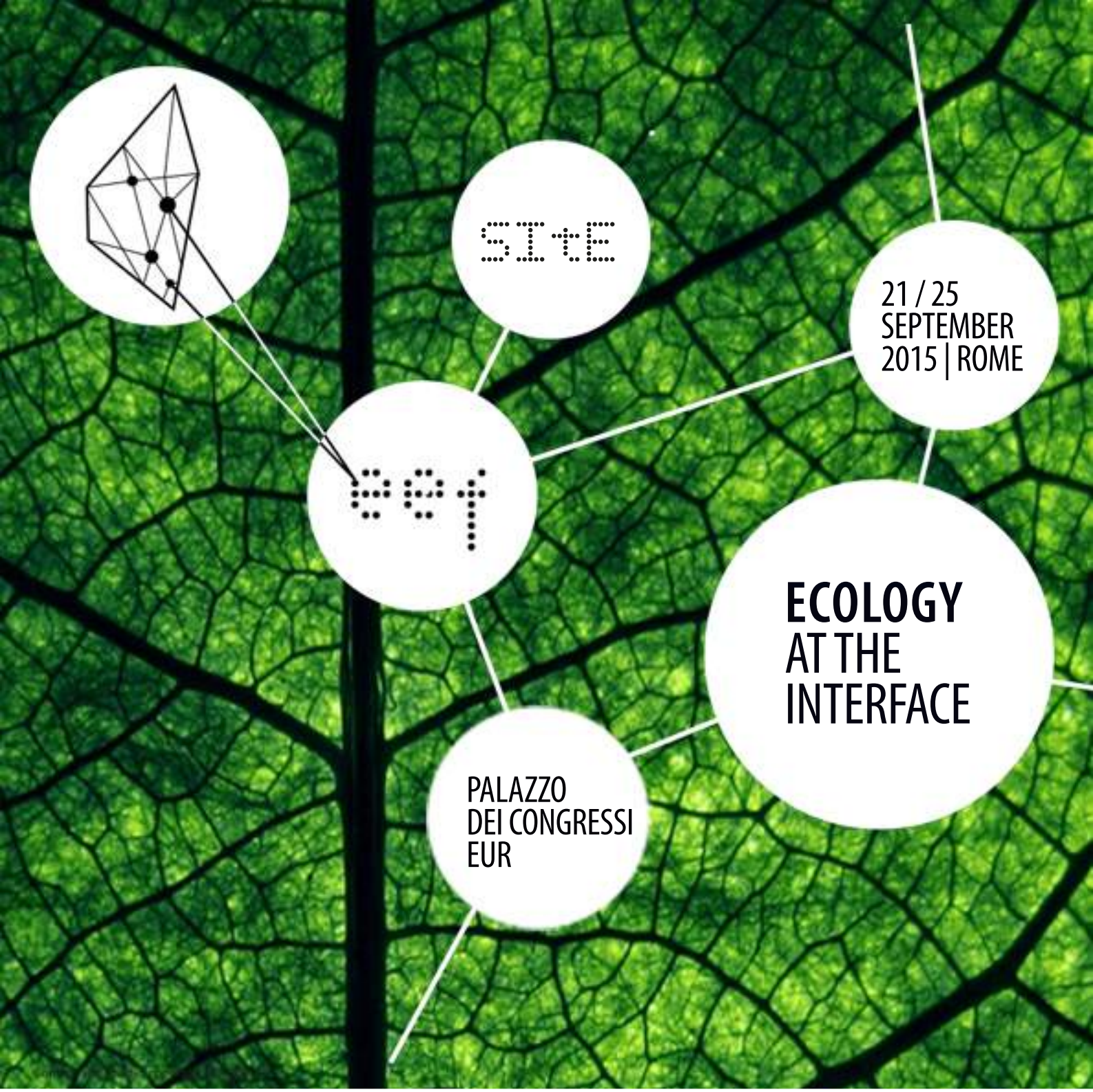

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ECOLOGY
AT THE
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PLENARY LECTURES

PL01 - "THE COUPLED HUMAN - CLIMATE SYSTEM: FUTURE CHALLENGES AND VULNERABILITIES"

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The concentrations of greenhouse gases in the atmosphere are at the highest they have been in the past 800 million years. Current levels of CO_2 have increased by 30% from 280 ppm in pre-industrial times to 401 ppm today (2015), and they continue to rise. Current levels of CH_4 of 2000 ppm are now nearly triple their pre-industrial value of 700 ppm. N_2O concentration reached 327 ppb in 2014 compared with the 280 ppb of pre-industrial time. These changes are mainly caused by human activities. Agriculture and food will play a prominent role in the post-2015 development agenda. The agro-food sector alone accounts for some 80 percent of total freshwater use, 30 percent of total energy demand, and 12-30 percent of man-made greenhouse gas emissions worldwide. With global food production expected to increase 70 percent by 2050 (coupled with meat dietary changes), the sector is facing unprecedented resource pressures and strong perturbations to the climate systems. However only 45% on average of CO_2 from anthropogenic emissions has remained in the atmosphere while land and oceans have sequestered the other half, in approximately equal proportions. Thus the current climate system vulnerability is hanging on the delicate balance between human induced greenhouse gases emissions and mitigation options and the natural dynamics of land and ocean systems, which could alternate between a sink or source of greenhouse gases depending on the magnitude and sign of climate feedbacks.

PL02 - SOCIOLOGY, ECOLOGY AND ENVIRONMENTAL SUSTAINABILITY

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In the second half of the 19th Century the fields of sociology and ecology developed from some similar disciplinary points of origin and understanding of their subject matter. During the course of the 20th Century, however, sociology became of purely “social” science, focusing on social facts (norms, values etc.) as explanatory variables for social processes, whereas ecology developed into a “natural” science focusing on material, biological, and physical factors as explanans. This plenary lecture will highlight (good) reasons for disconnecting the two fields but alsomethodological and theory basedchallenges at re-connecting the “two cultures.” This is done to further clarify the relevanceof interdisciplinary connections for our understandingof sustainable development as well as of communicating critical ecological issues to a concerned public.

