators and 31% for phytophagous invertebrates. Cereal and legume crops enhanced plants interesting for pollinators and birds respectively. Organic farming in Gallecs has increased and conserved crop and weed diversity, including segetal and rare species, and has fostered plant species that may enhance the preservation of higher trophic levels, or promote services such as pollination.

TS.19-0-5

Room A2, Thursday 7th Feb. 13.15 h.

Are weed diversity affected by tillage system in dryland crops under Mediterranean conditions?Alarcón Vllora, M^a Remedios¹; Hernández-Plaza, Eva²; Navarrete, Luis³; Sánchez, M^a Jesús⁴; Sánchez, Ana María⁵

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Tillage is a crop management practice oriented to avoid the competition between weeds and crops. The type of tillage largely influences the environmental conditions at farm scale and then the structure of weed communities. The relationship between weed community diversity and tillage -under Mediterranean conditions- could inform about the most beneficial tillage practices for weed conservation on dryland-crops. We evaluate the response of weed communities to three different tillage systems (subsoil, minimum and no-tillage, representing a gradient of contrasting intensity) and to inter-annual climatic variability. We established a trial during nine years using a cereal-legume rotation. We characterized climatic variability through precipitation and temperature during crop emergence. Using linear mixed models, we analysed the effects of tillage and climatic conditions on taxonomic diversity (Simpson diversity and evenness) and functional community structure (community weight means, CWM, and mean pair distance, MPD) of seven response traits: four regenerative traits (seed weight, emergence time, seed dispersal ability and seed longevity index) and three traits related to resource allocation (growth habit, plant height and specific leaf area). Although tillage systems and climatic conditions sorted species according to values of regenerative traits none of the studied tillage was consistently associated with a greater diversity. No-tillage (less soil disturbance) showed lower taxonomic diversity and higher functional diversity respect to multitrait MPD. A potentially more competitive weed community - composed by species with lower seed weight and earlier emergence time- may be favoured by priority effects of competence. Additionally, higher precipitation declines regenerative traits and taxonomic diversity.

TS.19-0-6

Room A2, Thursday 7th Feb. 15.00 h.

Trade-offs in the provision and stability of ecosystem services in agroecosystems: a theoretical frameworkMontoya, Daniel¹; Haegeman, Bart²; Gaba, Sabrina³; De Mazancourt, Claire⁴; Bretagnolle, Vincent⁵; Loreau, Michel⁶

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World agriculture largely depends on animal pollination, but pollinator biodiversity is declining, mainly due to the increase of crop land at the expense of semi-natural habitat. There is evidence that changes in land use generate trade-offs in the delivery of ecosystem services in agricultural landscapes. However, we know little about how the stability of ecosystem services responds to landscape composition, and what ecological mechanisms underlie these trade-offs. Here, we develop a model to investigate the dynamics of three ecosystem services in intensively-managed agroecosystems - biodiversity, pollination-independent crop yield, and crop pollination -, and address two questions: (i) What are the trade-offs between biodiversity and the magnitude and stability of crop yield in agricultural landscapes?; (ii) How does landscape composition and crop pollination dependence influence these trade-offs? Our model reveals trade-offs and synergies imposed by land-use intensification that affect not only the magnitude but also the stability of ecosystem service delivery. Trade-offs involving crop pollination are strongly affected by the degree to which crops depend on pollination and by their relative requirement for pollinator densities. Given that agriculture has become more pollination-dependent over time, it is essential to understand the mechanisms driving these trade-offs to ensure food security. We extend this model to derive optimal landscape compositions for three groups of stakeholders assumed to value different ecosystem services most - individual farmers, agricultural unions and conservationists. We further investigate agricultural management to maximize multifunctionality of agricultural landscapes.

TS.19-0-7

Room A2, Thursday 7th Feb. 15.15 h.

Green and blue infrastructure and farmland biodiversity: Optimizing CAP greening as conservation tool

Concepción Cuevas, Elena Daniela¹; Aneva, Ina²; Simeon Lukanov, Simeon³; Moreno, Gerardo⁴; Oppermann, Rainer⁵; Pardo, Adara⁶; Rolo, Víctor⁷; Schraml, Antonia⁸; Ullrich, Benjamin⁹; Díaz, Mario¹⁰

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Agricultural intensification has driven the elimination of seminatural habitats and landscape elements, such as stream and field margins, hedgerows, grasslands or woodlands, which are now called green and blue infrastructure (GBI). GBI is crucial for ensuring ecological connectivity and biodiversity conservation in agricultural landscapes. Greening of the Common Agricultural Policy (CAP) introduced compulsory agri-environment requirements linked to direct payments in the last CAP programming period (2014-2020) in order to support the conservation of GBI, and then biodiversity across the wider countryside. We investigate how the implementation of CAP greening is affecting the provision of GBI in farmland, and how this in turn impacts on biodiversity. We count with six case study areas in three European countries that cover a variety of agricultural systems (i.e., grasslands in Bulgaria, mixed farming systems in Germany, and dehesas and dry cereal croplands in Spain). In each case study area, we carried out habitat (GBI) and biodiversity (bird and plant) monitoring surveys in 20-25 plots (25 ha each) in spring 2018. As a result, we count with a detailed characterization of GBI elements within plots with associated biodiversity data, which can be linked to distinct greening options implemented in each case study area. We present an exhaustive assessment of the capacity CAP greening to promote GBI and biodiversity conservation across European agricultural landscapes. We also analyze the likely non-linear relationships between GBI and biodiversity that could constraint CAP greening effectiveness, and discuss how this policy tool could be improved to benefit biodiversity the most.

TS.19-0-8

Room A2, Thursday 7th Feb. 15.30 h.

Biodiversity on the rocks: the role of rock outcrops in promoting heterogeneity in semi-natural landscapes

Chozas, Sergio¹; Tapia, Susana²; Palmeirim, Jorge³; Correia, Otilia⁴

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Conversion of natural habitats to farm and forestry land is considered one of the main threats to biodiversity worldwide. Moreover, farms are increasingly being transformed into monoculture exploitations highly contributing for biodiversity loss. The montado is an agroforestry system dominant in the Southern region of the Iberian Peninsula. These cork and holm oak wood pastures are recognized as a hotspot of biodiversity. However a combination of factors is threatening this system, in some cases compromising its habitat heterogeneity and consequently its potential to hold biodiversity. Therefore, it is important to understand the potential role of landscape elements in enhancing the ecological diversity of montado. This includes rocky outcrops, rock island-like formations that are not cleared due to its rocky nature and therefore grazing and farming activities are limited. We analyzed the role of both presence and size of rock outcrops in species composition and functional diversity patterns of plants in montados. We found that the presence of these elements clearly increases montado landscape biodiversity. Moreover, this increase did not compromise the economic productivity of montados since even small outcrops significantly increase both compositional and functional diversities. We also found that this effect is higher when maximizing the perimeter-area ratio of the outcrops. In conclusion, our results indicated that minor changes in management strategies, such as the protection and enlargement of pre-existing rock outcrops and the establishment of small "artificial outcrops" may add relevant habitat heterogeneity in montado and increase the capacity of agroforestry landscapes to support biodiversity.

TS.19-0-9

Room A2, Thursday 7th Feb. 15.45 h.

Farm and landscape scale approach to assess habitat quality and biodiversity conservation in Irish agricultural systemsRotchés Ribalta, Roser¹; Ruas, Sara²; Moran, James³; Ó Huallacháin, Daire⁴

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Biodiversity has undergone significant declines in agricultural ecosystems throughout Europe due to changes in farming practices. Conservation of natural resources, including biodiversity, and halting the degradation of habitats in these systems are key environmental objectives of the European Union. The EU has allocated significant resources to these objectives through the Common Agricultural Policy. However, deficiencies in the design, targeting and monitoring of measures have resulted in poor effectiveness. Therefore, there is a growing need to develop measures with strong evidence base to support their effectiveness at preserving biodiversity and ecosystem health. For this reason, the current study aimed at assessing the habitat quality and diversity in Irish farms across varying management intensities and considering different scales of approach: field, parcel, farm and landscape. Such evaluation addressed gaps in knowledge related to the importance of habitat quality and landscape configuration in halting biodiversity loss and enhancing the ecosystem health in agricultural landscapes in Ireland. Thus, it provides the basis for the development of more targeted and successful agri-environmental schemes aimed at promoting habitat quality and biodiversity preservation. Data on habitat diversity and habitat quality were collected from 60 farms across a gradient of intensities in two contrasting regions in Ireland (N-W and S-E). Results highlight the importance of habitat diversity and landscape composition at larger scales (i.e. farm and landscape) to maintain and enhance habitat quality on Irish farms and, thus, the significance of considering them in the design of farmland biodiversity measures for different biodiversity targets within the agricultural landscape.

TS.19-0-10

Room A2, Thursday 7th Feb. 16.00 h.

Farming practices and flower resources determine plant reproduction in Mediterranean landscapesMendoza García, Marian¹; Batáry, Péter²; Blanco Moreno, José M.³; Chamorro, Lourdes⁴; Sans, F. Xavier⁵

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Organic farming practices are thought to mitigate pollinator decline in intensive agricultural landscapes and, in consequence, could improve pollination services through direct (lack of pesticides) and indirect (increased availability of plant resources) effects. However, information on the effect of the proportion of organically managed arable land and local flower resources (local flower cover and local land use and management) on pollinator abundance and pollination is missing. In five landscapes varying in their proportion of organically managed arable land, we placed pan traps and two phytometer species with different pollination syndromes in field margins of both organic and conventional cereal fields and legume fields. Bee abundance was not enhanced either by the proportion of organically managed land at the landscape scale or by local flower cover. Bee abundance did not also increase in field margins next to legume crops, probably caused by abundant food resources leading to a pollinator dilution. The proportion of organically managed land enhanced the fruit set of generalist species, whereas it did not have an effect on specialist species. Competition for pollinators could occur between the phytometer species and species thriving in plant communities in the immediate vicinity. However, despite the negative effect of local flower cover, the fruit set benefited from nearby legume crops. In conclusion, policies ameliorating landscape features (e.g. increasing flower abundance) coupled with the promotion of organic farming at the regional level and insect-pollinated and flower-rich crops (e.g. legumes) are the main ways to improve pollination services in Mediterranean arable landscapes.

TS.19-0-11

Room A2, Thursday 7th Feb. 16.15 h.

Quantifying the potential of agrobiodiversity to adapt agriculture to climate changeMorales Castilla, Ignacio¹; Wolkovich, Elizabeth M.²

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Agrobiodiversity is often regarded to as a solution to mitigate the negative impacts of climate change on crops and particular attention has been focused in exploiting the intraspecific genetic variation within a given crop. However, there are few tests quantifying how much an increase in crop diversity would decrease the reductions in the yield or the quality of a crop due to changing climate. In an era of data blooming, it becomes possible to do so at large spatial and temporal scales by combining niche models commonly used in ecology with process-based models common in agronomy. Using winegrapes as a study system due to both their large diversity and their economic importance (300\$ billion industry), I develop a quantitative approach to assess the adaptive potential provided by agrobiodiversity. The results show that increasing cultivar diversity can decrease the loss of agricultural regions by up to 50% as long as climate change does not approach the most severe warming scenarios. More importantly, this work provides a robust approach to test whether or not similar patterns would hold for crops other than winegrapes.

TS.19-0-12

Room A2, Thursday 7th Feb. 16.30 h.

Processes maintaining weed functional diversity: weed species match local CWM values but not for all traitsHernández Plaza, María Eva¹; González-Andújar, Jose Luis²; Egea Cobrero, Valle Egea Cobrero³; Bastida, Fernando⁴

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Weed species contribute to plant diversity in agroecosystems and the functional structure of their communities could relate to key functions like crop biomass production. In non-agricultural systems, it has been suggested that under processes constraining functional diversity, community weighted mean values (CWM) represent the optimal local trait strategy for the given environmental conditions. Using a previously developed methodology, we test this idea and ask whether weed species are more likely to occur where their trait values are similar to the local CWM. We recorded the number of weed individuals in 35 wheat fields (10 plots/field). From literature we gathered data on traits: maximum height, SLA, functional type, growth form, life form and flowering onset and duration. Independently for each species and trait we computed the absolute difference between the species trait value and the CWM of the community (computed excluding the focal species). We regressed these values against each species values of occurrence. Negative slopes indicate species matching our expectation, positive slopes indicate species with alternative strategies. We used a randomization procedure to test whether the number of species with significant slopes was greater than expected by random. For five traits there were more species with significantly negative slopes than randomly expected. Regarding life form and growth form, there were a similar number of species with negative than with positive slopes. Species representing alternative strategies to their local CWM tended to be grasses, to have higher SLA, a late flowering onset, low seed weight and a non erect growth form.

TS.19-0-13

Room A2, Thursday 7th Feb. 16.45 h.

Economic quantification of species interactions and their sensitivity to climate change. Alterations of food-web complexity threats the economic value of biocontrol services by native predators in the near futureHerrera Vega, José Manuel¹; Jiménez-Navarro, Gerardo²; Silva, Bruno³; Daniels, Silvie⁴; Maiorano, Luigi⁵; Rodríguez-Pérez, Javier⁶

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There is an growing body of knowledge showing that biodiversity conservation affects economic activities by providing ecosystem services in managed ecosystems. Species interactions are key to maintain ecological functionality and complexity in rich communities, but still there is no methodological framework assessing species interactions from the point of view of its economic value in productive systems. Here we economically value biocontrol services and species interactions modulated by pest-predator food-webs. More specifically, we provided a methodological framework (i.e. integrating spatially-explicit ecological complexity and market-price approaches) in economic valuable crops in Europe, using two hierarchical steps: (i) we integrate food webs and distribution maps of both native flying vertebrates and insect pest species and (ii) we assessed the ecological and economic value of species interactions and complexity of species communities by integrating ecological production functions to ecological processes in biocontrol services. By projecting how climate change scenarios will affect the distribution of both predators and pests, we assessed the uncertainty of such economic values for biocontrol services in the near future. The analyses and results of our framework emphasize the importance to quantitatively incorporate the economic value on conserving ecological complexity in rich species communities, and how such ecosystem service may be altered in the near future.

TS.19. Posters

TS.19-P-1

External pavilion, Poster session 2: Wednesday 6th - Thursday 7 th Feb.

Intraspecific variability in functional traits of 81 cultivars of *Olea europaea*Olmo, Manuel¹; Quero, José Luis²; Muñoz, Concepción³; Morello, Pablo⁴; Villar, Rafael⁵

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Species with agronomic interest have normally undergone a strong domestication process. This can lead to either a decrease on intraspecific variability due to the reduction of variability, or the opposite trend, when genotypes with very different traits are selected and these traits become fixed. The olive tree (*Olea europaea*) is a typically Mediterranean species, with great economic interest and a large number of traditional cultivars worldwide. In this study, 81 international olive cultivars were selected representing different genetic gene pools and a wide geographical range to gather the maximum intraspecific variability. These cultivars were growing in the same experimental conditions being part of the University of Córdoba collection of the World Olive Germplasm Bank. These particular setting allowed us to study the intraspecific variation of several functional traits (leaves and stems) without influence of a different environment. A strong intraspecific variation in functional traits was found. For example, leaf mass per area (LMA) varied between 200 and 350 g m⁻², leaf thickness from 500 to 840 µm, net photosynthetic rate from 10 to 18 µmol CO₂ m⁻² s⁻¹. The negative relationship between the LMA and the net photosynthetic rate per unit mass indicated an intraspecific leaf economic spectrum in *Olea europaea*, similar to that found among species worldwide. Therefore, it is concluded that olive domestication process in this case has favored functional intraspecific variability in olive cultivars.

TS.19-P-2

External pavilion, Poster session 2: Wednesday 6th - Thursday 7 th Feb.

Landscape, altitude and agricultural management impacts on the biodiversity linked to Andalusian vineyardsPuerta-Piñero, Carolina¹; Calvillo, Estefanía²; Fernández, Carmen³; Mejía, Luis⁴; Rodríguez-Echeverría, Susana⁵

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Under a general context dominated by agriculture intensification as well as climate and land use changes, it is key to disentangle their impacts on productive systems. As study sites we use 25 plots of vineyards in Andalusia, 9 organic management while the rest non-organic farming, going from 22 to 1289 m asl and with different landscape surroundings. We used mammals, plants, mycorrhizae and endophytic fungi (AMF and endophytes hereafter) as focal biological groups to evaluate the influence of landscape, environment and management on the biodiversity linked to this productive systems. For this, we searched for species (sometimes as morphotypes) richness and abundance within 9 strains/ plots for the fungi and plant cover and 12 (border or row) transects for the mammals. Though we are still including and processing new data from the field and lab, we give here some preliminary results: 1) Overall, we found, at least, 9 species of mammals, 21 morphotypes of AMF spores and 37 endophytic fungi species; 2) Relative abundances of individuals and plant cover varied significantly among plots, while, on the other hand, species richness varied for mammals, plants and endophytes but not for AMF; 3) The factor "plot", implicitly including landscape, soil type, cultural management and microclimatic conditions, was the most relevant when combining the effect of management (organic vs non-organic), plot and altitude within the same GLM, and 4) Preliminary analyses show that organic vineyards does not necessarily imply higher species richness or abundance in any of the taxa included.

TS.19-P-3

External pavilion, Poster session 2: Wednesday 6th - Thursday 7 th Feb.

Not all field margins are equally useful: margin vegetation and distance to margin affect biological control of cereal aphidsSalat Moltó, Agnès¹; Blanco Moreno, José Manuel²; Caballero López, Berta³

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Biological control of aphids in cereal is carried out by different groups of natural enemies that may benefit from the presence of semi-natural habitats provided by vegetated field margins. These may be covered by different types of vegetation, ranging from short herbaceous patches to trees, with an enormous variation of vertical structure. The aim of this study is to assess the local effect of the type of field margin vegetation (herbaceous or bushy, which are the most common ones found in Mediterranean cereal fields) and the distance to it (3 m or 20 m) on the predation of aphids. We assessed predation rates in six barley fields by means of two transects in each field, one per distance, in which we exposed 20 aphids glued to paper labels for 24 h. We evaluated the abundance of potential natural enemies by means of a visual survey along each transect. Fields with bushy margins registered higher predation rates but lower abundances of natural enemies, although differences between groups were observed. Higher distances to margin decreased the observed abundances of natural enemies but had no overall effect on predation. Furthermore, we found an interaction between type of vegetation and distance to the margin: the effect of margin vegetation was stronger in transects further inside the field. We conclude that the type of margin vegetation plays a role in the presence and efficiency of natural enemies of aphids, although it depends on the group of enemies and the distance from the margin.

Thematic Session 20: Towards some new perspectives of the causes and consequences of dieback and mortality processes: current knowledge and future challenges

Day: Tuesday 5th February
Schedule: 18:00h 20:00h
Location: Room A4

Coordinators:

Luis Matías Resina, Universidad de Jaén, Spain

Raúl Sánchez-Salguero, Universidad Pablo de Olavide, Spain

Juan Carlos Linares, Universidad Pablo de Olavide, Spain

The world is getting warmer rapidly, and mortality events are raising over the past 30 years in both terrestrial and marine ecosystems, revealing the high vulnerability of many populations in all biomes, through growth decline, loss of vigour and, in many cases, death. These episodes can have the potential to rapidly alter ecosystem services, with important implications on the carbon-water balance, communities and population dynamics. Besides the presence of inciting (e.g. heat and drought events) and contributing factors (e.g. opportunistic biotic agents), predisposition of particular species, or populations and individuals of a given species is considered as central for understanding why some organisms survive while others succumb to climatic stress. There is also a gap of knowledge about the role of intraspecific trait variability, that might be caused either by genetic or local environmental differences, on determining key mechanisms leading mortality events, such as the carbon starvation–hydraulic failure model for plants. This session calls to join efforts to improve our understanding on how ecosystems respond to changes in climate and which functional or structural traits make some species more prone to dieback and mortality episodes. Contributions including experimental, observational as well as theoretical studies are welcome for any biomes or scale.

TS.20. Oral talks

TS.20-MT-1

Room A4, Tuesday 5th Feb. 18.00 h.

Drought-induced dieback: what I have learnt by going to the fieldCamarero Martinez, Jesús Julio¹

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Most of the world is getting warmer, and it is projected to warm further, and some regions are becoming drier. Heat and drought stress have been linked to forest dieback or die-off across multiple biomes. Dieback is characterized by multiple symptoms corresponding to a loss of vitality and ecosystem dysfunction (browning, drops in productivity, pronounced leaf shedding and crown transparency, growth decline, architectural anomalies, elevated tree mortality, shifts in composition). In most of these episodes the main drivers seem to be “global-change-type” droughts characterized by elevated temperatures, whereas pathogens or pests often play a secondary role. Based on my own observational experience, I will emphasize the ecological knowledge gained by going to the field regarding the vulnerability of tree and shrub species and individuals against drought-induced damage. I will examine if: (ii) older, smaller and/or slow-growing trees are always more vulnerable to drought stress than younger, taller and/or fast-growing trees of the same tree or shrub species, (ii) “drought-tolerant” shrubs are less prone to drought-induced dieback than “drought-tolerant” coexisting trees, (iii) long-term growth series (tree-ring width data) can be used as early-warning signals of impending death in tree species, (iv) past forest management and use predisposes to drought-triggered dieback, and (v) stabilizing processes buffer the negative demographic impacts of dieback and revert shifts in composition. I will summarize the conclusions derived from study cases addressing these questions and carried out mainly in Spain. To conclude, I will examine critically how field-based knowledge often conflicts with scientific literature.

TS.20-O-2

Room A4, Tuesday 5th Feb. 18.30 h.

A global assessment of forest dynamics following drought-induced mortality eventsBatllori, Enric¹; Lloret, Francisco²

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Forest mortality related to extreme drought has been reported worldwide, affecting all biomes and plant types (angiosperm vs. gymnosperms, evergreen vs. deciduous). The forecasted increased frequency and intensity of drought events as a consequence of global climate change could promote an increasingly widespread drought-induced mortality in the future. However, little understanding exists on the replacement processes after drought-induced mortality events. We assess (through a collaborative initiative) the extent of short-term self-replacement patterns in temperate forest ecosystems worldwide (N = 135 sites) in relation to: species traits, the major bioclimatic characteristics of reporting sites, and past management and disturbance legacies in the affected sites. We found that self-replacement occurred in ~45% of the sites whereas in ~30% of the study sites there was no replacement by woody vegetation. Self-replacement was higher in forests dominated by resprouting species, but no significant trends were found in relation to the bioclimatic characteristics of the reporting sites (environmental location) or of the dominant species (bioclimatic ‘niche’). Shifts to both more xeric and to moister communities were observed. Those were driven by species with higher limits of tolerance to dry conditions and by species with wider bioclimatic ranges, respectively. On the other hand, past burning and thinning activities seem to derive in lesser extents of self-replacement whereas we found no clear and significant trends between self-replacement patterns and biotic disturbances.

TS.20-0-3

Room A4, Tuesday 5th Feb. 18.45 h.

Using species climatic suitability as a predictor of heat-wave induced forest die-offMargalef Marrase, Jordi¹; Pérez-Navarro, María Ángeles²; Lloret, Francisco³

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Forest die-off events have been largely reported during last years across many biomes. There is a well-established relationship between climatic variables and forest decay at local scale but when a large scale is used, this relationship could be disguised, particularly when comprising species with different climatic requirements. Thus, standardization on how similar climatic conditions are faced by different species is needed. In this study we used estimations of species' climatic suitability calculated from Species Distribution Models (SDMs) using bioclimatic variables. This approach allows to standardize local climatic variability, corresponding to historical periods and to extreme climatic events, in relation to the climatic conditions in which the different species occur. We studied forest die-off across France during the 2003 heat-wave. Die-off affectation was estimated with MODIS remote sensor imagery. Historical climatic suitability (HCS), climatic suitability during the event (ECS) and interannual variability of suitability (HCS-SD)) for each specie was calculated with Boosted Regression Tree models using European Forest Inventories occurrences and CHELSA database. Our results show there is a relationship between climatic suitability and die-off affectation across regional scale, although the relevance of the variables are species-dependent. *Quercus ilex* and *Castanea sativa* populations are more affected when their HCS is high, indicating a "core population" vulnerability, while *Abies alba* and *Betula pendula* populations have more affectation when they suffer low ECS, reinforcing the significance of the extreme event. Our study supports the use of climatic suitability estimated from SDMs to assess population responses to climate change, particularly when involving extreme situations.

TS.20-0-4

Room A4, Tuesday 5th Feb. 19.00 h.

Evaluating the impact of empirical mortality algorithms on a dynamic vegetation model across EuropeThrippleton, Timothy¹; Hülsmann, Lisa²; Cailleret, Maxime³; Bugmann, Harald⁴

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Accurately simulating tree mortality is one of the biggest challenges for the projection of future forest development. Since mechanistic (i.e. process-based) mortality models are still restricted to relatively small scales due to the limited understanding of complex physiological processes, empirical (i.e. statistical) mortality algorithms are increasingly used as a pragmatic alternative in dynamic vegetation models (DVMs). However, little is known about their impact on model behavior under present and future climate, and a comprehensive comparison of the many different empirical mortality algorithms within a DVM framework is still lacking. Here, we investigated the behavior of seven inventory-based mortality algorithms for the widespread species *Pinus sylvestris* within the DVM ForClim across several sites in Europe under present and future climate scenarios. Our results show strongly diverging mortality patterns among the seven mortality algorithms. Based on their behavior, we identified two groups, which were associated with algorithm formulation (i.e. types of variables considered), but not with their geographic origin. The decisive difference was whether algorithms considered competition directly via a competition index or indirectly via altered tree growth. The growth-based algorithms yielded overall better performances when compared to empirical data and were less prone to extreme behaviors under future climate scenarios. Overall, our results suggest that selecting a suitable empirical mortality algorithm for a DVM application should not be based primarily on its geographic origin, but rather on the type of its formulation. Specifically, we suggest the use of growth-based mortality algorithms, especially in DVM applications to no-analogue future climates.

TS.20-0-5

Room A4, Tuesday 5th Feb. 19.15 h.

Do long-term nutrient imbalances contribute to drought-triggered forest dieback? Insights from tree-ring chemistrySánchez-Salguero, Raúl¹; Hevia, Andrea²; Querejeta, Jose I.³; Sangüesa-Barreda, Gabriel⁴; Gazol, Antonio⁵; Camarero, J. Julio⁶

(1) Universidad Pablo de Olavide; (2) Forest and Wood Technology Research Centre (CETEMAS); (3) Centro de Edafología y Biología Aplicada del Segura (CEBAS-CSIC); (4) Universidad de Valladolid; (5) Instituto Pirenaico de Ecología (IPE-CSIC); (6) Instituto Pirenaico de Ecología (IPE-CSIC)

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Forest dieback induces major ecological and environmental changes, reducing productivity and vitality, as well as, altering physiological and hydraulic mechanisms but also impacting nutrient availability. To improve our knowledge on the relationships between drought-induced dieback and long-term nutrient imbalances, we combined wood traits (tree-ring width and wood density), soil properties and long-term chemical information (1900-2010) by destructive and non-destructive Micro X-ray fluorescence (μ XRF) techniques. We study two major European conifers with ongoing drought induced dieback in two sites with contrasting water deficits: *Abies alba*, (mesic site) and *Pinus sylvestris* (xeric site) in NE Spain. We evaluate the role of nutrient imbalances by quantifying chemical elements in declining (D) and non-declining (ND) trees. We used dendrochronology and generalized additive mixed models to analyse wood traits and trends in tree-ring nutrient contents. We found that D trees presented lower growth and higher minimum wood density, corresponding to a smaller lumen of earlywood tracheids, than ND trees. Moreover, most of the tree-ring nutrients showed higher contents in D trees during the last decades (e.g. K, Mg and Mn), whilst Ca and Na were higher in ND trees. The Mn/Al and Ca/Mn ratios showed the highest differences between D and ND trees. Our results indicate that the retrospective quantifications of Mn may allow forecasting dieback up to five decades before the onset of growth decline prior to the dieback. μ XRF non-destructive technique provide a robust tool to better understand the capacity of trees to withstand drought-induced dieback.

TS.20-0-6

Room A4, Tuesday 5th Feb. 19.30 h.

Oak dieback strongly influences the diversity, composition and network structure of soil microbial communities with feedbacks on regenerationGómez Aparicio, Lorena¹; Domínguez-Begines, Jara²; Ávila, Jose Manuel³; García, Luis V.⁴; Muñoz-Pajares, A. Jesús⁵

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Forested landscapes are rapidly being transformed by increasing rates of tree mortality caused by global-change factors such as exotic pathogens or extreme droughts. Disturbance of tree communities can have cascading impacts on biodiversity at all organization levels. However, how soil microorganisms respond to tree dieback and the implications for ecosystem recovery is largely unknown. Here we combined spatially-explicit neighborhood models, DNA metabarcoding, and a field experiment to explore how the decline of the Mediterranean tree *Quercus suber* altered the diversity, composition and network structure of belowground fungal communities in forests invaded by the exotic pathogen *Phytophthora cinnamomi*, and whether such changes had cascading impacts on *Q. suber* recruitment. We found that *Q. suber* dieback caused a reduction of the taxonomic diversity of soil fungal communities but increased their phylogenetic diversity, likely due to the colonization of unhealthy soils by rare taxa not present in healthy soils. Tree neighborhoods dominated by defoliated or dead oaks had soil fungal communities with higher relative abundance of saprophytic and pathogenic fungi, lower abundance of ectomycorrhizal fungi, and very distinct network structure (e.g. lower modularity) than healthy neighborhoods. Such changes had negative feedbacks on *Q. suber* regeneration, since seedling performance was negatively related to fungal phylogenetic diversity but positively influenced by ectomycorrhizal abundance. Our results showed that oak dieback exerted a strong influence on the diversity and structure of soil fungal networks, promoting new assemblages impoverished in mutualistic taxa. This implies that oak dieback has far-reaching multi-trophic effects that may affect regeneration and ecosystem recovery.

TS.20-0-7

Room A4, Tuesday 5th Feb. 19.45 h.

Looking for genomics and dendroclimatic adaptive dynamics to climate change in declining tree species

Linares Calderón, Juan Carlos¹; Gallego-Rodríguez, Francisco Javier²; Cobo-Simón, Irene³; Méndez-Cea, Belén⁴; Sánchez-Salguero, Raúl⁵; Casas-Gómez, Pablo⁶; Seco, José Ignacio⁷; Merino, José Ángel⁸

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Heritable adaptive dynamics is the raw material for evolutionary responses to environmental changes. The genetic and epigenetic variability in ecologically important traits, as climate-growth sensitivity and gas exchange regulation, is crucial to predict the ability of a species to respond to current climate changes. Next-generation sequencing coupled with individual-based tree climate-growth sensitivity might be a reliable way to quantify local adaptations and the underlying genetic basis where they rely. Besides, recent findings support that non-genetic variation acquired during the life of an organism can sometimes be passed on to offspring by epigenetic inheritance. Hence, the epigenome structure of long-live organisms, like trees, may change during growth and such changes sometimes would be inherited to the regeneration, established under warmer and dryer environments. We use the drought-sensitive fir *Abies pinsapo* as experimental model. This relict tree has showed widespread mortality and growth decline over the last decades, which have been related to land-use and recent climate changes. We hypothesize that higher individual heterozygosity will result in more climate adaptive capacity, as regards the relationship between individual genetic diversity and tree-rings growth. Our results suggest that declining populations, growing near to the range limits of the species, are especially likely to experience different processes of local selection, which might be related to intraspecific variability in growth trends, decline and mortality patterns.

TS.20. Posters

TS.20-P-1

External pavilion, Poster session 1: Monday 4th - Tuesday 5th Feb.

The oak dieback phenomenon in Italy: the need of a multiproxy assessmentColangelo, Michele¹; Camarero, J. Julio²; Borghetti, Marco³; Gentilesca, Tiziana⁴; Gazol, Antonio⁵; Sánchez-Salguero, Raúl⁶; Oliva, Jonàs⁷; Redondo, Miguel-Angel⁸; Ripullone, Francesco⁹

(1) University of Basilicata; (2) Instituto Pirenaico de Ecología (IPE-CSIC); (3) University of Basilicata; (4) University of Basilicata; (5) Instituto Pirenaico de Ecología (IPE-CSIC); (6) University Pablo de Olavide; (7) Universitat de Lleida; (8) Swedish University of Agricultural Sciences; (9) University of Basilicata

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Widespread forest dieback and increased mortality rates have been described for Mediterranean oak species, as a consequence of temperatures rising and drying trends. So far the attention on these species has generally been limited, perhaps because they are often regarded as well-adapted to the dry conditions typical of Mediterranean areas. Here, we investigated the contrasting oaks vulnerability for species with low (*Quercus pubescens*), intermediate (*Q. cerris*, *Q. frainetto*) and high (*Q. robur*) sensitivity to water shortages. We applied a multi-proxy approach for a retrospective characterization of wood traits (tree-ring width, wood anatomy) and functioning (δ¹³C, water-use efficiency and non-structural carbohydrates-NSCs) in coexisting trees differently affected by dieback. Furthermore, we evaluated the role of pathogens of the genus *Phytophthora* in the observed decline. Our main findings suggest that: (i) droughts and warm summer conditions triggered oak decline in all studied species in spite of the large differences in sensitivity to climatic stressors; (ii) *Phytophthora* spp. pathogens detected in some sampled trees may play a role predisposing trees to decline; (iii) smaller oaks are more prone to die than taller conspecifics; (iv) recent decrease in growth trends constitutes a valuable early-warning signals of impending dieback and death; (v) differences in wood anatomical traits between dead and living trees were not always significant, being species-dependent; (vi) these species displayed contrasting responses in term of water use; and (vii) in most of cases these species showed no significant differences in NSCs, suggesting that it is unlikely that dieback is caused by carbon starvation mechanism.

TS.20-P-2

External pavilion, Poster session 1: Monday 4th - Tuesday 5th Feb.

Tree mortality in Scots pine (*Pinus sylvestris* L.) is explained by the climatic suitability of host tree and bark-beetle populationsJaime González, Luciana Andrea¹; Batllori, Enric²; Lloret, Francisco³

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Bark-beetle attack is a major driver of tree mortality that may be critical for forest dynamics under future climates with increased extreme episodes. Climatic conditions and host tree characteristics determine the extent and severity of bark-beetle infestation. However, it remains unclear how the climatic suitability, both of the host tree and the pest, contribute to mortality and infestation processes. We surveyed 22 forest stands, in Northeast Spain, with evidence of recent Scots pine bark-beetle infestation and drought-induced mortality. We recorded the position, size and status of all trees, in addition to bark-beetle presence and intensity of attack. At stand-level, we calculated tree density, basal area and species richness. To estimate the climatic suitability of the host tree and bark-beetle species we built Species Distribution Models using Maxent. Subsequently, we modeled the tree mortality and bark-beetle infestation processes by means of generalized linear mixed models. The results showed that smaller and closer trees experience higher mortality than larger and distant trees, as well as higher presence and intensity of attack. Interestingly, we found a positive interaction between Scots pine suitability and the intensity of attack; higher values of host's suitability tend to favor the contribution of bark-beetle infestation in tree mortality with regard to other causes such as drought. Our findings evidence that Scots pine populations in suitable climatic conditions were likely to be infested even at low values of bark-beetles species' suitability. We suggest this may respond to a major investment in growth instead of tree defenses in suitable areas.

TS.20-P-3

External pavilion, Poster session 1: Monday 4th - Tuesday 5th Feb.

Effects of intraspecific variability in functional traits on growth responses to drought along an environmental gradient in three Mediterranean tree speciesSerra Maluquer, Xavier¹; Gazol, Antonio²; Sangüesa-Barreda, Gabriel³; Imbert, J. Bosco⁴; Camarero, J. Julio⁵

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Extreme climatic events such as droughts or heat waves are expected to increase in the future, altering the stability and function of different ecosystems. In the case of forests drops in productivity and mortality events triggered by drought and warm periods have already been described during the last decades. Tree-ring width series give the opportunity to reconstruct the tree vitality and evaluate growth responses to such events at short (1-3 yr) and long time (decades) scales. Moreover using individual growth series enables to evaluate the relationships between intraspecific variability in different intrinsic factors (functional traits), competitive status, growth rates and responses to drought, aiding to determine characteristics that confer growth resilience. Here we aim to evaluate relationships between several functional traits and tree growth responses to drought, at short and long time scales. We study three different north Iberian populations across a marked climatic gradient of three dominant Mediterranean tree species, *Quercus faginea*, *Quercus ilex* and *Pinus halepensis*. We measured tree size, wood density, specific leaf area and leaf to sapwood area ratio at individual level. We evaluated the importance of the intraspecific variability of these functional traits at; 1- tree performance (growth trends) and 2- Growth responses to drought events. We expect a high intraspecific variability in functional traits and tree growth across the environmental gradient. We also expect that responses to drought would be determined by the intraspecific variability in the evaluated functional traits suggesting a better predisposition of some individuals to cope with droughts.

Thematic Session 21: Understanding the contaminants in a changing world: linking terrestrial and aquatic systems

Day: Tuesday 5th February and Wednesday 6th February
Schedule: 18:00h 20:00h | 12:00h 13:30h - 18:00h 19:30h
Location: Room A3

Coordinators:

Andrea G. Bravo, Institute of Marine Sciences, CSIC, Spain

Sergi Diez, Institute of Environmental Assessment and Water Research, CSIC, Spain

Juan Carlos Nóvoa, Universidad de Vigo, Spain

Silvia G. Acinas, Institute of Marine Sciences, CSIC, Spain

Victor Matamoros, Institute of Environmental Assessment and Water Research, CSIC, Spain

Albert Palanques, Institute of Marine Sciences, CSIC, Spain

Luis R. Vieira, CIIMAR - Interdisciplinary Centre of Marine and Environmental Research, Portugal

The toxicity and spread of pollutants (heavy metals and emerging pollutants, POPs, microplastics, etc) in the landscape has raised international concerns. Understanding the processes and fate of contaminants at the interface of terrestrial and aquatic systems is a prerequisite for the development of remediation and risk management strategies that result in a decrease of the contaminants in the environment and biota. Moreover, future environmental changes such as increases in temperature, land use, runoff, brownification, and primary production may alter the biogeochemical cycling of the contaminants in both terrestrial and aquatic (i.e. continental and marine) environments. We seek presentations revealing contaminants effects, transformation, attenuation and/or transport across terrestrial and aquatic ecosystems at a range of scales from the individual catchment to continents and oceans. Contributions addressing the role of ecosystem function in pollution remediation (e.g. wetland systems) or assessing the risks of pollutants for human health (e.g. food safety) are also encouraged.