PL03 - THE ECOLOGY OF ARCHITECTURE

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Green building is a no-brainer. Everybody wants it. Investors love it. Politicians think the future should see more of it. More and more buildings are erected carrying labels such as “sustainable” “plus energy” “LEED certified” and so on. However, not enough of the results are really convincing. Optimizing only narrowly selected aspects neglects the integrative quality of good building and its development over time – architecture.

Although the idea of architecture has morphed to many different forms and can be approached in a surprising variety of ways, it seems necessary from time to time to ask if the emperor really wears clothes. Is the current interest in energy and ecology really benefiting architecture or is it producing laboratory arrangements which are appropriate to investigate parts of an equation, but without offering an overall result.

Tendencies such as the aging society, the increasing complexity of technical systems and global markets have to be interpreted in a way that allows architecture to persist even though the prediction of the future is a difficult business. It is nevertheless essential as buildings may last up to thousands of years.

PL04 - IPBES AND ITS FIRST FAST-TRACK ASSESSMENT: THEMATIC ASSESSMENT OF POLLINATORS, POLLINATION AND FOOD PRODUCTION

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The Intergovernmental Platform on Biodiversity and Ecosystem Services was established to review, assess, and critically evaluate available information about the state of the planet's biodiversity and ecosystems, and the essential services they provide to society. It supports knowledge generation, capacity building, and policy. About 65 participants from 29 countries, representing academia, government agencies, museums and herbaria, and industry, have been working since 2014 to complete the first IPBES report, which is expected to be released early in 2016. It includes an overview of existing knowledge and information on pollination, plant mating and breeding systems, diversity of pollinators and their contribution to crop production, global change drivers that directly or indirectly impact pollinators and pollination services, market and non-market value of the contributions of pollinators and pollination services, traditional and indigenous knowledge concerning pollinators, and institutional and policy mechanisms. Its goals are to summarize all of the available information about the ecosystem service and the pollinators that provide it, describe the status and trends of pollinator populations, and provide the knowledge base that will be required by policy makers to foster and protect this important service that is responsible for about one of every three bites of food that we eat.

PL05 - GLOBAL CHANGE AND ECOSYSTEMRESPONSE: CROSS-SCALE INTERACTIONS AND THE CHAIN OF UNCERTAINTIES

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Ecosystems provide essential goods and services to human societies. However, anthropogenic pressures have caused serious threat to ecosystem functions and processes, potentially leading to loss of ecosystem services. Monitoring ecosystem conditions and services, and modeling their future behavior, is urgently needed.

In modeling ecosystem conditions, new challenges emerge. The scales of climate projections do not match those at which most ecosystems function. A downscaling chain is then set in place, where global projections force regional simulations, and statistical downscaling is applied to reach ecosystem scales. Uncertainties, however- generated by climate models, by downscaling and by unknown parameters in ecosystem models - can propagate and amplify.

Small-scale ecosystem changes can also feed back on climate, in the framework of cross-scale interactions. A scale mismatch is again in place, because small-scale processes are not well represented in the biome models adopted in climate simulations. Here, the problem is up scaling (or parameterizing) small-scale ecosystem dynamics to an averaged description, keeping track of the transitions happening at the ecosystem level.

Without offering any immediate solution, this talk will delve into these issues, in the framework of the newly-approved European H2020 Project "ECOPOTENTIAL: Improving future ecosystem benefits through Earth Observations".

PL06 - METABOLISM OF MEGACITIES

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A team of 28 researchers from 19 countries has conducted the first comprehensive study of the energy and materials flows for the world's 27 megacities. In aggregate, the world's 27 megacities are home to 6.7% of global population, but produce 12.6% of global solid waste, and consume 9.9% of global gasoline and 9.3% of global electricity. Eleven megacities (New York, Tokyo, Moscow, Seoul, Los Angeles, Shanghai, Guangzhou, Osaka, Tehran, Mexico City and London) consume in excess of 1 million GJ/year. Rates between the lowest and highest consuming megacities differ by a factor of 28 for energy per capita, 23 for water per capita, 19 for waste production per capita, 35 for total steel consumption and 6 for total cement. Many of the megacities are consuming resources at rates below those which support a basic standard of living for all citizens. Differences in the resource flows of megacities are influenced by climate, urban form, economic activity and scale effects. Lower density megacities are found to have greater building floor area per capita, explaining their higher per capita use of electricity. Many of the megacities are growing rapidly in population, but even faster in energy use.

PL07 - VOLTERRA'S LEGACY: VARIATIONS AND FLUCTUATIONS IN THE NUMBERS OF COEXISTING SPECIES

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Inspired by the key contributions of Vito Volterra in the 1920s, I will discuss the progress that has been made since in our understanding of the variations and fluctuations in the numbers of coexisting species. Species coexistence is often attributed to niche differentiation. This approach suggest an equilibrium view of our natural world, in which changes in species composition through, e.g. climate change can be predicted from knowledge of their niches.

However, models predict that networks of interacting species can produce complex dynamics, such that the species composition never reaches an equilibrium state. These model predictions are supported by laboratory experiments with microbial and plankton communities, but field demonstrations are rare. Here, I present field data of species fluctuations at the edge of chaos in a rocky intertidal community, sustained by a complex cyclic succession for more than 20 years.

These non-equilibrium dynamics are more challenging to analyze and forecast than the classic equilibrium approach pervading ecological thinking. Yet, it seems that a non-equilibrium perspective is needed, if we are to predict changes in the species composition of our planet’s ecosystems.

PL08 - PATTERNS OF PLANT INVASIONS IN AND FROM CENTRAL EUROPE

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Invasive species are those non-native species that proliferate and cause ecological or economic harm. The flora of Central Europe is a suitable study case because not only the flora is well known but environmental conditions, as well. I start with a focus on species and ask, which species become invasive, in particular, what are the characteristics of species that become invasive in Central Europe. Here we showed that it is a (i) combination of species traits which make a species invasive, but that (ii) those traits that characterise successful (widely distributed) alien species differ from successful native species. Further, we analysed which environmental drivers are most important in explaining the level of invasions (i.e. the number of alien plant species). This differs among habitat types and will change according to future scenario conditions. Nevertheless, the most important driver in Europe are human (socio-economic) activities. Interestingly, though, they are those drivers of the early 20th Century rather than late 20th century explains the current pattern of invasions. Finally, I will briefly look at patterns of Central European alien in North America: (i) What are the main drivers of success? And (ii) what are the consequences of mutual species exchange on the distinctiveness of the floras, i.e. do European and North American Floras get more similar or more different?

PL09 - VULNERABILITY AND RESILIENCE OF COASTAL ECOSYSTEMS AND FISHERIES TO CLIMATE CHANGE

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Marine and coastal ecosystems and human communities around the world are impacted by climate change, resulting in decreased ocean productivity, altered food web dynamics, habitat degradation, economic losses, and health and safety risks as a consequence of the changing and more variable climate. Climatic impacts occur both through altered physical conditions and variability, e.g., seawater temperature and sea level, and through a suite of chemical changes, including ocean acidification and hypoxia. The capacity of local ecosystems and associated human communities to adapt to these pressures depends on their resilience, that is the ability of ecosystems to absorb disturbance while retaining function and continuing to provide ecosystem services, and the ability of people to adapt to change in their environment by altering their behaviors and interactions. I will present and discuss results of an interdisciplinary research program investigating the current impacts of climate change on coastal marine ecosystems and human communities of the Pacific coast of Baja California, Mexico, and the influences of local and global feedbacks on the resilience and adaptive capacity of these systems.

PLANT TRAITS - A TOOL TOWARDS A MORE PREDICTIVE ECOLOGY?

S01.1 - FROM PLANT TRAITS TO ECOSYSTEM PROCESSES: BRIDGING ECOPHYSIOLOGY AND MACROECOLOGY

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This presentation will outline an emerging mathematical theory of plant functional ecology, which links plant and ecosystem processes through testable hypotheses derived from the principle of optimization by natural selection. The development and testing of this theory has depended on the availability of extensive data sets on climate, leaf traits (including δ13C measurements), and ecosystem properties including green vegetation cover and land-atmosphere CO_2 fluxes. Achievements to date include unified explanations for observed climate and elevation effects on leaf CO_2 drawdown (ci:c-a- ratio) and photosynthetic capacity (Vcmax), growth temperature effects on the Jmax:Vcmax ratio, the adaptive nature of acclimation to enhanced CO_2 concentration, the controls of leaf versus sapwood respiration, the controls of leaf N content (Narea), the relative constancy of the light use efficiency of gross primary production, and the relative conservatism of leaf dark respiration with climate. These findings call into question a number of assumptions in state-of-the-art terrestrial ecosystem models, and provide a foundation for next-generation vegetation models that will rest on a firm theoretical and empirical basis. We will demonstrate predictable and well supported quantitative relationships between traits and environment, for which distinctions among plant functional types are a poor surrogate.

S01.2 - USING FUNCTIONAL TRAITS TO MODEL PLANT SPECIES' SENSITIVITY TO LANDUSE CHANGE

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Continued reliable delivery of ecosystem functions and services depends on the maintenance of functionally-diverse ecological assemblages. However, the loss of species from assemblages that results from land-use change is often ecologically and phylogenetically non-random. What functional traits are associated with the sensitivity or robustness of a plant species to land-use change? Here we analyse all the flowering plant species in the PREDICTS database - a global compilation of surveys of how local terrestrial biodiversity responds to land use and related pressures – in order to estimate each species' sensitivity to land conversion. We then model the resulting species estimates as a function of their functional traits in a phylogenetic comparative analysis, in order to identify the set of traits that are most consistently associated with decine or loss of species when natural or semi-natural habitats are converted to human use.

S01.3 - A GLOBAL VIEW AND MEASUREMENT OF PLANT ECOLOGICAL STRATEGIES

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The interface between humans and the remainder of the biosphere is characterised by rapid and drastic ecosystem perturbation, and plants are useful indicators of such changes that 'sit still and wait to be counted'. Grime's competitor, stress-tolerator, ruderal (CSR) theory includes a practical classification method that is starting to find applications as a descriptive and predictive tool, but it is calibrated using a national flora. Using the TRY plant functional trait database (www.try-db.org), leaf economics and size data for 3068 tracheophytes (representing 198 families, six continents and all 14 principal biomes) were used to produce a multivariate analysis of trait variability, to generate a globally-calibrated CSR classification tool ('Stratefy'). Strategies were determined within biomes, plant families and life-forms. Fourth-corner and RLQ analyses highlighted correlations between strategies and environmental data globally and locally. Certain biomes (e.g. tropical moist and dry broadleaf forests) exhibited convergence of CSR strategies but others exhibited strategy divergence (e.g. deserts). Convergence was also evident for certain life-forms (e.g. perennial graminoids) but not others (e.g. perennial forbs). C-, S- and R-selection were variously correlated with different climatic variables worldwide depending on life-form or family. We shall include a practical demonstration of the Stratefy tool.

S01.4 - PREDICTIVE TRAIT-BASED COMMUNITY ECOLOGY AND BIOGEOGRAPHY: PROMISES AND LIMITS

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Trait-based ecology offers an operational framework to compare organisms, communities and ecosystems by treating the biota as a continuous distribution of functional traits. In a community ecology perspective, functional traits are expected to reveal assembly processes, under the hypothesis that trait and niche axes covary. As such, a predictive framework to trait-based community ecology can be envisioned, with direct applied perspectives for several fields - notably conservation ecology, restoration ecology and agroecology. However species coexistence and local abundances, two regularly-mentioned targets of predictive community ecology, are driven by complex, often unpredictable, processes. Thus predictions in community ecology may be elusive, at least at local scale. Overall, I will present the promises and limits of predictive trait-based community ecology using the precision-realism-generality triangle framework. Next, I will expose how the emergent field of functional biogeography can provide predictive insights, for both biodiversity patterns and ecosystem functions, at large spatial scale, by bridging biodiversity and ecosystem science. As a case study, I will illustrate a predictive functional biogeography approach using the upscaling of a plant trait - leaf dry matter content - averaged at ecosystem level and country-wide predictions of forage digestibility.