TS.21. Oral talks

TS.21-O-1

Room A3, Tuesday 5th Feb. 18.00 h.

Assessing the environmental effects of WWTP effluents by means of ecosystem-level manipulation

Elosegi, Arturo¹; Atristain, Miren²; Barrado, Miren³; de Guzmán, Ioar⁴; González, José Manuel⁵; Larrañaga, Aitor⁶; Pereda, Olatz⁷; Pérez-Calpe, Vicki⁸; Solagaistua, Libe⁹; von Schiller, Daniel¹⁰

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Waste Water Treatment Plants (WWTP) greatly improve the status of the receiving river ecosystems. Nevertheless, their effluents still consist of complex cocktails whose ecological effects are far from clear, as the receiving water mass is usually subject to other anthropogenic pressures. We performed a BACI (Before-After, Control-Impact) experiment to assess their ecological effects in the field. We diverted part of the effluent of a large, urban WWTP into the lowermost 100 m of a small, unpolluted tributary stream. A 100-m long reach upstream from the diversion point was used as a control, and both reaches were studied for a year prior and a year after the diversion. Laboratory ecotoxicological experiments showed the effluent to promote microbial activity and not to affect gammarid survival, even at full concentration, thus suggesting no effect in the field. Nevertheless, the ecosystem-level manipulation revealed subtle but statistically significant effects in the field. Although communities did not lose pollution-intolerant taxa, pollution-tolerant species, especially chironomids, increased in abundance, thus reducing invertebrate diversity. Additionally, the effluent enhanced benthic chlorophyll and biofilm enzymatic activities, reduced nutrient uptake capacity, and enhanced benthic primary production and leaf breakdown. The results point to a subtle effect of this effluent on the receiving river ecosystems, which would likely remain unnoticed had the receiving water body been subject to additional anthropogenic pressures. Ecosystem-level manipulation is a powerful approach to unveil environmental impacts.

TS.21-O-2

Room A3, Tuesday 5th Feb. 18.15 h.

Complex responses of a biofilm to sewage outflow: an experimental approach

SABATER, LAIA¹; Montemurro, Nicola²; Ginebreda, Antoni³; Perez, Sandra⁴; Barceló, Damià⁵

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Wastewater effluents represent the primary source of anthropogenic chemicals such as pharmaceuticals, and nutrients into the environment. Since they are not completely removed during the conventional wastewater treatment processes, they may pose a potential risk to the freshwater ecosystems. Whereas nutrients at certain concentrations have a subsidy effect on biota, organic pollutants have a stress effect. In addition, their combination can bring unexpected and contrasting effects in rivers. Of particular importance is the capacity of the biological community to resist (resistance) and subsequently recover (resilience) in front of the impact. A way to evaluate the effect of wastewater effluent on natural systems is to study it under controlled and simplified conditions. We exposed twenty-four artificial streams to a range of WWTP effluent concentrations, from no effluent to pure effluent, during 34 days, followed by 22 days of recovery under no effluent conditions. The experimental design was previously proved to be convenient for the study of biofilms and its interaction with contaminants. Pollution load associated with the WWTP effluent was characterized analyzing physical-chemical parameters (pH, dissolved oxygen, conductivity, and temperature), nutrients, organic matter, heavy metals and organic micropollutants in the water phase. The effects of chemicals on the biofilms were expressed as variations on biomass, community composition, and function (such as the photosynthetic efficiency or the extracellular enzymatic activities). Our preliminary results indicate a complex response of the biofilms in front of the wastewater gradient. We notice changes on the system balance and the final return to equilibrium.

TS.21-0-3

Room A3, Tuesday 5th Feb. 18.30 h.

Assessing the effects of a wastewater treatment plant (WWTP) effluent on stream food webs through stable isotope analysisDe Guzmán Martínez, Loar¹; Buceta, Mikel²; Brauns, Mario³; González, José Manuel⁴; Larrañaga, Aitor⁵; Von Schiller, Daniel⁶; Elozegi, Arturo⁷

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Point source pollution, including effluents from waste water treatment plants (WWTP), is one of the most relevant stressors in aquatic ecosystems. Effluents are complex mixtures of nutrients, organic matter and other pollutants that can alter stream communities and ecosystem functioning. We aimed at assessing the effects of WWTP effluents on the structure of stream food webs by analysing stable isotope ($d^{15}N$ and $d^{13}C$) ratios in basal resources (biofilm, bryophytes, filamentous algae, fine benthic organic matter, aquatic and terrestrial coarse particulate organic matter) and consumers (macroinvertebrates and fish). To do so, we performed a BACI (Before-After, Control-Impact) experiment, in which we diverted part of a WWTP effluent into the lowermost 100 m of an unpolluted stream in Elgoibar (Gipuzkoa, N Iberian Peninsula), using an upstream reach as control. Significant temporal and spatial variation of the isotopic signatures were observed for many resources and consumers. Nevertheless, WWTP effluent also altered significantly the signature of biofilm, filamentous algae, and, primary and secondary consumers, with all the isotopic drifts occurring in the same direction. Our results suggest that food webs downstream of the WWTP are subsidized substantially by effluents from the WWTP.

TS.21-0-4

Room A3, Tuesday 5th Feb. 18.45 h.

Seasonal variability of antibiotic resistance in bacterial communities from an alluvial aquiferFillol, Mireia¹; Lekunberri, Itziar²; Borrego, Carles³; Gros, Meritxell⁴; Boy-Roura, Mercè⁵; Mas-Pla, Josep⁶

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This study describes the spatial and temporal variability of antibiotic residues, antibiotic resistance genes (ARGs) and groundwater bacterial communities in an alluvial aquifer in relation to different pollution sources. A seasonal survey in the Baix Fluvià alluvial aquifer (Girona) was carried out in eight groundwater wells and two stream locations along the Fluvià River. Samples were analyzed for hydrochemistry, antibiotic pollution, concentration of seven ARGs conferring resistance to main antibiotic families and the composition of bacterial communities. Results showed that the most frequently detected antibiotics were sulfonamides, fluoroquinolones and macrolides. Significant changes in antibiotic concentration were observed in most wells, attributed to hydrological dynamics as well as to physico-chemical and biochemical processes (sorption and degradation) that control the fate of different contaminants. Additionally, the amount and timing of manure fertilization and the concentration of antibiotics in manure may also play a role on determining their random distribution in the aquifer. Beta diversity analysis of samples according to the phylogenetic relatedness of bacterial communities revealed a site-based clustering with no seasonal trend and a clear segregation between groundwater and surface water communities. Similar grouping was observed when samples were ordinated according to the concentration of the studied ARGs. Among all target genes, *int11* (the integrase of class-1 integrons), *sul1* (encoding resistance to sulfonamides) and *blaTEM* (resistance to betalactams) were prevalent in groundwater. Our results demonstrate a substantial impact of anthropogenic activities in the aquifer that may have serious, but yet unpredictable, consequences for both environmental and human health.

TS.21-0-5

Room A3, Tuesday 5th Feb. 19.00 h.

Long-term nitrate pollution reduces ecosystem functioning in the presence and absence of an invasive predatorCano Rocabayera, Oriol¹; Maceda-Veiga, Alberto²; Muñoz, Isabel³; Salvadó, Humbert⁴; Vilumara, Joan⁵; Cáceres, Gustavo⁶; Perkins, Daniel M⁷; O’Gorman, Eoin⁸; Woodward, Guy⁹; de Sostoa, Adolf¹⁰

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Global change factors consist of a variety of biotic and abiotic alterations induced by human activities, which may interact in complex ways and cause far reaching impacts on ecosystems. Nutrient pollution and the introduction of alien predators are among the world’s worst anthropogenic impacts. However, there is limited insight into their additive and interactive effects on Mediterranean ponds,, one of the most at risk ecosystems around the world. Here we explored the effects of ecologically relevant nitrate concentrations (subsidy and pollutant) and mosquitofish densities (alien species) using mesocosms inoculated with microbes, algae and invertebrates from a natural lake. The experiment ran for 72 days and changes in water quality alongside the biomass of all organisms in the water column and sediment were monitored at 0, 7, 36 and 72 days. Two ecosystem processes, primary productivity ([chlorophyll-a]) and organic-matter processing (leaf litter decomposition), were measured simultaneously to explore via an index of multi-functionality their associations with the structure of aquatic communities and water quality. Nitrate first acted as a subsidy but as a pollutant over time, and its effects was not offset by the top-down control exerted by the mosquitofish, which had an overall neutral effect in this study.

TS.21-0-6

Room A3, Tuesday 5th Feb. 19.15 h.

Effects of emerging chemical contaminants on aquatic systems: from cells to populations and communitiesCassio, Fernanda¹; Martins, Nuno²; Pradhan, Arunava³

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Emerging chemical contaminants (ECCs) have been detected in the environment, but the knowledge on their fate and biological effects is still limited, especially those resulting from mixtures exposure. ECCs are sourced by industrial, domestic and hospital effluents, livestock and aquaculture. Wastewater treatment plants are not designed to eliminate ECCs, which have been found in several aquatic ecosystems. Silver nanoparticles have been incorporated into a wide range of consumer products, mainly because of the antimicrobial effect of Ag⁺. Moreover, the human population requiring healthcare is escalating, leading to an increase in the quantity and diversity of pharmaceuticals consumed. We will present preliminary results of the project EMERGEMIX “Impacts of mixtures of emerging contaminants in aquatic ecosystems across multi-levels of biological organization. To that end, we compared the ability of cells from different organisms or communities to initiate an efficient antioxidant system under ECC exposure. Proteomic responses to ECC exposure were correlated to biomarkers of stress to inform about their effects on cellular end ecological functions.

TS.21-0-7

Room A3, Tuesday 5th Feb. 19.30 h.

Unraveling the effects of multiple stressors on diatoms and macroinvertebrates in European basinsDe Castro-Català, Núria¹; Dolédec, Sylvain²; Sabater, Sergi³; Muñoz, Isabel⁴

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Rivers suffer of an important decrease in species diversity compared to other ecosystems. This decrease is due to the effects of a variety of stressors related with human activities. Species provide different roles in the functioning of the ecosystem, and their loss may reduce the capacity of response of the ecosystems to a stressor. The effects on diversity will obviously differ based on the type of stressors and their combination and severity, as well as on the characteristics of the local community composition, and the community tolerance to the type of stressor affecting the system. Multiple trait-based approaches, which rely on the hypothesis that environmental conditions act as a template on which evolution forges specific combinations of organism traits, may provide a mechanistic interpretation of the stressor effects on communities. MTBA can potentially help unravel the effects of multiple stressors on communities, and can be a useful complement of the traditional biodiversity assessment using community structure. We present the results of the analyses of the structural and functional biodiversity patterns for macroinvertebrate and diatom communities of the Adige, the Sava, and the Evrotas rivers, and the links of these patterns with different environmental descriptors. Overall, significant relationships between diversity indexes and trait composition, and environmental variables describing hydrological, hydro-morphological alteration, and pollution (pesticides and pharmaceuticals) were detected. The results put in evidence the impact of the combined effects of multiple stressors on diversity in the three basins, which may serve as representatives of the real situation in European freshwater systems.

TS.21-0-8

Room A3, Tuesday 5th Feb. 19.45 h.

Modelling the impacts of a wastewater treatment plant (WWTP) under global change in a low-order Mediterranean streamNadal Sala, Daniel¹; Pascual-Benito, Miriam²; Tobella, Marta³; Ballesté, Elisenda⁴; Porcuna, Helena⁵; Gracia, Carles⁶; Sabater, Francesc⁷; Lucena, Francisco⁸; Blanch, Anicet⁹; García-Aljaro, Cristina¹⁰; Sabaté, Santiago¹¹

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Ongoing climate change is projected to deeply impact natural systems. Furthermore, human society pressure upon natural systems is expected to increase in Mediterranean area next decades. Wastewater treatment plants (WWTP) water additions to low-order and low-discharge Mediterranean streams strongly modify their water quality, thus threatening both human and ecosystem's health. During three years, we monitored WWTP impacts in a Mediterranean stream. We focused at nutrient and microbiological dynamics according to One Health approach. For five microorganism indicators of fecal contamination and two nutrients indicators, we developed a correlative model between the particle inactivation constant "k", and the discharge and daily mean temperatures. Then, we modeled the assimilation distance, defined as the distance to which pre-WWTP values are reached for each indicator. In parallel, we developed the GOTStream, a process-based model that calculates water balances in a sub-catchment basis, according to soil cover, climate conditions and WWTP water addition. Then, we joined GOTStream projections under different land use and climate change scenarios with correlative models. Our results suggest that a moderate warming and a reduction in discharge will decrease the assimilation distance for all indicators, by increasing water residence time and by increasing reactivity of biological processes due to higher temperatures. However, as climate change will reduce the natural river discharge, an increase of WWTP pollutant pouring due to increases of human activity will result in a larger AD, thus amplifying the negative impact of the WWTP on water quality and to a longer distance from the plant.

TS.21-0-9

Room A3, Wednesday 6th Feb. 12.00 h.

Studies of interaction between hydrophobic anthropogenic dissolved organic carbon and marine microorganisms

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Hundreds of thousands of synthetic organic chemicals are in commerce for industrial, agricultural and household applications. These chemicals reach the environment, in addition to the hydrocarbons released resulting from fossil fuels use. The co-occurrence of the myriad of these compounds at ultra-trace concentrations represent the major component of the anthropogenic dissolved organic matter (ADOC). Whereas harmful effects of some organic pollutants have been described for some marine biota, the effects towards the base of the food webs, the microorganisms, remains uncharacterized. We show and discuss the results from several experiments performed in polar, temperate and tropical seawaters, where microbial communities were challenged with ADOC at environmental relevant concentrations. We have used metatranscriptomic and metagenomic approaches, along with quantification of selected model families of hydrophobic ADOC quantified by gas chromatography coupled to mass spectrometry to assess of the influence of realistic mixtures of hydrophobic organic pollutants at background concentrations to marine microbial communities. We observed impacts on biodiversity and functionality. Since the number and quantity of ADOC chemicals in use and in the environment has exponentially increased during the Anthropocene, it is expected that ADOC influences become more relevant over the next decades.

TS.21-0-10

Room A3, Wednesday 6th Feb. 12.15 h.

Multi-contaminant analyses in the pelagic food web of the urbanised Bay of Marseille

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The Bay of Marseille is highly impacted by multiple contamination sources: sewage, harbour, industry, agriculture and tourism. In this study we sampled in the Bay of Marseille, in March 2017, a marine food web from plankton (0.7 to 2000 µm) to planctivorous fish (Boops boops), to mesopredators (Trachurus trachurus, Trachurus mediterraneus, Scomber colias, Merluccius merluccius, Illex coindetii, Todarodes sagittatus) and finally to top predators (Sarda sarda). All these fishes and cephalopod species are exploited by local fisheries and consumed. Multi-contaminant analysis was performed including key organic (e.g PCBs) and inorganic (e.g. total Hg, and 26 minor elements and metallic trace elements) contaminants. In addition, d13C () and d15N () stable isotope analyses and biochemical measures (lipids) were performed in order to describe contamination patterns of this food web. Species, size and trophic levels influenced contaminant concentrations. The cephalopod Illex coindetii had the highest values of As, Cd, Co, Cu and Pb, while Sarda sarda had the highest values for PCBs, Hg and Cs. Among consumers, the mean d15N increased from 8.5 () for Boops boops to 10.5 () for Sarda sarda, corresponding to increasing estimated mean trophic levels from 3.7 to 5.2. Biomagnification was highlighted for some PCBs in some cases, and Hg. Some individuals of Trachurus trachurus and Sarda sarda presented higher Hg values than the maximum limit allowed for consumption (CE, 2006). However, for all the species, mean concentrations of the measured inorganic contaminants were lower than the maximum limit allowed by the European Union for marketing.

TS.21-0-11

Room A3, Wednesday 6th Feb. 12.30 h.

The use of organic contaminants in aquatic and terrestrial food webs to track particular ecological processesBartrons, Mireia¹; Nagar, Nupur²; Catalan, Jordi³; Grimalt, Joan O.⁴; Vander Zanden, M. Jake⁵; Jeppesen, Erik⁶; Bruçet, Sandra⁷

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Organic contaminants are toxic substances usually produced for use in agricultural, industrial, and domestic applications. Because of their long-range atmospheric transport capacity, POPs are distributed worldwide. The global distillation theory predicts that there will be a temperature-dependent partitioning of these low volatility compounds in the environment. Concentration patterns of POPs in agreement with the theory have been observed for different environmental compartments, such as lake sediments and mosses, and along altitudinal and latitudinal gradients. In this talk, I will review the state of the question of POPs bioaccumulation in aquatic and terrestrial, alpine and arctic food webs, and present some hypotheses concerning processes worthy of investigation.

TS.21-0-12

Room A3, Wednesday 6th Feb. 12.45 h.

Marine pollution impacts on the viability of *Cystoseira crinita* populationsde Caralt, Sonia¹; Verdura, Jana²; Verges, Alba³; Ballesteros, Enric⁴; Cebrian, Emma⁵

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In the Mediterranean Sea, species of the genus *Cystoseira* (Order Fucales) are amongst the most important canopy-forming seaweeds on photophilic rocky bottoms, since they provide food and habitat for many other organisms. However, *Cystoseira* species are highly vulnerable to anthropogenic stressors, such as habitat destruction, pollution and overgrazing, shifting to simpler and less structured habitats. Among them, pollution has been identified as one of the most important causes of decline. Specifically, during the last decades *Cystoseira crinita* is facing severe declines in coastal areas of Spain, Italy, France, Croatia and Montenegro, being one of the most vulnerable species among this genus, mainly attributed to sea surface pollution and eutrophication. The aim of this study is to evaluate through laboratory experiments the effects of several common pollutants such as heavy metals (copper, lead), herbicides (glyphosate) and eutrophication (nitrates) on recruits, juveniles and adults of *C. crinita*. Recruitment, survival, growth and photosynthetic activity have been monitored to determine the negative impact of these pollutants on the different life stages of *C. crinita*. Whereas adult specimens are tolerant to moderate levels of pollution, recruits and juveniles are more sensitive to these pollutants, compromising the long-term viability of these populations. The identification of the most harmful contaminants and the most vulnerable life stages of *C. crinita* can help to develop effective conservation plans and recovery strategies.

TS.21-0-13

Room A3, Wednesday 6th Feb. 13.00 h.

The presence and effects of microplastics on marine zooplankton: a reviewR. Vieira, Luis¹; Guilhermino, Lúcia²; Guilhermino, Lúcia³

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Microplastics have become a global environmental issue due to their ubiquity in the oceans and other ecosystems, bioavailability and ability to adsorb toxic pollutants. The investigation involving these particles in the aquatic environment requires data on their abundance, distribution and composition, proving a realistic indication of the extent of the problem. Marine zooplankton represents an important link in the energy transfer in marine food webs. These organisms feed on organisms with a size range similar to that of several microplastics present in marine ecosystems and ingest such particles either intentionally and by passive filtration. Thus, it is important to study the uptake and ingestion of microplastics by marine zooplankton, and the potential accumulation and adverse effects on these organisms. In this review, the evidences of ingestion, accumulation and effects of microplastics on marine zooplankton were compiled. Moreover, data on the abundance and distribution of microplastics in the marine environment were summarized. Additionally, challenges and gaps of knowledge were identified. The revision made highlights the importance of zooplankton in the fate and distribution of microplastics in marine ecosystems, the effects of these particles and the chemicals that they carry over the zooplankton, and the implications for ecosystems functioning.

TS.21-0-14

Room A3, Wednesday 6th Feb. 18.00 h.

Anaerobic mercury methylation in the oxic water column of freshwater systemsGarcía Bravo, Andrea¹; Gascón, Elena²; Cosio, Claudia³; Bouchet, Sylvain⁴; Adatte, Thierry⁵; Amouroux, David⁶; Loizeau, Jean-Luc⁷

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The formation of methylmercury (MeHg) is carried out by specific groups of anaerobic bacteria as iron-reducing bacteria, sulphate-reducing bacteria, methanogens, Firmicutes and Methanomicrobia. The finding of Hg(II) methylation processes in oxic water column of marine ecosystems was a breakthrough in the conceptual model of Hg biogeochemical cycling. By combining field and laboratory based experiments, we evaluated the role of sinking particles on Hg(II) methylation in the oxic water column of the largest Lake in Western Europe (Lake Geneva). Differences in THg concentrations between sediments and sinking particles were not statistically significant ($p > 0.05$). In contrast, MeHg concentrations were up to ten-fold greater in sinking particles than in sediments. Hg(II) methylation rates were one order of magnitude greater in sinking particles. Furthermore, the amendment of molybdate (an inhibitor of sulphate-reducing bacteria) to sinking particles significantly decreased Hg methylation (~80 % inhibition). In this study we demonstrate that MeHg is biologically formed in sinking particles of oxic water column of lake systems and we highlight that sulfate reduction is an important metabolic pathway involved in the process. We conclude that MeHg formed in water column has been underestimated but might represent a significant pool of MeHg for aquatic food webs.

TS.21-0-15

Room A3, Wednesday 6th Feb. 18.15 h.

Decreasing the impact of metal mining effluents from abandoned mines on freshwater ecosystemsVendrell Puigmtijà, Lidia¹; Abril, Meritxell²; Llenas, Laia³; Colon, Joan⁴; Ponsá, Sergio⁵; Espinosa, Carmen⁶

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Abandoned mines cause serious environmental damage to their surroundings, with considerable impacts on freshwater ecosystems. These impacts occurred mainly through the uncontrolled discharge of polluted effluents, which may contain high concentrations of heavy metals. Currently, no real solution exists for this significant environmental problem, leaving a legacy of global pollution. The final aim of LIFE DEMINE project is to demonstrate the efficiency of an innovative treatment based on membrane processes and electrocoagulation to decrease the overall environmental and ecological impact caused by metal mining effluents from abandoned mines on freshwater ecosystems, using the aquatic biofilm as ecological indicator. To do that, we incubated natural biofilm from a reference stream in a set of microcosms under controlled temperature and light conditions. After two weeks of colonization, the incubated biofilm was exposed to untreated and treated mining effluents, simulating their entrance into the aquatic ecosystems. After two weeks of exposure, we observed a clear reduction in the photosynthetic efficiency and a clear shift in the algal community composition of the aquatic biofilm affected by the untreated mining effluent compared to the treated one. These observations evidenced the negative ecological impact caused by metal mining effluents on aquatic ecosystems and the potential of the innovative treatment proposed in LIFE DEMINE to improve the quality and biodiversity of the water bodies affected by abandoned mines.

TS.21-0-16

Room A3, Wednesday 6th Feb. 18.30 h.

The ups and downs of mercury in an Audouin's gull breeding colony: long-term trends of mercury pollutionSánchez-Fortún, Moisès¹; Ouled-Cheikh, Jazel²; García-Tarrasón, Manuel³; Jover, Lluís⁴; Sanpera, Carola⁵

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Mercury is a pervasive pollutant that can have strong negative effects on wildlife and humans. Top predators, such as seabirds, are frequently used as indicators of environmental pollution for contaminants that biomagnify through food webs (e.g., mercury), as they are able to reflect changes in the levels of contaminants from lower trophic levels. We investigated the temporal trends of mercury levels in a population of Audouin's gull (*Ichthyaeetus audouinii*), during a 14 years period (2004, 2008-2018) in the Ebro Delta (NE Spain). The Ebro Delta is a highly mercury-polluted area, due to both anthropogenic (e.g., industrial waste) and natural sources of mercury. Recently, restoration actions to remove toxic sludges from the area are aiming to reduce the pollution caused by industries in the past. Thus, evaluating the temporal dynamics of mercury on this species could serve as a proxy on the adequacy of the restoration actions that have been undergoing so far. Since mercury is acquired mostly through diet, we also used a stable isotopic approach to detect diet changes in the population and whether these are correlated with the mercury levels observed. Mercury and stable isotopes analyses were evaluated in feathers from fledglings. Feathers in birds represent a major route for mercury excretion and, therefore, are regarded as a good proxy of the mercury load of individuals. Our results suggest that mercury trends observed in the population studied can be explained due to dietary shifts and to the restoration efforts taking place in the area.

TS.21-0-17

Room A3, Wednesday 6th Feb. 18.45 h.

Capacity and phenotypic characterization of isolated methylmercury marine bacteria detoxifiers

Sanz Sáez, Isabel¹; Pereia Garcia, Carla²; Trujillo Cuadra, Laura³; Pla i Ferriol, Martí⁴; Capilla, Miguel⁵; G. Bravo, Andrea⁶; Rodríguez, Rosa del Carmen⁷; Sebastian, Marta⁸; G. Acinas, Silvia⁹; Sánchez, Olga¹⁰

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Bacterial transformation of inorganic-mercury (HgII) and methylmercury (MeHg) is performed by the mer operon and is known to be harboured in diverse marine bacterial taxa. However, little is known about the tolerance capacity and phenotypic characterization of marine bacteria displaying merA (volatilizes HgII to Hg⁰) or merAB (volatilizes HgII to Hg⁰ and degrade MeHg to HgII) genes. In this study, we performed a functional screening of these genes in 306 marine bacterial cultures from *Alteromonas* sp. and *Marinobacter* sp. since they have the mer operon and present a broad geographical distribution covering different depths and latitudinal gradients. Our PCR functional screening identified 24.5% of the isolates presenting the merA and only 9.2% presenting both merAB genes. Additionally, the Minimum Inhibitory Concentration (MIC) for HgCl₂ and MeHg was determined for a total of 103 PCR positive strains. Strain ISS312 presented the highest tolerance, with a MIC of 70µM and 10µM for HgCl₂ and MeHg, respectively. This strain, affiliated to *Alteromonas mediterranea* DE, presented a 10h longer lag-phase and a slower growth rate when growing with MeHg, but reached a similar concentration (cells/ml) compared to the control. Additionally, it was able to degrade 5µM of MeHg in 24h. Interestingly, inclusion bodies (IB) were observed inside cells and TEM-EDX analysis pointed out to poly-P as their probable nature. In summary, our functional screening analyses helped to understand the capacity of marine bacteria to detoxify MeHg and to propose *Alteromonas* sp. ISS312 as a potential candidate to be used in bioremediation experiments.

TS.21-0-18

Room A3, Wednesday 6th Feb. 19.00 h.

Year-to-year variation in mercury deposition fluxes to a deciduous forest soil

Gómez Armesto, Antía¹; Méndez-López, Melissa²; Campillo-Cora, Claudia³; Pérez-Rodríguez, Paula⁴; Arias-Estévez, Manuel⁵; Nóvoa-Muñoz, Juan Carlos⁶

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Deposition of Hg through litterfall to forest soils is an important pathway for Hg transfer to the uppermost soil layers. Only the litterfall can account up for 30-70 % of all the Hg deposited into terrestrial ecosystems. Litterfall samples were collected in a *Quercus robur* dominated plot during 2015 and 2016 by means of circular mess collectors. The samples were classified in oak leaves, twigs and miscellaneous. The total biomass flux was significantly different ($t=2.982$; $p=0.003$) between 2015 and 2016 (524 g m⁻² and 417 g m⁻², respectively), being in both cases highly influenced by leaves fluxes. In 2015 the month with the highest leaves flux to soil was January (99 g m⁻²) while in 2016 was December (97 g m⁻²). In fact, leaves fluxes were significantly different for both years ($t=3.289$; $p=0.001$) but not for the twigs and miscellaneous fluxes. Regarding Hg fluxes, they were significantly different for both years ($t=2.607$; $p=0.010$), being the 2015 mean flux (19.7 µg m⁻²) greater than the 2016 one (13.3 µg m⁻²). Because the Hg fluxes are very influenced by the total biomass fluxes, the months with the highest mean Hg fluxes were January for 2015 (6.9 µg m⁻²) and December for 2016 (4.7 µg m⁻²). In addition, the Hg fluxes were significantly different for leaves ($t=3.396$; $p=0.001$), twigs ($t=-2.109$; $p=0.040$) and miscellaneous ($t=-2.570$; $p=0.012$) of both years. The main conclusion is that Hg fluxes to soil are very conditioned by the total biomass fluxes, especially in the case of the leaves.

TS.21-0-19

Room A3, Wednesday 6th Feb. 19.15 h.

Diffusive Gradient in Thin Films as a useful tool to measure bioavailable mercury in aquatic and terrestrial environmentsTurull, Marta¹; Diez, Sergi²

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The Diffusive Gradient in thin films (DGT) technique was developed in 1994 to determine bioavailable trace metals in the environment. Since then, some many studies have been done employing this technique to study different trace elements, such as mercury (Hg). In this presentation, homemade DGT devices using a selective ion-exchange resin, and a polyacrylamide gel as the diffusive layer using an open resin (>5 nm), have been used to in situ kinetically labile Hg in aquatic and terrestrial environments. To analyze bioavailable Hg in aquatic environments, two different studies will be shown. A field study carried out in a river in Queensland (Australia) to determine the impact of a pesticide used for control of pineapple disease of sugarcane. Besides, a field study in the Ebro River (Spain) was also demonstrated the effectiveness of this technique to analyze the impact of Hg in the aquatic food chain correlating these values with phytochelatins in different species of aquatic plants. On terrestrial environments, the DGT technique is also a good tool to predict Hg uptake by plants. A new design of homemade DGT using a bis-acrylamide as a restricted layer (<1 nm) has been performed to determine different species of Hg in agricultural soils. We have used open and restricted diffusive layers to distinguish between inorganic and organic bioavailable species, giving more information of Hg mobility, uptake and bioaccumulation in the food chain.

TS.21. Posters

TS.21-P-1

External pavilion, Poster session 1: Monday 4th - Tuesday 5th Feb.

Organic UV filters in the Mondego River, PortugalApel, Christina¹; Bento, Celia²; Ferreira, Carla³; Ebinghaus, Ralf⁴

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Organic UV filters are of emerging concern due to their large production volumes and potential adverse effects on ecosystems and the human health. UV filters are used as ingredients in personal care products such as body creams, facial make-up, and sunscreens to protect the human skin against effects of UV radiation. Furthermore, they are widely used in plastic products, paints, and coatings to improve product stability against UV light. UV filters may enter the environment directly through recreational activities or indirectly through wastewater treatment plant (WWTP) discharges. Their presence has been shown in different environmental matrices, revealing their potential for persistence or pseudo-persistence. The aim of this study is to investigate the occurrence of UV filters in the Mondego River, Portugal, which is strongly used for recreational purposes during spring/summer and subject to discharges from several WWTPs. Surface water and surface sediment samples were collected and analyzed for 15 substances. The freeze-dried sediment samples were extracted using an accelerated solvent extractor (ASE-350, DIONEX, Germany) method. The water samples were enriched and eluted using an automated solid-phase extraction (Freestyle Xana, LCTech, Germany) method. The instrumental analysis was performed on an Agilent UHPLC-MS/MS system operating with dopant-assisted atmospheric pressure photoionization (DA-APPI). The results show the presence of UV filters in the lower Mondego River, reveal concentration levels, and identify their input pathways.

TS.21-P-2

External pavilion, Poster session 1: Monday 4th - Tuesday 5th Feb.

Sulfachloropyridazine adsorption/desorption in agricultural soilsConde Cid, Manuel¹; Nóvoa-Muñoz, Juan Carlos²; Arias-Estévez, Manuel³; Nuñez-Delgado, Avelino⁴; Álvarez-Rodríguez, Esperanza⁵; Fernández-Sanjurjo, María José⁶

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Sulfachloropyridazine (SCP) is a sulfonamide antibiotic commonly used in veterinary medicine. Following administration to cattle, a significant proportion of this antibiotic is excreted, reaching the soil mainly by spreading of organic amendments. Once in the soil, this compound undergoes different physicochemical and biological processes, including adsorption/desorption, affecting its transport to water bodies and subsequent absorption by crops. In this work we used batch-type experiments to study SCP adsorption/desorption in 20 agricultural soils. The adsorption capacity of the different soils was mainly dependent on organic carbon content and on effective cation exchange capacity values (eCEC), with those soils having higher levels of both parameters being the ones that presented higher adsorption, and vice versa. On the other hand, all studied soils showed high SCP desorption percentages, in most cases above 25% of the amounts previously adsorbed. In addition, desorption was negatively and significantly correlated with adsorption, with soils showing the highest adsorption also being the ones that presented the lowest desorption, and vice versa. In view of that, we can conclude that this antibiotic was very poorly adsorbed on the studied soils, especially to those characterized by low organic matter and eCEC levels, allowing its easy transportation into waters and crop uptake, thus entering the food chain, causing a relevant important risk for human and environmental health.

TS.21-P-3

External pavilion, Poster session 1: Monday 4th - Tuesday 5th Feb.

Understanding the role of vegetation on the attenuation of emerging contaminants from wastewater by constructed wetlandsDe Paz Taxé, Agnès¹; Matamoros, Victor²

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Constructed wetlands (CWs) have been shown to be able to remove emerging contaminants (ECs) from wastewater due to the presence of vegetation, nevertheless no information is available on the mechanism that plants use to do so. In this work we have studied the effect of vegetation on the attenuation of 5 ECs (benzotriazole, sulfamethoxazole, carbamazepine, bisphenol A and diclofenac) from synthetic wastewater and correlated that attenuation with the presence of certain chemical root exudates. The experimental design included 6 methacrylate columns of 30 cm in length and 9 cm in diameter, each of them filled with sand (2 mm in diameter). 3 columns were planted with *Phragmites australis* and 3 unplanted. The columns were operated in continuous flow mode with synthetic wastewater spiked with ECs at low ($\mu\text{g/L}$) concentration range. Three different hydraulic loading rates (HLR) were tested to assess the removal of the selected ECs (70, 140 and 280 mm/d). Water samples were collected at the influent and effluent of each of the columns and target analytes monitored by using SPE-UPLC-UV analytical methodology, whereas root exudates were analyzed by SPE-GC-ORBITRAP. The results showed that the columns with vegetation removed ECs more efficiently than the unplanted ones (35% vs. 80%, on average at the lowest HLR), which can be explained by the role of plant radicular system. Chemical exudates linked to the removal of ECs were identified. Overall, the study highlighted that the greater removal of ECs in CWs is carried out by the release of root exudates.

TS.21-P-4

External pavilion, Poster session 1: Monday 4th - Tuesday 5th Feb.

Environmental impact of mercury in aquatic ecosystems of high ecological valueDíez, Sergi¹; Marrugo-Negrete, José²; L. Lázaro, Wilkinson³; Guimaraes, Jean R. D.⁴

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Mercury (Hg) releases from artisanal and small-scale gold mining (ASGM) is estimated to be about 1600 tonnes/year, making it the largest global demand sector for Hg. ASGM produces up to 30% of the annual gold output employing more than 10 million miners in over 70 countries. For the sector, mercury amalgamation remains the method of choice to extract gold from the ore and because of generally low technical awareness, unnecessary high quantities of mercury are used with almost all ending up in the environment. This method releases Hg into the environment in its metallic form during amalgamation and as Hg vapour during the burning process; therefore mercury is easily distributed into the air, soil, water, and sediments. Once mercury reaches open waterways, it can be transformed (methylated) into methylmercury (MeHg) by biotic or abiotic processes. Bioaccumulation and biomagnification of transformed Hg into food chains poses a significant human health risk. This presentation will discuss the magnitude of the problem and its environmental impact in some highly ecologically valuable scenarios. The two areas studied are the Pantanal of Mato Grosso in Brazil and the Mojana floodplain in Colombia. Finally, environmental impacts on biota will be compared with those in the Ebro river basin in Spain, where a waste deposit with extreme levels of Hg, because of mercury-cell chlor-alkali plants, dumped in the Flix reservoir is threatening the Ebro Delta wetland.

TS.21-P-5

External pavilion, Poster session 1: Monday 4th - Tuesday 5th Feb.

Capability of using microalgae for removing antibiotics and pesticides from groundwaterFerrando Cansino, Laura¹; Matamoros, Víctor²

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Groundwater pollution due to the intensification of farming activities (pesticides and manure application) has increased in the recent years in response to the high population growth. In fact, 7% of the European groundwater monitoring stations have already reported excess for one or more pesticides, whereas a major public concern has raised due to the occurrence of antibiotics in groundwater via manure amending. Current drinking water technologies are expensive to build and require a high level of energy consumption (membrane and advanced oxidation treatments). The aim of this study was to assess the capability of using a low cost water treatment technology based on microalgae for the elimination of 4 pesticides (atrazine, bentazone, diuron, and mecoprop) and 3 antibiotics (sulfacetamide, sulfametazine, and sulfamethoxazole) from groundwater. Free and co-immobilized microalgae reactors were operated in continuous flow mode for more than 3 months. Luffa sponge, polyurethane foam with porosity of 30 and 10 were used as immobilization materials. Results showed that co-immobilized microalgae reactors resulted in a greater elimination of compounds than free microalgae reactors. This can be explained by the increase of the biodegradation of ECs due to algal-bacterial symbiosis. Finally, the decrease of the HRT from 8 to 2 days decreased removal efficiency of most of the studied contaminants, but co-immobilized reactors still showed the best performance. In this work we have demonstrated that the use of microalgae is a plausible drinking water technology for removing pesticides and antibiotics from groundwater.

TS.21-P-6

External pavilion, Poster session 1: Monday 4th - Tuesday 5th Feb.

Microbial responses to anthropogenic dissolved organic carbon in Arctic and Antarctic coastal seawaterCerro-Gálvez, Elena¹; Lundin, Daniel²; Casal, Paulo³; Piña, Benjamín⁴; Dachs, Jordi⁵; Vila-Costa, María⁶

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Hydrophobic organic pollutants are continuously being introduced in seawater through atmospheric deposition, increasing the pool of anthropogenic dissolved organic carbon (ADOC). They accumulate in cellular lipids and have harmful effects on marine biota, but responses of microorganisms are still uncharacterized. We challenged coastal microbial communities from Ny-Ålesund (Svalbard, Arctic) and Livingston Island (South Shetlands, Antarctica) with close to in situ ADOC concentrations. In Arctic waters, growth of ADOC-degrading bacteria that belonged to the rare biosphere was observed after short incubations of 24 hours. In Antarctica, there was a lower response. Sub-lethal effects were discovered at gene level by metatranscriptomics. ADOC additions increased transcripts for microbial respiration and cell growth in ubiquitous groups such as Flavobacteriia, Gammaproteobacteria and SAR11, suggesting their use as nutritive source. Additionally, a suite of cellular adaptations and detoxifying mechanisms, including remodeling of membrane lipids and transporters, was detected. Responses to ADOC are used to create a conceptual framework for bacteria-ADOC interactions. This work shows for first time that environmental relevant ADOC concentrations influence the marine microbial communities, a perturbation potentially growing during the Anthropocene.

TS.21-P-7

External pavilion, Poster session 1: Monday 4th - Tuesday 5th Feb.

Podzolic soils: rather than a simple Hg reservoir?

Nóvoa Muñoz, Juan Carlos¹; Gómez-Armesto, Antía²; Méndez-López, Melissa³; Pontevedra-Pombal, Xabier⁴; García-Rodeja Gayoso, Eduardo⁵; Arias-Estévez, Manuel⁶

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The role of soils in Hg accumulation is often restricted only to the uppermost soil horizons where Hg is tightly associated to organic matter. However, podzolic soils (spread > 485 million ha worldwide) are also able to retain Hg in subsurface soil horizons. This study shows the pattern of total Hg (HgT) with soil depth in two podzolic soils (MD-7 and LOB) and its environmental implications. The highest HgT concentrations were found in the O horizon with 184 and 131 ng g⁻¹ in MD-7 and LOB, respectively. Deeper, HgT diminished progressively in both soils with the lowest value (5 ng g⁻¹) in the E horizon of MD-7 soil. In the illuvial subsurface horizons (Bh, Bhs and Bs), enriched in organic compounds and Al and Fe oxyhydroxides transported from uppermost soil layers, HgT raised up to 100 ng g⁻¹ to diminish again towards the bottom of both profiles (in C horizons), where HgT were 22 and 36 ng g⁻¹ in MD-7 and LOB, respectively. Podzolization, the pedogenetic process that takes place in podzolic soils, contributes to Hg detoxification in the uppermost soil layers through the Hg transport downwards. This results in less Hg to cause toxicity in the root zone for soil microorganism and plants, as well as less Hg availability to be mobilized to freshwater courses by runoff or erosion. Moreover, illuvial subsurface horizons act as an additional soil protection barrier in podzolic soils precluding that Hg reach groundwater, where it can be transformed in highly toxic organo-Hg species.

TS.21-P-8

External pavilion, Poster session 1: Monday 4th - Tuesday 5th Feb.

Effects of insecticide chlorpyrifos on hatching and resting egg quality of the rotifer *Brachionus manjavacas*

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Chlorpyrifos is an organophosphate pesticide widely used in crops and is considered a spread spectrum insecticide. This is why it is currently included in the Water Framework Directive as a priority substance. According to this policy, priority substances are those that have high risk of contamination for the aquatic environments and they must be controlled in their application areas. Therefore, the periodical quantification of chlorpyrifos is mandatory in water bodies corresponding to each Spanish Hydrographic Confederation. Target organisms are crop pests but, due to its toxicity, it should be tested on other non-target organisms, for example zooplankton. Toxicity tests are usually performed with adults but, the influence of toxics is poorly studied over hatching or quality of resting forms. In this study, the influence of chlorpyrifos was evaluated using resting eggs collected from a multiclonal laboratory population of the rotifer species *Brachionus manjavacas*. Our experiment included eight replicates of four concentrations: 0.0, 0.008, 0.08 and 0.8 µg L⁻¹. After inoculation, we daily checked the number of hatchlings and the degradation state of each egg, during five days. Most of the eggs hatched at control, 0.008 and 0.08 but only one individual hatched at 0.8 µg L⁻¹. Degradation of resting eggs increased with concentration and time. Since the harmful concentration was above the stipulated in the Directive, and due to the rapid degradation of the chemical once applied, we conclude that negative effects at the population level are not likely. However, pest control practice should be carefully monitored and managed.

TS.21-P-9

External pavilion, Poster session 1: Monday 4th - Tuesday 5th Feb.

Mercury dynamics in the Ebro Delta rice paddy food webSampera, Carolina¹; Sánchez-Fortún, Moisés²; Jover, Clara³; Jover, Lluís⁴

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Moises Sánchez-Fortún; Clara de Jover; Lluís de Jover; Carola Sanpera* Industrial activities have promoted changes in the mercury cycle which have prompted the interest of the scientific community. During the last fifty years a chlor-alkali industry located 100 km above the Ebro Delta river mouth (Spain) has spilled mercury-rich residues into the river. The huge quantity of mercury spilled together with the dispersion caused by the river flow had resulted in a wide distribution of this metal, reaching different ecosystems (rice-paddies, lagoons, flood plains) and even the neighboring coastal area. Rice paddies constitute potential methylation basins where inorganic mercury in solution is methylated and then transferred to aquatic and terrestrial food webs. In this work we analyzed total mercury in rice (*Oryza sativa*) and animals (both, invertebrates and vertebrates) collected in rice paddies and belonging to the rice-field food web. The effect of several rice cultivation practices associated to different flooding patterns (conventional vs. ecological cultivation, flooded vs. dry cultivation) on mercury content is also assessed.

Thematic Session 22: Unveiling the diversity and function of macro and microorganisms through a molecular lens

Day: Thursday 7th February

Schedule: 12:00h 13:30h – 15:00h 17:00h

Location: Room M3

Coordinators:

Marta Sebastián, Instituto de Oceanografía y Cambio Global (IOCAGULPGC), Spain

Clara Ruiz González, Institut de Ciències del Mar (ICM-CSIC), Spain

Isabel Ferrera, Institut de Ciències del Mar (ICM-CSIC), Spain

Andrea García-Bravo, Institut de Ciències del Mar (ICM-CSIC), Spain

Owen Wangensteen, UiT the Arctic University of Norway, Norway

Living organisms ranging from the tiniest microbes to plants and animals drive the Earth biogeochemical cycles. Understanding how these diverse communities and their processes vary across environmental gradients or habitats (soils, sediments, waters) is essential to comprehend ecosystem functioning and any potential responses to global change. The development of molecular techniques such as high throughput sequencing technologies or single-cell genomics has made possible new ways of looking at macro and microorganisms in the environment, providing a tremendous boost to the field of ecology. In this session, we will explore how molecular tools help us to understand ecological processes across temporal and spatial scales. We invite contributions exploring the diversity and function of living communities in a wide range of environments (e.g., terrestrial, aquatic) and describing how molecular tools improve the current understanding of ecology and biogeochemical cycles.

TS.22. Oral talks**TS.22-MT-1**

Room M3, Thursday 7th Feb. 12.00 h.

Temporal dynamics in gene expression patterns: shedding light on microbial functions and interactionsAlonso Saez, Laura¹; Clokie, Martha²; Morán, Xosé Anxelu G.³; González, José M.⁴

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Microbial communities show large variations across spatial and temporal scales in the Ocean and understanding their dynamics remains a major challenge in biogeochemistry modelling. Recent Global Ocean surveys have released a huge amount of information on the biogeography of microbial taxa and potential functions using metagenomics. However, metatranscriptomic datasets, targeting the active members of microbial communities, are still scarce. We analysed a set of eight coastal metatranscriptomes collected over two years at a time-series station in the Southern Bay of Biscay. Focusing on diagnostic genes of globally important biogeochemical processes, we identified key active microbial players and the temporal variability in marker gene expression under contrasting environmental conditions. Despite the limited size of our dataset, recurrent temporal patterns were found for some marker genes, including *amoA*, *coxL* and *nifH*, which may have implications for the seasonality of the associated functions. The analysis of phage-origin transcripts in the same dataset allowed us to assess the dynamics of phages actively infecting different microbial groups. A significant positive relationship between the abundance of transcripts from some of the most abundant phage types (infecting SAR11, SAR116 and cyanobacteria) and their putative hosts was found. Yet, the ratio of increase in phage transcripts per host cell was lowest for pelagiphages, suggesting a weaker phage sensitivity of the widespread SAR11 group. In summary, our results highlight the relevance of studying temporal patterns of gene expression to unveil important aspects of the functioning and interactions of marine microbial communities.

TS.22-O-2

Room M3, Thursday 7th Feb. 12.30 h.

Mining eukaryotic community DNA data: from metabarcoding to metaphylogeographyTurón, Xavier¹; Wangensteen, Owen²

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Metabarcoding, the detection of biodiversity from environmental DNA or community DNA, is revolutionizing ecological assessment in terrestrial, freshwater, and marine environments. We are witnessing a shift from 18S rDNA to mitochondrial COI as preferred metabarcoding marker. In turn, COI has been extensively used for the assessment of phylogeographic patterns. Thus, COI-based metabarcoding datasets contain an untapped reservoir of intraspecies genetic information for hundreds of molecular operational taxonomic units (MOTUs) at a time, whose exploitation can open a new field we call metaphylogeography. The switch from interspecies to intraspecies focus in metabarcoding requires solving the problem of artifacts and sequencing errors. These erroneous reads are easily joined to the correct MOTU during the clustering step in metabarcoding, but remain a source of noise if intraspecific patterns are the goal. Using as a case study littoral marine communities of two National Parks (Cabrera Archipelago and Atlantic Islands), we present a procedure for denoising COI metabarcoding data in order to assess phylogeographic patterns. The pipeline is based in the use of the within-sample mean square of *amova* as a measure of noise to guide a two-step pruning procedure of the sequence dataset. We ended up with a set of 356 MOTUs, of which 210 were Metazoans, for which we could perform phylogeographic analyses (networks, *amovas*) and extract Phylum-wise trends. Two species previously studied by conventional Sanger sequencing served as a benchmark. Our results show the potential of metabarcoding datasets for generating community-wide information on intraspecies genetic variation.

TS.22-0-3

Room M3, Thursday 7th Feb. 12.45 h.

Assessing belowground plant distribution through metabarcoding techniques

Illuminati, Angela¹; Escudero, Adrián²; Matesanz, Silvia³; Pias, Beatriz⁴; Sánchez, Ana M.⁵; Chacón-Labela, Julia⁶; de la Cruz, Marcelino⁷; S. Pescador, David⁸; López-Angulo, Jesús⁹; Díaz, Carlos¹⁰

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In the last decades, trait based plant ecology has emerged to explore diversity and detect relevant standing processes in plant communities. Although it has provided a complete route map to explore plant community assembly, we are far from knowing the main forces determining plant species coexistence at fine spatial scales. Mainly due to the lack of methodological tools, community ecology studies have been carried out analysing the aboveground species distribution. However, there is a question that is clearly waiting for a response: how can we understand plant community processes if we do not know how they are structured belowground? Recently-developed molecular tools are opening new perspectives in the study of plant communities. In our study, we aimed to verify if the aboveground species distribution can be or not a good predictor of the belowground species allocation. In this attempt, we employed metabarcoding techniques for the identification of belowground species and then we compared above- and below- fractions by using spatial pattern analysis. Results suggested that only a very little part of the belowground distribution matches with the aboveground counterpart. As we expected, the “hidden” portion of plant communities is mainly unknown and hardly can be predicted by the mere observation of the aerial community part. Molecular tools are giving us a new way to explore local species distribution and plant-plant interactions patterns and dynamics.

TS.22-0-4

Room M3, Thursday 7th Feb. 13.00 h.

Community composition and temporal dynamics of sand-dwelling dinoflagellates from the NW Mediterranean Sea

Reñé, Albert¹; Hoppenrath, Mona²; Reboul, Guillaume³; Moreira, David⁴; López-García, Purificación⁵

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Dinoflagellates are a key component of protist communities in planktonic marine environments, and their diversity and distribution has been thoroughly studied worldwide. However, some environments, like benthic ones, remain poorly studied, and most research focuses on epiphytic toxic species. In this study, we have characterized the community of sand-dwelling dinoflagellates from some Mediterranean Sea locations, an area lacking of studies on those organisms, with monthly samplings of coastal sediments during six months. The study was performed combining classical morphological techniques and high-throughput sequencing (HTS). The morphological identification of organisms present in the sediment samples, combined with their molecular characterization using single-cell PCR technique, allowed a refined classification of HTS reads. The results obtained show that the three studied locations have similar richness and community composition. The communities are dominated by a few taxa, even though each site is characterized by the presence of some particular species. Those dominant taxa show a temporal dynamics from spring to summer. While some increase their relative abundances along time, others decrease it, resulting in the same temporal pattern in all three locations. The combination of both approaches allowed to detect a large number of unknown species, and it reflects the need of further taxonomic studies to characterize the diversity these organisms in coastal Mediterranean locations

TS.22-0-5

Room M3, Thursday 7th Feb. 13.15 h.

For all audiences: the impact of incorporating immature stages on biodiversity assessment of mega-diverse groupsDomènech, Marc¹; Enguidanos Garcia, Alba²; Wangensteen, Owen S.³; Malumbres-Olarte, Jagoba⁴; Arnedo, Miquel A.⁵

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Early detection methods for monitoring ecosystem changes are essential to identify and tackle unanticipated threats. Arthropods have the potential to inform on biodiversity changes at finer spatial and shorter temporal scales than vertebrates. The use of rapid biodiversity assessment protocols can ameliorate the daunting task of sampling highly abundant groups. However, the poor taxonomic knowledge of many arthropods limits their use as bioindicators, especially in groups, such as spiders, for which traditional taxonomy is based on specific life stages (generally adults). Spiders are amongst the most abundant and ubiquitous predators in terrestrial ecosystems, and play a key role in trophic networks and ecosystem functioning. To date, spider inventories have been solely based on adult specimens, which may bias biodiversity estimates, especially in single surveys conducted in highly seasonal places. Here, we assess the impact of identifying and recording immature individuals on estimates of species-richness and replacement of spider communities associated with oak forests. We used a metabarcoding approach by sequencing a 313bp COI fragment to assess species richness of pools of immature spiders collected from 16 1-ha plots. We compared alpha diversity values and taxonomic and functional beta-diversities with and without immatures, and we identified the variables associated with differences in the number of species represented by only immature specimens. Our results reveal that an important component of local diversity is missing if only adult specimens are analyzed. The inclusion of immatures improves our ability to estimate biodiversity shifts in time and space.

TS.22-0-6

Room M3, Thursday 7th Feb. 15.00 h.

Insights into the ecology of marine aerobic anoxygenic phototrophic bacteriaFerrera, Isabel¹; Auladell, Adrià²; Sánchez, Olga³; Gasol, Josep M⁴; Auladell, Adrià⁵; Sánchez, Olga⁶; Gasol, Josep M⁷

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The study of marine microbes has bloomed thanks to the use of molecular tools opening new windows into ecological studies. One of the major advances achieved last decade was the discovery of marine photoheterotrophic bacteria, which challenged our view on microbial food webs in the ocean. These organisms are heterotrophs that rely mainly on organic matter but are capable of harvesting light to supplement their energy requirements. In the last years, we have used various approaches to uncover the ecology of a group of marine photoheterotrophs, the aerobic anoxygenic phototrophic bacteria (AAPs). In particular, we have combined infrared microscopy, quantitative PCR and Illumina sequencing with large sampling initiatives (i.e., the Blanes Bay Microbial Observatory and the Malaspina circumnavigation expedition) as well as with manipulation experiments to explore their diversity, seasonality, biogeography and, more importantly, their functional role in marine ecosystems. Our results confirm that the AAPs are widely distributed in the global surface oceans and that the different phylogenetic groups present a certain degree of biogeography. Moreover, we have demonstrated that these bacteria show a clear seasonality both in abundance and community structure. But foremost, we have found that the AAPs are fast-growing bacteria contributing significantly to the recycling of organic matter and that they can be stimulated by light in the marine environment. The results of our ongoing work will be presented and discussed in detail at the conference.

TS.22-0-7

Room M3, Thursday 7th Feb. 15.15 h.

Multi-partner symbiosis: microbes and polychaetes in sponge hostsTuron Rodrigo, Marta¹; Uriz, M. Jesús²; Martín, Daniel³

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Sponges establish tight associations with both, micro- and macroorganisms. However, while studies on sponge microbiomes have proliferated in the last decades, nothing is currently known about the microbiomes of sponge-associated polychaetes: whether they are related to those of their host sponges, depend on the environmental conditions or, as in other invertebrates (sponges and ascidians), are species-specific. In this study, we analysed the microbial communities of four common sponge species (*Clathria reinwardti*, *Amphimedon paraviridis*, *Neofibularia hartmani* and *Aaptos suberitoides*) and their symbiotic polychaetes (*Haplosyllis* spp.) in different locations of Nha Trang Bay (Central Vietnam). Sponges and polychaetes were identified by molecular and morphological features, and their respective microbial communities were analysed by high-throughput sequencing of the V4 region of the 16S rRNA gene. Microbiomes revealed a high exclusivity in sponges and their respective polychaetes, with low degree of overlap among them. In *A. paraviridis* and *A. suberitoides*, each sponge species was associated to a single polychaete species. In *C. reinwardti* and *N. hartmani*, two different polychaete species were found depending on the host location. Overall, we found environmentally independent, species-specific associations of microbes with their eukaryotic partners. Conversely, although specific, the sponge-polychaete associations may vary depending on the host habitat, which suggests ecologically modulated relationships.

TS.22-0-8

Room M3, Thursday 7th Feb. 15.30 h.

Is microbial community composition related to the quality of dissolved organic matter in the North Atlantic waters?Rodríguez Ramos, Tamara¹; Guerrero-Feijoo, Elisa²; Nieto Cid, Mar³; Varela Rozados, Marta M.⁴; Guerrero-Feijoo, Elisa⁵; Nieto Cid, Mar⁶; Varela Rozados, Marta M.⁷

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Dissolved organic matter (DOM) constitutes the main substrate and energy source for heterotrophic microorganisms, but the role of DOM quality in shaping microbial communities is quite unknown yet. The aim of this study is to investigate if the diversity and composition of marine microbial communities (Archaea and Bacteria) is related to the optical properties of DOM through the water column (0 – 5000 m), along two transects off the Galicia and Cantabria coasts (Fisterra and Santander sections). Microbial community composition and diversity were determined using Illumina sequencing of the 16S rDNA gene, and DOM optical indices were calculated from fluorescence and absorbance spectra. Cluster analysis showed that overall microbial community composition was not significantly different between Santander and Fisterra; instead, communities changed through the water column and along each transect. Microbial OTU richness increased from coast to open ocean and from surface to deep waters at both sections. In epipelagic waters, microbial communities were associated to protein-like substances (fluorescence peak T), while in meso- and bathy-pelagic zones they were linked to humic-like substances (fluorescence peak M), considered to be photo-labile and bio-refractory. Besides, both fluorescence peaks decreased from coastal to open ocean stations, likely associated to primary production gradients but also to changes in the taxonomic composition and/or in the relative contribution of specific phylotypes to community composition. Taken together, our results suggest a strong link between the optical properties of DOM and the different patterns of diversity for Archaea and Bacteria, providing support for the functional classification of microbial communities.

TS.22-0-9

Room M3, Thursday 7th Feb. 15.45 h.

Effects of introduced fish on Pyrenean high mountain lakes: a DNA metabarcoding approachOsorio, Víctor¹; Puig, Maria Àngels²; Sabás, Ibor³; Buchaca, Teresa⁴; Jo, Hyunbin⁵; Pou-Rovira, Quim⁶; Miró, Alexandre⁷; Lucati, Federica⁸; Caner, Jennifer⁹; Ventura, Marc¹⁰

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Pyrenean high mountain lakes are naturally fishless. However, many of them have been stocked with trout and European minnow (*Phoxinus* sp.). Previous studies have identified these fish introductions as having negative effects on ecosystems and their communities. We applied a COI DNA metabarcoding approach to genetically assess the effects of fish introduction on the composition and structure of macroinvertebrate and zooplankton assemblages. Macroinvertebrate and zooplanktonic samples were collected from 29 and 40 lakes, respectively, in the Catalan Pyrenees, mainly differing on having trout, minnow, presence of both, or being fishless. Gut content samples from 10 minnow and 9 trout individuals, from 7 different lakes, were also analysed in order to directly study invasive fish diet. The OTU richness in most fishless lakes samples was higher than in the other categories. Populations of the most conspicuous invertebrate groups, including the larger ones, clingers, and swimmers, were specially affected by fish presence, and were underrepresented in samples from minnow and trout-containing lakes. Burrower taxa dominated the littoral assemblage of lakes with minnow presence. In contrast, lakes with trout had a littoral assemblage more similar to fishless lakes. Both minnow and trouts exhibited in most cases a generalist diet, preying on zooplankton and aquatic insect taxa. Minnow populations seemed to be under a major intraspecific competition, and gut contents of some individuals included very few prey items.

TS.22-0-10

Room M3, Thursday 7th Feb. 16.00 h.

Relationship between functional and taxonomic diversity of the aquatic microbial communities from lenitic ecosystems from Costa Rica and SpainMiralles Lorenzo, Javier¹; Morant, Daniel²; Picazo, Antonio³; Rochera, Carlos⁴; Castillo, Andreu⁵; Gálvez, Ángel⁶; Rueda, Juan⁷; Sahuquillo, Maria⁸; Bonilla, Fabian⁹; Sasa, Mahmoud¹⁰; Morales, Lylian¹¹; Monrós, Juan¹²; Armengol, Javier¹³; Mesquita, Francesc¹⁴; Camacho, Antonio¹⁵

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In this work we studied the community level physiological profile (CLPP) of the aquatic microbial communities of different Tropical and Mediterranean lagoons located in Costa Rica and the Mediterranean region of Spain, and the relationship between their genetic and their functional diversity. To obtain the metabolic profile, we used Biolog-Ecoplates, a type of multiwell plates which contain 31 different carbon sources and a redox dye. If the aquatic microbial community can metabolize the carbon source, the redox dye will turn blue. Thus, with this method, a specific metabolic profile was obtained for each lagoon. With this profile, the lagoons can be clustered in different types on the basis of their respective carbon sources consumption. On the other hand, the taxonomic diversity was obtained by the extraction of the total DNA of the aquatic microbial communities and the sequencing of the V4 region of the 16S rDNA by MySeq (Illumina). After the filtering of the raw sequences, we obtained the taxonomic diversity of the aquatic microbial communities of each lagoon. The results show that these lagoons can be clustered by their CLPP, and form groups that clearly differ from each other. Also, the taxonomic diversity and community assemblages show differences among the lagoons, which can be related to some environmental variables. Finally, the functional and the genetically-obtained taxonomic diversity of these lagoons showed contrasting patterns of convergence or divergence, demonstrating the complexity of their relationship. This work was supported by the project CLIMAWET (GL2015-69557-R) funded by MINECO and FEDER-EU Funds.

TS.22-O-11

Room M3, Thursday 7th Feb. 16.15 h.

The contribution of proteomic analysis in understanding the mechanisms of nitrogen tolerance in the lichen *Xanthoria parietina*Munzi, Silvana¹; Gouveia, Catarina²; Cruz, Cristina³; Branquinho, Cristina⁴; Varela Coelho, Ana⁵

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The lichen *Xanthoria parietina* is known for being tolerant to environmental nitrogen (N) concentrations that are toxic to many of the other lichen species. Ecological and physiological observations, in the laboratory and in the field, provided evidence that the mechanisms responsible for this tolerance are partially constitutive and partially induced by high availability of N in the environment, that is, some mechanisms are developed by the lichen only when the thalli are grown in N polluted areas. To identify these mechanisms, physiological and proteomics analyses were performed on thalli of *X. parietina* collected in areas with different N availabilities, i.e. a farm hosting 300 cows and a remote area where grazing has been excluded for 20 years. Thalli from the N-rich environment showed a higher content of chitin, a N-containing cellular component considered a potential N-sink, and a higher content in proteins, around 1.5 the amount in thalli from the N-poor environment. The analysis of the proteome revealed that the expression of 17% and 4% of the proteins was up- and downregulated, respectively, in the lichens from the N-rich environment. Changes mostly occurred in proteins involved in the protein synthesis machinery (production, regulation, transport), carbohydrate metabolism and production of stress proteins. The overexpression of proteins responsible for polyamines biosynthesis, tolerance to oxidative stress and energetic metabolism confirmed observations from previous studies. Acknowledgements: SM thanks the Fundação para a Ciência e Tecnologia (FCT) Investigador grant and the FCT project IF/00964/2013.

TS.22-O-12

Room M3, Thursday 7th Feb. 16.30 h.

Unveiling the seasonality of Ciliophora: from the whole community to individual speciesCanals, Oriol¹; Obiol, Aleix²; Massana, Ramón³

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Ciliophora protists are key components of microbial communities in marine ecosystems, playing an essential role as a link between lower and higher trophic levels in the food web. In temperate areas, it has been demonstrated that the community structure of ciliates varies throughout the year, following a strong seasonal pattern, but much less is known about the dynamics at lower taxonomic scales, including well defined groups and individual species. Here, we studied the Ciliophora community of an oligotrophic coastal site in the Mediterranean Sea (Blanes Bay) by using high-throughput sequencing of the 18S rDNA V4 region. The two small-size fractions analyzed (pico- and nanoplankton) were very similar and represented well the Ciliophora diversity in the system, which we divided in 11 taxonomic groups and about 950 species. During the 10-years long period investigated, the Ciliophora community exhibited a marked seasonality, and a recurrent seasonal dynamic was observed for Hypotrichia, Nassophorea and Oligohymenophorea groups. Hypotrichia was exclusively composed by seasonally recurrent species, while Nassophorea, Oligohymenophorea, and the non-seasonal groups were composed by both seasonal and non-seasonal species. Unveiling the taxa driving the seasonal patterns of the Ciliophora community will improve our understanding about its ecology, and will lead to a deeper knowledge of the marine ecosystem dynamics, by determining, for example, the trophic role that these species play and the main factors that influence their population dynamics.

TS.22-O-13

Room M3, Thursday 7th Feb. 16.45 h.

Seasonal dynamics of the marine snow-associated and free-living demethylating bacterial community

Steiner, Paul¹; Sintes, Eva²; Simó, Rafel³; De Corte, Daniele⁴; Pfannkuchen, Daniela Maric⁵; Ivancic, Ingrid⁶; Najdek, Mirjana⁷; Herndl, Gerhard J.⁸

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Marine phytoplankton produce dimethylsulfoniopropionate (DMSP), which, upon release into the ambient water, is mainly degraded by Bacteria either via the DMSP cleavage or demethylation pathway. It has been hypothesized that the extent of DMSP demethylation depends on DMSP availability and bacterial sulfur demand, which could lead to potential niche differentiation of the demethylating bacterial community. In this study, we determined DMSP concentrations in marine snow and the ambient water over a seasonal cycle. Subsequently, we linked these DMSP concentrations to the abundance of Bacteria harboring the *dmdA* gene encoding the enzyme that catalyzes the demethylation reaction. In marine snow, DMSP concentrations were up to four times higher than in the ambient water and three times higher in marine snow in summer than in winter. Certain subclades of demethylating Bacteria were detected only in the ambient water and some of them exhibited strong seasonal dynamics. The demethylating bacterial community in marine snow expressed weaker seasonal dynamics than in the ambient water. The strong correlation of the representative oligotypes of the demethylating bacterial subclades with DMSP concentrations suggest a distinct and fine-tuned niche partitioning among demethylating bacterial subclades. Our results reveal a pronounced seasonal variability and spatial heterogeneity in DMSP concentrations and the associated demethylating bacterial community and point to the occurrence of specific oligotypes with different affinities for DMSP in coastal waters where marine snow is present.

TS.22. Posters

TS.22-P-1

External pavilion, Poster session 2: Wednesday 6th - Thursday 7 th Feb.

Seasonality of the structure and function of the NW Mediterranean coastal microbiomeAuladell Martín, Adrià¹; Ferrera, Isabel²; Logares, Ramiro³; Júnior, Célio Dias Santos⁴; Balagué, Vanessa⁵; Reñé, Albert⁶; Garcés, Esther⁷; Gasol, Josep M⁸

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Disentangling seasonality of marine microbiomes is crucial to unveil patterns of biodiversity, stability, predictability, interactions between species and response to disturbances, including global change. Long-term microbial observatories are thus key to understand microbial variation over time and across environmental gradients, particularly in temperate zones encompassing meteorological seasons. We have used high-throughput sequencing to explore the long term seasonality of microbial communities at the coastal Blanes Bay Microbial Observatory (BBMO) in the NW Mediterranean Sea. In particular, we sequenced 16S rRNA gene amplicons (tags) in monthly samples taken over 10 years to investigate the dynamics of free-living and particle-attached bacterial assemblages. We found that both size-fractions show clear seasonal patterns of alpha diversity with higher richness in fall and winter and that community structure clearly differs both by season and size-fraction, being the former a stronger driver than the latter. Moreover, we observed that both seasonality and lifestyle trends vary depending on taxonomy. In addition, we used metagenomics to examine functional seasonal trends, i.e., the presence of the different functional genes at different seasons. Using the metagenomic data, a full catalog of genes from the coastal ocean has been generated and that has allowed to extract patterns of seasonality of key functional genes in the major marine biogeochemical cycles. The results will be presented at the conference and the potential relevance of the seasonality in structure and function for the ecosystem functioning will be discussed.

TS.22-P-2

External pavilion, Poster session 2: Wednesday 6th - Thursday 7 th Feb.

How to visualize the interaction between a virus and its host in a marine environment?Castillo, Yaiza Mercedes¹; Sebastián, Marta²; Forn, Irene³; Grimsley, Nigel⁴; Yau, Sheree⁵; Sà, Elisabet Laia⁶; Lara, Elena⁷; Moraru, Cristina⁸; Vaqué, Dolores⁹

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Marine viruses are the most abundant entities (107 viruses mL⁻¹) and the main reservoir of genomic diversity in the oceans. They are key players in the marine microbial food webs, controlling the abundances and shaping the diversity of microbes, and thus impacting the biogeochemical cycles. Several questions have arisen since the discovery of the relevance of viruses in the marine environment: who are they? How many are there? and especially, who infects whom? Nowadays, it is possible to count the viral abundances (e.g. through flow cytometry, epifluorescence microscopy, etc.), but there is still a large gap on knowing who infects whom. Although the development of high throughput sequencing gives information on viral diversity and potential hosts, it is difficult to visualize each specific virus-host interaction. With that goal in mind, we are currently working with a technique called VirusFISH (Virus Fluorescent in situ Hybridization). With this technique, we are able to visualize, thanks to fluorescence microscopy, the interactions between viruses and their eukaryotic hosts at different stages over time. Also, we are able to detect and count a specific virus within the natural community. How does it work? We design and synthesize several fluorescently labeled probes (~10 DNA molecules of 300bp length each), that will specifically attach to the genome of our virus of interest. Thus, we can monitor the timing and magnitude of infections in natural microbial communities, and understand the impact of the virus in the abundance and function of its host.

TS.22-P-4

External pavilion, Poster session 2: Wednesday 6th - Thursday 7 th Feb.

Quantitative metabarcoding in the future: shotgun metagenomics of insects with sequenced genomesGarrido Sanz, Lidia¹; Piñol Pascual, Josep²; Senar Rosell, Miquel Àngel³

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DNA metabarcoding is a technique used for biodiversity assessment, yet doubts remain about whether it can provide quantitative results. The processes leading from the extracted DNA to the relative species abundance are affected by many biases, the most important one being the PCR amplification step using 'universal' primers targeting certain genomic regions. Universal primers do not perfectly match the DNA of all species and, consequently, enrichment is not performed equitably; so, the proportions in the final mixture do not mirror the original proportion of each species in the sample. Avoiding the PCR step (shotgun metagenomics) may provide a genuine biomass-reads relationship and, consequently, reproduce the original relative abundance of each species in the mixture; but, in eukaryotes, the scarcity of assembled genomes makes the technique still unsuitable. We simulate a future time, when the entire genome of most of species would be sequenced, to implement a metagenomic methodology followed by a quantitative molecular-based identification algorithm, while testing the assumption that shotgun metagenomics can be used to obtain the relative abundance of all species in mixtures. Here six different mock mixtures of insects' DNA, whose genomes are available at RefSeq database, were directly sequenced (PCR-free) and used to estimate the original proportion of each species in samples. Our results showed that we could quantify with confidence the relative abundance of species in complex mixtures ($r > 0.96$). This highlights that, when most eukaryotic genomes were assembled, it would be possible to use PCR-free, shotgun metagenomics for the large-scale biodiversity assessments.

TS.22-P-5

External pavilion, Poster session 2: Wednesday 6th - Thursday 7 th Feb.

Using high-throughput DNA sequencing of spider and earwig gut contents to evaluate intraguild predation and pest control potential in citrusMestre, Laia¹; Romeu-Dalmau, Carla²; Agustí, Núria³; Barrientos, José Antonio⁴; Espadaler, Xavier⁵; Symondson, William O. C.⁶; Piñol, Josep⁷

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Generalist predators provide biological control services on farmland, but also consume alternative prey and engage in intraguild predation. For a better assessment of their pest control potential, field data on the species-specific composition and seasonal variability of the diets of generalist predators is required. We focused on four spiders and two earwig species living in tree canopies in an organic citrus grove in Catalonia (NE Spain) and sampled them periodically between May and October to encompass the spring and summer aphid peaks of one year. We pooled individual samples after DNA extraction, PCR-amplified them with a general primer pair for arthropods, and massively sequenced the product using an Ion Torrent PGM. Predator sequences were discarded bioinformatically and the rest were blasted against a genomic database of species including the most common pest and natural enemies that co-occur at the study site. Earwig (*Forficula*) diets were composed almost exclusively by aphids (*Aphis spiraecola*), although *F. auricularia* also fed on coccinellids (*Scymnus subvillosus*), and *F. pubescens* on barkflies (*Trichopsocus clarus*). Spider diets were highly distinct: *Xysticus* spp. was basically feeding on *A. spiraecola*, which was also detected in *Philodromus cespitum*. Still, *P. cespitum* mainly fed on *T. clarus* as alternative prey, just like *Clubiona leucaspis*. *Theridion* spp. consumed high proportions of coccinellids (*Rodolia cardinalis*). Our results show that both spiders and earwigs have marked dietary preferences despite the wide spectrum of prey available, thereby differing in their biocontrol potential for aphids.

TS.22-P-6

External pavilion, Poster session 2: Wednesday 6th - Thursday 7 th Feb.

Prokaryotic diversity and community structure revision of metagenomics data in Spanish wetlandsPicazo, Antonio¹; Rochera, Carlos²; Miralles-Lorenzo, Javier³; Morant, Daniel⁴; Camacho, Antonio⁵

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Concepts like biodiversity or community structure are basic topics in ecology, with a large literature and conceptually well established. However, when these classical notions have been applied to abundant data (in cases like bacteria and archaea), results do not come close to reality. So, a new conceptual and non-technical approach should be developed within the new metagenomics reality. Despite the fact that the best option is to analyze the full 16S sequence, nowadays it is not technically and economical viable in routine analysis. Therefore, over the past decade, high-throughput short-read 16S rRNA gene amplicon sequencing has eclipsed clone-dependent long-read Sanger sequencing for microbial community profiling. In this work we studied water and sediment diversity and community structure of 9 wetlands (saline lakes and coastal freshwater marshes). We carried out two different metagenomic analysis of V1-V3 16S region and Miseq 2x250 illumina of V4 region. We explored biodiversity and community structure results between the different types of studied ecosystems with the two analysis developed. Results showed differences in the ecological parameters defined as well as the strength of each metagenomic method at different taxonomic levels. We concluded that V4 is a better option for community structural analysis, whereas V1-V3 is a better option for biodiversity analysis. This work was supported by the project CLIMAWET (GL2015-69557-R) funded by MINECO and FEDER-EU Funds.

TS.22-P-7

External pavilion, Poster session 2: Wednesday 6th - Thursday 7 th Feb.

From DNA sequence reads to roots biomass in belowground: correcting biases in DNA metabarcoding studiesSánchez Pescador, David¹; Matesanz, Silvia²; Illuminati, Angela³; Chacón-Labela, Julia⁴; de la Cruz, Marcelino⁵; Sánchez, Ana M.⁶; Pias, Beatriz⁷; López-Angulo, Jesús⁸; Díaz, Carlos⁹; Escudero, Adrián¹⁰

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Recent advances in DNA metabarcoding using high-throughput genomic tools open new opportunities to characterise simultaneously different groups of organisms (e.g. microorganisms) or parts of them (e.g. plants roots). Nevertheless, quantifying relative abundances through DNA sequence reads currently represents a bottleneck inherent to the very nature of the biologic samples and the technique itself. Conducting an experiment with five plant species (*Bupleurum fruticosum*, *Helianthemum cinereum*, *Linum suffruticosum*, *Stipa pennata* and *Thymus vulgaris*) and sequencing pairwise mixtures with known root mass (mock communities) in different proportions (20/80, 50/50 and 80/20), we assessed whether proportions of DNA sequences reads matched the proportion of mass added or whether application of a relative correction factor (RCF) by specie and/or by proportion was necessary. In general, the proportion of DNA sequence reads did not accurately enough match the proportion of root mass added, and consequently, application of RCFs was necessary to account for sources of bias. Mean RCFs differed among species and proportions and ranged from 0.14 (for *H. cinereum* at 80%) to 44.1 (for *S. pennata* at 20%). To verify the validity of RCFs improving relative abundance estimates, we applied the estimated RCFs in five-species mixtures with known root mass. When we used the specific 50/50 mean RCFs, the proportion of DNA sequences reads accurately predicted the proportion of roots mass added in each case. These results indicate that a correction factor approach represents a useful tool for correcting biases in DNA metabarcoding studies and quantifying relative species abundances by sampling roots in the soil.