S01.5 - REVISITING HISTORICAL SEMI-NATURAL GRASSLANDS PLOTS TO ASSESS SHIFTS IN PLANT FUNCTIONAL TRAITS

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Semi-natural grasslands are extraordinarily species-rich ecosystems currently threatened by changes in traditional land-use. Whereas many studies focused on the biodiversity loss associated to this threat, less attention has been paid to the shifts in plant functional traits that may occur within them. Our study is based on the re-visitation of historical vegetation plots originally performed in semi-natural grasslands. We aim at assess the extent and direction of shifts in plant species traits and define the drivers of these shifts. In 2013-2014 we resampled vascular plants in 135 plots along the Apennine that were already sampled between 1960 and 1990. We measured those traits that indicate plant strategy (life form, growth form, height, clonality, photosynthetic pathway), adaptation to herbivory (spinescence, specific leaf area), nutrient availability (N and P content, nutrient uptake strategy), and dispersal ability (seed mass, dispersal mode). Environmental variables, grazing data, and landscape metrics were associated to each plot. We classified the new plots into broad vegetation types associated to different change pathways. For each vegetation type we measured functional structure through community-weighted mean and functional divergence, and used these metrics as response variables in multiple regression models to test for the influence of environmental, grazing, and landscape variables.

S01.6 - NITROGEN DEPOSITION IN EUROPE AND TRADE-OFFS FOR SOIL DECOMPOSITION AND POLLINATION SERVICES

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Spatial clustering reveals long-term effects of nitrogen deposition on soil carbon-to-nitrogen ratios in Europe. While an inverse correlation between this anthropogenic input and soil C:N seems intuitive, the extent to which this relationship holds and affects ecosystem services like decomposition rate and traits like pollination has never been investigated before. Our results show that the C:N ratio varies more across natural ecosystems with a history of low (chronic) nitrogen pollution and that it remains surprisingly rather constant elsewhere. Moreover, despite the investigated deposition of nitrogen since the 1880s, it turns out that soils, plants and arthropods supposed to be under low pressure are not only the most affected by nitrogen accumulation, but also the most responsive to the short-term supply of atmospheric nitrogen in their recent past. Besides pest lepidopterans belonging to the Pieridae, clearly enhanced by nitrogen, butterflies were more sensitive to nitrogen deposition than moths. Hence, plants sharing the butterfly-pollination syndrome are under pressure near agroecosystems with excessive ammonia. A comparable trend is recognizable belowgrounds, as fungivore microarthropods (in contrast to bacterial-feeding nematodes) are suffering under N-accumulation. These functional shifts in ecological stoichiometry resulted in changed food-web structure, steeper allometric scaling, lower decomposition rate, and less nutrient cycling.

S01.7 - CONSIDERATIONS ON A DATA-DRIVEN APPROACH TO IDENTIFY PLANT'S IMPRINT ON ECOSYSTEM FUNCTIONING

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Terrestrial ecosystems strongly determine the exchange of carbon, water and energy between the biosphere and atmosphere. These exchanges are influenced and partly driven by environmental conditions (e.g. local meteorology, soils), but generally mediated by organisms, i.e. plants and soil microorganisms. In commonly used terrestrial biosphere models, this principle is implemented by process-based descriptions of plant functioning at the organ level and scaling to ecosystem level. In order to validate these model formulations, we need an independent empirical approach to understand the plant's imprint on ecosystem functioning. We use land-atmosphere exchange of fluxes of CO_2, H_2O and energy in tandem with environmental controls available in the FLUXNET synthesis database (www.fluxdata.org) to quantify "ecosystem functional properties" (EFPs). The latter are generally time-invariant ecosystem specific properties, for instance process sensitivities or efficiencies that shape ecosystem scale responses. Our crucial question is if plant traits measured at the organ level (available e.g. in the TRY database; www.try-db.org) can empirically elucidate the characteristics of EFPs. In this study we follow this new avenue to study the role of plants for biogeochemical cycles across a large number of different globally distributed ecosystem types, aiming to address emerging difficulties and possible solutions.

S01.8 - USING ECOSYSTEM LEVEL CO_2 FLUXES, HYPERSPECTRAL REMOTE SENSING AND PLAN TRAITS TO EVALUATE THE EFFECTS OF NUTRIENT AVAILABILITY ON THE FUNCTIONING OF A MEDITERRANEAN GRASSLAND

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Recent studies have shown how human induced N/P imbalances affect essential ecosystem processes, and might be particularly important in water-limited ecosystems. In this contribution we will present an experiment conducted over a Mediterranean grassland, where 16 plots of 10x10 meters are manipulated by adding nutrient (N, P, and NP). The overall objective was to investigate the response of gross primary productivity (GPP), ecosystem respiration (Reco), plant traits and the functional response of vegetation to meteorology under different nutrient availability. The second objective was to evaluate the capability of hyperspectral data and Solar Induced Fluorescence (SIF) to track short- and long-term GPP and light use efficiency variation under different N and P fertilization treatments by using Light Use Efficiency and Radiative Transfer Modelling. As third objective we developed a Reco model using as driver remote sensing information. The results showed significant differences in GPP values between plots with and without N addition. We also found that vegetation indices sensitive to pigment variations and physiology (such as photochemical reflectance index PRI) and SIF showed differences between different treatments. We will also discuss how using remote sensing information alone can efficiently describe spatio-temporal variations of GPP and Reco under different nutrient availability.

S01.9 - INCORPORATING IMPUTATION AND DATA UNCERTAINTY INTO A TREE FUNCTIONAL TRAIT DATABASE

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Plant functional traits are increasingly being used in functional and community ecology thanks to the availability of large ecological databases. However, missing and heterogeneous data may severely bias trait-based analyses. We assess the effects of data imputation and data uncertainty on five tree functional traits (leaf biomass to sapwood area ratio, foliar nitrogen, maximum height, specific leaf area and wood density) in the Ecological and Forest Inventory of Catalonia, an extensive spatial database (covering 31900 km^2). We tested the performance of a single imputation by the k-nearest neighbors algorithm (kNN) and a Multiple Imputation with Chained Equations (MICE). Using only functional traits as predictors, both kNN and MICE greatly improved the precision over a simple imputation using species-specific mean trait values. MICE yielded imputations which preserved the covariance structure of the data and provided an estimate of between-imputation uncertainty. Species identity and stand structure, not climate or spatial structure were the predictors that most contributed to improve MICE imputations. We also quantify the uncertainty derived from sampling variability, data processing and from the influence of forest management on trait data. Our ultimate goal is to provide a combined estimate of both data and imputation uncertainty of tree functional trait estimates.