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ALMARAZ, PABLO	GS.03-0-2 Tue 12:15
ALMEIDA ALEIXO, CRISTIANA	TS.10-0-21 Thu 16:00
ALMEIDA, SALOME FP	TS.11-0-5 Wed 13:15
ALOMAR, DAVID	TS.10-0-11 Wed 19:15
ALONSO SAEZ, LAURA	TS.22-MT-1 Thu 12:00
ALONSO, CONCHITA	TS.07-MT-1 Wed 12:00
ALONSO, DAVID	GS.05-0-2 Tue 12:15; TS.11-0-2 Wed 12:30; GS.01-0-9 Tue 16:30; GS.05-0-12 Wed 12:15
ALONSO, MIGUEL	GS.02-P-9 Mon-Tue; GS.01-P-3 Mon-Tue
ALONSO-BLANCO, CARLOS	TS.07-P-7 Wed-Thu
ALOS, JOSEP	TS.17-0-9 Tue 16:45; TS.17-0-6 Tue 16:00
ALVAREZ DEL RIO, MIGUEL	GS.02-0-2 Tue 12:15
ALVAREZ GONZALEZ, JUAN GABRIEL	TS.09-P-2 Mon-Tue
ALVAREZ LOSADA, OSCAR	TS.02-P-2 Mon-Tue
ALVAREZ RUIZ, LOLA	TS.07-P-1 Wed-Thu
ALVAREZ TRONCOSO, ROMINA	TS.02-P-3 Mon-Tue
ALVAREZ, ALBERT	GS.04-0-2 Thu 12:15
ALVAREZ, JOSEP	GS.02-0-11 Tue 18:00
ALVAREZ, MARTA	GS.05-0-7 Tue 16:00
ALVAREZ, PABLO	GS.03-P-12 Wed-Thu
ALVAREZ-COBELAS, MIGUEL	TS.13-0-1 Tue 18:00
ALVAREZ-GARRIDO, LUCIA	TS.10-0-7 Wed 18:15
ALVAREZ-MARTINEZ, JOSE MANUEL	TS.12-0-4 Tue 19:00; GS.04-0-12 Thu 16:15; GS.04-0-11 Thu 16:00
ALVAREZ-RODRIGUEZ, ESPERANZA	TS.21-P-2 Mon-Tue
ALVAREZ-SALGADO, XOSE ANTON	TS.03-0-5 Wed 13:15; GS.05-0-7 Tue 16:00
ALVES-MARTINS, FERNANDA	GS.03-P-3 Wed-Thu
AMAT, JUAN A.	GS.05-0-21 Wed 19:00
AMBROSO, STEFANO	TS.18-0-7 Tue 19:30
AMETZAGA, IBONE	GS.04-0-4 Thu 12:45
AMEZTEGUI, AITOR	GS.04-0-3 Thu 12:30; TS.08-0-4 Thu 12:45
AMOUROUX, DAVID	TS.21-0-14 Wed 18:00
ANADON-ROSELL, ALBA	TS.09-0-7 Tue 16:15; TS.02-P-17 Mon-Tue; TS.06-0-11 Tue 18:30
ANDIVIA, ENRIQUE	TS.11-P-1 Wed-Thu; GS.03-P-3 Wed-Thu; TS.11-0-4 Wed 13:00; TS.11-P-9 Wed-Thu
ANDRADE, PEDRO	GS.01-P-5 Mon-Tue
ANDRES PASTOR, PILAR	GS.04-0-13 Thu 16:30
ANDREU, VICENTE	TS.06-0-3 Tue 12:45
ANEVA, INA	TS.19-0-7 Thu 15:15
ANSARI, MOHD I.	GS.05-0-10 Tue 16:45
ANTON GAMAZO, ANDREA	GS.02-P-8 Mon-Tue
ANTUNES, AGOSTINHO	TS.07-0-12 Thu 12:00; TS.07-0-12 Thu 12:00
ANZA, MIKEL	GS.05-P-4 Wed-Thu
APARICIO CAMIN, NURIA	TS.02-0-29 Thu 16:30
APEL, CHRISTINA	TS.21-P-1 Mon-Tue
APONTE, CRISTINA	GS.03-P-3 Wed-Thu
AQUILUE, NURIA	GS.03-0-18 Wed 18:30
AQUINO-ALFONSO, OLGA	TS.15-0-9 Tue 16:45
ARAGON, GREGORIO	TS.10-P-7 Wed-Thu; GS.01-0-3 Tue 12:30
ARAGON, PEDRO	TS.12-P-2 Mon-Tue
ARAUJO, MIGUEL B.	GS.03-0-29 Thu 15:15; TS.05-0-3 Thu 12:45; TS.02-0-16 Wed 18:30; GS.01-0-10 Tue 16:45
ARBONES, BELEN	TS.18-0-1 Tue 18:00
ARDANUY, AGNES	GS.01-0-6 Tue 13:15
ARELLANO, GOZALO	TS.08-0-12 Thu 16:15
ARENAS, SALVADOR	TS.10-0-15 Thu 13:00

ARGUDO FERNANDEZ, MARIA	GS.05-P-2 Wed-Thu
ARI NORIEGA, JORGE	GS.03-P-3 Wed-Thu
ARIAS DEL REAL, REBECA	TS.02-O-12 Wed 13:00
ARIAS-ESTEVEZ, MANUEL	TS.21-P-2 Mon-Tue; TS.21-O-18 Wed 19:00; TS.21-P-7 Mon-Tue
ARIN, LAURA	GS.05-P-3 Wed-Thu; TS.03-O-8 Wed 18:30; GS.03-O-31 Thu 15:45; GS.05-P-11 Wed-Thu; TS.16-P-3 Mon-Tue
ARISTA, MONTSERRAT	TS.07-P-9 Wed-Thu
ARISTEGUI, JAVIER	GS.05-O-5 Tue 13:00; GS.05-O-7 Tue 16:00
ARMAS KULIK, CRISTINA	TS.14-P-1 Mon-Tue
ARMAS, CRISTINA	GS.05-O-13 Wed 12:30
ARMENGOL, JAVIER	GS.02-P-9 Mon-Tue; TS.22-O-10 Thu 16:00; TS.04-O-8 Wed 18:30
ARNAN, XAVIER	GS.03-O-6 Tue 13:15; TS.10-P-8 Wed-Thu; GS.03-P-3 Wed-Thu
ARNEDO, MIQUEL	TS.14-O-14 Tue 19:00; TS.22-O-5 Thu 13:15
ARNELAS, ITZIAR	TS.04-O-3 Wed 12:45
ARNOLDI, JEAN-FRANCOIS	TS.08-O-3 Thu 12:30
ARNTZ, WOLF E.	TS.18-O-2 Tue 18:15
ARRIBAS, PAULA	TS.02-P-1 Mon-Tue
ARRONDO, ENEKO	TS.17-O-8 Tue 16:30
ARRONTES JUNQUERA, JULIO	TS.02-P-2 Mon-Tue
ARROYO, JUAN	TS.15-O-2 Tue 12:30
ARROYO, LUIS	TS.07-O-8 Wed 18:30
ARTHUR, ROHAN	GS.01-O-9 Tue 16:30; TS.11-O-2 Wed 12:30; TS.17-O-4 Tue 13:00
ARTIGAS, JOAN	TS.14-O-17 Tue 19:45
ASENSIO, DOLORES	TS.04-O-5 Wed 13:15
ASPILLAGA, ENEKO	TS.02-O-2 Tue 18:30; TS.02-P-10 Mon-Tue; TS.02-P-10 Mon-Tue
ASSIS, JORGE	TS.11-MT-1 Wed 12:00
ASTARLOA, AMAIA	TS.05-O-12 Thu 16:30
ASTIGARRAGA, JULEN	TS.11-O-4 Wed 13:00
ATER, MOHAMMED	GS.01-P-9 Mon-Tue
ATRISTAIN, MIREN	TS.21-O-1 Tue 18:00; TS.06-O-10 Tue 18:15
AULADELL, ADRIA	TS.22-P-1 Wed-Thu; TS.22-O-6 Thu 15:00; TS.22-O-6 Thu 15:00
AURELIE, DUFOUR	TS.21-O-10 Wed 12:15
AVILA CASTELLS, ANNA	TS.01-O-4 Tue 12:45
AVILA, JOSE MANUEL	TS.14-O-4 Tue 13:00; TS.20-O-6 Tue 19:30
AVILES, JESUS MIGUEL	GS.03-O-19 Wed 18:45; TS.07-O-7 Wed 18:15
AZCARATE, FRANCISCO MARTIN	GS.03-P-17 Wed-Thu
AZCON-AGUILAR, CONCEPCION	TS.14-P-6 Mon-Tue
AZZURRO, ERNESTO	TS.11-O-16 Thu 15:00

B

BADENHAUSSER, ISABELLE	TS.05-O-10 Thu 16:00
BAHN, MICHAEL	TS.11-P-4 Wed-Thu
BAIXERAS, JOAQUIN	TS.18-O-5 Tue 19:00
BAL, MARIE-CLAUDE	TS.15-P-2 Mon-Tue
BALAGUE, VANESSA	GS.05-P-3 Wed-Thu; GS.05-P-10 Wed-Thu; TS.22-P-1 Wed-Thu
BALDO, LAURA	GS.05-O-18 Wed 18:15
BALESTRIERI, ALESSANDRO	TS.07-P-4 Wed-Thu
BALLEN-SEGURA, MIGUEL ANGEL	GS.05-O-19 Wed 18:30
BALLESTE, ELISENDA	TS.21-O-8 Tue 19:45
BALLESTEROS, ENRIC	GS.03-P-8 Wed-Thu; TS.21-O-12 Wed 12:45; TS.11-O-15 Thu 13:15; GS.02-O-13 Tue 18:30; TS.11-P-3 Wed-Thu
BALLESTEROS-CANOVAS, JUAN ANTONIO	GS.03-P-3 Wed-Thu
BAMBI, PAULINO	TS.03-O-7 Wed 18:15
BANARU, DANIELA	TS.21-O-10 Wed 12:15
BANQUE, MIREIA	TS.12-P-1 Mon-Tue; GS.04-O-1 Thu 12:00
BANZA, JOÃO	TS.03-O-9 Wed 18:45

BAÑARES-DE DIOS, GUILLERMO	TS.04-0-3 Wed 12:45
BAÑERAS, LLUIS	GS.05-0-3 Tue 12:30
BARAÑANO, CARLOTA	GS.03-P-1 Wed-Thu
BARAZA, ELENA	GS.02-P-3 Mon-Tue
BARBA, JOSEP	TS.03-0-3 Wed 12:45; TS.03-0-9 Wed 18:45
BARBARO, LUC	GS.03-0-17 Wed 18:15
BARBERA, GONZALO	TS.01-0-6 Tue 13:15
BARBETA, ADRIA	TS.09-0-5 Tue 13:15; TS.10-0-23 Thu 16:30
BARBIER, MATTHIEU	GS.03-0-8 Tue 16:15
BARCELO, ANNA	TS.11-0-7 Wed 18:15
BARCELO, DAMIA	TS.21-0-2 Tue 18:15
BARCELONA, AINA	TS.11-P-2 Wed-Thu
BARDGETT, RICHARD D.	TS.14-0-6 Tue 16:00
BARLUENGA, MARTA	GS.05-0-18 Wed 18:15
BARQUIN, JOSE	GS.04-0-11 Thu 16:00; TS.12-0-4 Wed 18:15; TS.02-0-15 Wed 18:15; GS.04-0-12 Thu 16:15
BARRADO, MIREN	TS.21-0-1 Tue 18:00
BARRANTES, OLIVIA	GS.03-P-13 Wed-Thu
BARREIRO FELPETO, ALDO	GS.03-0-16 Wed 18:00
BARRIENTOS, JOSE ANTONIO	TS.22-P-5 Wed-Thu
BARRON, EDUARDO	TS.15-0-2 Tue 12:30
BARTOLOME, JORDI	GS.02-P-3 Mon-Tue; GS.03-0-30 Thu 15:30
BARTOMEUS, IGNASI	GS.03-0-34 Thu 16:30
BARTRONS, MIREIA	TS.21-0-11 Wed 12:30; GS.03-0-4 Tue 12:45; TS.14-0-14 Tue 19:00
BARTUMEUS, FREDERIC	GS.02-0-5 Tue 13:00; TS.17-P-4 Mon-Tue; TS.17-P-2 Mon-Tue
BAS, MARIA	GS.03-0-28 Thu 15:00; TS.06-MT-1 Tue 12:00
BASAGUREN, ANA	TS.14-0-16 Tue 19:30
BASCOMPTE, JORDI	PT-8 Thu 10:00
BASTIAS, CRISTINA C.	GS.03-P-12 Wed-Thu; TS.10-P-2 Wed-Thu
BASTIAS, ELLIOT	TS.06-0-4 Tue 13:00; TS.01-0-6 Tue 13:15
BASTIDA, FERNANDO	TS.19-0-12 Thu 16:30
BASTIEN, CARRE	TS.21-0-10 Wed 12:15
BATALLA, MERITXELL	TS.15-MT-1 Tue 12:00
BATANERO, GEMA L.	GS.05-0-21 Wed 19:00
BATARY, PETER	TS.19-0-10 Thu 16:00
BATLLORI, ENRIC	TS.20-0-2 Tue 18:30; TS.20-P-2 Mon-Tue
BATRIU, EFREM	TS.02-P-17 Mon-Tue
BAUSA, MARTA	TS.11-0-8 Wed 18:30
BEGER, MARIA	TS.07-P-2 Wed-Thu
BEIER, CLAUS	TS.03-0-6 Wed 18:00; TS.14-0-14 Tue 19:00
BELINCHON OLMENDA, ROCIO	GS.03-0-1 Tue 12:00
BELLIDO, JOSE MARIA	TS.11-P-8 Wed-Thu; TS.11-0-9 Wed 18:45
BELLIURE, JOSABEL	TS.07-P-1 Wed-Thu
BELLOT, JUAN	TS.08-0-14 Thu 16:45
BENAVIDES, RAQUEL	TS.10-0-13 Thu 12:30; TS.10-P-2 Wed-Thu; TS.07-0-5 Wed 13:15; TS.10-P-3 Wed-Thu
BENESPERI, RENATO	GS.01-0-3 Tue 12:30
BENGOA, MIKEL	GS.02-0-5 Tue 13:00
BENITEZ-MALVIDO, JULIETA	TS.05-0-13 Thu 16:45
BENITO, BLAS M	TS.15-0-6 Tue 16:00
BENNASAR FIGUERAS, ANTONI	GS.05-P-5 Wed-Thu
BENNETT, SCOTT	TS.11-0-13 Thu 12:45; TS.11-0-18 Thu 15:30
BENOÎT, LEBRETON	TS.21-0-10 Wed 12:15
BENTO, CELIA	TS.21-P-1 Mon-Tue
BERAUER, BERND	TS.11-P-4 Wed-Thu

BERDALET, ELISA	TS.18-0-3 Tue 18:30; GS.03-0-31 Thu 15:45; GS.05-P-11 Wed-Thu; GS.02-0-11 Tue 18:00
BERG, BJÖRN	TS.03-0-6 Wed 18:00
BERNAL, SUSANA	TS.01-0-1 Tue 12:00; TS.06-0-4 Tue 13:00; TS.03-P-1 Wed-Thu; TS.13-0-6 Tue 19:15; TS.01-0-5 Tue 13:00
BERNARDO, RUBEN	GS.03-P-3 Wed-Thu
BERTRAND, ISABELLE	TS.14-0-3 Tue 12:45
BEUSEN, ARTHUR	TS.01-0-3 Tue 12:30
BIANCHI, ELISABETTA	GS.01-0-3 Tue 12:30
BISHOP, KEVIN H.	TS.01-0-2 Tue 12:15
BJARNI, SIGURDSSON	TS.14-0-9 Tue 16:45
BLACKFORD, JEREMY	GS.03-0-9 Tue 16:30
BLANCH, ANICET	TS.21-0-8 Tue 19:45
BLANCHET, SIMON	TS.06-0-10 Tue 18:15
BLANCO, JUAN A.	GS.03-P-19 Wed-Thu
BLANCO, LIDIA	TS.19-0-3 Thu 12:45
BLANCO-MORENO, JOSE MANUEL	TS.19-0-10 Thu 16:00; TS.19-P-3 Wed-Thu; TS.19-0-4 Thu 13:00
BLANCO-SANCHEZ, MARIO	TS.10-0-4 Wed 13:00; TS.07-P-8 Wed-Thu
BLASCO, DOLORS	TS.18-0-3 Tue 18:30
BLENDINGER, PEDRO G.	GS.03-0-11 Wed 12:15
BLOMBERG, SIMON P.	TS.07-P-2 Wed-Thu
BOADA, JORDI	TS.11-0-2 Wed 12:30
BOBERG, JOHANNA	GS.02-0-12 Tue 18:15
BOCHET, ESTHER	TS.11-0-20 Thu 16:00
BODE, ANTONIO	GS.05-P-14 Wed-Thu
BODEGA, GUILLERMO	TS.06-P-1 Mon-Tue
BÖHNING-GAESE, KATRIN	GS.03-0-11 Wed 12:15
BOHORQUEZ, JULIO	GS.05-P-7 Wed-Thu; GS.05-0-15 Wed 13:00; GS.05-P-13 Wed-Thu
BOIEIRO, MARIO	TS.05-P-1 Wed-Thu; TS.10-0-21 Thu 16:00
BOIX, DANI	TS.06-MT-1 Tue 12:00; GS.03-0-28 Thu 15:00
BONADA, NURIA	TS.02-0-11 Wed 12:45; TS.02-0-13 Wed 13:15; GS.01-0-12 Wed 12:15; TS.02-0-15 Wed 18:15; TS.02-0-10 Wed 12:30
BONELLO, PIERLUIGI ENRICO	TS.07-0-24 Thu 16:30
BONET, ANDREU	TS.06-P-6 Mon-Tue
BONET, FRANCISCO JAVIER	GS.03-0-12 Wed 12:30; TS.02-P-6 Mon-Tue
BONET, JOSE ANTONIO	GS.05-0-14 Wed 12:45
BONILLA, FABIAN	TS.04-0-8 Wed 18:30; TS.22-0-10 Thu 16:00
BONILLA-ROSS, GERMAN	GS.05-0-20 Wed 18:45
BONKOWSKI, MICHAEL	GS.03-0-3 Tue 12:30
BOOKWALTER, JAMIE	TS.02-P-5 Mon-Tue
BOQUETE SEOANE, MARIA TERESA	TS.10-P-1 Wed-Thu
BORATYŃSKI, ADAM	TS.04-P-2 Wed-Thu
BOREUX, VIRGINIE	TS.10-P-8 Wed-Thu
BORGES, PAULO	TS.02-MT-1 Tue 18:00; TS.05-P-1 Wed-Thu
BORGHETTI, MARCO	TS.20-P-1 Mon-Tue
BORG-KARLSON, ANNA KARIN	TS.07-0-24 Thu 16:30
BORJA, ANGEL	TS.15-0-5 Tue 13:15
BORRAS, ANTONI	TS.02-0-25 Thu 15:30
BORREGO, CARLES	GS.05-0-22 Wed 19:15; TS.21-0-4 Tue 18:45
BOSCH, JORDI	GS.03-0-6 Tue 13:15; TS.05-0-8 Thu 15:30; TS.10-P-8 Wed-Thu
BOTA, GERARD	GS.04-0-5 Thu 13:00
BOTELLA, FRANCISCO	TS.07-0-21 Thu 15:45; TS.02-0-26 Thu 15:45
BOU, JORDI	GS.03-P-2 Wed-Thu
BOUCHET, SYLVAIN	TS.21-0-14 Wed 18:00
BOUKCIM, HASSAN	TS.14-0-3 Tue 12:45
BOURGUET, DENIS	GS.04-0-7 Thu 15:00

BOUTEN, WILLEM	TS.17-0-3 Tue 12:45; TS.17-P-3 Mon-Tue
BOUWMAN, LEX	TS.01-0-3 Tue 12:30
BOYERO, LUZ	TS.03-0-7 Wed 18:15; TS.14-0-16 Tue 19:30
BOYRA, GUILLERMO	TS.05-0-12 Thu 16:30
BOY-ROURA, MERCE	TS.21-0-4 Tue 18:45
BRACHERT, THOMAS	TS.11-0-19 Thu 15:45
BRANQUINHO, CRISTINA	GS.03-P-11 Wed-Thu; TS.10-P-1 Wed-Thu; GS.01-P-11 Mon-Tue; TS.22-0-11 Thu 16:15; TS.10-P-5 Wed-Thu; TS.07-0-22 Thu 16:00; TS.10-0-21 Thu 16:00
BRAUNS, MARIO	TS.21-0-3 Tue 18:30
BRAVO, ANDREA G.	TS.21-0-17 Wed 18:45
BRERETON, TOM	TS.08-0-2 Thu 12:15
BRETAGNOLLE, VINCENT	TS.19-0-6 Thu 15:00
BRIGIDO GARCIA, CONSUELO CARMEN	GS.01-P-9 Mon-Tue
BRODERSEN, KASPER E.	GS.05-P-7 Wed-Thu
BROENNIMANN, OLIVIER	TS.08-0-9 Thu 15:30
BROOKER, ROB W.	GS.03-0-5 Tue 13:00
BROTONS, LLUIS	GS.03-0-18 Wed 18:30; TS.08-0-11 Thu 16:00; TS.02-0-14 Wed 18:00; GS.04-0-3 Thu 12:30
BRUCET, SANDRA	GS.03-0-4 Tue 12:45; TS.21-0-11 Wed 12:30
BRUGGEMAN, JORN	GS.03-0-9 Tue 16:30
BRUNO, DANIEL	TS.06-0-7 Tue 16:15; TS.07-P-4 Wed-Thu
BUATOIS, BRUNO	TS.14-0-5 Tue 13:15
BUCETA, MIKEL	TS.21-0-3 Tue 18:30
BUCHACA, TERESA	GS.02-0-13 Tue 18:30; GS.03-P-8 Wed-Thu; TS.22-0-9 Thu 15:45; TS.06-P-3 Mon-Tue; TS.06-0-9 Tue 18:00; TS.06-0-8 Tue 16:30
BUEE, MARC	TS.14-P-6 Mon-Tue
BUGALHO, MIGUEL N.	TS.03-0-9 Wed 18:45
BUGMANN, HARALD	TS.20-0-4 Tue 19:00
BUIDE DEL REAL, MARIA LUISA	TS.07-0-25 Thu 16:45
BÜNTGEN, ULF	GS.03-0-30 Thu 15:30
BUÑUEL MORENO, XAVI	TS.17-0-4 Tue 13:00
BURJACHS, FRANCESC	TS.15-P-2 Mon-Tue
BURRACO, PABLO	TS.07-0-11 Wed 19:15

C

CABALLERO, BERTA	TS.19-P-3 Wed-Thu; TS.02-P-5 Mon-Tue
CABELLO, JAVIER	TS.02-P-6 Mon-Tue; TS.10-0-19 Thu 15:30; TS.16-P-1 Mon-Tue
CABON, ANTOINE	TS.09-0-8 Tue 16:30
CABOT, JOSEP	TS.02-0-25 Thu 15:30
CABRERA BRUFAU, MIGUEL	TS.03-0-8 Wed 18:30
CABRERA, JOSEP	TS.02-0-25 Thu 15:30
CACERES, GUSTAVO	TS.21-0-5 Tue 19:00
CAETANO, CRISTINA	TS.09-P-1 Mon-Tue; TS.02-0-21 Thu 12:30
CAILLERET, MAXIME	TS.20-0-4 Tue 19:00
CAIOLA, NUNO	GS.03-0-13 Wed 12:45
CALATAYUD, JOAQUIN	GS.03-P-3 Wed-Thu; TS.11-P-9 Wed-Thu
CALDEIRA, MARIA C.	TS.03-0-9 Wed 18:45
CALDERO PASCUAL, MARIA	GS.03-P-4 Wed-Thu
CALIZ, JOAN	GS.05-0-12 Wed 12:15; TS.11-0-7 Wed 18:15; GS.05-0-17 Wed 18:00
CALLEJA, JUAN ANTONIO	GS.03-0-30 Thu 15:30; TS.05-0-8 Thu 15:30
CALLEJA, JUANCHO	TS.10-P-1 Wed-Thu; GS.03-0-6 Tue 13:15
CALLEJA, MARIA L.	GS.05-0-10 Tue 16:45
CALVILLO, ESTEFANIA	TS.19-P-2 Wed-Thu
CAMACHO, ANTONIO	TS.16-0-3 Tue 18:45; TS.01-P-1 Mon-Tue; TS.04-0-8 Wed 18:30; TS.22-P-6 Wed-Thu; TS.12-P-4 Mon-Tue; TS.03-0-2 Wed 12:30; TS.01-0-7 Tue 16:00; TS.22-0-10 Thu 16:00

CAMARERO, J. JULIO	TS.20-MT-1 Tue 18:00; TS.20-P-1 Mon-Tue; TS.02-O-21 Thu 12:30; TS.20-P-3 Mon-Tue; TS.20-O-5 Tue 19:15; TS.09-O-5 Tue 13:15; TS.09-O-2 Tue 12:30; TS.09-O-3 Tue 12:45; TS.09-P-2 Mon-Tue
CAMARERO, LLUIS	GS.05-O-17 Wed 18:00; TS.02-P-20 Mon-Tue; TS.01-O-4 Tue 12:45; GS.05-O-20 Wed 18:45
CAMBROLLE, JESUS	TS.10-O-17 Thu 15:00
CAMEJO, ADRIANA	TS.15-O-9 Tue 16:45
CAMPILLO-CORA, CLAUDIA	TS.21-O-18 Wed 19:00
CAMPO, JULIAN	TS.06-O-3 Tue 12:45
CAMPOS CANDELA, ANDREA	TS.17-O-6 Tue 16:00
CAMPOS, DANIEL	TS.17-P-2 Mon-Tue
CANALS, ORIOL	TS.22-O-12 Thu 16:30
CANDEL-PEREZ, DAVID	GS.03-P-19 Wed-Thu
CANELLES TRABAL, QUIM	GS.03-O-18 Wed 18:30
CANER, JENNY	TS.22-O-9 Thu 15:45; TS.06-O-9 Tue 18:00; GS.02-O-5 Tue 13:00
CANHA PINTO HESPAHOL, HELENA	GS.02-O-18 Tue 19:45
CANO ROCABAYERA, ORIOL	TS.21-O-5 Tue 19:00
CANO, CARLOS	GS.02-O-10 Tue 16:45
CAÑEDO-ARGÜELLES, MIGUEL	TS.02-O-15 Wed 18:15; GS.01-P-4 Mon-Tue; TS.02-O-10 Wed 12:30; TS.02-O-11 Wed 12:45; TS.02-O-13 Wed 13:15; TS.02-O-11 Wed 12:45
CAÑELLAS, ISABEL	TS.09-P-5 Mon-Tue
CAÑELLAS-BOLTA, NURIA	TS.15-O-3 Tue 12:45
CAO, ANXO	GS.02-P-2 Mon-Tue; GS.02-O-7 Tue 16:00; GS.02-P-4 Mon-Tue
CAPARROS, JOCELYNE	TS.03-O-11 Wed 19:15
CAPDEVILA, POL	TS.07-P-2 Wed-Thu; TS.02-O-2 Tue 18:30; TS.02-P-10 Mon-Tue
CAPILLA, MIGUEL	TS.21-O-17 Wed 18:45
CAPITAN, JOSE A.	GS.01-O-9 Tue 16:30; GS.05-O-2 Tue 12:15
CAPLAT, PAUL	TS.14-O-7 Tue 16:15; TS.14-O-7 Tue 16:15
CAPO SERVERA, MIQUEL	GS.02-P-3 Mon-Tue
CARABASSA, VICENÇ	TS.06-O-3 Tue 12:45
CARAZO, PAU	TS.07-O-18 Thu 15:00; TS.07-O-10 Wed 19:00
CARBONE, MARIAH	TS.03-O-9 Wed 18:45
CARDONA, CARLES	GS.02-P-3 Mon-Tue
CARMONA, CARLOS P.	GS.03-O-3 Tue 12:30
CARMONA, MARIA JOSE	TS.07-O-4 Wed 13:00; TS.07-O-17 Thu 13:15
CARNICER, JOFRE	TS.11-O-17 Thu 15:15; TS.11-O-17 Thu 15:15
CARRARA, ARNAUD	TS.03-O-9 Wed 18:45
CARRASCO BAREA, LORENA	TS.14-P-2 Mon-Tue
CARREIRA, JOSE A.	TS.14-O-2 Tue 12:30; TS.10-O-7 Wed 18:15
CARRILLO, EMPAR	TS.02-O-4 Tue 19:00; TS.06-O-11 Tue 18:30; TS.02-P-17 Mon-Tue
CARRILLO, LAURA	TS.16-P-3 Mon-Tue
CARRION, JOSE	TS.15-P-1 Mon-Tue; TS.15-O-2 Tue 12:30
CARRIQUI, MARC	TS.10-O-22 Thu 16:15
CARRO-MARTINEZ, NOELIA	TS.11-P-1 Wed-Thu
CARVALHO, BARBARA	TS.10-P-2 Wed-Thu; TS.10-P-3 Wed-Thu
CARVALHO, GABRIEL MARTINS	TS.04-O-3 Wed 12:45
CASADO, A	TS.11-O-17 Thu 15:15
CASADO, JESUS	GS.04-O-12 Thu 16:15
CASAL, PAULO	TS.21-P-6 Mon-Tue; TS.21-O-9 Wed 12:00
CASAMAYOR, EMILIO	GS.05-O-12 Wed 12:15; GS.05-O-2 Tue 12:15; GS.05-O-17 Wed 18:00; GS.01-O-9 Tue 16:30
CASANELLES ABELLA, JOAN	TS.02-P-7 Mon-Tue
CASAS-GALLEGO, MANUEL	TS.15-O-2 Tue 12:30
CASAS-GOMEZ, PABLO	TS.09-O-2 Tue 12:30; TS.20-O-7 Tue 19:45
CASES, MERITXELL	TS.06-P-3 Mon-Tue
CASSIO, FERNANDA	TS.21-O-6 Tue 19:15; GS.03-O-21 Wed 19:15

CASTAGNEYROL, BASTIEN	GS.03-O-17 Wed 18:15
CASTAÑO, CARLES	GS.05-O-14 Wed 12:45
CASTELAR, SARA	TS.01-O-5 Tue 13:00
CASTELLS, EVA	TS.07-O-20 Thu 15:30
CASTILLA ALVAREZ, ANTONIO RAMON	TS.06-O-2 Tue 12:30
CASTILLA-BELTRAN, ALVARO	TS.15-O-8 Tue 16:30
CASTILLO GARCIA, MIGUEL	GS.03-P-5 Wed-Thu
CASTILLO, ANDREU	TS.22-O-10 Thu 16:00
CASTILLO, FEDERICO J.	GS.03-P-19 Wed-Thu
CASTILLO, YAIZA MERCEDES	TS.22-P-2 Wed-Thu; GS.05-O-8 Tue 16:15
CASTILLO-ESCRIVA, ANDREU	GS.03-O-29 Thu 15:15; GS.01-O-10 Tue 16:45; TS.04-O-8 Wed 18:30
CASTRILLON, ALBA	TS.06-P-3 Mon-Tue
CASTRO, ANTONIO	TS.06-O-3 Tue 12:45
CASTRO, CARMEN G	TS.18-O-1 Tue 18:00
CASTRO, DANIEL	TS.02-O-11 Wed 12:45; TS.02-O-11 Wed 12:45
CASTRO, PABLO	TS.10-P-2 Wed-Thu
CASWELL, BRYONY	TS.15-O-5 Tue 13:15
CATALAN, JORDI	TS.15-MT-1 Tue 12:00; TS.15-O-7 Tue 16:15; GS.05-O-19 Wed 18:30; TS.21-O-11 Wed 12:30; TS.11-O-10 Wed 19:00; GS.05-O-17 Wed 18:00; GS.05-O-20 Wed 18:45
CAUJAPE-CASTELLS, JULI	TS.15-O-4 Tue 13:00
CAVIERES, LOHENGRIN	TS.10-P-7 Wed-Thu; GS.05-O-13 Wed 12:30; GS.01-O-16 Wed 13:15
CAYUELA, LUIS	TS.10-P-10 Wed-Thu; TS.10-P-10 Wed-Thu; GS.03-P-9 Wed-Thu; TS.04-O-3 Wed 12:45
CAZORLA, BEATRIZ P.	TS.16-P-1 Mon-Tue
CEA, ALEX	GS.03-P-3 Wed-Thu
CEBRIAN, EMMA	TS.11-P-3 Wed-Thu; GS.02-O-8 Tue 16:15; TS.21-O-12 Wed 12:45; TS.11-O-15 Thu 13:15; TS.11-O-16 Thu 15:00
CEFALI, MARIA ELENA	TS.11-P-3 Wed-Thu
CERA, ANDREU	TS.14-P-3 Mon-Tue; TS.14-O-11 Tue 18:15
CERDEIRA, JORGE ORESTES	TS.02-O-16 Wed 18:30
CEREZO, ROSA	TS.01-O-6 Tue 13:15
CERMEÑO, PEDRO	GS.03-O-31 Thu 15:45; TS.16-O-2 Tue 18:30; TS.03-O-8 Wed 18:30
CERRO-GALVEZ, ELENA	TS.21-O-9 Wed 12:00
CERVANTES ARANGO, SANDRA	TS.07-O-5 Wed 13:15
CHACON-LABELLA, JULIA	TS.19-O-2 Thu 12:30; TS.22-P-7 Wed-Thu; TS.22-O-3 Thu 12:45
CHAMORRO, LOURDES	TS.19-O-4 Thu 13:00; TS.06-P-4 Mon-Tue; TS.19-O-10 Thu 16:00
CHANG, CHAOTING	TS.10-P-9 Wed-Thu; TS.03-O-9 Wed 18:45
CHANO, VICTOR MANUEL	TS.11-P-10 Wed-Thu
CHAVES, ROCIO	TS.08-O-10 Thu 15:45; TS.08-P-1 Wed-Thu
CHECA, RAQUEL	TS.07-O-14 Thu 12:30
CHIA-TING, CHEN	TS.21-O-10 Wed 12:15
CHILA, ANTONINA	TS.10-P-1 Wed-Thu
CHIN-PAMPILLO, JUAN	GS.05-P-9 Wed-Thu
CHIRINO, ESTEBAN	TS.08-O-14 Thu 16:45
CHIRINOS, VALERIA	TS.07-O-10 Wed 19:00
CHOUCIÑO, PALOMA	TS.16-O-2 Tue 18:30
CHOZAS, SERGIO	TS.19-O-8 Thu 15:30; TS.02-O-28 Thu 16:15
CHRISTIAN, RE	TS.21-O-10 Wed 12:15
CHUST, GUILLEM	GS.01-O-15 Wed 13:00; TS.08-O-2 Thu 12:15; TS.05-O-12 Thu 16:30
CIAVATTA, STEFANO	GS.03-O-9 Tue 16:30
CID PUEY, NURIA	TS.02-O-13 Wed 13:15
CID, NURIA	TS.02-O-11 Wed 12:45; TS.02-O-11 Wed 12:45
CLARAMUNT, BERNAT	GS.04-O-10 Thu 15:45; TS.02-O-27 Thu 16:00; TS.02-P-5 Mon-Tue
CLAVE, LAURA	TS.10-O-23 Thu 16:30
CLAVERO, MIGUEL	GS.02-O-3 Tue 12:30; TS.02-O-14 Wed 18:00

CLEMENTE, MARIA JOSE	TS.10-0-22 Thu 16:15
CLEMINSON, MARIA	TS.06-0-12 Tue 18:45
CLIMENT, EMILIO	TS.06-P-6 Mon-Tue
CLOKIE, MARTHA	TS.22-MT-1 Thu 12:00
COBO-SIMON, IRENE	TS.20-0-7 Tue 19:45
COCHERO, JOAQUIN	TS.06-0-4 Tue 13:00
COGO, GLAUCIA COGO	GS.01-0-8 Tue 16:15
COLADO, RAQUEL	TS.02-P-15 Mon-Tue
COLANGELO, MICHELE	TS.20-P-1 Mon-Tue
COLINAS VALLEJO, NOEMI	TS.07-0-4 Wed 13:00
COLL, LLUIS	GS.01-0-1 Tue 12:00; TS.08-0-4 Thu 12:45; GS.04-0-3 Thu 12:30
COLL, MARTA	TS.11-0-9 Wed 18:45; TS.05-0-11 Thu 16:15; TS.11-P-8 Wed-Thu
COLLANTES, FRANCISCO	GS.02-0-5 Tue 13:00
COLOMBAROLI, DANIELE	TS.15-P-1 Mon-Tue
COLOMER, JORDI	TS.11-P-2 Wed-Thu
COLON, JOAN	TS.21-0-15 Wed 18:15; GS.05-0-16 Wed 13:15
COMAPOSADA, ANDREA	TS.02-0-29 Thu 16:30
COMAS, MAR	TS.07-P-3 Wed-Thu
COMESAÑA, MARIA	TS.11-P-5 Wed-Thu
COMPTE, JORDI	TS.06-MT-1 Tue 12:00; GS.03-0-28 Thu 15:00
CONCEPCION CUEVAS, ELENA DANIELA	TS.19-0-7 Thu 15:15
CONDE CID, MANUEL	TS.21-P-2 Mon-Tue
CONDIT, RICHARD	GS.01-0-1 Tue 12:00
CONROY, MICHAEL	TS.02-0-25 Thu 15:30
CONTI, LUISA	GS.03-P-7 Wed-Thu; GS.03-P-7 Wed-Thu
CONTRERAS PEINADO, LAURA	GS.01-P-1 Mon-Tue
COOPMAN, RAFAEL	TS.10-0-22 Thu 16:15
CORBERA, JORDI	TS.18-0-7 Tue 19:30
CORDERO HERRERA, IRENE	TS.14-0-6 Tue 16:00
CORDERO-RIVERA, ADOLFO	TS.07-0-6 Wed 18:00; GS.02-0-14 Tue 18:45
CORRALES-GONZALEZ, MAYKOLL	TS.01-P-1 Mon-Tue; TS.01-0-7 Tue 16:00
CORREIA, MARTA RAQUEL CARDOSO	GS.03-P-6 Wed-Thu
CORREIA, OTILIA	TS.19-0-8 Thu 15:30
CORREIRA, ALEXANDRA C.	TS.05-0-11 Thu 16:15
CORTEGOSO GALMAN, ANDREA	GS.01-P-2 Mon-Tue
CORTES PUJOL, MIQUEL ANGEL	GS.01-0-21 Wed 19:00
CORTES, AMPARO	TS.04-P-2 Wed-Thu
CORTES, PAU	TS.03-P-4 Wed-Thu
CORTES-FOSSATI, FERNANDO	TS.02-P-8 Mon-Tue
CORTINA, JORDI	TS.06-P-6 Mon-Tue
CORTIZAS, SOFIA	TS.11-0-17 Thu 15:15
CORZO, ALFONSO	GS.05-0-15 Wed 13:00; GS.05-P-7 Wed-Thu; GS.05-P-13 Wed-Thu
COSIO, CLAUDIA	TS.21-0-14 Wed 18:00
COSTA, JOSE	TS.05-MT-1 Thu 12:00
COULSON, LAURA	TS.13-P-1 Mon-Tue
COURTOIS, ELODIE A.	TS.04-0-5 Wed 13:15
CRESCENZO, VALERIO	TS.06-0-3 Tue 12:45
CRESPO BASTIAS, CRISTINA	TS.10-P-3 Wed-Thu
CRIADO, CONSTANTINO	TS.15-0-4 Tue 13:00
CRISPI, OLIVIER	TS.03-0-11 Wed 19:15
CRONBERG, NILS	TS.10-P-1 Wed-Thu
CRUSET, ELOI	TS.06-P-3 Mon-Tue; TS.06-0-8 Tue 16:30; TS.06-0-9 Tue 18:00
CRUZ, CRISTINA	GS.02-0-15 Tue 19:00; TS.22-0-11 Thu 16:15; GS.05-0-4 Tue 12:45
CRUZ DE CARVALHO, RICARDO	TS.10-P-1 Wed-Thu
CRUZ-ALONSO, VERONICA	TS.06-P-1 Mon-Tue; TS.10-0-3 Wed 12:45; TS.11-0-4 Wed 13:00
CUNILLERA-MONTCUSI, DAVID	TS.06-MT-1 Tue 12:00

CURIEL YUSTE, JORGE	TS.16-0-6 Tue 19:30; TS.03-0-9 Wed 18:45
CURSACH, JOANA	GS.02-P-3 Mon-Tue
D	
DACHS, JORDI	TS.21-P-6 Mon-Tue; TS.21-0-9 Wed 12:00
DALL'OSTO, MANUEL	GS.05-0-11 Wed 12:00
DALSGAARD, BO	TS.05-0-4 Thu 13:00
DANIAU, ANNE-LAURE	TS.15-0-9 Tue 16:45
DANIELS, SILVIE	TS.19-0-13 Thu 16:45
DANUSEVICIUS, DARIUS	TS.07-0-5 Wed 13:15
DATRY, THIBAUT	TS.02-0-13 Wed 13:15
DE BELLO, FRANCESCO	GS.03-P-7 Wed-Thu; GS.01-0-3 Tue 12:30
DE CACERES, MIQUEL	GS.01-0-1 Tue 12:00; GS.04-0-1 Thu 12:00; GS.04-0-2 Thu 12:15; GS.04-0-3 Thu 12:30; TS.12-P-1 Mon-Tue; TS.09-0-8 Tue 16:30
DE CARALT, SONIA	TS.21-0-12 Wed 12:45; TS.11-P-3 Wed-Thu; TS.11-0-15 Thu 13:15
DE CASTRO-CATALA, NURIA	TS.21-0-7 Tue 19:30
DE CORTE, DANIELE	TS.22-0-13 Thu 16:45
DE FRUTOS, ANGEL	GS.03-P-13 Wed-Thu
DE GUZMAN, IOAR	TS.21-0-3 Tue 18:30; TS.21-0-1 Tue 18:00; TS.06-0-10 Tue 18:15
DE LA CRUZ, LYDIA	TS.10-P-3 Wed-Thu
DE LA CRUZ, MARCELINO	TS.10-0-9 Wed 18:45; TS.10-0-10 Wed 19:00; TS.22-P-7 Wed-Thu; TS.22-0-3 Thu 12:45
DE LA CUEVA, INES	TS.02-0-27 Thu 16:00
DE LA PEÑA, EDUARDO	TS.19-0-3 Thu 12:45
DE LA RUA, PILAR	GS.03-0-26 Thu 13:00
DE LAS HERAS, JORGE	TS.08-0-13 Thu 16:30
DE MANUEL, BERENICE	TS.04-0-8 Wed 18:30
DE MAZANCOURT, CLAIRE	TS.19-0-6 Thu 15:00
DE MIGUEL, SERGIO	GS.04-0-5 Thu 13:00; GS.04-0-3 Thu 12:30
DE NASCIMENTO, LEA	TS.15-0-4 Tue 13:00; TS.15-0-8 Tue 16:30
DE PAZ TAXE, AGNES	TS.21-P-3 Mon-Tue
DE PEDRO, MANUEL	TS.07-0-13 Thu 12:15
DE SOSTOA, ADOLF	TS.21-0-5 Tue 19:00
DE VOS, JURRIAN	TS.07-0-22 Thu 16:00
DEANGELIS, PAOLO	TS.14-0-14 Tue 19:00
DECKMYN, GABY	TS.16-0-6 Tue 19:30
DEEYTO, ELVIRA	GS.03-P-4 Wed-Thu
DEL CAMPO, RUBEN	TS.01-0-6 Tue 13:15
DEL JESUS, MANUEL	GS.04-0-12 Thu 16:15
DEL REY GRANADO, MARIA	TS.14-0-3 Tue 12:45
DEL RIO, MIREN	TS.09-P-5 Mon-Tue
DEL VALLE GARCIA, JOSE CARLOS	TS.07-0-25 Thu 16:45
DELACOUR, SARAH	GS.02-0-5 Tue 13:00
DELEGIDO, JESUS	TS.12-P-3 Mon-Tue
DELGADO ROMERO, JOSE ANTONIO	GS.05-0-4 Tue 12:45
DELGADO SAEZ, JUAN ANTONIO	TS.10-P-4 Wed-Thu
DELGADO, JOSE ANTONIO	GS.02-0-5 Tue 13:00
DELGADO, MAXIMINO	GS.05-P-3 Wed-Thu
DELGADO-BAQUERIZO, MANUEL	TS.14-MT-1 Tue 12:00; GS.05-0-13 Wed 12:30; GS.03-0-3 Tue 12:30
DELVIGNE, CAMILLE	TS.10-0-23 Thu 16:30
DELZON, SYLVAIN	TS.08-0-7 Thu 15:00
DE-MIGUEL, SERGIO	GS.04-0-1 Thu 12:00
DERACK, MCHICH	TS.06-P-6 Mon-Tue
DERING, MONIKA	TS.04-P-2 Wed-Thu
DETTORI, ETTORE	TS.07-P-4 Wed-Thu; TS.06-0-7 Tue 16:15
DEVIDAL, SEBASTIEN	TS.14-0-5 Tue 13:15

DEVRESSE, QUENTIN	TS.03-0-11 Wed 19:15
DIAZ BARRADAS, MARIA CRUZ	TS.02-0-28 Thu 16:15
DIAZ, CARLOS	TS.22-P-7 Wed-Thu; TS.22-0-3 Thu 12:45
DIAZ, DAVID	TS.02-P-10 Mon-Tue; TS.02-P-10 Mon-Tue
DIAZ, MARIO	TS.07-0-8 Wed 18:30; TS.19-0-7 Thu 15:15
DIAZ-DELGADO HERNANDEZ, RICARDO	TS.12-MT-1 Tue 18:00
DIAZ-GUERRA, LAURA	TS.11-P-7 Wed-Thu; TS.10-0-4 Wed 13:00
DIAZ-MARTINEZ, PALOMA	TS.11-P-1 Wed-Thu
DIAZ-PENDON, JUAN ANTONIO	TS.19-0-3 Thu 12:45
DIAZ-PEÑA, EVA	GS.01-0-3 Tue 12:30
DIAZ-PINES, EUGENIO	TS.14-0-15 Tue 19:15
DIEZ, OIHANE	TS.08-0-5 Thu 13:00; TS.08-0-5 Thu 13:00
DIEZ, SERGI	TS.21-P-4 Mon-Tue; TS.21-0-19 Wed 19:15
DJUKIC, IKA	TS.03-0-6 Wed 18:00; TS.11-P-4 Wed-Thu
DOBLAS, ENRIQUE	TS.14-0-13 Tue 18:45; GS.04-0-13 Thu 16:30
DOLEDEC, SYLVAIN	TS.21-0-7 Tue 19:30
DOMENE, XAVIER	GS.05-P-9 Wed-Thu
DOMENECH, GINEBRA	TS.16-P-3 Mon-Tue
DOMENECH, MARC	TS.22-0-5 Thu 13:15
DOMINGO, FRANCISCO	TS.16-P-1 Mon-Tue
DOMINGUEZ, MARIA TERESA	TS.14-0-8 Tue 16:30; TS.14-P-5 Mon-Tue
DOMINGUEZ-BEGINES, JARA	TS.20-0-6 Tue 19:30
DONAZAR, JOSE A.	TS.17-0-3 Tue 12:45; TS.17-0-8 Tue 16:30
DONOSO CUADRADO, ISABEL	GS.03-0-11 Wed 12:15
DOÑA, CAROLINA	TS.12-P-4 Mon-Tue; TS.03-0-2 Wed 12:30; TS.16-0-3 Tue 18:45
DOS SANTOS, PATRICIA	TS.07-0-22 Thu 16:00
DRAP, PIERRE	TS.07-0-12 Thu 12:00
DRAPER, ISABEL	GS.03-P-3 Wed-Thu
DRUCKENBROD, DANIEL	TS.08-0-8 Thu 15:15
DRUMMOND, JEN	TS.03-P-1 Wed-Thu; GS.04-0-9 Thu 15:30; TS.06-0-5 Tue 13:15; TS.01-0-5 Tue 13:00
DUANE, ANDREA	TS.08-0-11 Thu 16:00; GS.03-0-18 Wed 18:30
DUARTE, CARLOS M	PT-1 Mon 17:30; TS.11-P-5 Wed-Thu; TS.11-0-13 Thu 12:45; GS.05-0-5 Tue 13:00; GS.02-P-8 Mon-Tue
DUMACK, KENNETH	GS.03-0-3 Tue 12:30
DUQUE LAZO, JOAQUIN	GS.02-0-6 Tue 13:15
DURAN, JORGE	TS.14-P-1 Mon-Tue
DURAN, MARIO	TS.07-0-16 Thu 13:00

E	
EBINGHAUS, RALF	TS.21-P-1 Mon-Tue
EBONG, MBUOTIDEM SAMPSON	TS.04-0-10 Wed 19:00
EDO, ANTONIO	TS.06-P-2 Mon-Tue
EDWARDS, MARY	TS.15-0-8 Tue 16:30
EGEA COBRERO, VALLE	TS.19-0-12 Thu 16:30
ELOSEGI, ARTURO	TS.21-0-1 Tue 18:00; TS.21-0-3 Tue 18:30; GS.05-0-22 Wed 19:15; TS.06-0-10 Tue 18:15
ELUSTONDO, DAVID	TS.11-0-7 Wed 18:15
EMMERSON, MARK	TS.14-0-7 Tue 16:15; TS.14-0-7 Tue 16:15
EMMETT, BRIDGET	TS.14-0-14 Tue 19:00
ENCALADA, ANDREA	TS.07-0-6 Wed 18:00
ENGUIDANOS GARCIA, ALBA	TS.22-0-5 Thu 13:15
EPELDE, LUR	GS.05-P-4 Wed-Thu; GS.05-P-6 Wed-Thu
ERITJA, ROGER	GS.02-0-5 Tue 13:00
ERSOY, ZEYNEP	GS.03-0-4 Tue 12:45
ESCARTIN, SANTI	GS.02-0-5 Tue 13:00

ESCRIBANO AVILA, GEMA	TS.07-0-9 Wed 18:45
ESCRIBANO BAILON, MARIA TERESA	TS.07-0-25 Thu 16:45
ESCUADERO, ADRIAN	TS.10-0-9 Wed 18:45; TS.22-0-3 Thu 12:45; GS.03-P-3 Wed-Thu; TS.02-0-19 Thu 12:00; TS.04-0-2 Wed 12:30; TS.07-P-8 Wed-Thu; TS.08-0-10 Thu 15:45; TS.10-0-10 Wed 19:00; TS.14-0-11 Tue 18:15; GS.01-0-16 Wed 13:15; TS.10-0-4 Wed 13:00; TS.10-P-2 Wed-Thu; TS.10-P-2 Wed-Thu; TS.22-P-7 Wed-Thu
ESPADALER, XAVIER	TS.22-P-5 Wed-Thu
ESPELTA, JOSEP MARIA	TS.08-0-5 Thu 13:00; GS.03-P-6 Wed-Thu; TS.14-0-13 Tue 18:45; TS.16-P-2 Mon-Tue
ESPIGARES, TISCAR	TS.11-0-20 Thu 16:00
ESPINOSA, CARLOS IVAN	TS.04-0-9 Wed 18:45; TS.04-0-3 Wed 12:45
ESPINOSA, CARMEN	GS.05-0-16 Wed 13:15; TS.21-0-15 Wed 18:15
ESPINOZA, DAVID	TS.02-P-16 Mon-Tue
ESPUNY, JAUME	TS.06-0-11 Tue 18:30; TS.02-P-17 Mon-Tue
ESPUNYES, JOHAN	GS.03-0-30 Thu 15:30
ESTEBANEZ-PEREZ, BELEN	TS.10-P-1 Wed-Thu
ESTEVE, MIGUEL ANGEL	TS.02-P-14 Mon-Tue; TS.08-0-9 Thu 15:30
ESTIARTE, MARC	TS.11-P-4 Wed-Thu; TS.14-0-14 Tue 19:00
ESTRADA, MARTA	GS.05-P-3 Wed-Thu; GS.05-P-11 Wed-Thu; TS.16-0-2 Tue 18:30; TS.18-0-3 Tue 18:30
ESTRUCH, CARME	TS.03-0-9 Wed 18:45
EXPOSITO-BAREA, ISABEL	TS.15-P-2 Mon-Tue
EXPOSITO-GRANADOS, MONICA	GS.03-0-19 Wed 18:45

F

FACON, BENOIT	GS.04-0-7 Thu 15:00
FAGUNDEZ, JAIME	GS.02-0-7 Tue 16:00
FAISCA, PEDRO	GS.01-0-10 Tue 16:45; GS.03-0-29 Thu 15:15
FAJARDO, ALEX	TS.02-0-21 Thu 12:30
FARINA, SIMONE	TS.11-P-3 Wed-Thu
FEDRIANI LAFFITTE, JOSE MARIA	GS.03-0-14 Wed 13:00; TS.06-0-2 Tue 12:30; GS.03-0-15 Wed 13:15
FEIO, MARIA JOÃO	GS.03-0-24 Thu 12:30; TS.11-0-5 Wed 13:15
FELIP, MARISOL	GS.05-0-19 Wed 18:30; GS.05-0-20 Wed 18:45
FERNANDEZ ALONSO, MARIA JOSE	TS.14-0-15 Tue 19:15
FERNANDEZ GONZALEZ, CONSOLACION	TS.02-P-2 Mon-Tue
FERNANDEZ JUAREZ, VICTOR	GS.05-P-5 Wed-Thu
FERNANDEZ, BEATRIZ	GS.04-0-4 Thu 12:45
FERNANDEZ, CARMEN	TS.19-P-2 Wed-Thu
FERNANDEZ, EMILIO	GS.03-P-1 Wed-Thu
FERNANDEZ, JOSE ANGEL	TS.10-P-1 Wed-Thu
FERNANDEZ-ALAEZ, CAMINO	TS.02-0-8 Wed 12:00; TS.02-P-9 Mon-Tue
FERNANDEZ-ALAEZ, MARGARITA	TS.02-P-9 Mon-Tue; TS.02-0-8 Wed 12:00
FERNANDEZ-CASTRO, BIEITO	TS.16-0-2 Tue 18:30
FERNANDEZ-DE-UÑA, LAURA	TS.09-0-8 Tue 16:30
FERNANDEZ-MAZUECOS, MARIO	GS.01-P-7 Mon-Tue
FERNANDEZ-MONTBLANC, TOMAS	TS.12-0-3 Tue 18:45
FERNANDEZ-MUÑOZ, RAFAEL	TS.19-0-3 Thu 12:45
FERNANDEZ-PALACIOS, JOSE MARIA	TS.15-0-4 Tue 13:00; TS.15-0-8 Tue 16:30
FERNANDEZ-PINOS, MARI-CARMEN	TS.21-0-9 Wed 12:00
FERNANDEZ-SANJURJO, MARIA JOSE	TS.21-P-2 Mon-Tue
FERRANDIS, PABLO	TS.08-0-10 Thu 15:45; TS.08-P-1 Wed-Thu; TS.08-0-13 Thu 16:30; GS.03-P-3 Wed-Thu
FERRANDO CANSINO, LAURA	TS.21-P-5 Mon-Tue
FERREIRA, CARLA	TS.21-P-1 Mon-Tue
FERREIRA, CATARINA	GS.03-0-16 Wed 18:00; GS.03-0-16 Wed 18:00

FERREIRA, MARIANA	TS.05-P-1 Wed-Thu
FERREIRA, VERONICA	PT-6 Wed 10:00
FERRERA, ISABEL	TS.22-O-6 Thu 15:00; TS.22-P-1 Wed-Thu; GS.05-O-9 Tue 16:30
FERRERO VAQUERO, VICTORIA	TS.19-O-3 Thu 12:45
FERRIO, JUAN PEDRO	TS.14-P-3 Mon-Tue; GS.03-O-33 Thu 16:15
FIGUEIRA, ETELVINA	TS.11-O-5 Wed 13:15
FIGUEIRAS, FRANCISCO G	TS.18-O-1 Tue 18:00; TS.16-O-2 Tue 18:30
FILLOL, MIREIA	TS.21-O-4 Tue 18:45
FITZE, PATRICK S.	TS.10-O-8 Wed 18:30
FLANAGAN, NICOLA	TS.04-O-2 Wed 12:30
FLECHA, SUSANA	TS.11-P-6 Wed-Thu
FLEXAS, JAUME	TS.10-O-22 Thu 16:15; GS.02-P-1 Mon-Tue
FLO, VICTOR	TS.16-O-4 Tue 19:00; GS.01-O-5 Tue 13:00
FLORES RUIZ, LORENA	TS.11-O-23 Thu 16:45
FLORES, OMAR	TS.16-O-6 Tue 19:30
FLORIN, MAXIMO	TS.01-O-7 Tue 16:00
FLYNN, KEVIN JOHN	GS.03-O-9 Tue 16:30
FLYNN-CARROLL, ALEX	TS.17-O-5 Tue 13:15
FOCHETTI, ROMOLO	TS.02-P-20 Mon-Tue
FONT, BLANCA	TS.06-P-3 Mon-Tue; TS.06-O-8 Tue 16:30; TS.06-O-9 Tue 18:00
FONT, JOAN	TS.11-P-7 Wed-Thu
FONTAN, ALMUDENA	TS.08-O-2 Thu 12:15
FORERO, MANUELA	TS.17-P-3 Mon-Tue
FORN, IRENE	TS.22-P-2 Wed-Thu
FORNOFF, FELIX	TS.10-P-8 Wed-Thu
FORNOS, PAU	TS.16-P-3 Mon-Tue
FORT, FLORIAN	TS.14-O-3 Tue 12:45
FORTEZA, MARINA	TS.11-O-18 Thu 15:30
FORTIN, MARIE-JOSEE	GS.01-O-1 Tue 12:00
FORTUÑO, PAU	GS.01-P-4 Mon-Tue; TS.02-O-11 Wed 12:45; TS.02-O-10 Wed 12:30; TS.02-O-11 Wed 12:45
FRANCH-GRAS, LLUIS	TS.07-O-17 Thu 13:15
FRASCHETTI, SIMONETTA	TS.11-P-3 Wed-Thu
FRASCONI WENDT, CLARA	TS.10-O-21 Thu 16:00
FREIXA, ANNA	TS.01-O-8 Tue 16:15
FRID, CHRIS	TS.15-O-5 Tue 13:15
FROJAN, MARIA	TS.18-O-1 Tue 18:00
FROMIN, NATHALIE	TS.14-P-4 Mon-Tue; TS.14-O-5 Tue 13:15; TS.14-O-3 Tue 12:45
FUCHSLUEGER, LUCIA	TS.14-O-9 Tue 16:45
FUENTES, DAVID	TS.11-O-8 Wed 18:30
FUSTE-ETXEBERRIA, AMAIA	TS.02-P-19 Mon-Tue
FUTTER, MARTYN N.	TS.01-O-2 Tue 12:15

G

GABA, SABRINA	TS.19-O-6 Thu 15:00
GACIA, ESPERANÇA	GS.03-P-8 Wed-Thu; TS.06-O-4 Tue 13:00; TS.01-O-5 Tue 13:00
GAËL, GUILLOU	TS.21-O-10 Wed 12:15
GAGO, JORGE	TS.10-O-22 Thu 16:15
GAITAN, JUAN	GS.03-O-27 Thu 13:15
GALICIA HERBADA, DAVID	GS.02-O-2 Tue 12:15
GALLAGHER, RUAIRI	TS.08-O-2 Thu 12:15
GALLAND, THOMAS	GS.03-P-7 Wed-Thu; GS.03-P-7 Wed-Thu
GALLARDO, ANTONIO	TS.14-O-4 Tue 13:00; TS.14-P-7 Mon-Tue
GALLEGO- FERNANDEZ, JUAN B.	GS.02-O-16 Tue 19:15
GALLEGO, DIEGO	TS.08-O-7 Thu 15:00
GALLEGO-RODRIGUEZ, FRANCISCO JAVIER	TS.20-O-7 Tue 19:45

GALVEZ, ANGEL	TS.04-0-8 Wed 18:30; TS.22-0-10 Thu 16:00
GALVEZ, ELENA	TS.21-P-6 Mon-Tue
GALVEZ, JOSE ANGEL	GS.05-P-13 Wed-Thu
GANGOSO, LAURA	TS.17-0-3 Tue 12:45
GARBISU, CARLOS	GS.05-P-6 Wed-Thu; GS.05-P-4 Wed-Thu
GARCES PASTOR, SANDRA	TS.15-0-3 Tue 12:45
GARCES, ESTHER	TS.22-P-1 Wed-Thu
GARCIA ALFONSO, MARINA	TS.17-0-3 Tue 12:45
GARCIA BARROS, ENRIQUE	TS.02-P-13 Mon-Tue
GARCIA BRAVO, ANDREA	TS.21-0-14 Wed 18:00
GARCIA CALLEJAS, DAVID	TS.05-0-3 Thu 12:45
GARCIA CORRAL, LARA SILVIA	TS.11-P-5 Wed-Thu
GARCIA DE DIONISIO, SANDRA	TS.07-0-3 Wed 12:45
GARCIA DE LA RIVA, ENRIQUE	TS.13-P-2 Mon-Tue
GARCIA FERNANDEZ, ALFREDO	TS.02-0-5 Tue 19:15; TS.02-0-18 Wed 19:00; TS.07-0-14 Thu 12:30; TS.11-P-12 Wed-Thu
GARCIA GONZALEZ, MARIA BEGOÑA	TS.02-0-23 Thu 13:00; TS.10-0-18 Thu 15:15
GARCIA GUERRA, MIGUEL	GS.03-P-9 Wed-Thu
GARCIA LOPEZ, MARIA AUXILIADORA	TS.02-0-20 Thu 12:15
GARCIA MURCIA, ANA	GS.01-P-3 Mon-Tue
GARCIA NOVO,, FRANCISCO	TS.18-0-6 Tue 19:15
GARCIA PALACIOS, PABLO	GS.03-0-27 Thu 13:15; TS.19-0-2 Thu 12:30; TS.19-0-2 Thu 12:30
GARCIA RODRIGUEZ, JOSE ANTONIO	TS.10-P-10 Wed-Thu; TS.10-P-10 Wed-Thu
GARCIA, CESAR	GS.02-0-18 Tue 19:45
GARCIA, CRISTINA	GS.01-0-13 Wed 12:30
GARCIA, FRANCISCA C.	GS.05-0-10 Tue 16:45
GARCIA, LUIS V.	TS.20-0-6 Tue 19:30
GARCIA, MARIA	TS.11-0-16 Thu 15:00
GARCIA-ALJARO, CRISTINA	TS.21-0-8 Tue 19:45
GARCIA-BARON, ISABEL	TS.02-0-17 Wed 18:45; TS.08-0-2 Thu 12:15
GARCIA-BERTHOUS, EMILI	GS.02-0-10 Tue 16:45
GARCIA-CERVIGON, ANA ISABEL	TS.02-0-21 Thu 12:30; TS.09-P-1 Mon-Tue; TS.09-0-6 Tue 16:00; TS.02-0-20 Thu 12:15
GARCIA-COMAS, CARMEN	TS.10-0-6 Wed 18:00; GS.03-0-4 Tue 12:45
GARCIA-CRIADO, FRANCISCO	TS.02-P-9 Mon-Tue
GARCIA-FAYOS POVEDA, PATRICIO	TS.11-0-20 Thu 16:00
GARCIA-GALEA, EDUARDO	GS.01-P-5 Mon-Tue
GARCIA-GIRON, JORGE	TS.02-0-8 Wed 12:00; TS.02-P-9 Mon-Tue
GARCIA-GONZALEZ, FRANCISCO	TS.07-0-18 Thu 15:00
GARCIA-PEDRERO, ANGEL	TS.09-P-3 Mon-Tue; TS.09-0-6 Tue 16:00
GARCIA-ROA, ROBERTO	TS.07-0-10 Wed 19:00; TS.07-0-18 Thu 15:00
GARCIA-ROBLEDO, EMILIO	GS.05-0-6 Tue 13:15; GS.05-0-15 Wed 13:00; GS.05-P-13 Wed-Thu
GARCIA-RODEJA GAYOSO, EDUARDO	TS.21-P-7 Mon-Tue
GARCIA-ROGER, EDUARDO M.	TS.07-0-17 Thu 13:15; TS.07-0-4 Wed 13:00
GARCIA-RUBIES, ANTONI	TS.02-P-10 Mon-Tue
GARCIA-TARRASON, MANUEL	TS.21-0-16 Wed 18:30
GARCIA-VALDES, RAUL	TS.11-0-23 Thu 16:45; GS.04-0-1 Thu 12:00
GARRABOU, JOAQUIM	TS.02-P-10 Mon-Tue; TS.02-P-10 Mon-Tue; TS.02-0-2 Tue 18:30; TS.07-0-12 Thu 12:00
GARRIDO SANCHEZ, JOSE LUIS	GS.03-0-14 Wed 13:00; TS.05-0-5 Thu 13:15
GARRIDO SANZ, LIDIA	TS.22-P-4 Wed-Thu
GARRIDO, JOSEFINA	TS.02-P-3 Mon-Tue
GARRIGA, JOAN	TS.17-P-2 Mon-Tue
GARROTE GARCIA, PEDRO JOSE	TS.06-0-2 Tue 12:30
GASCO, GABRIEL	GS.05-P-9 Wed-Thu
GASCON, ELENA	TS.21-0-14 Wed 18:00

GASCON, STEPHANIE	GS.03-O-28 Thu 15:00; TS.06-MT-1 Tue 12:00
GASOL, JOSEP M	GS.05-O-7 Tue 16:00; TS.16-O-2 Tue 18:30; TS.22-O-6 Thu 15:00; TS.22-O-6 Thu 15:00; TS.22-P-1 Wed-Thu; GS.05-O-5 Tue 13:00; GS.05-P-10 Wed-Thu; GS.05-O-9 Tue 16:30
GASPAR, RUI	GS.02-O-17 Tue 19:30
GAUDES, AINHOA	TS.06-P-4 Mon-Tue
GAVLOVA, KATERINA	GS.02-P-4 Mon-Tue; GS.02-P-2 Mon-Tue; GS.02-O-7 Tue 16:00
GAXIOLA, AURORA	GS.05-O-13 Wed 12:30
GAZOL, ANTONIO	TS.20-P-3 Mon-Tue; TS.20-O-5 Tue 19:15; TS.20-P-1 Mon-Tue
GEA-IZQUIERDO, GUILLERMO	TS.09-O-8 Tue 16:30
GENTILESCA, TIZIANA	TS.20-P-1 Mon-Tue
GERBER, STEFAN	TS.13-O-6 Tue 19:15
GIAKOUMI, SYLVAIN	TS.02-O-17 Wed 18:45
GICH, FREDERIC	GS.05-O-3 Tue 12:30; GS.05-P-2 Wed-Thu
GIL ROMERA, GRACIELA	TS.15-O-6 Tue 16:00
GIL, LORENZO	GS.03-P-18 Wed-Thu
GIL, LUIS	TS.15-P-1 Mon-Tue
GILBERT, JUAN DIEGO GILBERT	TS.02-O-9 Wed 12:15
GILBERT, TOM	GS.01-O-10 Tue 16:45
GILI, JOSEP-MARIA	TS.18-O-2 Tue 18:15; TS.18-O-7 Tue 19:30
GILLESPIE, LAUREN	TS.14-O-5 Tue 13:15
GIL-MARTINEZ, MARTA	TS.14-P-5 Mon-Tue
GIMENEZ, ANDRES	TS.05-O-13 Thu 16:45; GS.01-O-2 Tue 12:15; TS.07-O-21 Thu 15:45; TS.02-O-26 Thu 15:45
GIMENEZ, DAVID	GS.05-O-2 Tue 12:15
GIMENO CHOCARRO, TERESA EFIGENIA	TS.10-O-23 Thu 16:30
GIMENO, EUGENIA	TS.06-O-3 Tue 12:45
GINEBREDI, ANTONI	TS.21-O-2 Tue 18:15
GINER, MARIA DE LA LUZ	GS.03-P-5 Wed-Thu
GIONCHETTA, GIULIA	TS.14-O-17 Tue 19:45
GIORDANI, PAOLO	GS.01-O-3 Tue 12:30
GIRALDO, ALAN	TS.04-O-4 Wed 13:00
GIUSSANI, VALENTINA	GS.02-O-11 Tue 18:00
GOBERNA, MARTA	GS.05-O-1 Tue 12:00; TS.06-O-6 Tue 16:00
GODOY, OSCAR	PT-7 Thu 9:00; TS.05-O-10 Thu 16:00; TS.02-O-22 Thu 12:45; TS.14-O-12 Tue 18:30
GOLO, RAUL	GS.02-O-8 Tue 16:15; TS.11-O-16 Thu 15:00
GOMA, JOAN	GS.01-P-4 Mon-Tue
GOMEZ FERNANDEZ, ALICIA	TS.10-O-2 Wed 12:30
GOMEZ FERNANDEZ, ENRIQUE JOSE	GS.05-O-4 Tue 12:45
GOMEZ SAL, ANTONIO	TS.02-O-7 Tue 19:45
GOMEZ, AFRICA	TS.07-O-17 Thu 13:15
GOMEZ, ANDREA	GS.05-O-11 Wed 12:00
GOMEZ, DANIEL	TS.02-O-23 Thu 13:00; TS.06-P-1 Mon-Tue
GOMEZ, JOSE MARIA	TS.05-O-8 Thu 15:30
GOMEZ, ROSA	TS.13-O-5 Tue 19:00
GOMEZ-APARICIO, LORENA	TS.20-O-6 Tue 19:30; TS.14-O-12 Tue 18:30; TS.02-O-3 Tue 18:45; TS.02-O-22 Thu 12:45; TS.14-O-4 Tue 13:00; TS.10-O-3 Wed 12:45; TS.14-P-7 Mon-Tue
GOMEZ-ARMESTO, ANTIA	TS.21-O-18 Wed 19:00; TS.21-P-7 Mon-Tue
GOMEZ-CONSARNAU, LAURA	GS.05-O-7 Tue 16:00
GOMEZ-GENER, LLUIS	TS.03-P-3 Wed-Thu
GOMEZ-GONZALEZ, SUSANA	TS.07-O-16 Thu 13:00
GOMEZ-GRAS, DANIEL	TS.02-O-2 Tue 18:30
GOMEZ-LETONA, MARKEL	GS.05-O-5 Tue 13:00
GOMEZ-MARTINEZ, CARMELO	TS.10-O-11 Wed 19:15

GONÇALVES JUNIOR, JOSE FRANCISCO	TS.03-0-7 Wed 18:15
GONÇALVES LELES, SUZANA	GS.03-0-9 Tue 16:30
GONÇALVES, DAVID	GS.01-P-5 Mon-Tue
GONÇALVES, JOÃO	TS.12-0-5 Tue 19:15; GS.01-0-13 Wed 12:30; GS.02-0-18 Tue 19:45
GONZALEZ DE ANDRES, ESTER	GS.03-P-19 Wed-Thu
GONZALEZ GRAU, JUAN MIGUEL	GS.05-0-4 Tue 12:45
GONZALEZ MEGIAS, ADELA	GS.03-0-22 Thu 12:00
GONZALEZ RODRIGUEZ, LUIS	GS.02-0-4 Tue 12:45
GONZALEZ, EUDALDO	TS.08-0-7 Thu 15:00
GONZALEZ, FRANCISCO	TS.06-0-3 Tue 12:45
GONZALEZ, JOSE M.	TS.22-MT-1 Thu 12:00
GONZALEZ, JOSE MANUEL	TS.21-0-3 Tue 18:30; TS.21-0-1 Tue 18:00
GONZALEZ, JOSEP-ABEL	TS.11-P-7 Wed-Thu
GONZALEZ, LUIS	GS.02-0-14 Tue 18:45; GS.02-P-6 Mon-Tue
GONZALEZ, NATALIA	TS.11-P-5 Wed-Thu
GONZALEZ-ANDUJAR, JOSE LUIS	TS.19-0-12 Thu 16:30
GONZALEZ-DELGADO, SARA	TS.11-0-6 Wed 18:00
GONZALEZ-ESTEVEZ, MIGUEL ANGEL	TS.10-0-11 Wed 19:15
GONZALEZ-GARCIA, MARTA	TS.09-P-4 Mon-Tue
GONZALEZ-GAYA, BELEN	TS.21-0-9 Wed 12:00
GONZALEZ-LAGOS, CESAR	TS.02-MT-24 Thu 15:00
GONZALEZ-MANCEBO, JUANA MARIA	TS.10-P-1 Wed-Thu
GONZALEZ-MARTINEZ, SANTIAGO C.	TS.07-0-13 Thu 12:15; TS.07-0-23 Thu 16:15
GONZALEZ-MORENO, PABLO	GS.02-P-7 Mon-Tue
GONZALEZ-SAMPERIZ, PENELOPE	TS.15-0-6 Tue 16:00
GONZALEZ-SOLIS, JACOB	TS.17-P-4 Mon-Tue
GORE, JEFF	TS.17-0-7 Tue 16:15
GORI, ANDREA	TS.02-0-2 Tue 18:30
GORT ESTEVE, ARACELI	TS.09-0-4 Tue 13:00
GÖTZENBERGER, LARS	GS.03-P-7 Wed-Thu; GS.03-P-7 Wed-Thu
GOURAGUINE, ADAM	GS.03-0-20 Wed 19:00
GOUVEIA, CATARINA	TS.22-0-11 Thu 16:15
GOZALO, BEATRIZ	GS.03-0-3 Tue 12:30
GRABS, THOMAS	TS.01-0-2 Tue 12:15
GRAÇA, MANUEL A.S.	GS.01-0-8 Tue 16:15
GRACIA, CARLES	GS.02-0-9 Tue 16:30; TS.21-0-8 Tue 19:45
GRACIA, EVA	GS.01-0-2 Tue 12:15; TS.02-0-26 Thu 15:45; TS.05-0-13 Thu 16:45; TS.07-0-21 Thu 15:45
GRACIOLLI, GUSTAVO	GS.01-P-1 Mon-Tue
GRAMMELIS, PANAGIOTIS	TS.06-0-3 Tue 12:45
GRANADOS, VERONICA	TS.02-0-12 Wed 13:00
GRANDA, VICTOR	TS.12-P-1 Mon-Tue; TS.16-0-4 Tue 19:00; GS.01-0-5 Tue 13:00
GRANJA, LUIS	TS.06-P-4 Mon-Tue
GRANJEL, RODRIGO R.	TS.05-0-10 Thu 16:00
GRANZOW-DE LA CERDA, IÑIGO	TS.04-0-3 Wed 12:45
GRAU, ANTONI	TS.12-0-3 Tue 18:45
GRAU, ORIOL	TS.04-0-11 Wed 19:15; TS.16-0-5 Tue 19:15; TS.04-0-5 Wed 13:15
GRAVEL, DOMINIQUE	TS.05-0-3 Thu 12:45
GREEN, ANDY J.	GS.05-0-21 Wed 19:00
GREMILLET, DAVID	TS.17-P-3 Mon-Tue
GRIMALT, JOAN O.	TS.21-0-11 Wed 12:30
GRIMSLEY, NIGEL	TS.22-P-2 Wed-Thu
GRINYO, JORDI	TS.18-0-7 Tue 19:30
GRIVET, DELPHINE	TS.07-0-24 Thu 16:30
GROS, MERITXELL	TS.21-0-4 Tue 18:45
GROSS, NICOLAS	GS.03-0-3 Tue 12:30; GS.03-0-27 Thu 13:15; TS.05-0-10 Thu 16:00

GRUBE, MARTIN	GS.01-O-3 Tue 12:30
GRUBER, NICOLAS	TS.03-P-4 Wed-Thu
GRÜNZWEIG, JOSE	TS.03-O-9 Wed 18:45
GUACH, HELENA	GS.05-P-2 Wed-Thu
GUADAYOL, OSCAR	GS.05-P-11 Wed-Thu
GUARESCHI, SIMONE	TS.06-O-7 Tue 16:15
GUBAU, MARINA	TS.03-P-3 Wed-Thu
GUERRERO, FRANCISCO GUERRERO	TS.02-O-9 Wed 12:15
GUERRERO, MARIA MERCEDES	TS.13-O-5 Tue 19:00
GUERRERO-FEIJOO, ELISA	GS.05-P-14 Wed-Thu; TS.22-O-8 Thu 15:30; TS.22-O-8 Thu 15:30
GUERRIERI, ROSSELLA	TS.11-O-7 Wed 18:15
GUIDOLOTI, GABRIELE	TS.03-O-9 Wed 18:45
GUIJARRO, BEATRIZ	GS.01-O-21 Wed 19:00
GUILHEM, DE BARROS	GS.01-O-11 Wed 12:00
GUILHERMINO, LUCIA	TS.21-O-13 Wed 13:00; TS.21-O-13 Wed 13:00
GUILLEMAUD, THOMAS	GS.04-O-7 Thu 15:00
GUIMARAES, JEAN R. D.	TS.21-P-4 Mon-Tue
GUIOTE, CARMEN	TS.07-P-5 Wed-Thu
GUISAN, ANTOINE	TS.08-O-9 Thu 15:30
GUISANDE COLLAZO, ALEJANDRA	GS.02-O-4 Tue 12:45
GUISANDE, CASTOR	TS.02-P-13 Mon-Tue
GULIAS, JAVIER	TS.10-O-22 Thu 16:15
GUSMAN, ELIZABETH	TS.04-P-1 Wed-Thu
GUTIERREZ MERINO, EMILIA	TS.09-MT-1 Tue 12:00; TS.09-O-4 Tue 13:00; TS.09-P-5 Mon-Tue
GUTIERREZ, DAVID	TS.02-P-3 Mon-Tue
GUTIERREZ, EDUARDO	TS.14-O-8 Tue 16:30; TS.14-P-7 Mon-Tue
GUTIERREZ, INES	TS.06-O-3 Tue 12:45
GUTIERREZ, PAULA	TS.02-O-17 Wed 18:45
GUTIERREZ-CANOVAS, CAYETANO	TS.02-O-10 Wed 12:30; GS.01-O-12 Wed 12:15; TS.02-O-11 Wed 12:45; TS.02-O-11 Wed 12:45