S01.10 - GAP-FILLING FOR MULTIVARIATE PLANT TRAIT ANALYSES – TRAIT PREDICTION USING BAYESIAN HIERARCHICAL PROBABILISTIC MATRIX FACTORIZATION

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The identification of trait syndromes and their relation to biogeographic drivers offers an exciting approach to quantify and understand the global functional diversity of plants. All plants have to integrate all traits at all times to survive. This integration on a whole plant basis leads to the definition of their ecologic strategy. All plant strategies together give rise to a multivariate body, which was shaped by plant's evolutionary history and the habitats' environmental limits. Thus pivotal factors to modern plants can potentially be excavated by the analysis of this multivariate body. The plant trait database TRY (www.try-db.org) holds an unprecedented number of trait data. However, data sparsity severely limits the application of multivariate methods. Therefore we developed Bayesian Hierarchical Probabilistic Matrix Factorization (BHPMF) to fill gaps in the trait dataset, accounting for prediction uncertainty. We demonstrate the precision and relative stability of BHPMF-filled data for different gap sizes and data origins. Moreover, multivariate analyses, like Principle Component Analysis (PCA), appear to be stable with gap-filling. A PCA with 18 traits and 45,000 gap-filled species finally reveals major syndromes of plant traits and the distribution of species within. The BHPMF algorithm can apparently provide sufficient information to perform meaningful analyses in an ecological context.

S01.11 - DIVERSIFYING PLANT TRAITS IN A DGVM – THE LPJML-FIT APPROACH

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Functional diversity plays an important role for vegetation dynamics and productivity as well as ecosystem stability. Until now Dynamic Global Vegetation Models (DGVM) condensed functional diversity to Plant Functional Types (PFTs) which are parameterized with constant values for each considered plant trait. We have developed an individual- and trait-based version of the LPJmL DGVM called LPJmL-FIT (LPJmL with Flexible Individual Traits). By incorporating the natural range of selected tree traits and connecting them by empirical trade-offs derived from the TRY database and supported by the theory of leaf and stem economics spectra we are able to simulate several plant strategies and to reproduce observed trait distributions in tropical South America. We show that the regional distributions of traits in the Amazon rainforest are driven by climate variability. LPJmL-FIT allows analyzing the link between functional diversity and ecosystem functioning such as carbon storage. Further analysis investigates the role of flexible individual traits under changing climate conditions.

S01.12 - TRAIT-BASED ECOSYSTEM MODELING: PROJECTING TRAITS COMMUNITIES AND FUNCTIONAL DIVERSITY

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The ability to project patterns of traits, community composition and diversity is an important challenge in ecology and it is required to understand how climate change and disturbances may influence vegetation. Dynamic vegetation models are powerful tools to investigate vegetation patterns and associated biogeochemical fluxes under past, present and future conditions. However, many models are limited by the representation of vegetation by using static plant functional types and by their simplistic representation of competition. Here, we present a trait-based dynamic vegetation modeling approach, the aDGVM2. Plants in the model are characterized by an individual combination of trait values and traits are linked by trade-offs. Successful plants can pass their trait values to the next generation whereas other strategies are filtered out. The aDGVM2 assembles plant communities that are well adapted to the environment and to disturbance regimes. We show that the model can simulate vegetation patterns in tropical and subtropical regions and how trait patterns, vegetation distribution and diversity respond to disturbances such as fire and herbivory. The aDGMV2 links trait data and models in a way not possible in most alternative models and it provides a framework to integrate Earth system modeling and functional biology.

THE (MACRO)ECOLOGY OF ANIMAL SPECIES DECLINE

S02.1 - DEFAUNATION IN THE ANTHROPOCENE: RESPONSE OF ANIMAL POPULATIONS TO HUMAN MEDIATED DRIVERS

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We live amid a global wave of anthropogenically driven biodiversity loss. Over the past decade, numerous metrics for biodiversity—including species abundance, extinction risk, distribution, genetic variability, species turnover, and trait diversity—have been used to create indicators to track how biodiversity has changed.These indicators have made it clear that biodiversity loss, however it is measured, is showing little sign of abatement and that humans must respond to safeguard the provision of natural services on which we all rely. But which metrics provide the most informative indicators under which circumstances? And how can the growing list of indicators best serve conservation policy decisions? I review the responses of animal populations to a range of human mediated drivers of change, showing wherebiological science has been effective at tracking recent changes in nature, and where gaps remain. I then examine prospects for predicting future changes, and why they matter to the biosphere and humans. I argue that evidence-based modelling can allow the causal relationships between policy actions, biodiversity change and indicators of change to be better understood. Developed correctly, indicators can start to tell us how we can best conserve biodiversity, not simply that we are failing to do so.

S02.2 - CONTRASTING CHANGES IN THE ABUNDANCE AND DIVERSITY OF NORTH-AMERICAN BIRD ASSEMBLAGES

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Although it is generally recognized that global biodiversity is declining, temporal trends in biodiversity have received little attention compared to spatial patterns. In particular, it is largely unexplored whether different biodiversity metrics show similar temporal trends. We used long-term monitoring data (1971-2010) of the North American Breeding Bird Survey in order to assess changes in a suite of biodiversity metrics covering abundance, taxonomic diversity, functional diversity and phylogenetic diversity. We did this for all bird species together as well as sub-groups based on breeding habitat affinity (grassland, woodland, wetland and shrubland). Among the most pronounced trends was a distinct decrease in overall mean bird abundance, mainly driven by declines of the most abundant species. The disproportionate decline of common, relatively small species coincided with an increase in community-weighted mean body mass as well as increases in taxonomic and functional diversity metrics relying on evenness. Patterns of change differed, however, among the sub-groups, with both abundance and diversity increasing for woodland birds and decreasing for grassland species. The contrasting changes between metrics and species groups underscore the relevance of considering multiple biodiversity metrics simultaneously and challenge the use of particular species groups as surrogates for overall biodiversity.