H

HAEGEMAN, BART	TS.19-O-6 Thu 15:00
HALLIN, SARA	GS.05-O-17 Wed 18:00; GS.05-O-20 Wed 18:45
HAMONTS, KELLY	GS.03-O-3 Tue 12:30
HAMPE, ARNDT	GS.03-O-17 Wed 18:15
HARMON, JASON	GS.03-O-25 Thu 12:45
HARO, SARA	GS.05-P-7 Wed-Thu; GS.05-O-15 Wed 13:00
HATHORNE, ED C.	TS.11-O-19 Thu 15:45
HÄTTENSCHWILER, STEPHAN	TS.14-P-4 Mon-Tue; TS.14-O-5 Tue 13:15
HEER, KATRIN	TS.07-O-5 Wed 13:15
HEIMBURGER, LARS-ERIC	TS.21-O-10 Wed 12:15
HEINO, JANI	TS.02-O-13 Wed 13:15
HELENO, RUBEN	TS.05-MT-1 Thu 12:00; TS.05-O-2 Thu 12:30
HELLSTEIN, SOFIE	TS.11-O-7 Wed 18:15
HEMROVA, LUCIE	GS.03-O-1 Tue 12:00
HENARES, IGNACIO	TS.02-P-6 Mon-Tue
HENDRIKS, IRIS	TS.11-P-6 Wed-Thu; GS.02-P-8 Mon-Tue
HERAULT, BRUNO	TS.04-O-11 Wed 19:15; TS.04-O-5 Wed 13:15
HERES, ANA-MARIA	TS.10-P-2 Wed-Thu
HEREU, BERNAT	TS.02-P-10 Mon-Tue; GS.01-P-8 Mon-Tue; TS.07-P-2 Wed-Thu; TS.06-O-12 Tue 18:45; TS.02-O-2 Tue 18:30
HERMOSO, VIRGILIO	TS.02-O-14 Wed 18:00; GS.04-O-5 Thu 13:00; TS.02-O-15 Wed 18:15
HERNANDEZ AGÜERO, JUAN ANTONIO	GS.03-P-9 Wed-Thu
HERNANDEZ DEL AMO, ELENA	GS.05-O-3 Tue 12:30
HERNANDEZ PAZMIÑO, NATHALIA	TS.10-P-4 Wed-Thu

HERNANDEZ ROJAS, ADRIANA CAROLINA	GS.01-0-7 Tue 16:00
HERNANDEZ, JOSE CARLOS	TS.11-0-6 Wed 18:00
HERNANDEZ-CASTELLANO, CARLOS	TS.05-0-8 Thu 15:30; GS.03-0-6 Tue 13:15
HERNANDEZ-PLAZA, EVA	TS.19-0-12 Thu 16:30; TS.19-0-5 Thu 13:15
HERNANDEZ-URCERA, JORGE	TS.18-0-4 Tue 18:45
HERNANDO, CARLOS	TS.12-P-2 Mon-Tue
HERNANDO-MORALES, VICTOR	GS.05-P-14 Wed-Thu
HERNDL, GERHARD	TS.03-0-5 Wed 13:15; TS.22-0-13 Thu 16:45
HERRADOR, BELEN	TS.14-0-8 Tue 16:30; TS.10-0-17 Thu 15:00
HERRANDO, SERGI	GS.04-0-2 Thu 12:15
HERRERA VEGA, JOSE MANUEL	TS.19-0-13 Thu 16:45
HERRERA, CARLOS M.	TS.07-MT-1 Wed 12:00
HERRERA, JOSE M.	GS.02-P-7 Mon-Tue
HERRERA-GRAO, TONY	TS.02-0-15 Wed 18:15
HERRERO, ASIER	TS.11-0-12 Thu 12:30; GS.03-P-10 Wed-Thu; TS.11-P-9 Wed-Thu; GS.05-0-8 Tue 16:15
HERRERO, OSCAR	TS.19-0-3 Thu 12:45
HEVIA, ANDREA	TS.09-0-3 Tue 12:45; TS.20-0-5 Tue 19:15; TS.09-P-2 Mon-Tue
HICKS, LETTICE C.	TS.13-0-3 Tue 18:30; TS.14-0-6 Tue 16:00
HIDALGO, MARIA DOLORES	TS.10-0-17 Thu 15:00; TS.14-0-8 Tue 16:30; TS.10-0-17 Thu 15:00; S.11-P-10 Wed-Thu
HIGES, MARIANO	GS.03-0-26 Thu 13:00
HINOJOSA CENTENO, MARIA BELEN	GS.05-P-8 Wed-Thu; GS.05-P-1 Wed-Thu
HINZ, HILMAR	GS.03-0-20 Wed 19:00
HMIMSA, YOUNES	GS.01-P-9 Mon-Tue
HODAR, JOSE ANTONIO	GS.03-P-10 Wed-Thu; GS.03-0-12 Wed 12:30; GS.03-0-22 Thu 12:00
HOLMSTRUP, MARTIN	TS.14-0-14 Tue 19:00
HOLUB, PETR	TS.14-0-5 Tue 13:15
HOMET GUTIERREZ, PABLO	TS.14-0-12 Tue 18:30
HOPPENRATH, MONA	TS.22-0-4 Thu 13:00
HORTAL, JOAQUIN	GS.03-P-11 Wed-Thu; TS.02-P-13 Mon-Tue
HSIEH, CHIH-HAO	GS.03-0-4 Tue 12:45
HUALLACHAIN, DAIRE O.	TS.19-0-9 Thu 15:45
HUBBELL, STEPHEN	GS.01-0-1 Tue 12:00
HUETE-STAUFFER, TAMARA M.	GS.05-0-10 Tue 16:45
HÜLSMANN, LISA	TS.20-0-4 Tue 19:00
HUREL, AGATHE	TS.07-0-23 Thu 16:15
HURTADO, PILAR	GS.01-0-3 Tue 12:30; TS.10-P-7 Wed-Thu
I	
IBANEZ, INES	TS.06-P-1 Mon-Tue
IBAÑEZ MARTI, CARLES	GS.03-0-13 Wed 12:45
IBAÑEZ RAFFAELE, MARIA DE LAS MERCEDES	TS.03-P-2 Wed-Thu
IBAÑEZ, BEATRIZ	TS.14-0-4 Tue 13:00
ILLA BACHS, ESTELA	TS.02-0-4 Tue 19:00
ILLUMINATI, ANGELA	TS.22-0-3 Thu 12:45; TS.22-P-7 Wed-Thu
IMBERT, J. BOSCO	GS.03-P-19 Wed-Thu; TS.20-P-3 Mon-Tue
INCLAN, ROSA M.	TS.03-0-9 Wed 18:45
INTXAUSTI, IÑAKI	TS.08-0-2 Thu 12:15
IRIGOIEN, XABIER	GS.01-0-15 Wed 13:00; TS.05-0-12 Thu 16:30; GS.05-0-10 Tue 16:45
IRIONDO, JOSE M	TS.02-0-18 Wed 19:00; TS.07-0-14 Thu 12:30; TS.07-0-3 Wed 12:45; TS.02-0-5 Tue 19:15; TS.11-P-12 Wed-Thu
ISAZA-TORO, ESTEFANIA	TS.04-0-4 Wed 13:00
ISERN-FONTANET, JORDI	GS.02-0-11 Tue 18:00
ITURRARTE, GABONE	GS.01-0-12 Wed 12:15
IVANCIC, INGRID	TS.22-0-13 Thu 16:45

IVESA, LIJLIANA	TS.11-P-3 Wed-Thu
J	
JACOBS, DOUGLASS	TS.11-O-22 Thu 16:30
JAEN-LUCHORO, DANIEL	GS.05-P-5 Wed-Thu
JAEN-MOLINA, RUTH	TS.15-O-4 Tue 13:00
JAIME GONZALEZ, LUCIANA ANDREA	TS.20-P-2 Mon-Tue
JAIME, BAEZA	TS.06-P-5 Mon-Tue
JANSSENS, IVAN	TS.04-O-11 Wed 19:15; TS.14-O-9 Tue 16:45; TS.04-O-5 Wed 13:15; TS.16-O-5 Tue 19:15; TS.14-O-14 Tue 19:00
JARA-GUERRERO, ANDREA	TS.04-O-9 Wed 18:45
JARMA, DAYANA AYELEN	TS.02-O-9 Wed 12:15
JARQUE, LAIA	GS.03-O-30 Thu 15:30
JAUREGI, LEIRE	GS.05-P-6 Wed-Thu
JAVIER, CASTRO-JIMENEZ	TS.21-O-10 Wed 12:15
JELIAZKOV, ALIENOR	TS.02-MT-24 Thu 15:00
JENNINGS, ELEANOR	GS.03-P-4 Wed-Thu
JENTSCH, ANKE	TS.11-P-4 Wed-Thu
JEPPESEN, ERIK	TS.21-O-11 Wed 12:30
JEZKOVA, IVANA	TS.07-O-19 Thu 15:15
JIMENEZ BLASCO, IRENE	GS.01-P-5 Mon-Tue
JIMENEZ CHACON, ALEJANDRO	TS.14-O-12 Tue 18:30
JIMENEZ ESCOBAR, MARIA DOLORES	TS.10-P-4 Wed-Thu
JIMENEZ MELERO, RAQUEL	TS.02-O-9 Wed 12:15
JIMENEZ, BEGOÑA	TS.21-O-10 Wed 12:15; TS.21-O-9 Wed 12:00
JIMENEZ, CARLOS	TS.14-O-8 Tue 16:30
JIMENEZ-ALFARO, BORJA	TS.12-O-4 Wed 18:15
JIMENEZ-ARIAS, JUAN LUIS	GS.05-O-15 Wed 13:00; GS.05-P-13 Wed-Thu
JIMENEZ-FRANCO, MARIA VICTORIA	TS.02-O-26 Thu 15:45; TS.07-O-21 Thu 15:45
JIMENEZ-NAVARRO, GERARDO	TS.19-O-13 Thu 16:45
JIMENEZ-ONTIVEROS, VICENTE	GS.05-O-12 Wed 12:15
JO, HYUNBIN	TS.22-O-9 Thu 15:45
JOHN COSTELLO, MARK	GS.01-P-8 Mon-Tue
JOHNSON, ANDREW	GS.03-O-20 Wed 19:00
JOHNSON, DAVID	GS.01-O-6 Tue 13:15
JONES, CHRISTOPHER M	GS.05-O-17 Wed 18:00
JORBA PEIRO, MONTSERRAT	TS.06-P-2 Mon-Tue
JORDA, GABRIEL	TS.11-O-13 Thu 12:45
JORDANO BARBUDO, PEDRO	TS.05-O-6 Thu 15:00
JOUX, FABIEN	TS.03-O-11 Wed 19:15
JOVER, CLARA	TS.21-P-9 Mon-Tue
JOVER, LLUIS	TS.21-O-16 Wed 18:30; TS.21-P-9 Mon-Tue
JUAN, MUÑOZ-ARNANZ	TS.21-O-10 Wed 12:15
JUEN, LEANDRO	GS.03-P-3 Wed-Thu
JUHANSON, JAANIS	GS.05-O-20 Wed 18:45
JULIA, RAMON	TS.15-P-2 Mon-Tue
JUMP, ALISTAIR	TS.11-MT-11 Thu 12:00; TS.11-O-14 Thu 13:00; TS.08-O-5 Thu 13:00
JURADO, ISMAEL	TS.06-P-3 Mon-Tue; TS.06-O-8 Tue 16:30

K	
KAARTVEDT, STEIN	GS.05-O-10 Tue 16:45
KALLEN, SVEN	TS.06-O-3 Tue 12:45
KAPPEL SCHMIDT, INGER	TS.03-O-6 Wed 18:00
KASSANDRA, DE PAO MENDONCA	TS.21-O-10 Wed 12:15
KEPFER-ROJAS, SEBASTIAN	TS.03-O-6 Wed 18:00
KERGUNTEUIL, ALAN	GS.01-P-2 Mon-Tue

KERSTING, DIEGO KURT	TS.11-0-19 Thu 15:45
KESSLER, MICHAEL	GS.01-0-7 Tue 16:00
KEVIN, LIAUTAUD	GS.03-0-8 Tue 16:15
KHAN, HARES	TS.03-0-10 Wed 19:00
KISSLING, W. DANIEL	GS.03-0-11 Wed 12:15
KITZLER, BARBARA	TS.14-0-15 Tue 19:15
KLEIN, ALEXANDRA-MARIA	TS.10-P-8 Wed-Thu
KLEM, KAREL	TS.11-P-4 Wed-Thu
KLUGE, JÜRGEN	GS.01-0-7 Tue 16:00
KNEESHAW, DANIEL	TS.08-0-4 Thu 12:45
KNOHL, ALEXANDER	TS.16-P-1 Mon-Tue
KÖHLER, MEIKE	TS.09-0-4 Tue 13:00
KÖHLER, STEPHAN J.	TS.01-0-2 Tue 12:15
KORKOUMPAS, DIMITRIOS	TS.06-0-3 Tue 12:45
KO UTHOVA, ALICA	GS.01-0-3 Tue 12:30
KOTHAWALA, DOLLY	TS.01-MT-9 Tue 16:30
KOVACS-LANG, EDIT	TS.14-0-14 Tue 19:00
KRÖEL-DULAY, GYÖRGY	TS.11-P-4 Wed-Thu; TS.14-0-14 Tue 19:00
KRÖMER, THORSTEN	GS.01-0-7 Tue 16:00
KRUIJT, BART	TS.16-P-1 Mon-Tue
KÜLH, MICHAEL	GS.05-P-7 Wed-Thu

L

LAAS, ALO	TS.03-0-10 Wed 19:00
LADO RODRIGUEZ, CARLOS	TS.04-P-3 Wed-Thu
LANGER, TERESA	TS.03-0-5 Wed 13:15
LANZAS, MONICA	GS.04-0-5 Thu 13:00
LANZEN, ANDERS	GS.05-P-4 Wed-Thu
LAPIEDRA, ORIOL	TS.17-0-2 Tue 12:30
LARA GOMEZ, MIGUEL ANGEL	GS.01-P-9 Mon-Tue
LARA, CARLOS	TS.07-0-14 Thu 12:30; TS.02-0-18 Wed 19:00; TS.02-0-5 Tue 19:15; TS.11-P-12 Wed-Thu
LARA, ELENA	GS.05-0-8 Tue 16:15; TS.22-P-2 Wed-Thu
LARA, MIGUEL	GS.05-P-13 Wed-Thu; GS.05-0-15 Wed 13:00
LARRAÑAGA, AITOR	TS.06-0-10 Tue 18:15; TS.21-0-3 Tue 18:30; GS.05-0-22 Wed 19:15; TS.21-0-1 Tue 18:00
LARSEN, ELISABETH	TS.08-0-14 Thu 16:45
LARSEN, KLAUS STEENBERG	TS.11-P-4 Wed-Thu
LASKURAIN, NERE AMAIA	TS.11-0-12 Thu 12:30; TS.11-P-9 Wed-Thu
LASSALETTA, LUIS	TS.01-0-3 Tue 12:30
LATASA, MIKEL	TS.16-0-2 Tue 18:30
LATTORE, MARTINA	TS.17-0-5 Tue 13:15
LAUDON, HJALMAR	TS.01-0-2 Tue 12:15
LAZARO CASTILLO, AMPARO	TS.10-0-11 Wed 19:15
LAZARO, WILKINSON L.	TS.21-P-4 Mon-Tue
LE BISSONNAIS, YVES	TS.14-0-3 Tue 12:45
LEAHY, KRISTIAN	TS.02-P-18 Mon-Tue
LEBLANS, NIKI	TS.14-0-9 Tue 16:45
LEBLOND, SEBASTIEN	TS.10-P-1 Wed-Thu
LECHUGA LAGO, YAIZA	GS.02-0-4 Tue 12:45
LECHUGA, VICTOR	TS.10-0-7 Wed 18:15; TS.14-0-2 Tue 12:30
LECINA-DIAZ, JUDIT	GS.04-0-2 Thu 12:15
LEDESMA, JOSE L. J.	TS.01-0-2 Tue 12:15
LEDO LANÇAO, VERONICA	TS.10-P-2 Wed-Thu
LEDOUX, JEAN-BAPTISTE	TS.07-0-12 Thu 12:00; TS.02-0-2 Tue 18:30
LEDRU, MARIE-PIERRE	TS.15-0-9 Tue 16:45

LEDUC, ALAIN	TS.08-0-4 Thu 12:45
LEE, SANG HOON	TS.05-0-4 Thu 13:00
LEFEBVRE, LOUIS	TS.17-MT-1 Tue 12:00
LEGENDE, PIERRE	PT-3 Tue 10:00; GS.01-0-1 Tue 12:00
LEINFELDER, REINHOLD	TS.11-0-19 Thu 15:45
LEIVA, MARIA JOSE	TS.03-P-2 Wed-Thu
LEIZEAGA, AINARA	TS.13-0-3 Tue 18:30; TS.14-0-6 Tue 16:00
LEKUNBERRI, ITZIAR	TS.21-0-4 Tue 18:45
LEMONS, MARCO	GS.02-0-17 Tue 19:30
LEMONS, VALERIA	TS.02-P-21 Mon-Tue
LENDINEZ, SANDRA	TS.05-0-9 Thu 15:45
LEON-SANCHEZ, LUPE	TS.14-0-7 Tue 16:15
LEPS, JAN	GS.03-P-7 Wed-Thu
LEVERKUS, ALEXANDRO BITOL	GS.01-0-18 Wed 18:15
LI, YAN	TS.08-0-6 Thu 13:15
LINARES, CRISTINA	TS.02-0-2 Tue 18:30; GS.01-P-8 Mon-Tue; TS.02-P-10 Mon-Tue; TS.06-0-12 Tue 18:45; TS.11-0-19 Thu 15:45; TS.07-P-2 Wed-Thu; TS.02-P-10 Mon-Tue; TS.07-0-12 Thu 12:00; TS.07-0-12 Thu 12:00
LINARES, JUAN CARLOS	TS.20-0-7 Tue 19:45; TS.14-0-2 Tue 12:30; TS.09-0-2 Tue 12:30; TS.09-0-3 Tue 12:45
LLENAS, LAIA	TS.21-0-15 Wed 18:15; GS.05-0-16 Wed 13:15
LLOP, ESTEVE	GS.01-P-6 Mon-Tue
LLORENS, ISMAEL	TS.11-0-8 Wed 18:30
LLORENS, LAURA	TS.11-P-7 Wed-Thu; TS.14-P-2 Mon-Tue; TS.11-P-11 Wed-Thu
LLORENS, LLEONARD	GS.03-P-18 Wed-Thu
LLORET LLORET, ELENA	TS.11-P-8 Wed-Thu
LLORET, FRANCISCO	TS.20-0-2 Tue 18:30; TS.20-0-3 Tue 18:45; TS.20-P-2 Mon-Tue; TS.08-0-9 Thu 15:30; TS.14-0-2 Tue 12:30
LLORET, JOSEP	TS.11-0-21 Thu 16:15
LLORET-CABOT, ROGER	TS.17-P-2 Mon-Tue
LLOVET MARTIN, ALBA	GS.05-P-9 Wed-Thu
LLOVET, JOAN	TS.03-0-9 Wed 18:45
LLUENT, ARTUR	TS.02-0-4 Tue 19:00
LLURBA, ROSA	GS.03-0-33 Thu 16:15
LLUSIA, DIEGO	TS.04-0-6 Wed 18:00
LLUSIA, JOAN	TS.11-0-17 Thu 15:15
LO CASCIO, MAURO	TS.03-0-9 Wed 18:45
LO, YUEH-HSIN	GS.03-P-19 Wed-Thu
LOBO, SARA	GS.03-P-11 Wed-Thu; GS.01-P-11 Mon-Tue
LOGARES, RAMIRO	TS.22-P-1 Wed-Thu
LÖHMUS, KRISTA	TS.11-P-4 Wed-Thu
LOIZEAU, JEAN-LUC	TS.21-0-14 Wed 18:00
LOPEZ NUÑEZ, FRANCISCO ALEJANDRO	GS.02-P-5 Mon-Tue
LOPEZ PERALTA, ANA MARIA	TS.10-0-10 Wed 19:00
LOPEZ, CARLOS	TS.11-0-17 Thu 15:15
LOPEZ, DAVID	TS.12-0-4 Wed 18:15
LOPEZ, GERMAN	TS.06-P-6 Mon-Tue
LOPEZ, NAIARA	TS.14-0-16 Tue 19:30
LOPEZ-ANGULO, JESUS	GS.01-0-16 Wed 13:15; TS.22-P-7 Wed-Thu; TS.22-0-3 Thu 12:45
LOPEZ-GARCIA, PURIFICACION	TS.22-0-4 Thu 13:00
LOPEZ-GOLDAR, XOSE	TS.07-0-24 Thu 16:30; TS.07-0-15 Thu 12:45
LOPEZ-LETONA, MARKEL	GS.05-0-7 Tue 16:00
LOPEZ-MARTINEZ, MARIA ANGELES	TS.02-P-1 Mon-Tue
LOPEZ-NICOLAS, ANTONIO	TS.02-0-6 Tue 19:30
LOPEZ-RODRIGUEZ, MARIA D.	TS.02-P-6 Mon-Tue
LOPEZ-RUBIO, ROBERTO	TS.02-0-19 Thu 12:00

LOPEZ-SENDINO, PAULA	TS.07-0-12 Thu 12:00; TS.02-0-2 Tue 18:30; TS.07-0-12 Thu 12:00
LOREAU, MICHEL	TS.08-0-3 Thu 12:30; GS.03-0-8 Tue 16:15; TS.19-0-6 Thu 15:00
LORENZO ILLAN, TERESA	GS.05-P-1 Wed-Thu
LORENZO LAZARO, ANA	TS.02-P-11 Mon-Tue
LORENZO RODRIGUEZ, PAULA	GS.02-P-6 Mon-Tue
LOUBET, BENJAMIN	TS.16-P-1 Mon-Tue
LOUZAO, MAITE	TS.08-0-2 Thu 12:15; TS.05-0-12 Thu 16:30; TS.02-0-17 Wed 18:45
LOZANO BERNAL, YUDI MIRLEY	TS.13-0-2 Tue 18:15
LUCAS-BORJA, MANUEL ESTEBAN	TS.08-0-13 Thu 16:30
LUCATI, FEDERICA	TS.06-0-9 Tue 18:00; TS.06-P-3 Mon-Tue; TS.22-0-9 Thu 15:45
LUCENA, FRANCISCO	TS.21-0-8 Tue 19:45
LUCIENTES, JAVIER	GS.02-0-5 Tue 13:00
LUCIO PEREIRA, CATIA	GS.01-0-10 Tue 16:45; GS.03-0-29 Thu 15:15
LUDWIG, WOLFGANG	TS.01-0-3 Tue 12:30
LUKANOV, SIMEON	TS.19-0-7 Thu 15:15
LUNDIN, DANIEL	TS.21-P-6 Mon-Tue; TS.21-0-9 Wed 12:00
LUPION, CARLA	GS.02-0-1 Tue 12:00
LUPON, ANNA	TS.13-0-6 Tue 19:15; TS.01-0-1 Tue 12:00
LUQUE, SANDRA	GS.01-0-11 Wed 12:00
LURGI, MIGUEL	GS.03-0-30 Thu 15:30
LUZURIAGA, ARANTZAZU	TS.08-P-1 Wed-Thu; TS.08-0-10 Thu 15:45; GS.03-P-3 Wed-Thu; TS.10-0-10 Wed 19:00; GS.01-0-16 Wed 13:15

M

MABRITO, ISABEL	GS.05-0-9 Tue 16:30
MACEDA, ALBERTO	TS.02-0-29 Thu 16:30; TS.21-0-5 Tue 19:00
MACIA, MANUEL JUAN	TS.04-0-3 Wed 12:45
MADIROLAS PEREZ, GABRIEL	TS.17-0-7 Tue 16:15
MADRIGAL-GONZALEZ, JAIME	TS.11-P-9 Wed-Thu; TS.11-P-1 Wed-Thu; GS.03-P-3 Wed-Thu
MAESTRE, FERNANDO	GS.03-0-27 Thu 13:15; GS.03-0-3 Tue 12:30
MAGALHAES, SARA	PT-2 Tue 9:00
MAGRACH, AINHOA	GS.03-0-34 Thu 16:30
MAGRO, SANDRA	TS.11-0-3 Wed 12:45; GS.03-P-12 Wed-Thu
MAGUAS, CRISTINA	GS.02-0-15 Tue 19:00; TS.02-0-28 Thu 16:15
MAINGUY, JEAN	GS.05-0-5 Tue 13:00
MAIORANO, LUIGI	TS.19-0-13 Thu 16:45
MAJADA, JUAN	TS.09-P-4 Mon-Tue
MAKOVEC, TIHOMIR	TS.12-0-3 Tue 18:45
MALHIR, YADVINDER	TS.04-MT-1 Wed 12:00
MALUMBRES-OLARTE, JAGOBA	GS.01-0-14 Wed 12:45; TS.22-0-5 Thu 13:15
MANCER, ARNALD	GS.01-P-10 Mon-Tue
MÄND, PILE	TS.11-P-4 Wed-Thu
MANGIALAGIO, LUISA	TS.11-P-3 Wed-Thu
MANRIQUE, ESTEBAN	TS.14-P-1 Mon-Tue
MANZANEDA, ANTONIO J.	TS.05-0-9 Thu 15:45
MARAÑÓN, EMILIO	TS.16-0-2 Tue 18:30
MARAÑÓN, SARA	TS.14-0-9 Tue 16:45; TS.03-0-9 Wed 18:45
MARAÑÓN, TEODORO	TS.14-P-5 Mon-Tue
MARBA, NURIA	TS.11-0-13 Thu 12:45; TS.11-0-18 Thu 15:30; GS.02-P-8 Mon-Tue
MARCE, MAGI	TS.18-0-7 Tue 19:30
MARCE, RAFAEL	TS.03-0-10 Wed 19:00; TS.03-P-3 Wed-Thu
MARCER, ARNALD	TS.07-P-7 Wed-Thu
MARCH SALAS, MARTI	TS.10-0-8 Wed 18:30
MARCHANTE, ELIZABETE	GS.02-P-5 Mon-Tue
MARCOS, BRUNO	GS.01-0-13 Wed 12:30
MARCOS-GARCIA, PATRICIA	TS.02-0-6 Tue 19:30

MARGALEF MARRASE, JORDI	TS.20-0-3 Tue 18:45
MARGALEF, OLGA	TS.04-0-5 Wed 13:15
MARIANI, SIMONE	GS.02-0-5 Tue 13:00
MARIANI, STEFANO	TS.11-0-6 Wed 18:00; TS.15-0-3 Tue 12:45
MARIN-VINDAS, CAROLINA	GS.05-P-10 Wed-Thu
MARQUET, PABLO A	GS.05-0-13 Wed 12:30
MARRASE, CELIA	GS.05-P-11 Wed-Thu; TS.03-0-8 Wed 18:30; TS.18-0-3 Tue 18:30; GS.05-0-5 Tue 13:00; GS.05-0-11 Wed 12:00; GS.03-0-31 Thu 15:45
MARRUGO-NEGRETE, JOSE	TS.21-P-4 Mon-Tue
MARTI, EUGENIA	TS.01-0-5 Tue 13:00; TS.06-0-4 Tue 13:00; TS.01-0-6 Tue 13:15; TS.01-0-1 Tue 12:00; TS.03-P-1 Wed-Thu; TS.06-0-5 Tue 13:15; GS.04-0-9 Thu 15:30
MARTIN BENITO, DARIO	TS.08-0-8 Thu 15:15
MARTIN CACHEDA, LUCIA	TS.10-P-2 Wed-Thu
MARTIN FORES, IRENE	GS.01-0-19 Wed 18:30
MARTIN GONZALEZ, ANA MARIA	TS.05-0-4 Thu 13:00
MARTIN LOPEZ, BERTA	GS.04-P-2 Wed-Thu
MARTIN, DANIEL	TS.22-0-7 Thu 15:15
MARTINEZ DE ARAGON, JUAN	GS.05-0-14 Wed 12:45
MARTINEZ DIAZ-CANEJA, BREZO	TS.02-P-2 Mon-Tue
MARTINEZ LOPEZ, VICENTE	GS.03-0-26 Thu 13:00
MARTINEZ MENENDEZ, JESUS MARTINEZ	GS.01-0-8 Tue 16:15
MARTINEZ NUÑEZ, CARLOS	TS.05-0-9 Thu 15:45
MARTINEZ PASTOR, M ^a CARMEN	GS.01-0-2 Tue 12:15
MARTINEZ SUAREZ, JUAN GABRIEL	TS.07-0-7 Wed 18:15
MARTINEZ, ISABEL	TS.10-P-7 Wed-Thu; GS.01-0-3 Tue 12:30
MARTINEZ, JUAN GABRIEL	TS.07-0-7 Wed 18:15
MARTINEZ, UDANE	TS.05-0-12 Thu 16:30
MARTINEZ, YASMINA	TS.02-P-3 Mon-Tue
MARTINEZ-ABAIGAR, JAVIER	TS.10-P-1 Wed-Thu
MARTINEZ-ALONSO, CELIA	TS.09-P-4 Mon-Tue
MARTINEZ-CAPEL, FRANCISCO	TS.02-0-6 Tue 19:30
MARTINEZ-GARCIA, FRANCISCO J.	TS.02-0-6 Tue 19:30
MARTINEZ-MENA, MARIA	TS.03-0-9 Wed 18:45
MARTINEZ-VARELA, ALICIA	TS.21-0-9 Wed 12:00
MARTINEZ-VILALTA, JORDI	TS.10-MT-12 Thu 12:00; TS.10-0-14 Thu 12:45; GS.01-0-20 Wed 18:45; TS.11-0-23 Thu 16:45; TS.16-0-4 Tue 19:00; GS.01-0-5 Tue 13:00; TS.12-P-1 Mon-Tue; TS.10-0-20 Thu 15:45; TS.09-0-8 Tue 16:30; GS.04-0-1 Thu 12:00
MARTIN-FORES, IRENE	GS.03-P-12 Wed-Thu
MARTIN-HERNANDEZ, RAQUEL	GS.03-0-26 Thu 13:00
MARTIN-LOPEZ, BERTA	GS.04-0-8 Thu 15:15
MARTIN-RODRIGUEZ, IRENE	GS.01-P-7 Mon-Tue
MARTINS, ANABELA	TS.02-P-12 Mon-Tue
MARTINS, NUNO	TS.21-0-6 Tue 19:15
MAS, JOSE ANTONIO	GS.05-P-12 Wed-Thu
MASO, ALBERT	TS.18-0-5 Tue 19:00
MAS-PLA, JOSEP	TS.21-0-4 Tue 18:45
MASPONS, JOAN	TS.14-0-14 Tue 19:00
MASSANA, RAMON	TS.22-0-12 Thu 16:30; GS.05-P-10 Wed-Thu
MATAMOROS, VICTOR	TS.21-P-5 Mon-Tue; TS.21-P-3 Mon-Tue
MATEO, MIGUEL ANGEL	TS.03-0-4 Wed 13:00; TS.03-0-4 Wed 13:00
MATESANZ, SILVIA	TS.07-0-2 Wed 12:30; TS.10-0-9 Wed 18:45; TS.22-P-7 Wed-Thu; TS.07-P-8 Wed-Thu; TS.10-P-3 Wed-Thu; TS.22-0-3 Thu 12:45; TS.19-0-2 Thu 12:30; TS.07-0-3 Wed 12:45; TS.10-0-4 Wed 13:00; TS.19-0-2 Thu 12:30

MATIAS, LUIS	TS.02-0-22 Thu 12:45; TS.14-0-8 Tue 16:30; TS.14-0-12 Tue 18:30; TS.10-0-17 Thu 15:00
MATIAS, MIGUEL	GS.03-0-29 Thu 15:15; GS.01-0-10 Tue 16:45
MATOS, PAULA	TS.10-P-5 Wed-Thu; TS.07-0-22 Thu 16:00
MATTANA, STEFANIA	GS.05-P-9 Wed-Thu; TS.11-0-7 Wed 18:15
MATTEUCCI, GIORGIO	TS.11-0-7 Wed 18:15
MATURANO RUIZ, ADRIAN	TS.11-0-8 Wed 18:30
MAXIME, LENORMAND	GS.01-0-11 Wed 12:00
MAYOL, MARIA	TS.07-0-13 Thu 12:15
MAYRHOFER, HELMUT	GS.01-0-3 Tue 12:30
MCCARTHY, VALERIE	GS.03-P-4 Wed-Thu
MCCULLEY, REBECCA	TS.03-0-9 Wed 18:45
MCKINLEY, EMMA	TS.03-0-4 Wed 13:00; TS.03-0-4 Wed 13:00
MEDINA, MERCEDES	TS.06-P-2 Mon-Tue
MEDINA, NAGORE	TS.10-P-1 Wed-Thu; GS.03-P-3 Wed-Thu
MEDRANO, ALBA	TS.06-0-12 Tue 18:45; TS.02-0-2 Tue 18:30; TS.02-P-10 Mon-Tue
MEDRANO, MONICA	TS.07-MT-1 Wed 12:00
MEIJIDE, ANA	TS.16-P-1 Mon-Tue
MEINZER, FREDERICK	TS.09-0-8 Tue 16:30
MEJIA, LUIS	TS.19-P-2 Wed-Thu
MELERO, YOLANDA	TS.10-0-5 Wed 13:15; GS.02-0-1 Tue 12:00
MELIAN, CARLOS	GS.03-P-3 Wed-Thu
MENCIO, ANNA	GS.03-0-28 Thu 15:00
MENCUCCINI, MAURIZIO	GS.01-0-20 Wed 18:45; TS.10-0-20 Thu 15:45; TS.11-0-7 Wed 18:15
MENDEZ, GONZALO	GS.03-P-1 Wed-Thu
MENDEZ-CEA, BELEN	TS.20-0-7 Tue 19:45
MENDEZ-LOPEZ, MELISSA	TS.21-0-18 Wed 19:00; TS.21-P-7 Mon-Tue
MENDOZA GARCIA, MARIAN	TS.19-0-10 Thu 16:00
MENDOZA SAGRERA, IRENE	TS.04-0-7 Wed 18:15
MENDOZA-FERNANDEZ, ANTONIA	TS.14-0-11 Tue 18:15
MENDOZA-LERA, CLARA	TS.13-0-4 Tue 18:45
MENENDEZ, MARGARITA	TS.02-0-12 Wed 13:00
MENENDEZ, ROSA	GS.03-0-22 Thu 12:00
MENENDEZ-SERRA, MATEU	GS.05-0-2 Tue 12:15
MERBT, STEPHANIE N.	TS.01-0-5 Tue 13:00
MERCADE, ARNAU	TS.02-P-17 Mon-Tue
MEREDITH, WARREN	GS.04-0-9 Thu 15:30; TS.03-P-1 Wed-Thu
MERILÄ, PÄIVI	TS.11-0-7 Wed 18:15
MERINERO, SONIA	GS.01-0-3 Tue 12:30
MERINO MARTIN, LUIS	TS.14-0-3 Tue 12:45
MERINO, JOSE ANGEL	TS.20-0-7 Tue 19:45
MERLO, ENCARNACION	TS.14-0-11 Tue 18:15
MESQUITA, FRANCESC	TS.22-0-10 Thu 16:00; TS.04-0-8 Wed 18:30
MESTRE, LAIA	TS.22-P-5 Wed-Thu
MICHALSKI, GREG	TS.11-0-7 Wed 18:15
MIGUEL LOBO, JORGE	TS.02-P-13 Mon-Tue
MILCU, ALEXANDRU	TS.14-0-5 Tue 13:15
MILLA, RUBEN	TS.10-0-2 Wed 12:30; TS.19-0-2 Thu 12:30; TS.19-0-2 Thu 12:30
MILLAN, ANDRES	TS.02-P-13 Mon-Tue; TS.02-0-10 Wed 12:30; TS.06-0-7 Tue 16:15; TS.07-P-4 Wed-Thu; TS.02-P-1 Mon-Tue
MIÑANO, JESUS	TS.13-0-5 Tue 19:00
MIRALLES-LORENZO, JAVIER	TS.22-0-10 Thu 16:00; TS.16-0-3 Tue 18:45; TS.01-0-7 Tue 16:00; TS.22-P-6 Wed-Thu; TS.03-0-2 Wed 12:30
MIRO, ALEXANDRE	TS.06-P-3 Mon-Tue; TS.06-0-8 Tue 16:30; TS.06-0-9 Tue 18:00; TS.11-0-10 Wed 19:00; TS.11-0-10 Wed 19:00; GS.02-0-13 Tue 18:30; TS.22-0-9 Thu 15:45

MIRO, ISABEL	GS.01-P-3 Mon-Tue
MITRA, ADITEE	GS.03-O-9 Tue 16:30
MOLEON, MARCOS	GS.04-P-1 Wed-Thu; GS.04-O-8 Thu 15:15
MOLINA VALERO, JUAN ALBERTO	TS.09-P-2 Mon-Tue
MOLINA-MORALES, MERCEDES	TS.07-O-7 Wed 18:15
MOLINA-VENEGAS, RAFAEL	GS.03-P-3 Wed-Thu
MOLOWNY, ROBERTO	GS.02-O-1 Tue 12:00; GS.03-O-6 Tue 13:15; TS.01-O-4 Tue 12:45; TS.05-O-3 Thu 12:45; GS.04-O-13 Thu 16:30
MONCALVILLO, BELEN	TS.07-O-3 Wed 12:45
MONLEON, VICENTE	TS.11-O-20 Thu 16:00
MONROS, JUAN	TS.22-O-10 Thu 16:00; TS.04-O-8 Wed 18:30
MONTAGNA, PAOLO	TS.11-O-19 Thu 15:45
MONTAGUD TARRASO, DANIEL	GS.03-O-35 Thu 16:45
MONTALVO, TOMAS	GS.02-O-5 Tue 13:00
MONTEIRO, JULIANA	TS.10-P-5 Wed-Thu; GS.01-P-11 Mon-Tue
MONTEMURRO, NICOLA	TS.21-O-2 Tue 18:15
MONTERO-SERRA, IGNASI	GS.01-P-8 Mon-Tue; TS.02-O-2 Tue 18:30; TS.07-O-12 Thu 12:00; TS.07-O-12 Thu 12:00; TS.02-P-10 Mon-Tue
MONTESINOS NAVARRO, ALICIA	GS.03-O-32 Thu 16:00
MONTOYA, DANIEL	TS.19-O-6 Thu 15:00
MONTSERRAT-MARTI, GABRIEL	TS.14-P-3 Mon-Tue; TS.14-O-11 Tue 18:15
MORALES CASTILLA, IGNACIO	TS.19-O-11 Thu 16:15
MORALES SANCHEZ, JOSE ANGEL	GS.02-O-16 Tue 19:15
MORALES, LILLIAM	TS.04-O-8 Wed 18:30
MORALES, LYLIAN	TS.22-O-10 Thu 16:00
MORALES, NINA	TS.17-O-2 Tue 12:30; TS.17-O-2 Tue 12:30
MORALES-MOLINO, CESAR	TS.15-P-1 Mon-Tue; GS.03-P-3 Wed-Thu
MORALES-REYES, ZEBENSUI	GS.04-P-1 Wed-Thu; GS.04-P-2 Wed-Thu; GS.04-O-8 Thu 15:15
MORAN, ALEJANDRA	GS.04-O-3 Thu 12:30; GS.03-O-18 Wed 18:30; GS.04-O-1 Thu 12:00
MORAN, JAMES	TS.19-O-9 Thu 15:45
MORAN, PALOMA	GS.03-P-1 Wed-Thu
MORAN, XOSE ANXELU G.	GS.05-O-10 Tue 16:45; TS.16-O-2 Tue 18:30; TS.22-MT-1 Thu 12:00
MORANT, DANIEL	TS.03-O-2 Wed 12:30; TS.12-P-4 Mon-Tue; TS.16-O-3 Tue 18:45; TS.22-O-10 Thu 16:00; TS.01-O-7 Tue 16:00; TS.22-P-6 Wed-Thu
MORANTA, JOAN	GS.03-O-20 Wed 19:00
MORARU, CRISTINA	TS.22-P-2 Wed-Thu
MORCILLO, LUNA	TS.08-O-7 Thu 15:00
MOREIRA SUGAI, LARISSA SAYURI	TS.04-O-6 Wed 18:00
MOREIRA, BRUNO RICARDO	TS.10-P-6 Wed-Thu
MOREIRA, DAVID	TS.22-O-4 Thu 13:00
MOREIRA, VICTOR	TS.16-O-2 Tue 18:30
MOREIRA, XOAQUIN	GS.01-P-2 Mon-Tue
MORELL, CARLOS	TS.11-P-6 Wed-Thu
MORELLATO, L. PATRICIA	TS.04-O-7 Wed 18:15
MORELLO, PABLO	TS.19-P-1 Wed-Thu
MORENO KLEMMING, JUAN	TS.17-O-5 Tue 13:15
MORENO MATEOS, DAVID	TS.06-O-14 Tue 19:15; TS.06-O-13 Tue 19:00
MORENO, GERARDO	TS.19-O-7 Thu 15:15
MORENO, JOSE MANUEL	GS.05-P-1 Wed-Thu; GS.05-P-8 Wed-Thu; TS.08-O-12 Thu 16:15
MORENO, MARINA	TS.07-O-21 Thu 15:45
MORENO, RICARDO	TS.02-P-6 Mon-Tue
MORENO-RUEDA, GREGORIO	TS.07-P-6 Wed-Thu
MORENTE, JAVIER	TS.02-O-18 Wed 19:00; TS.07-O-14 Thu 12:30; TS.02-O-5 Tue 19:15; TS.11-P-12 Wed-Thu
MORETTI, MARCO	GS.03-O-23 Thu 12:15; TS.02-P-7 Mon-Tue
MORILLO, JOSE ANTONIO	GS.05-O-13 Wed 12:30

MORRIS, WILLIAM F.	TS.10-0-18 Thu 15:15
MORTAGUA, ANDREIA	TS.11-0-5 Wed 13:15
MOTA, JUAN F.	TS.14-0-11 Tue 18:15
MOURIÑO-CARBALLIDO, BEATRIZ	TS.16-0-2 Tue 18:30; TS.18-0-4 Tue 18:45
MOURRE, BAPTISTE	TS.12-0-3 Tue 18:45
MOUTAHIR, HASSANE	TS.06-P-6 Mon-Tue; TS.08-0-14 Thu 16:45
MOYA PEREZ, JUAN MIGUEL	TS.02-P-14 Mon-Tue
MOYA, DANIEL	TS.08-0-13 Thu 16:30
MOYANO, ENCARNACION	GS.02-0-11 Tue 18:00
MUELLER, THOMAS	GS.03-0-11 Wed 12:15
MUFFLER, LENA	TS.09-0-5 Tue 13:15
MUNGUIRA, MIGUEL L.	TS.02-P-13 Mon-Tue
MUNNE, ANTONI	GS.01-P-3 Mon-Tue
MÜNZBERGOVA, ZUZANA	GS.03-0-1 Tue 12:00
MUNZI, SILVANA	TS.22-0-11 Thu 16:15
MUÑOZ, CONCEPCION	TS.19-P-1 Wed-Thu
MUÑOZ, IRENE	GS.03-0-26 Thu 13:00
MUÑOZ, ISABEL	TS.02-0-12 Wed 13:00; TS.21-0-5 Tue 19:00; TS.21-0-7 Tue 19:30
MUÑOZ, JULIO CESAR	TS.08-0-7 Thu 15:00
MUÑOZ, MARTA	TS.11-0-21 Thu 16:15
MUÑOZ-GALLEGO, RAQUEL	GS.03-0-15 Wed 13:15
MUÑOZ-MAS, RAFAEL	TS.02-0-6 Tue 19:30
MUÑOZ-PAJARES, A. JESUS	TS.20-0-6 Tue 19:30
MUÑOZ-RAMOS, MARINA	TS.07-0-3 Wed 12:45
MURRIA, CESC	GS.01-0-12 Wed 12:15; TS.02-MT-24 Thu 15:00; TS.02-0-11 Wed 12:45; TS.02-0-11 Wed 12:45
MUTZ, MICHAEL	TS.13-0-4 Tue 18:45; TS.13-0-7 Tue 19:30
N	
NADAL-SALA, DANIEL	TS.21-0-8 Tue 19:45; TS.06-0-5 Tue 13:15; GS.02-0-9 Tue 16:30; TS.10-0-24 Thu 16:45
NAGAR, NUPUR	TS.21-0-11 Wed 12:30
NAJDEK, MIRJANA	TS.22-0-13 Thu 16:45
NAJI, WALID	TS.06-P-6 Mon-Tue
NARANJO-CIGALA, AGUSTIN	TS.15-0-4 Tue 13:00
NARBONA, EDUARDO	TS.07-0-25 Thu 16:45; TS.07-P-9 Wed-Thu
NASCIMBENE, JURI	GS.01-0-3 Tue 12:30
NAVARRETE, LUIS	TS.19-0-5 Thu 13:15
NAVARRO CANO, JOSE ANTONIO	TS.06-0-6 Tue 16:00
NAVARRO, GABRIEL	TS.12-0-3 Tue 18:45; GS.03-P-14 Wed-Thu; TS.12-0-3 Tue 18:45
NAVARRO, JOAN	TS.17-P-3 Mon-Tue; TS.05-0-11 Thu 16:15; TS.11-P-8 Wed-Thu
NAVARRO, NURIA	GS.05-P-12 Wed-Thu
NAVARRO-CANO, JOSE A.	GS.05-0-1 Tue 12:00
NAVARRO-CERRILLO, RAFAEL	GS.01-P-9 Mon-Tue; GS.03-P-15 Wed-Thu; GS.02-0-6 Tue 13:15
NAVARRO-FERNANDEZ, CARMEN MARIA	TS.14-P-5 Mon-Tue
NEGRO, JUAN JOSE	TS.02-P-19 Mon-Tue
NEIVA, JOAO	TS.11-MT-1 Wed 12:00
NETO, JOÃO M	GS.02-0-17 Tue 19:30; GS.03-0-24 Thu 12:30
NEUMAN, MAGNUS	GS.03-P-3 Wed-Thu
NEUSCHULZ, EIKE LENA	GS.03-0-11 Wed 12:15
NICOLAS, MANUEL	TS.11-0-7 Wed 18:15
NICOLAU, JOSE MANUEL	TS.11-0-20 Thu 16:00
NIETO CID, MAR	TS.22-0-8 Thu 15:30; TS.22-0-8 Thu 15:30
NINOT, JOSEP MARIA	TS.02-P-17 Mon-Tue; TS.06-0-11 Tue 18:30
NINYEROLA, MIQUEL	TS.15-MT-1 Tue 12:00
NISSSEN, CARA	TS.03-P-4 Wed-Thu

NOGUE, SANDRA	TS.15-0-8 Tue 16:30; TS.15-0-4 Tue 13:00
NOGUEIRA, CARLA	TS.03-0-9 Wed 18:45
NOGUEIRA, ENRIQUE	TS.18-0-4 Tue 18:45
NOGUES, SALVADOR	GS.03-0-33 Thu 16:15
NOTIVOL, EDUARDO	TS.07-0-23 Thu 16:15; TS.07-0-5 Wed 13:15
NOVAIS, SARA	GS.02-0-17 Tue 19:30
NOVOA-MUÑOZ, JUAN CARLOS	TS.21-P-7 Mon-Tue; TS.21-P-2 Mon-Tue; TS.21-0-18 Wed 19:00
NUNES ANTUNES, CRISTINA	TS.02-0-28 Thu 16:15
NUNES, ALICE	TS.10-0-21 Thu 16:00
NUÑEZ-DELGADO, AVELINO	TS.21-P-2 Mon-Tue
NUÑEZ-OLIVERA, ENCARNACION	TS.10-P-1 Wed-Thu
O	
O'BRIEN, DAVID	TS.06-P-3 Mon-Tue; TS.06-0-9 Tue 18:00
OBERNOSTERER, INGRID	TS.03-0-11 Wed 19:15
OBIOL, ALEIX	TS.22-0-12 Thu 16:30
OBRADOR, BIEL	TS.03-P-3 Wed-Thu; TS.03-0-10 Wed 19:00; GS.03-0-28 Thu 15:00
OBRIST, MARTIN	TS.02-P-7 Mon-Tue
OCHOA, VICTORIA	GS.03-0-3 Tue 12:30
OCHOA-HUESO, RAUL	TS.14-0-10 Tue 18:00; TS.14-P-1 Mon-Tue
OGEE, JERÔME	TS.10-0-23 Thu 16:30
O'GORMAN, EOIN	TS.21-0-5 Tue 19:00
OJEDA, FERNANDO	GS.01-P-7 Mon-Tue; TS.07-0-16 Thu 13:00
OLANO, JOSE MIGUEL	TS.09-P-3 Mon-Tue; TS.02-0-20 Thu 12:15; TS.09-0-6 Tue 16:00; TS.09-P-1 Mon-Tue; TS.02-0-21 Thu 12:30
OLIVA, FRANCESC	TS.14-0-17 Tue 19:45
OLIVA, JONAS	GS.02-0-12 Tue 18:15; GS.05-0-14 Wed 12:45; TS.20-P-1 Mon-Tue
OLIVEIRA, RICARDO	TS.11-0-5 Wed 13:15
OLIVERAS MENOR, IMMA	TS.04-MT-1 Wed 12:00
OLIVIER, ARGAGNON	GS.01-0-11 Wed 12:00
OLLER, JOSEP MARIA	TS.18-0-5 Tue 19:00
OLMO, CARLA	TS.21-P-8 Mon-Tue; GS.02-P-9 Mon-Tue; TS.04-0-8 Wed 18:30
OLMO, MANUEL	TS.19-P-1 Wed-Thu; TS.10-0-15 Thu 13:00
OLTRA, AITANA	GS.02-0-5 Tue 13:00
ONAINDIA, MIREN	GS.04-0-4 Thu 12:45
ONTIVEROS, VICENTE J	GS.01-0-9 Tue 16:30; GS.05-0-2 Tue 12:15
OPGENOORTH, LARS	TS.07-0-5 Wed 13:15
OPPERMANN, RAINER	TS.19-0-7 Thu 15:15
ORBAN, ILO	TS.11-P-4 Wed-Thu
ORDEIX, MARC	GS.05-0-16 Wed 13:15
ORIZAOLA, GERMAN	TS.07-0-11 Wed 19:15
ORLOVIC, SASA	TS.11-P-4 Wed-Thu
ORNOSA, CONCEPCION	GS.03-0-26 Thu 13:00
ORO DE RIVAS, DANIEL	TS.08-0-1 Thu 12:00
ORTEGA-RETUERTA, EVA	TS.03-0-11 Wed 19:15; GS.05-0-7 Tue 16:00
ORTELLS, RAQUEL	TS.07-0-19 Thu 15:15; TS.21-P-8 Mon-Tue
ORTIZ BALLESTEROS, PEDRO	TS.07-P-9 Wed-Thu
ORTIZ DIAZ, MARIA LAURA	TS.08-P-1 Wed-Thu; TS.08-0-10 Thu 15:45
ORTIZ-ALVAREZ, RÜDIGER	GS.05-0-2 Tue 12:15
ORWIG, DAVID	TS.08-0-8 Thu 15:15
OSORIO, VICTOR	TS.22-0-9 Thu 15:45; GS.02-0-13 Tue 18:30; TS.02-P-20 Mon-Tue; TS.06-P-3 Mon-Tue; TS.06-0-8 Tue 16:30
OSPINA-CALDERON, NHORA	TS.04-0-2 Wed 12:30
OTERO, NEUS	TS.02-0-10 Wed 12:30
OTERO-FERRER, JOSE LUIS	TS.16-0-2 Tue 18:30
OULED-CHEIKH, JAZEL	TS.21-0-16 Wed 18:30

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PAAPSPYROU, SOKRATIS	GS.05-O-15 Wed 13:00
PACHECO, MANUEL	TS.02-P-6 Mon-Tue
PADRON, PEDRO	TS.04-P-2 Wed-Thu
PAGES, JORDI F.	TS.03-O-4 Wed 13:00
PAGES, MARTA	GS.01-P-8 Mon-Tue; TS.06-O-12 Tue 18:45; TS.02-P-10 Mon-Tue
PAGES-ESCOLA, MARTA	TS.02-O-2 Tue 18:30
PALACIN-LIZARBE, CARLOS	GS.05-O-17 Wed 18:00
PALACIO, SARA	TS.14-O-11 Tue 18:15; TS.14-P-3 Mon-Tue
PALACIOS RODRIGUEZ, GUILLERMO	GS.01-P-9 Mon-Tue
PALAU, JOSE LUIS	TS.08-O-14 Thu 16:45
PALLARES, SUSANA	TS.02-P-15 Mon-Tue; TS.02-P-1 Mon-Tue
PALMEIRIM, JORGE	TS.19-O-8 Thu 15:30
PALMER, JOHN	GS.02-O-5 Tue 13:00
PALMER, MIQUEL	TS.17-O-6 Tue 16:00
PALMERO-INIESTA, MARINA	TS.16-P-2 Mon-Tue; TS.08-O-5 Thu 13:00
PALOMERA, ISABEL	TS.05-O-11 Thu 16:15
PANLILIO, MARIA	TS.17-P-2 Mon-Tue
PANNELL, JOHN R.	TS.07-O-13 Thu 12:15
PAPASPYROU, SOKRATIS	GS.05-P-7 Wed-Thu; GS.05-P-13 Wed-Thu
PAPUGA, GUILLAUME	GS.01-O-11 Wed 12:00
PARDO, ADARA	TS.19-O-7 Thu 15:15
PARDO, IKER	TS.02-O-23 Thu 13:00
PAREDES-ESQUIVEL, CALAUDIA	GS.02-O-5 Tue 13:00
PAREJO, DESEADA	GS.03-O-19 Wed 18:45
PARLADE, JAVIER	GS.05-O-14 Wed 12:45
PARRA ANGUIA, GEMA	TS.02-P-16 Mon-Tue
PASCOAL, CLAUDIA	GS.03-O-21 Wed 19:15
PASCUAL RICO, ROBERTO	GS.04-P-2 Wed-Thu
PASCUAL-BENITO, MIRIAM	TS.21-O-8 Tue 19:45
PASTOR, ADA	TS.01-O-8 Tue 16:15
PATARO, LUCIANO	GS.03-P-3 Wed-Thu
PATIÑO, JAIRO	TS.10-P-1 Wed-Thu
PAÜL, ELISABET	TS.02-O-29 Thu 16:30
PAULINO, CRISTINA	TS.11-MT-1 Wed 12:00
PAUSAS, JULI G.	TS.07-P-5 Wed-Thu; TS.15-O-2 Tue 12:30; TS.07-P-1 Wed-Thu; TS.10-P-6 Wed-Thu
PAVELKA, MARIAN	TS.16-P-1 Mon-Tue
PAVOINE, SANDRINE	TS.02-MT-24 Thu 15:00
PEARSON, GARETH	TS.11-MT-1 Wed 12:00; TS.11-MT-1 Wed 12:00
PEDERSON, NEIL	TS.08-O-8 Thu 15:15
PEGUERO, GUILLE	TS.14-O-14 Tue 19:00; TS.04-O-5 Wed 13:15
PELACHS, ALBERT	TS.15-P-2 Mon-Tue; TS.15-O-3 Tue 12:45
PELLISSIER, LOÏC	TS.02-P-7 Mon-Tue
PENNINO, MARIA GRAZIA	TS.11-O-9 Wed 18:45; TS.11-P-8 Wed-Thu
PEÑA, LORENA	GS.04-O-4 Thu 12:45
PEÑA, RAMON	TS.12-P-3 Mon-Tue
PEÑAS, JULIO	TS.16-P-1 Mon-Tue
PEÑUELAS, JOSEP	TS.03-MT-1 Wed 12:00; TS.01-O-3 Tue 12:30; TS.04-O-11 Wed 19:15; TS.09-O-5 Tue 13:15; TS.11-O-17 Thu 15:15; TS.11-P-4 Wed-Thu; TS.14-O-9 Tue 16:45; GS.03-O-30 Thu 15:30; TS.16-O-5 Tue 19:15; TS.11-O-17 Thu 15:15; TS.04-O-5 Wed 13:15; TS.11-O-7 Wed 18:15; TS.14-O-14 Tue 19:00
PERA, JOAN	GS.05-O-14 Wed 12:45
PERAL, LAURA	TS.18-O-7 Tue 19:30
PEREA MARTOS, ANTONIO JESUS	GS.03-O-14 Wed 13:00

PEREA, RAMON	TS.15-P-1 Mon-Tue
PEREDA, OLATZ	GS.05-O-22 Wed 19:15; TS.21-O-1 Tue 18:00
PEREIA GARCIA, CARLA	TS.21-O-17 Wed 18:45
PEREIRA, FERNANDO	TS.05-P-1 Wed-Thu
PEREIRA-SANDOVAL, MARCELA	TS.12-P-3 Mon-Tue
PEREIRO RODRIGUEZ, DIEGO	GS.02-O-4 Tue 12:45
PERES, CARLOS A.	TS.04-O-7 Wed 18:15
PEREZ CARMONA, CARLOS	TS.10-MT-1 Wed 12:00
PEREZ CRUZADO, CESAR	TS.09-P-2 Mon-Tue
PEREZ ESCUDERO, ALFONSO	TS.17-O-7 Tue 16:15
PEREZ, FRANCISCO JOSE	TS.02-O-3 Tue 18:45
PEREZ, JAVIER	TS.14-O-16 Tue 19:30
PEREZ, NOEMI	GS.05-O-11 Wed 12:00
PEREZ, SANDRA	TS.21-O-2 Tue 18:15
PEREZ-CALPE, VICKI	TS.21-O-1 Tue 18:00
PEREZ-FERNANDEZ, TONI	TS.02-P-15 Mon-Tue
PEREZ-GARCIA, FRANCISCO JAVIER	TS.14-O-11 Tue 18:15
PEREZ-GARCIA, JUAN MANUEL	GS.01-O-2 Tue 12:15
PEREZ-HAASE, AARON	TS.02-P-17 Mon-Tue; TS.06-O-11 Tue 18:30; TS.15-O-3 Tue 12:45
PEREZ-HERNANDEZ, F	TS.14-O-11 Tue 18:15
PEREZ-MILLA, ANTONIO J.	TS.05-O-9 Thu 15:45
PEREZ-NAVARRO, MARIA ANGELES	TS.08-O-9 Thu 15:30; TS.20-O-3 Tue 18:45
PEREZ-OBIAL, RAMON	TS.15-P-2 Mon-Tue; TS.15-MT-1 Tue 12:00; TS.15-O-3 Tue 12:45
PEREZ-QUEMADA, JORGE	TS.03-O-9 Wed 18:45
PEREZ-RAMOS, IGNACIO	TS.11-P-10 Wed-Thu; TS.14-O-8 Tue 16:30; TS.10-O-17 Thu 15:00
PEREZ-RODRIGUEZ, PAULA	TS.21-O-18 Wed 19:00
PEREZ-SILOS, IGNACIO	GS.04-O-12 Thu 16:15; GS.04-O-11 Thu 16:00; TS.12-O-4 Wed 18:15
PERICH PRUJA, AINA	TS.02-P-18 Mon-Tue
PERKINS, DANIEL M	TS.21-O-5 Tue 19:00
PESCADOR, DAVID S.	GS.01-O-16 Wed 13:15; TS.02-O-19 Thu 12:00; TS.22-O-3 Thu 12:45
PETERS, FRANCESC	TS.16-P-3 Mon-Tue; GS.03-O-31 Thu 15:45; GS.05-O-11 Wed 12:00; GS.05-P-11 Wed-Thu
PETERSEN, HENNING	TS.14-O-14 Tue 19:00
PETROVA, MARIIA	TS.21-O-10 Wed 12:15
PETRY, WILLIAM	GS.01-P-2 Mon-Tue
PFANNKUCHEN, DANIELA MARIC	TS.22-O-13 Thu 16:45
PIAS, BEATRIZ	TS.10-O-4 Wed 13:00; TS.22-O-3 Thu 12:45; TS.22-P-7 Wed-Thu
PICAZO, ANTONIO	TS.22-P-6 Wed-Thu; TS.01-O-7 Tue 16:00; TS.03-O-2 Wed 12:30; TS.01-P-1 Mon-Tue; TS.12-P-4 Mon-Tue; TS.16-O-3 Tue 18:45; TS.22-O-10 Thu 16:00
PICAZO, FELIX	TS.06-O-7 Tue 16:15
PICO, SERGIO	TS.07-O-16 Thu 13:00
PICO, XAVIER	TS.07-P-7 Wed-Thu; GS.01-P-10 Mon-Tue
PIEDRA, DAVID	GS.01-P-3 Mon-Tue
PIERA, JAUME	TS.02-P-18 Mon-Tue; TS.02-O-29 Thu 16:30
PIGOT, ALEX	TS.02-MT-24 Thu 15:00
PILEGAARD, KIM	TS.16-P-1 Mon-Tue
PINEDA, DAVID	GS.01-P-4 Mon-Tue
PINHASSI, JARONE	GS.05-P-11 Wed-Thu
PINHO, PEDRO	TS.07-O-22 Thu 16:00
PINO, JOAN	GS.02-O-1 Tue 12:00; GS.03-P-6 Wed-Thu; GS.04-O-13 Thu 16:30; TS.10-O-5 Wed 13:15; TS.14-O-13 Tue 18:45; TS.08-O-5 Thu 13:00; TS.16-P-2 Mon-Tue
PINTO, MARIA	TS.03-O-5 Wed 13:15
PIÑA, BENJAMIN	TS.21-O-9 Wed 12:00; TS.21-P-6 Mon-Tue
PIÑEIRO, JUAN	TS.14-O-10 Tue 18:00

PIÑOL, JOSEP	TS.22-P-4 Wed-Thu; TS.22-P-5 Wed-Thu
PIOTTI, ANDREA	TS.07-O-23 Thu 16:15
PISTON, NURIA	TS.02-O-20 Thu 12:15
PIZARRO, MANUEL	TS.02-O-23 Thu 13:00
PLA I FERRIOL, MARTI	TS.21-O-17 Wed 18:45
PLA RABES, SERGI	TS.15-O-7 Tue 16:15
PLA, MAGDA	GS.03-O-18 Wed 18:30
PLADEVALL-IZARD, EULALIA	TS.06-O-11 Tue 18:30; TS.02-P-17 Mon-Tue
PLANELLO, ROSARIO	TS.19-O-3 Thu 12:45
PLASSARD, CLAUDE	TS.14-O-3 Tue 12:45
PLAZA CUSINE, MIREIA	TS.17-O-5 Tue 13:15
PLAZA-ALVAREZ, PEDRO ANTONIO	TS.08-O-13 Thu 16:30
POBLADOR, SILVIA	TS.10-O-24 Thu 16:45; GS.02-O-9 Tue 16:30; TS.10-P-9 Wed-Thu
POLIMENE, LUCA	GS.03-O-9 Tue 16:30
POLO, VICENTE	GS.03-P-9 Wed-Thu
PONGE, JEAN-FRANÇOIS	TS.14-O-14 Tue 19:00
PONSA, SERGIO	TS.21-O-15 Wed 18:15; GS.05-O-16 Wed 13:15
PONTEVEDRA-POMBAL, XABIER	TS.21-P-7 Mon-Tue
PORCUNA, HELENA	TS.21-O-8 Tue 19:45
PORTELA, ANA PAULA	GS.02-O-18 Tue 19:45
POSTIGO-MIJARRA, JOSE MARIA	TS.15-O-2 Tue 12:30
POULTER, BENJAMIN	TS.08-O-8 Thu 15:15
POU-ROVIRA, QUIM	TS.06-O-8 Tue 16:30; TS.06-P-3 Mon-Tue; GS.02-O-13 Tue 18:30; TS.22-O-9 Thu 15:45; TS.06-O-9 Tue 18:00;
POWER, SALLY	TS.14-O-10 Tue 18:00
POYATOS, RAFAEL	GS.01-O-5 Tue 13:00; TS.03-O-3 Wed 12:45; TS.16-O-4 Tue 19:00
POZO, JESUS	TS.14-O-16 Tue 19:30
PRADA MONTEAGUDO, MARTA	TS.09-P-4 Mon-Tue
PRADHAN, ARUNAVA	TS.21-O-6 Tue 19:15
PRAT, NARCIS	TS.02-O-11 Wed 12:45; TS.02-O-11 Wed 12:45
PRECIOSO, MARTA	TS.07-O-7 Wed 18:15
PRENDA, JOSE	TS.02-P-19 Mon-Tue; TS.02-P-11 Mon-Tue; TS.02-P-11 Mon-Tue
PRETUS, JOAN LL.	TS.11-O-19 Thu 15:45
PRIETO BENITEZ, SAMUEL	TS.02-O-18 Wed 19:00
PRIETO RUBIO, JORGE	TS.14-P-6 Mon-Tue
PRIETO, IVAN	TS.13-P-2 Mon-Tue
PRIETO, LAURA	TS.12-O-3 Tue 18:45; GS.03-P-14 Wed-Thu
PRIETO, MARIA	GS.01-O-3 Tue 12:30; TS.10-P-7 Wed-Thu
PRIETO, SAMUEL	TS.11-P-12 Wed-Thu; TS.07-O-14 Thu 12:30; TS.02-O-5 Tue 19:15
PRUNIER, JEROME	TS.06-O-10 Tue 18:15
PUCHE, ERIC	TS.13-O-1 Tue 18:00; GS.03-P-16 Wed-Thu
PUERTA-PIÑERO, CAROLINA	TS.19-P-2 Wed-Thu
PUEYO, YOLANDA	GS.03-P-13 Wed-Thu; GS.03-P-5 Wed-Thu
PUGNAIRE, FRANCISCO	GS.05-O-13 Wed 12:30; TS.02-O-20 Thu 12:15; TS.14-P-1 Mon-Tue
PUIG, MARIA ANGELS	TS.02-P-20 Mon-Tue; TS.22-O-9 Thu 15:45; GS.02-O-13 Tue 18:30; TS.06-O-8 Tue 16:30
PUIGCERVER, MANEL	GS.01-P-5 Mon-Tue
PULIDO-VELAZQUEZ, MANUEL	TS.02-O-6 Tue 19:30
PYHÄJÄRVI, TANJA	TS.07-O-5 Wed 13:15
Q	
QUEREJETA, JOSE I.	TS.20-O-5 Tue 19:15
QUERO, JOSE L.	GS.03-O-3 Tue 12:30; GS.03-P-15 Wed-Thu; TS.19-P-1 Wed-Thu
QUINTANA, XAVIER	TS.06-MT-1 Tue 12:00; GS.03-O-28 Thu 15:00
QUINTERO, ANGELA	GS.03-O-16 Wed 18:00; GS.03-O-16 Wed 18:00

R

RADINGER, JOHANNES	GS.02-O-10 Tue 16:45
RADUJKOVIC, DAJANA	TS.11-P-4 Wed-Thu
RAHBK, CARSTEN	TS.05-O-4 Thu 13:00
RAMILO, ISABEL	TS.18-O-4 Tue 18:45
RAMIREZ ROJAS, IRENE	TS.04-O-5 Wed 13:15
RAMIREZ, FRANCISCO	TS.17-P-3 Mon-Tue
RAMIREZ, JOSE MANUEL	TS.02-O-9 Wed 12:15
RAMIREZ-VALIENTE, JOSE ALBERTO	TS.07-O-5 Wed 13:15; TS.07-O-2 Wed 12:30; TS.10-O-4 Wed 13:00; TS.07-O-23 Thu 16:15
RAMIS-MUNAR, GUILLEM	GS.05-P-5 Wed-Thu
RAMOS, BLANCA	TS.02-P-6 Mon-Tue
RAMOS-MERCHANTE, ADRIAN	TS.02-P-19 Mon-Tue
RAMOS-MUÑOZ, MARINA	TS.07-P-8 Wed-Thu; TS.10-O-4 Wed 13:00
RAMOS-SALA, MARC	GS.05-O-11 Wed 12:00
RASMANN, SERGIO	GS.01-P-2 Mon-Tue
RATCLIFFE, SOPHIA	TS.10-O-3 Wed 12:45
REAL, MONTSERRAT	GS.01-P-3 Mon-Tue
REBELO, HUGO	GS.02-P-5 Mon-Tue
REBOUL, GUILLAUME	TS.22-O-4 Thu 13:00
RECHE, ISABEL	GS.05-O-21 Wed 19:00
REDONDO, MIGUEL ANGEL	GS.02-O-12 Tue 18:15; TS.20-P-1 Mon-Tue
REGALADO, INGRID	TS.07-O-13 Thu 12:15
REGO, CARLA	TS.05-P-1 Wed-Thu
REGUERA, BEATRIZ	TS.18-O-4 Tue 18:45; TS.16-O-2 Tue 18:30
REINTHALER, DAVID	TS.11-P-4 Wed-Thu
RENWICK, KATE	TS.08-O-8 Thu 15:15
REÑE, ALBERT	TS.22-O-4 Thu 13:00; TS.22-P-1 Wed-Thu
REÑONES, OLGA	GS.03-O-20 Wed 19:00
RESCO, VICTOR	TS.16-MT-1 Tue 18:00
RETANA, JAVIER	GS.04-O-2 Thu 12:15
RETUERTO, RUBEN	TS.10-P-1 Wed-Thu
REUNING, LARS	TS.11-O-19 Thu 15:45
REVERTE, SARA	GS.03-O-6 Tue 13:15; TS.05-O-8 Thu 15:30
REVSBECH, NIELS PETER	GS.05-O-6 Tue 13:15
REY, ANA	TS.03-O-9 Wed 18:45
REY, PEDRO J.	TS.05-O-5 Thu 13:15; TS.05-O-9 Thu 15:45
REY-BENAYAS, JOSE MARIA	TS.06-P-1 Mon-Tue
REYES-GONZALEZ, JOSE MANUEL	TS.17-P-4 Mon-Tue
RIBA, MIQUEL	TS.07-O-13 Thu 12:15
RIBAS, ANGELA	GS.03-O-33 Thu 16:15; GS.05-P-9 Wed-Thu
RIBERA, IGNACIO	TS.02-P-15 Mon-Tue; TS.02-P-1 Mon-Tue
RIBOT, MIQUEL	TS.06-O-4 Tue 13:00; TS.01-O-5 Tue 13:00; GS.04-O-9 Thu 15:30; TS.06-O-5 Tue 13:15
RICART, MARTA	GS.05-O-16 Wed 13:15
RICHARD, SEMPERE	TS.21-O-10 Wed 12:15
RICHTER, ANDREAS	TS.14-O-9 Tue 16:45
RIIS, TENNA	TS.01-O-8 Tue 16:15; TS.01-O-8 Tue 16:15
RILLIG, MATTHIAS C	TS.13-O-2 Tue 18:15
RINCON, ANA	TS.14-P-6 Mon-Tue
RIPULLONE, FRANCESCO	TS.20-P-1 Mon-Tue
RITA, JUAN	GS.02-P-3 Mon-Tue
RIVAS-TORRES, ANAIS	TS.07-O-6 Wed 18:00
RIVEIRO, SHEILA F.	GS.01-P-6 Mon-Tue
ROBLEDANO, FRANCISCO	TS.06-O-7 Tue 16:15; TS.07-P-4 Wed-Thu
ROBLEDANO-ARNUNCI, JUAN JOSE	TS.07-O-23 Thu 16:15; TS.07-O-5 Wed 13:15

ROCES-DIAZ, JOSE V	GS.04-O-1 Thu 12:00
ROCHERA, CARLOS	TS.01-O-7 Tue 16:00; TS.01-P-1 Mon-Tue; TS.22-P-6 Wed-Thu; TS.03-O-2 Wed 12:30; TS.12-P-4 Mon-Tue; TS.16-O-3 Tue 18:45; TS.22-O-10 Thu 16:00
RODRIGO, ANSELM	TS.05-O-8 Thu 15:30; TS.10-P-8 Wed-Thu; GS.03-O-6 Tue 13:15
RODRIGO, MARIA A.	GS.03-P-16 Wed-Thu; TS.13-O-1 Tue 18:00
RODRIGUEZ ARRIBAS, CLARA	TS.10-P-7 Wed-Thu
RODRIGUEZ HIDAGLO, CLAUDIA MARINA	TS.11-P-11 Wed-Thu
RODRIGUEZ LARRINAGA, ASIER	TS.10-O-16 Thu 13:15
RODRIGUEZ PARRA, JONATAN	GS.02-O-14 Tue 18:45
RODRIGUEZ RAMOS, TAMARA	TS.22-O-8 Thu 15:30
RODRIGUEZ SANCHEZ, FRANCISCO	GS.01-O-4 Tue 12:45
RODRIGUEZ UÑA, ASUN	TS.06-O-13 Tue 19:00
RODRIGUEZ URBIETA, TERESA ITZIAR	TS.08-O-12 Thu 16:15
RODRIGUEZ, ALEXANDRA	TS.14-P-1 Mon-Tue
RODRIGUEZ, JONATAN	GS.02-P-6 Mon-Tue
RODRIGUEZ, JOSEP MANEL	TS.15-P-2 Mon-Tue
RODRIGUEZ, ROSA DEL CARMEN	TS.21-O-17 Wed 18:45
RODRIGUEZ-CALCERRADA, JESUS	TS.11-P-10 Wed-Thu
RODRIGUEZ-CARO, ROBERTO	TS.07-O-21 Thu 15:45; TS.02-O-26 Thu 15:45
RODRIGUEZ-CARRASCO, TERESA	TS.10-O-17 Thu 15:00
RODRIGUEZ-ECHEVERRIA, SUSANA	GS.05-O-13 Wed 12:30; TS.14-P-1 Mon-Tue; GS.03-P-6 Wed-Thu; TS.19-P-2 Wed-Thu
RODRIGUEZ-GALVEZ, SUSANA	GS.03-P-14 Wed-Thu
RODRIGUEZ-PEREZ, JAVIER	TS.19-O-13 Thu 16:45
RODRIGUEZ-ROS, PABLO	TS.03-P-4 Wed-Thu
RODRIGUEZ-TEIJEIRO, JOSE DOMINGO	GS.01-P-5 Mon-Tue
RODRIGUEZ-ZORRO, PAULA	TS.15-O-9 Tue 16:45
ROIG-OLIVER, MARGALIDA	GS.02-P-3 Mon-Tue
ROIZ, DAVID	GS.02-O-5 Tue 13:00
ROJO, CARMEN	TS.13-O-1 Tue 18:00; GS.03-P-16 Wed-Thu
ROLO, VICTOR	TS.19-O-7 Thu 15:15
ROMANI, ANNA	TS.11-P-11 Wed-Thu; TS.14-O-17 Tue 19:45; TS.01-O-8 Tue 16:15; TS.14-P-2 Mon-Tue
ROMANS, ELVIRA	GS.01-P-3 Mon-Tue
ROMERA-CASTILLO, CRISTINA	TS.03-O-5 Wed 13:15
ROMERO, ESTELA	TS.01-O-3 Tue 12:30; TS.16-P-3 Mon-Tue
ROMERO, JAVIER	TS.17-O-4 Tue 13:00; TS.18-O-5 Tue 19:00
ROMERO, JORGE	TS.07-O-3 Wed 12:45
ROMEU-DALMAU, CARLA	TS.22-P-5 Wed-Thu
ROMO, ANGEL	TS.04-P-2 Wed-Thu
ROMO, HELENA	TS.02-P-13 Mon-Tue
ROQUER-BENI, LAURA	TS.10-P-8 Wed-Thu
ROS, ANDREA	TS.02-P-6 Mon-Tue
ROS, JOANDOMENEC	TS.18-O-2 Tue 18:15
ROSAS, TERESA	TS.10-O-20 Thu 15:45; GS.01-O-20 Wed 18:45
ROSLIN, TOMAS	GS.03-O-6 Tue 13:15
ROSON PORTO, GABRIEL	GS.02-O-4 Tue 12:45
RØSTAD, ANDERS	GS.05-O-10 Tue 16:45
ROTCHES-RIBALTA, ROSER	TS.19-O-9 Thu 15:45; TS.19-O-4 Thu 13:00
ROUKS, JOHANNES	TS.13-O-3 Tue 18:30
ROUMET, CATHERINE	TS.14-O-3 Tue 12:45
ROUSK, JOHANNES	TS.14-O-6 Tue 16:00
ROVIRA, GRACIEL-LA	TS.02-O-2 Tue 18:30; TS.06-O-12 Tue 18:45; TS.02-P-10 Mon-Tue
ROVIRA, PERE	TS.06-P-5 Mon-Tue
ROY, SHOVLONLAL	GS.03-O-16 Wed 18:00; GS.03-O-16 Wed 18:00