S02.3 - BEYOND CORRELATION: SEARCHING FOR THE MECHANISMS BY WHICH SPECIES' TRAITS INFLUENCE EXTINCTION RISK

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Understanding and predicting the response of animal populations to anthropogenic activity is a major challenge in biodiversity conservation. Responses are influenced by extrinsic factors (the types of threats and environmental conditions) and also by intrinsic factors (not all species are equally affected by the same threats). Many studies have shed light on how intrinsic traits correlate with extinction risk, identifying what we may call vulnerability traits. However, the mechanisms by which these traits increase vulnerability remain largely unexplored; even though it is by understanding mechanisms that we can hope to predict responses to new future conditions. In this talk I present two recent efforts to explain how vulnerability traits influence extinction risk. The first example employs a recently developed methodology, phylogenetically-informed path analyses, to explore the direct and indirect paths by which body and brain size influence vulnerability to extinction among mammals. The second example explores the paths by which a population process: extinction risk, is influenced by the characteristics of the individuals (for example, their body mass), linking traits to the demographic rates that ultimately determine population dynamics. These two examples illustrate some of the possibilities to develop the necessary mechanistic framework to understand and predict biodiversity changes.

S02.4 - IMPORTANCE OF INTRINSIC AND EXTRINSIC CHARACTERISTICS TO IDENTIFY HOTSPOTS OF MAMMAL SPECIES AT RISK FROM CLIMATE CHANGE

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The distributions and populations of large mammals are declining globally, leading to an increase intheir extinction risk. We forecast the distribution of extant European large mammals (17 carnivores and10 ungulates) based on two Rio+20 scenarios of socio-economic development: business as usual andreduced impact by consumption change. These are linked to scenarios of land use change and climatechange through the spatial allocation of land claim until 2050. We modeled mammal distributionsbased on their habitat preferences recorded in the IUCN Red List database. We analyzed the geographicand taxonomic variation of habitat loss for large mammals, and the potential effect of the reducedimpact policy on loss mitigation. Averaging across scenarios, European large mammals would lose10% of their habitat by 2050 (25% in the worst-case scenario). The loss would be much higher forspecies in northwestern Europe, where habitat is expected to be lost due to climate and land usechange. Change in human consumption patterns would mark a substantial improvement in theconservation of habitat for European large mammals, but this would still be insufficient if they are notcapable to adapt locally or disperse.

S02.5 - SEA LEVEL RISE AND THE DECLINE OF WATER-BIRDS IN EUROPE

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Sea-level rise (SLR) will greatly alter littoral ecosystems, causing habitat change and loss for coastal species. The Mediterranean basin is clearly an area of great importance for the entire European sub-continent. It is considered a hotspot of biological diversity and is one of the regions that will face extensiveclimate changes. Furthermore is one of the most important wintering areas for many waterbirdsbreeding in central and north-eastern Europe. Considering the climate change scenarios (IPCC), we measured the impact of SLR on waterbirds wintering in the Mediterranean coastal wetlands, focusing in particular on 152 wetland areas included in the RAMSAR convention and located within 10km from the coast.Italy is the country hosting the highest number of areas (34), followed by Tunisia, Spain, Ukraina and France (respectively 21, 15, 15, 10 areas). Preliminary results show that at least 133 areas (87.5%) will be directly affected by SLR, with particularly important effects in Italy (with 94% of the areas affected by SLR) and France (90%), but also in Ukraine and Spain (more than 86% of the areas affected). Incidentally, Italy and France in particular are the countries hosting the highest number of wintering waterbirds, making the impact of SLR potentially important.

S02.6 - "THE BIGGER THEY ARE, THE HARDER THEY FALL"? ORGANISM SIZE AND SPECIES' SENSITIVITY TO LAND-USE IMPACTS

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Species vary in their susceptibility to decline in the face of human impacts, presumably because of ecological differences. Large size is a key ecological trait that has often been hypothesised to make species sensitive to anthropogenic changes: larger species may be the targets of exploitation, are often less abundant, may require larger habitat patches, typically have slower life history and are likely to evolve more slowly. Large size is associated with higher global extinction risk in some vertebrate groups, but general conclusions would be premature - outside of vertebrates, both the ecological correlates of large size and the patterns of extinction risk are less well understood. Here we analyse the PREDICTS database - a global, taxonomically-representative compilation of studies that surveyed components of terrestrial biodiversity at sites facing different levels of human pressure (www.predicts.org.uk) - to assess whether bigger always means worse. By combining community abundance data with species data on organism size, we calculate community-weighted mean size at each survey site, and use mixed-effects models to test whether the response to land use is consistent among a wide range of taxonomic groups. Our analyses provide the most general picture so far of how organism size affects species' sensitivity to land-use impacts.

S02.7 - HUMAN-DRIVEN BODY SIZE REDUCTION IN TERRESTRIAL MAMMAL COMMUNITIES

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Since Bergman's observation that homoeothermic animals increase in size with latitude, body size distribution has been a central focus of macroecological research. After more than 160 years the so called Bergman's rule is still under debate and macroecological investigation has led to a number of explanation for this pattern. Meanwhile, human activities have led to hundreds of species extinctions, as well as narrowing the distribution of many of the remaining species. Here we assess the extent to which human impact has shaped the current distribution of mammalian body size. We then used a comprehensive set of variables to predict the body size values registered in grid cells, including ecological, climatic and human impact variables. We finally explored how model's predictions are affected by the inclusion of human impact variables, and where current body size are predicted to be lower than expected in pristine natural conditions. Our model suggests that human impact has led to a general reduction in body size of terrestrial mammal communities, and mean and maximum body size are higher when predicted removing the effect of human impact. Our study supports previous findings on the pervasive effects of human impact on nature, as well as a human distortion of global macroecological patterns.