ROYER, JEAN-PHILIP	TS.07-0-12 Thu 12:00
ROZAS, VICENTE	TS.09-P-3 Mon-Tue; TS.09-P-1 Mon-Tue; TS.09-O-6 Tue 16:00
ROZENBERG, PHILIPPE	TS.09-P-1 Mon-Tue
RUAS, SARA	TS.19-O-9 Thu 15:45
RUBIO, AGUSTIN	TS.14-O-15 Tue 19:15
RUBIO, ANNA	TS.05-O-12 Thu 16:30
RUBIO, MARIA LUISA	TS.07-0-3 Wed 12:45; TS.02-O-18 Wed 19:00; TS.07-0-14 Thu 12:30; TS.02-0-5 Tue 19:15; TS.11-P-12 Wed-Thu
RUBIO-GRACIA, FRANCESC	GS.05-P-2 Wed-Thu
RUBIO-SAURA, NURIA	TS.07-P-4 Wed-Thu
RUEDA, JUAN	TS.22-O-10 Thu 16:00; TS.04-O-8 Wed 18:30
RUIZ CHECA, RAQUEL	TS.02-O-5 Tue 19:15; TS.02-O-18 Wed 19:00
RUIZ GOMEZ, FRANCISCO J.	GS.03-P-15 Wed-Thu; GS.02-O-6 Tue 13:15; GS.01-P-9 Mon-Tue
RUIZ GONZALEZ, CLARA	PT-9 Thu 18:00
RUIZ VALENZUELA, LUIS	TS.05-O-9 Thu 15:45
RUIZ, CARLOS	GS.03-O-26 Thu 13:00
RUIZ, CARLOTA	TS.07-0-12 Thu 12:00; TS.07-0-12 Thu 12:00
RUIZ, JAVIER	GS.03-P-14 Wed-Thu
RUIZ, RAQUEL	TS.11-P-12 Wed-Thu
RUIZ-BENITO, PALOMA	TS.10-0-3 Wed 12:45; TS.11-P-1 Wed-Thu; TS.06-P-1 Mon-Tue; TS.11-MT-11 Thu 12:00; TS.10-0-15 Thu 13:00; TS.11-O-4 Wed 13:00; TS.11-P-9 Wed-Thu
RUIZ-GONZALEZ, CLARA	GS.05-O-5 Tue 13:00
RUIZ-TAPIADOR, ILDEFONSO	GS.03-P-9 Wed-Thu
RUIZ-VERDU, ANTONIO	TS.12-P-3 Mon-Tue
RYU, WILLIAM	TS.17-P-2 Mon-Tue
S	
SA, ELISABET LAIA	TS.22-P-2 Wed-Thu
SAAVEDRA, CAMILO	TS.02-O-17 Wed 18:45
SABAS, IBOR	GS.02-O-13 Tue 18:30; TS.22-O-9 Thu 15:45; GS.03-P-8 Wed-Thu; TS.06-O-8 Tue 16:30; TS.06-P-3 Mon-Tue
SABATE, SANTIAGO	GS.02-O-9 Tue 16:30; TS.10-P-9 Wed-Thu; TS.06-O-5 Tue 13:15; TS.10-0-24 Thu 16:45; TS.21-O-8 Tue 19:45
SABATER, FRANCESC	TS.18-0-2 Tue 18:15; GS.02-O-9 Tue 16:30; TS.01-O-1 Tue 12:00; TS.10-0-24 Thu 16:45; GS.04-O-9 Thu 15:30; TS.01-O-5 Tue 13:00; TS.06-O-5 Tue 13:15; TS.21-O-8 Tue 19:45
SABATER, LAIA	TS.21-O-2 Tue 18:15
SABATER, SERGI	TS.21-O-7 Tue 19:30
SACRISTAN, SANDRA	TS.11-P-12 Wed-Thu; TS.02-O-5 Tue 19:15; TS.02-O-18 Wed 19:00; TS.07-0-14 Thu 12:30
SADAoui, MAHREZ	TS.01-0-3 Tue 12:30
SADYKOVA, DINARA	TS.14-0-7 Tue 16:15; TS.14-0-7 Tue 16:15
SAGRA, JAVIER	TS.08-0-13 Thu 16:30
SAHUQUILLO, MARIA	TS.22-O-10 Thu 16:00; TS.04-O-8 Wed 18:30
SAIZ BUSTAMANTE, HUGO	TS.05-O-7 Thu 15:15
SALA, JORDI	TS.06-MT-1 Tue 12:00
SALA, MARC	GS.05-O-20 Wed 18:45
SALA, MONTSERRAT	GS.05-O-11 Wed 12:00; TS.03-O-8 Wed 18:30; GS.03-O-31 Thu 15:45; GS.05-P-11 Wed-Thu
SALAT MOLTO, AGNES	TS.19-P-3 Wed-Thu
SALAZAR, JANIRE	TS.18-0-7 Tue 19:30
SALDAÑA LOPEZ, ASUNCION	GS.02-P-7 Mon-Tue
SALDAÑA-VAZQUEZ, ROMEO A.	GS.01-P-1 Mon-Tue
SALGUERO-GOMEZ, ROBERTO	TS.07-P-2 Wed-Thu
SALINAS, MARIA J.	TS.10-0-19 Thu 15:30

SALINAS, NORMA	TS.04-O-3 Wed 12:45
SALMERON-SANCHEZ, ESTEBAN	TS.14-O-11 Tue 18:15
SALMON, SANDRINE	TS.14-O-14 Tue 19:00
SALUDAS, IBOR	TS.11-O-10 Wed 19:00
SALVA-CATARINEU, MONTSERRAT	TS.04-P-2 Wed-Thu
SALVADO, HUMBERT	TS.06-P-4 Mon-Tue; TS.21-O-5 Tue 19:00
SALVADOR-FRANCH, FERRAN	TS.04-P-2 Wed-Thu
SALVANESCHI, PIETRO	TS.06-P-6 Mon-Tue
SAMPEDRO, LUIS	TS.10-O-16 Thu 13:15; TS.07-O-15 Thu 12:45; TS.07-O-24 Thu 16:30
SAMPERA, CAROLINA	TS.21-P-9 Mon-Tue
SAMUEL, ALLEAUME	GS.01-O-11 Wed 12:00
SAN MARTIN, DANIEL	TS.12-O-4 Wed 18:15
SANCHEZ ALVAREZ, ANA MARIA	TS.02-O-19 Thu 12:00
SANCHEZ CABRERA, MERCEDES	TS.07-P-9 Wed-Thu
SANCHEZ PESCADOR, DAVID	TS.22-P-7 Wed-Thu
SANCHEZ, ANA M.	GS.01-O-16 Wed 13:15; TS.22-O-3 Thu 12:45; TS.22-P-7 Wed-Thu
SANCHEZ, ANA MARIA	TS.10-O-10 Wed 19:00; TS.14-O-11 Tue 18:15; TS.19-O-5 Thu 13:15
SANCHEZ, ESTER	GS.03-P-16 Wed-Thu; TS.13-O-1 Tue 18:00
SANCHEZ, JAVIER	TS.02-P-6 Mon-Tue
SANCHEZ, JUAN MANUEL	TS.12-P-4 Mon-Tue
SANCHEZ, LAURA	TS.08-O-12 Thu 16:15
SANCHEZ, M ^a JESUS	TS.19-O-5 Thu 13:15
SANCHEZ, MANUEL	TS.10-O-15 Thu 13:00
SANCHEZ, OLGA	GS.05-O-9 Tue 16:30; TS.22-O-6 Thu 15:00; TS.22-O-6 Thu 15:00; TS.21-O-17 Wed 18:45
SANCHEZ, PABLO	GS.05-O-5 Tue 13:00
SANCHEZ-CAÑETE, ENRIQUE	TS.16-P-1 Mon-Tue
SANCHEZ-CARRILLO, SALVADOR	TS.13-O-1 Tue 18:00
SANCHEZ-CUESTA, RAFAEL	GS.03-P-15 Wed-Thu
SANCHEZ-FERNANDEZ, DAVID	TS.12-P-2 Mon-Tue; TS.02-P-13 Mon-Tue; TS.02-O-10 Wed 12:30; TS.02-P-1 Mon-Tue; TS.02-P-15 Mon-Tue
SANCHEZ-FORTUN, MOISES	TS.21-O-16 Wed 18:30; TS.21-P-9 Mon-Tue
SANCHEZ-HERRERA, MELISSA	TS.07-O-6 Wed 18:00
SANCHEZ-MELSIO, ALEXANDRE	GS.05-O-22 Wed 19:15
SANCHEZ-MONTOYA, MARIA DEL MAR	TS.13-O-5 Tue 19:00; TS.01-O-6 Tue 13:15
SANCHEZ-PINILLOS, MARTINA	TS.08-O-4 Thu 12:45
SANCHEZ-SALGUERO, RAUL	TS.20-O-5 Tue 19:15; TS.09-O-3 Tue 12:45; TS.09-P-2 Mon-Tue; TS.09-O-2 Tue 12:30; TS.20-O-7 Tue 19:45; TS.20-P-1 Mon-Tue; TS.09-P-1 Mon-Tue
SANCHEZ-ZAPATA, JOSE ANTONIO	GS.04-P-2 Wed-Thu; TS.17-O-8 Tue 16:30; GS.04-P-1 Wed-Thu; TS.17-O-8 Tue 16:30; GS.04-O-8 Thu 15:15
SANGIL, CARLOS	TS.11-O-6 Wed 18:00
SANGÜESA-BARREDA, GABRIEL	TS.09-O-6 Tue 16:00; TS.09-P-3 Mon-Tue; TS.09-O-2 Tue 12:30; TS.09-O-5 Tue 13:15; TS.20-P-3 Mon-Tue; TS.20-O-5 Tue 19:15; TS.09-P-1 Mon-Tue
SANMARTIN-VILLAR, IAGO	TS.07-O-6 Wed 18:00
SANPERA, CAROLA	TS.21-O-16 Wed 18:30
SANS, XAVIER	TS.19-O-10 Thu 16:00; TS.19-O-4 Thu 13:00
SANTAMANS, ANNA C.	TS.01-O-7 Tue 16:00; TS.03-O-2 Wed 12:30
SANTAMARIA, JORGE	TS.11-O-16 Thu 15:00; TS.11-O-15 Thu 13:15; TS.11-P-3 Wed-Thu
SANTANA, MARGARIDA	GS.05-O-4 Tue 12:45
SANTIAGO, FELISA	TS.02-P-9 Mon-Tue
SANTONJA, MATHIEU	TS.14-P-4 Mon-Tue
SANTOS, M. BEGOÑA	TS.02-O-17 Wed 18:45
SANTOS, RENATA	TS.05-P-1 Wed-Thu
SANTOS-JUNIOR, CELIO DIAS	TS.22-P-1 Wed-Thu

SANZ SAEZ, ISABEL	TS.21-0-17 Wed 18:45
SARDANS, JORDI	TS.04-0-11 Wed 19:15; TS.16-0-5 Tue 19:15; TS.01-0-3 Tue 12:30
SARREMEJANE, ROMAIN	TS.02-0-13 Wed 13:15
SASA, MAHMOUD	TS.04-0-8 Wed 18:30; TS.22-0-10 Thu 16:00
SATORRES, MARTA	TS.11-P-11 Wed-Thu
SAURA-MAS, SANDRA	TS.10-0-14 Thu 12:45; TS.10-0-20 Thu 15:45
SAURAS-YERA, TERESA	TS.06-P-5 Mon-Tue
SAVOLAINEN, OUTI	TS.07-0-5 Wed 13:15
SAVVA, IOANNIS	GS.02-P-8 Mon-Tue
SCHARNWEBER, TOBIAS	TS.09-0-7 Tue 16:15
SCHELKER, JAKOB	TS.13-P-1 Mon-Tue
SCHERER-LORENZEN, MICHAEL	TS.10-0-13 Thu 12:30
SCHIMANN, HEIDY	TS.04-0-5 Wed 13:15
SCHLEUNING, MATTHIAS	GS.03-0-11 Wed 12:15
SCHMID, BERNHARD	TS.19-MT-1 Thu 12:00
SCHMIDT, INGER KAPPEL	TS.11-P-4 Wed-Thu
SCHNEPF, ANDREA	TS.16-0-6 Tue 19:30
SCHÖB, CHRISTIAN	GS.03-0-5 Tue 13:00; TS.19-0-2 Thu 12:30; TS.19-0-2 Thu 12:30
SCHRAML, ANTONIA	TS.19-0-7 Thu 15:15
SCHRECKINGER, JOSE	TS.13-0-4 Tue 18:45
SCHROEDER, JULIA	TS.17-0-5 Tue 13:15
SCHUMER, RINA	TS.03-P-1 Wed-Thu; GS.04-0-9 Thu 15:30
SEBASTIA, MARIA TERESA	TS.03-P-2 Wed-Thu; GS.03-0-33 Thu 16:15
SEBASTIAN GONZALEZ, ESTHER	GS.01-0-17 Wed 18:00
SEBASTIAN, MARTA	GS.05-0-5 Tue 13:00; GS.05-0-7 Tue 16:00; GS.05-0-9 Tue 16:30; GS.05-P-10 Wed-Thu; TS.22-P-2 Wed-Thu; TS.21-0-17 Wed 18:45
SECO, JOSE IGNACIO	TS.20-0-7 Tue 19:45
SEGURA MARTINEZ, MATILDE	GS.03-P-16 Wed-Thu
SELLARES, NURIA	GS.05-0-16 Wed 13:15
SELVARAJ, JOHN JOSEPHRAJ	TS.04-0-4 Wed 13:00
SENAR ROSELL, MIQUEL ANGEL	TS.22-P-4 Wed-Thu
SENAR, JUAN CARLOS	TS.02-0-25 Thu 15:30
SENDRA, MARIA DOLORES	GS.03-0-35 Thu 16:45
SEOANE, JAVIER	GS.03-P-17 Wed-Thu
SERGIO, CECILIA	GS.02-0-18 Tue 19:45
SERRA MALUQUER, XAVIER	TS.20-P-3 Mon-Tue
SERRA VARELA, MARIA JESUS	GS.02-0-2 Tue 12:15
SERRA, MANUEL	TS.07-0-17 Thu 13:15; TS.07-0-4 Wed 13:00; TS.07-0-19 Thu 15:15
SERRA, SONIA	GS.03-0-24 Thu 12:30; GS.03-0-24 Thu 12:30
SERRA, TERESA	TS.11-P-2 Wed-Thu
SERRANO MORAL, MARIA SOCORRO	TS.02-0-3 Tue 18:45
SERRANO PEREZ-SERRANO, MARIA	TS.14-0-11 Tue 18:15
SERRANO, DAVID	TS.17-0-3 Tue 12:45
SERRANO, EMMANUEL	GS.03-0-30 Thu 15:30
SERRANO, HELENA	GS.03-P-11 Wed-Thu; TS.07-0-22 Thu 16:00
SERRANO, MARIA SOCORRO	TS.14-P-7 Mon-Tue
SERRANO-ORTIZ, PENELOPE	TS.03-0-9 Wed 18:45
SERRAO, ESTER	TS.11-MT-1 Wed 12:00
SERRAT, ALBA	TS.11-0-21 Thu 16:15
SERVIA, MARIA J.	GS.02-0-7 Tue 16:00; GS.02-P-4 Mon-Tue; GS.02-P-2 Mon-Tue
SHAW, MARK	GS.03-0-22 Thu 12:00
SHIHAN, AMMAR	TS.14-P-4 Mon-Tue; TS.14-0-3 Tue 12:45
SHIPLEY, BILL	TS.10-0-14 Thu 12:45
SHUGART, HERMAN	TS.08-0-8 Thu 15:15
SIGUT, LADISLAV	TS.16-P-1 Mon-Tue
SILIO-CALZADA, ANA	GS.04-0-12 Thu 16:15; TS.12-0-4 Wed 18:15

SILVA, BRUNO	TS.19-0-13 Thu 16:45
SILVA, CARLA O.	GS.02-0-17 Tue 19:30
SILVA, ELYSA	TS.06-P-6 Mon-Tue; TS.06-P-6 Mon-Tue
SILVA, JOSE LUIS	TS.02-0-23 Thu 13:00
SILVA, LUIS	GS.05-0-10 Tue 16:45
SILVA, MAURICIO	TS.02-P-21 Mon-Tue
SILVA, THIAGO	TS.04-0-6 Wed 18:00
SILVESTRE GRANDA, MARIOLA	GS.03-P-17 Wed-Thu
SIMO, RAFEL	TS.22-0-13 Thu 16:45; TS.03-P-4 Wed-Thu
SIMON BARRIUOSO, DIEGO	GS.03-P-9 Wed-Thu
SIM-SIM, MANUELA	GS.02-0-18 Tue 19:45
SINGH, BRAJESH K.	GS.03-0-3 Tue 12:30
SINTES, EVA	TS.22-0-13 Thu 16:45
SKOV, MARTIN W	TS.03-0-4 Wed 13:00
SKOVSHOLT, LOUIS J.	TS.01-0-8 Tue 16:15
SMILJANIC, MARKO	TS.09-0-7 Tue 16:15
SOININEN, JANNE	TS.02-0-13 Wed 13:15
SOL, DANIEL	TS.02-MT-24 Thu 15:00; TS.14-0-14 Tue 19:00
SOLA, CAROLINA	GS.01-P-3 Mon-Tue
SOLA, JORDI	TS.06-0-12 Tue 18:45
SOLAGAISTUA, LIBE	GS.05-0-22 Wed 19:15; TS.21-0-1 Tue 18:00
SOLAKIS, ANDROS	TS.21-P-8 Mon-Tue
SOLE, AIDA	TS.07-0-23 Thu 16:15; TS.07-0-5 Wed 13:15
SOLE, JORDI	TS.11-0-9 Wed 18:45
SOLE, JUDITH	TS.06-P-3 Mon-Tue
SOLER, ALBERT	TS.02-0-10 Wed 12:30
SOONG, JENNIFER	TS.14-0-9 Tue 16:45; TS.04-0-5 Wed 13:15; TS.16-0-5 Tue 19:15
SORENSEN, MARJORIE C.	GS.03-0-11 Wed 12:15
SORIA GARCIA, JUAN MIGUEL	TS.12-P-3 Mon-Tue
SORIA PERPINYA, XAVIER	GS.03-0-35 Thu 16:45
SORIA, FRANCISCO JAVIER	TS.02-P-1 Mon-Tue
SORIA, JUAN	GS.03-0-35 Thu 16:45
SORIA, MARIA	TS.02-0-11 Wed 12:45; TS.02-P-20 Mon-Tue
SORIA, SARA	GS.05-P-13 Wed-Thu; GS.05-0-15 Wed 13:00
SORIA, XAVI	TS.12-P-3 Mon-Tue
SORIANO, JOAN MANUEL	TS.15-P-2 Mon-Tue; TS.15-0-3 Tue 12:45
SOROLLA EDO, ALBERT	TS.06-0-4 Tue 13:00
SOTO, ANA ZAIDA	TS.11-0-6 Wed 18:00
SOTO-OTON, INMACULADA CONCEPCION	TS.07-P-4 Wed-Thu
SOUZA ALONSO, PABLO	GS.02-0-4 Tue 12:45
SPERLICH, DOMINIK	TS.10-P-9 Wed-Thu; TS.10-0-24 Thu 16:45
SPRETER, PHILIPP	TS.11-0-19 Thu 15:45
SROCZYNSKA, KATARZYNA	GS.01-0-10 Tue 16:45; GS.03-0-29 Thu 15:15
STAHL, CLEMENT	TS.04-0-5 Wed 13:15
STEENBEEK, JEROEN	TS.11-0-9 Wed 18:45
STEENBERG LARSEN, KLAUS	TS.03-0-6 Wed 18:00
STEFANESCU, CONSTANTI	TS.10-0-5 Wed 13:15; TS.11-0-17 Thu 15:15; GS.03-0-6 Tue 13:15; TS.05-0-8 Thu 15:30
STEINER, PAUL	TS.22-0-13 Thu 16:45
STENBERG, MARCELO	TS.03-0-9 Wed 18:45
STENLID, JAN	GS.02-0-12 Tue 18:15
STEPHANIE, JACQUET-SCHINTU	TS.21-0-10 Wed 12:15
STERCK, FRANK	TS.10-0-20 Thu 15:45
STIPOLJEV, SUNCICA	TS.07-0-12 Thu 12:00; TS.07-0-12 Thu 12:00
STOFFEL, MARKUS	GS.03-P-3 Wed-Thu
STOJNIC, SRDJAN	TS.11-P-4 Wed-Thu

STOKES, ALEXIA	TS.14-0-3 Tue 12:45
STUBBINGRON, RACHEL	TS.02-0-13 Wed 13:15
SUAREZ, MARIA	GS.03-0-12 Wed 12:30; TS.02-P-6 Mon-Tue
SUTTLE, CURTIS A.	GS.05-0-21 Wed 19:00
SYMONDSON, WILLIAM O. C.	TS.22-P-5 Wed-Thu

T

TABARES, PABLO	TS.07-0-14 Thu 12:30; TS.02-0-18 Wed 19:00; TS.11-P-12 Wed-Thu; TS.02-0-5 Tue 19:15
TALMON, YIFTACH	TS.03-0-9 Wed 18:45
TAPIA, SUSANA	TS.19-0-8 Thu 15:30
TARAZONA, EVA	TS.07-0-17 Thu 13:15
TARRATS, POL	TS.02-0-11 Wed 12:45; TS.02-0-11 Wed 12:45
TAUGOURDEAU, OLIVIER	TS.14-0-3 Tue 12:45
TAYLOR, ANDY	GS.01-0-6 Tue 13:15
TEIRA, EVA	GS.05-P-14 Wed-Thu
TEIXEIRA, ISABEL G	TS.18-0-1 Tue 18:00
TEJERO, PABLO	TS.02-0-23 Thu 13:00
THRIPPLETON, TIMOTHY	TS.20-0-4 Tue 19:00
TIBBETT, MARK	TS.14-P-5 Mon-Tue
TIETEMA, ALBERT	TS.14-0-14 Tue 19:00; TS.11-P-4 Wed-Thu
TIMOTEO, SERGIO	TS.05-0-2 Thu 12:30; TS.05-MT-1 Thu 12:00
TINNER, WILLY	TS.15-P-1 Mon-Tue
TINTORE, JOAQUIN	TS.12-0-3 Tue 18:45
TOBELLA, MARTA	TS.06-0-5 Tue 13:15; GS.04-0-9 Thu 15:30; TS.21-0-8 Tue 19:45; TS.01-0-5 Tue 13:00
TOCKNER, KLEMENT	TS.13-0-5 Tue 19:00
TOLEDO, BERNARDO	GS.01-P-10 Mon-Tue
TOMAS, JAN	TS.06-P-3 Mon-Tue; TS.06-0-9 Tue 18:00
TOMAS, JOAN	GS.03-P-18 Wed-Thu
TONIN, ALAN	TS.03-0-7 Wed 18:15
TORNERO, IRENE	TS.06-MT-1 Tue 12:00
TORRALBA, ANTONIO	TS.02-P-13 Mon-Tue
TORRELLA, ENRIQUE	TS.01-0-7 Tue 16:00
TORRES GARCIA, MARIA TRINIDAD	TS.10-0-19 Thu 15:30
TORRES, DANIEL	GS.01-P-4 Mon-Tue
TORRES, ELENA	TS.02-0-18 Wed 19:00; TS.02-0-5 Tue 19:15; TS.11-P-12 Wed-Thu; TS.07-0-14 Thu 12:30
TORRES, JOSE MANUEL	TS.08-0-7 Thu 15:00
TORRES-BONILLA, MIREYA	GS.05-P-8 Wed-Thu
TRAVESET, ANNA	GS.02-P-1 Mon-Tue; TS.07-0-9 Wed 18:45; GS.03-0-15 Wed 13:15; TS.05-0-13 Thu 16:45; TS.10-0-11 Wed 19:15
TREVIÑO ZEVALLOS, ITALO FRANCISCO	TS.04-P-3 Wed-Thu
TRIADO MARGARIT, XAVIER	GS.05-0-12 Wed 12:15
TRISOS, CHRISTOPHER	TS.02-MT-24 Thu 15:00
TRITTHART, MICHAEL	TS.13-0-7 Tue 19:30
TRUJILLO CUADRA, LAURA	TS.21-0-17 Wed 18:45
TURON RODRIGO, MARTA	TS.22-0-7 Thu 15:15
TURON, ANNA	GS.05-0-22 Wed 19:15
TURON, XAVIER	TS.22-0-2 Thu 12:30
TURULL, MARTA	TS.21-0-19 Wed 19:15

U

UBEDA, BARBARA	GS.05-P-13 Wed-Thu
UBERO-PASCAL, NICOLAS	TS.02-P-20 Mon-Tue
ULLRICH, BENJAMIN	TS.19-0-7 Thu 15:15

ULM, FLORIAN	GS.02-0-15 Tue 19:00
URBAN, OTMAR	TS.11-P-4 Wed-Thu
URBINA, IFIGENIA	TS.16-0-5 Tue 19:15; TS.04-0-5 Wed 13:15
URIZ, M.JESUS	TS.22-0-7 Thu 15:15
URRA, JULEN	GS.05-P-4 Wed-Thu
URREGO, PATRICIA	TS.12-P-3 Mon-Tue
USCOLA FERNANDEZ, MERCEDES	TS.11-0-22 Thu 16:30
USERO, FRANCISCO M.	TS.14-P-1 Mon-Tue
V	
VACONCELOS, VITOR	GS.03-0-16 Wed 18:00
VAESSEN, TIMOTHY N.	TS.06-0-4 Tue 13:00
VALBUENA-CARABAÑA, MARIA	TS.15-P-1 Mon-Tue
VALDECANTOS, ALEJANDRO	TS.11-0-8 Wed 18:30
VALDES CORRECHER, ELENA	GS.03-0-17 Wed 18:15
VALENCIA, ENRIQUE	GS.03-0-3 Tue 12:30; GS.03-P-7 Wed-Thu; GS.03-P-7 Wed-Thu
VALERIANO, CRISTINA	TS.09-P-5 Mon-Tue
VALIENTE-BANUET, ALFONSO	GS.03-0-32 Thu 16:00
VALLADARES, FERNANDO	GS.01-0-19 Wed 18:30; TS.10-0-13 Thu 12:30; TS.10-0-13 Thu 12:30; TS.10-P-3 Wed-Thu; TS.16-0-6 Tue 19:30; GS.03-P-12 Wed-Thu; TS.10-P-2 Wed-Thu
VALLEJO, RAMON	TS.06-P-5 Mon-Tue
VALLINA, SERGIO	TS.16-0-7 Tue 19:45; TS.03-P-4 Wed-Thu
VALLS, ALEIX	GS.03-0-25 Thu 12:45
VAN DUSSELDORP, MARLEEN	TS.11-P-4 Wed-Thu
VAN HALDER, INGE	GS.03-0-17 Wed 18:15
VAN KLEUNEN, MARK	TS.10-0-8 Wed 18:30
VAN LANGENHOVE, LEANDRO	TS.16-0-5 Tue 19:15; TS.04-0-5 Wed 13:15
VAN OVERVELD, THIJS	TS.17-0-3 Tue 12:45
VANDER ZANDEN, M. JAKE	TS.21-0-11 Wed 12:30
VANDERPOORTEN, ALAIN	TS.10-P-1 Wed-Thu
VANGUELOVA, ELENA	TS.11-0-7 Wed 18:15
VAQUE, DOLORS	GS.05-0-8 Tue 16:15; TS.22-P-2 Wed-Thu
VAQUER-SUNYER, RAQUEL	TS.11-0-18 Thu 15:30; TS.11-P-6 Wed-Thu
VARELA COELHO, ANA	TS.22-0-11 Thu 16:15
VARELA, MARTA M	GS.05-P-14 Wed-Thu; TS.16-0-2 Tue 18:30; TS.22-0-8 Thu 15:30; TS.22-0-8 Thu 15:30
VARELA, ZULEMA	GS.01-P-11 Mon-Tue; TS.10-P-1 Wed-Thu
VARGAS, PABLO	GS.01-P-7 Mon-Tue
VARGAS, RODRIGO	TS.03-0-3 Wed 12:45; TS.03-0-9 Wed 18:45
VASCONCELOS, VITOR MANUEL	GS.03-0-16 Wed 18:00
VAYREDA, JORDI	GS.04-0-2 Thu 12:15; GS.04-0-13 Thu 16:30; TS.12-P-1 Mon-Tue; GS.04-0-1 Thu 12:00
VAZQUEZ PIQUE, JAVIER	TS.09-0-3 Tue 12:45
VAZQUEZ-GONZALEZ, CARLA	TS.07-0-15 Thu 12:45
VEGA ALVAREZ, JULIA	TS.10-P-10 Wed-Thu
VEGAS-VILARRUBIA, TERESA	TS.15-0-3 Tue 12:45; TS.04-P-4 Wed-Thu
VELADO ALONSO, ELENA	TS.02-0-7 Tue 19:45
VELASCO, ESTHER	TS.18-0-4 Tue 18:45
VELASCO, JOSEFA	TS.02-P-1 Mon-Tue; TS.02-0-10 Wed 12:30; TS.06-0-7 Tue 16:15; TS.07-P-4 Wed-Thu
VELAYOS, GERMAN	TS.06-0-10 Tue 18:15
VENDRAMIN, GIOVANNI GIUSEPPE	TS.07-0-23 Thu 16:15
VENDRELL, BEGOÑA	TS.18-0-7 Tue 19:30; TS.18-0-2 Tue 18:15
VENDRELL, LIDIA	TS.21-0-15 Wed 18:15; GS.05-0-16 Wed 13:15
VENTRE LESPIAUCQ, AGUSTINA	TS.04-0-2 Wed 12:30

VENTURA, MARC	GS.02-0-5 Tue 13:00; TS.02-P-20 Mon-Tue; GS.03-P-8 Wed-Thu; TS.11-0-10 Wed 19:00; GS.02-0-13 Tue 18:30; TS.06-0-9 Tue 18:00; TS.06-P-3 Mon-Tue; TS.22-0-9 Thu 15:45; TS.06-0-8 Tue 16:30
VERBLE-PEARSON, ROBIN	TS.10-0-21 Thu 16:00
VERBRUGGEN, ERIK	TS.04-0-5 Wed 13:15
VERDAGUER, DOLORS	TS.11-P-11 Wed-Thu; TS.14-P-2 Mon-Tue; TS.11-P-7 Wed-Thu
VERDU, MIGUEL	TS.15-0-2 Tue 12:30; GS.03-0-32 Thu 16:00; GS.05-0-1 Tue 12:00; TS.06-0-6 Tue 16:00
VERDURA, JANA	TS.11-0-15 Thu 13:15; TS.11-P-3 Wed-Thu; TS.21-0-12 Wed 12:45
VERGES, ALBA	TS.11-0-15 Thu 13:15; GS.02-0-8 Tue 16:15; TS.21-0-12 Wed 12:45; TS.11-0-16 Thu 15:00; TS.11-P-3 Wed-Thu
VERHEYEN, KRIS	TS.03-0-6 Wed 18:00
VERKAIK, IRAIMA	TS.02-0-11 Wed 12:45; TS.02-0-11 Wed 12:45
VERRYCKT, LORE	TS.04-0-5 Wed 13:15; TS.16-0-5 Tue 19:15
VERSTRAETEN, ARNE	TS.11-0-7 Wed 18:15
VICCA, SARA	TS.11-P-4 Wed-Thu
VICENTE, EDUARDO	GS.03-0-35 Thu 16:45; TS.12-P-3 Mon-Tue
VICENTE, REBECA	GS.01-0-3 Tue 12:30
VIDAL, MERITXELL	TS.11-0-17 Thu 15:15
VIDEVA, OLGA	TS.08-0-12 Thu 16:15
VIEIRA, CRISTIANA	GS.02-0-18 Tue 19:45; TS.10-P-5 Wed-Thu
VIEIRA, JOÃO	TS.02-P-21 Mon-Tue
VIEIRA, LUIS R.	TS.21-0-13 Wed 13:00
VIEIRA, SIMONE	TS.02-0-28 Thu 16:15
VIEJO GARCIA, ROSA MARIA	TS.02-P-2 Mon-Tue
VIERA, GUSTAVO	TS.06-0-3 Tue 12:45
VIGOYA, LORENA	TS.11-P-5 Wed-Thu
VILA PLANELLA, MONTSERRAT	PT-4 Tue 15:00
VILA, MAGDA	GS.02-0-11 Tue 18:00
VILA, ROGER	TS.11-0-17 Thu 15:15
VILA-CABRERA, ALBERT	TS.11-0-14 Thu 13:00; TS.11-MT-11 Thu 12:00
VILA-COSTA, MARIA	TS.21-0-9 Wed 12:00; TS.21-P-6 Mon-Tue; TS.21-0-9 Wed 12:00
VILADRICH, NURIA	TS.02-0-2 Tue 18:30
VILAGROSA CARMONA, ALBERTO	TS.08-0-7 Thu 15:00
VILAR, LLUIS	GS.03-P-2 Wed-Thu
VILAS, DANIEL	TS.11-P-8 Wed-Thu
VILA-VIÇOSA, CARLOS MAGNO	GS.01-0-13 Wed 12:30
VILLA, ELENA	TS.14-P-7 Mon-Tue
VILLAMAÑA, MARINA	TS.16-0-2 Tue 18:30
VILLAR, RAFAEL	TS.10-0-15 Thu 13:00; TS.13-P-2 Mon-Tue; TS.19-P-1 Wed-Thu
VILLARI, CATERINA	TS.07-0-24 Thu 16:30
VILLARINO, ERNESTO	GS.01-0-15 Wed 13:00
VILLAR-SALVADOR, PEDRO	TS.11-0-22 Thu 16:30; TS.06-P-1 Mon-Tue; TS.11-0-22 Thu 16:30
VILLELLAS ARIÑO, JESUS	TS.10-0-18 Thu 15:15
VILLERO, DANI	TS.02-0-14 Wed 18:00
VILUMARA, JOAN	TS.21-0-5 Tue 19:00
VIÑEGLA, BENJAMIN	TS.10-0-7 Wed 18:15; TS.14-0-2 Tue 12:30
VITTECOQ, MARION	GS.05-0-21 Wed 19:00
VIURE, LAIA	GS.02-0-11 Tue 18:00
VIVES INGLA, MARIA	TS.11-0-17 Thu 15:15
VIZONI SCUDELLER, VERIDIANA	TS.04-P-4 Wed-Thu
VODOPOVIC, MARTIN	TS.12-0-3 Tue 18:45
VOGT, MEIKE	TS.03-P-4 Wed-Thu
VOLTAS, JORDI	GS.03-0-33 Thu 16:15
VON SCHILLER, DANIEL	PT-5 Wed 9:00; TS.13-0-7 Tue 19:30; TS.03-P-3 Wed-Thu; TS.21-0-3 Tue 18:30; GS.05-0-22 Wed 19:15; TS.06-0-10 Tue 18:15; TS.21-0-1 Tue 18:00

W

WALDNER, PETER	TS.11-0-7 Wed 18:15
WANGENSTEEN, OWEN	TS.11-0-6 Wed 18:00; TS.22-0-2 Thu 12:30; TS.15-0-3 Tue 12:45; TS.22-0-5 Thu 13:15
WATANABE, MIRAI	TS.11-0-7 Wed 18:15
WEDIN, MATS	GS.01-0-3 Tue 12:30
WEIGELHOFER, GABRIELE	TS.13-0-7 Tue 19:30; TS.13-P-1 Mon-Tue
WESENER, THOMAS	TS.02-P-15 Mon-Tue
WESSELMANN, MARLENE	GS.02-P-8 Mon-Tue
WEST, JASON	TS.02-0-28 Thu 16:15
WESTBERG, MARTIN	GS.01-0-3 Tue 12:30
WHITE, HANNAH	TS.14-0-7 Tue 16:15; TS.14-0-7 Tue 16:15
WHITTALL, JUSTEN BRYAN	TS.07-0-25 Thu 16:45
WIEGAND, THORSTEN	TS.02-0-26 Thu 15:45
WILFAHRT, PETER	TS.11-P-4 Wed-Thu
WILKES, MARTIN	TS.02-0-8 Wed 12:00
WILMKING, MARTIN	TS.09-0-7 Tue 16:15
WILMSHURST, JANET	TS.15-0-4 Tue 13:00
WINGATE, LISA	TS.10-0-23 Thu 16:30
WISER, SUSAN K.	GS.01-0-1 Tue 12:00
WOLKOVICH, ELIZABETH M.	TS.19-0-11 Thu 16:15
WOOD, JAMIE	TS.15-0-4 Tue 13:00
WOODRUFF, DAVID	TS.09-0-8 Tue 16:30
WOODWARD, GUY	TS.21-0-5 Tue 19:00
WU, NAICHENG	TS.01-0-8 Tue 16:15

Y

YAU, SHEREE	TS.22-P-2 Wed-Thu
YEARSLEY, JONATHAN	TS.14-0-7 Tue 16:15; TS.14-0-7 Tue 16:15
YELA, JOSE LUIS	TS.02-P-13 Mon-Tue
YESTE YESTE, ANTONIO	GS.03-P-19 Wed-Thu
YLL, ERRIKARTA-IMANOL	TS.15-P-2 Mon-Tue

Z

ZABALA BELENGUER, LUCIA	GS.02-P-9 Mon-Tue
ZABALA, MIKEL	TS.02-P-10 Mon-Tue
ZAFRA, ELENA	TS.15-P-1 Mon-Tue
ZAJKOVA, ZUZANA	TS.17-P-4 Mon-Tue
ZAMORANO-ELGUETA, CARLOS	TS.10-P-7 Wed-Thu
ZAPATA, REBECA	TS.18-0-7 Tue 19:30
ZAPATA, VICTOR	TS.06-0-7 Tue 16:15; TS.07-P-4 Wed-Thu
ZAS, RAFAEL	TS.10-0-16 Thu 13:15; TS.07-0-15 Thu 12:45; TS.07-0-24 Thu 16:30
ZAVALA, MIGUEL A.	TS.11-P-1 Wed-Thu; TS.10-0-3 Wed 12:45; TS.11-P-9 Wed-Thu; TS.11-0-4 Wed 13:00
ZECHMEISTER, HARALD	TS.10-P-1 Wed-Thu
ZELNIK, YUVAL	TS.08-0-3 Thu 12:30; GS.03-0-8 Tue 16:15
ZHANG, QI-BIN	TS.08-0-6 Thu 13:15
ZHUN, MAO	TS.14-0-3 Tue 12:45
ZINKE, JENS	TS.11-0-19 Thu 15:45
ZUFIAURRE, AITZIBER	GS.05-0-20 Wed 18:45
ZUNZUNEGUI, MARIA	GS.02-0-16 Tue 19:15; TS.02-0-28 Thu 16:15
ZUPPINGER-DINGLEY, DEBRA	GS.03-0-5 Tue 13:00

ACKNOWLEDGEMENTS

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