S02.8 - SETTING EQUITABLE CONSERVATION TARGETS: BIOLOGICAL PREDICTORS OF SPECIES PERSISTENCE

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Conservation assessments often require quantitative conservation targets, which allow to assess the efficacy of conservation actions and the adequacy of current species protection. As wildlife population viability largely depends on population and range size, the minimum viable population (MVP) and the minimum area requirements (MAR) of species are widely used conservation targets. However, high-quality, population-specific data are needed to quantify these targets, which has raised a call for general rules of thumb. In population viability analyses body size has been found to be an important factor predicting persistence. As a consequence, we might expect that body size provides a key biological predictor of MVP and MAR as well. However, this has not yet been analytically explored. Here, we systematically quantified these conservation targets for 4085 mammal species by combining logistic population models with allometric relationships on mammals. We demonstrate that smaller species require higher conservation targets than their larger counterparts, although variation around this trend due to environmental conditions is evident. We acknowledge that MVPs and MARs are context-dependent, but in the absence of accurate population-specific data in multi-species conservation this study provides quantitative equitable conservation targets based on ecological traits that can be used in conservation assessments.

S02.9 - MAMMALIAN PHYLOGENETIC DIVERSITY AREA RELATIONSHIPS AT A CONTINENTAL SCALE

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In analogy to the species-area relationship (SAR), the phylogenetic diversity-area relationship (PDAR) describes the tendency of phylogenetic diversity (PD) to increase with area. Although investigating PDAR has the potential to unravel the underlying processes shaping assemblages across spatial scales and to predict PD loss through habitat reduction, it has been little investigated so far. Here we investigate the universality and pervasiveness of the PDAR at continental scale using terrestrial mammals as study case. We define a metric that quantify the relative robustness of PD (compared to SR) to habitat loss and show that PD robustness is higher than SR robustness but that it varies among continents. We further use a null model approach to disentangle the relative effect of phylogenetic tree shape and non-random spatial distribution of evolutionary history on the PDAR. We find that for most spatial scales and for all continents except Eurasia, PDARs are not different from expected by this null model. Nevertheless, it appears that the relative robustness of PD to habitat loss compared to species richness is determined by the phylogenetic tree shape but also depends on the spatial structure of PD.

S02.10 - MACROECOLOGICAL PATTERNS OF DISTRIBUTION AND ENDEMISM OF EUROPEAN MONTANE MAMMALS

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We analyzed macroecological patterns of distribution and endemism of European montane (i.e. occurring only at median elevations ≥ 943 m a.s.l.) mammals, with the aims of testing two elevation diversity hypotheses: (a) Steven hypothesis (with species richness along altitudinal gradient is assumed to increase universally from cool highlands to warm lowlands), and (b) Rosenzweig hypothesis (mid-domain effect, with diversity along elevational gradients being a reflection of underlying patterns of primary productivity). Landscape of the study area was characterized by three environmental variables: land cover, land-use, and elevation. For each species, we collected spatially explicit information on the Extent Of Occurrence, endemicity level, conservation status, habitat preferences, elevation range, plus all available presence points. Montane species were 21.0% of the total (n = 258). Both the above-mentioned hypotheses were confirmed. Moreover, we found that, once corrected for the area effects, there were higher density of species (5.9 versus 2.0 species/100,000 Km^2), higher density of endemic species (4.1 versus 0.8 species/100,000 Km^2), higher density of threatened species (1.2 versus 0.2 species/100,000 Km^2). This means that if 1 km^2 of mountain area is lost, its impact on mammal diversity would be three times worst for the montane species and five times more for the endemic and threatened ones.

S02.11 - PROJECTED EFFECT OF GLOBAL CHANGE ON EUROPEAN LARGE MAMMALS

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The distributions and populations of large mammals are declining globally, leading to an increase intheir extinction risk. We forecast the distribution of extant European large mammals (17 carnivores and10 ungulates) based on two Rio+20 scenarios of socio-economic development: business as usual andreduced impact by consumption change. These are linked to scenarios of land use change and climatechange through the spatial allocation of land claim until 2050. We modeled mammal distributionsbased on their habitat preferences recorded in the IUCN Red List database. We analyzed the geographicand taxonomic variation of habitat loss for large mammals, and the potential effect of the reducedimpact policy on loss mitigation. Averaging across scenarios, European large mammals would lose10% of their habitat by 2050 (25% in the worst-case scenario). The loss would be much higher forspecies in northwestern Europe, where habitat is expected to be lost due to climate and land usechange. Change in human consumption patterns would mark a substantial improvement in theconservation of habitat for European large mammals, but this would still be insufficient if they are notcapable to adapt locally or disperse.

BIO-MONITORING: LESSONS FROM THE PAST, CHALLENGES FOR THE FUTURE

S03.1 - THE LIVING STREAM: A FUNCTIONAL APPROACH

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Over fifty years of research on freshwater macro-invertebrates has been driven largely by the state of the taxonomy of these organisms. Significant advances have been and continue to be made in developing ever more refined keys to macro-invertebrate groups (e.g. Merritt et al. 2008, 4th ed., An Introduction to the Aquatic Insects of North America). When advances in macro- invertebrate ecological research is restricted by the level of detail in identifications, then analysis by function is a viable alternative. The focus on function, namely adaptations of macro-invertebrates to habitats and the utilization of food resources, has facilitated ecological evaluation of freshwater ecosystems. This classification is based not on what insects eat, but how they obtain their food. These categories are called “functional feeding groups,” as the name implies, denoting their functional role when describing how and where they feed. This is the basis for the functional feeding group (FFG) method that was initially developed in the early 1960s. Taxonomy is applied only to the level of detail that allows assignment to one of five functional feeding group categories: detrital shredders, scrapers, filtering collectors, gatherers, and predators. I will discuss how each of these functional groups interacts to make up the “living stream”.

S03.2 - FRESHWATER DIATOMS AS INDICATORS OF ENVIRONMENTAL CHANGE: FROM THE COMMUNITY TO THE CELL LEVEL

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Freshwater diatoms have long been used for environmental assessment especially in lotic systems. The first steps were taken in the beginning of the XXth century followed by an active development of autoecological indices to infer degradation levels taking into account the diatom assemblages' ecological preferences and tolerances. More recently, a further step was given with the development of diatom based predictive models that resort to the concept of reference condition (one of the theoretical basis in the Water Framework Directive). More realistic results were attained with the predictive models in comparison to frequently used indices.Diatoms can also develop in extreme environments such as mining and volcanic areas showing a decrease in diversity and cell wall teratologies as well as morphometric alterations for some species, and can therefore, be used as indicators in these situations, too. Cellular mechanisms by which diatoms respond to metals have been described. Diatoms synthesize phytochelatins which are positively correlated to metal concentration. Another cellular mechanism describes the chelation of metals in the outermost layer of the frustule which is composed of the protein frustulin, thus providing evidence for its use as complementary tool for bioremediation and bioindication purposes. The use of diatoms for bioindication is, therefore, still a growing field of research.

S03.3 - ASSESSING THE HEALTH OF FRESHWATERS AND THEIR POTENTIAL TO PROVIDE ECOSYSTEM SERVICES

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Ecosystem health assessments are going through a revolution. The availability of monitoring data is increasing exponentially in both spatial coverage and frequency and this opens up the potential for much greater understanding of the status of ecosystems in response to multiple stressors and landscape connectivity. The requirements for assessments are also changing rapidly and there is now great demand to understand ecological responses in terms of changing ecosystem functions and their value in delivering the services freshwaters provide to society. This talk will highlight how these challenges are being addressed in freshwater biomonitoring, particularly through the use of phytoplankton. It will review the great advancements over the past decade in quantifying ecological responses and their uncertainty in relation to single stressors, yet highlight the dangers in considering single stressor metrics alone. A more holistic picture of ecosystem health, in terms of responses to multiple stressors, cross-scale interactions and functional change requires new approaches and new collaborations with spatial scientists, social scientists and citizens. The potential application of functional trait-based approaches and new monitoring datasets from earth observation and citizen science will be highlighted to address these future needs.

S03.4 - HOW DO WITHIN SITE VARIABILITY OF DETECTION PROBABILITY AND ABUNDANCE OF MACROINVERTEBRATES AFFECT THE RESULT OF MULTIMETRIC INDEXES?

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The sensitivity of a multimetric index to imperfect detection and aggregation of macroinvertebrates was assessed. We applied the index adopted in Italy for the evaluation of the quality status of water courses (STAR_ICMi) based on metrics used throughout Europe for biomonitoring. Macroinvertebrates were sampled in several streams in Northern Italy where organisms were collected with a surber net. At first, 30 surber replicates were taken instead of the ten required for the application of the index. Starting from the sampling results, artificial communities were simulated on the basis of detection probabilities of each taxon and two levels of aggregation. Precision of STAR_ICMi index, calculated as percentile confidence interval, was higher for low aggregation level than for high aggregation level. Abundance based metrics presented the highest coefficient of variation (CV) with high aggregation. The present exercise not only responds to specific impositions by the European legislation but represents a critical step to improve and refine the biomonitoring tools.

S03.5 - NATURAL DYNAMICS AFFECT SUBMERGED AQUATIC VEGETATION DEPTH DISTRIBUTION, DIVERSITY AND ABUNDANCE IN DEEP LAKES

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Although various studies have investigated human-induced shifts in macrophyte distribution and dominance, the importance of natural variability in submerged aquatic vegetation (SAV) dynamics has been widely underestimated. The aim of our study was to compare the spatial and structural features of SAV in four deep lakes in central Italy that are characterized by different trophic conditions and by the absence of evident human impacts over a 3-year time period (2010−2013). The results revealed a significant rearrangement of SAV within the deepest communities, which are dominated by charophytes (below a depth of 5 m), and the consequent reduction in the maximum growing depth of macrophytes. Moreover, increased species diversity was recorded in the first meters of depth (0-5 m) as a result of the migration of mid-depth species to lower depths, though without inducing marked structural changes in the SAV. A significant increase in spring precipitation in some years (which is in keeping with local climate variability) may be associated with that changes we observed, which suggests that climate fluctuations may be a determining factor in the short-term dynamics of SAV in deep lakes.

S03.6 - MAPPING MACROPHYTE FUNCTIONAL GROUPS USING MULTI-TEMPORAL SATELLITE DATA: APPROACH OVERVIEW AND CAPABILITIES

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Macrophytes, including helophytes, are one of the most important biological components of inland water systems. The macrophyte-dominated habitats play a relevant role in the global carbon and nutrient cycles, as well as in the provision of suitable niches for aquatic fauna and threatened taxa. Despite their relevance, relatively little effort has been performed so far in extensively mapping aquatic vegetation cover and characteristics at regional to global scales, including the elaboration of robust approaches to assess morpho-ecological gradients, structural complexity and functional status of macrophyte dominated habitats.For their synoptic characteristics, Earth Observation satellite data are the ideal tool for such a target, especially with the new generation of fine resolution multispectral platforms soon available (2015-2016). In this context, we present an approach for mapping macrophyte communities using multi-temporal vegetation indices specifically optimized for aquatic vegetation derivable for a vast group of satellite sensors. This approach has been tested so far over temperate to sub-tropical shallow lakes and wetlands areas, demonstrating a good degree of flexibility and applicability in the context of macrophytes monitoring applications that aim to go beyond the local scale. Eventually, the capabilities of our approach in mapping macrophytes functional groups are discussed.

S03.7 - STEPS TOWARDS PROTOCOLS FOR INCLUDING LICHENS IN ROUTINE MONITORING OF FRESHWATER HABITATS AS PART OF THE IMPLEMENTATION OF THE EU WATER FRAMEWORK DIRECTIVE

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In freshwater habitats, lichens are found wherever suitable solid substrata, alkaline to moderate acidic water, sufficient light, and low to moderate silting occur. Research on their ecology highlights the sensitiveness of this functional group to factors which cannot be technically measured by singular visits, and have relevance for human planning purposes and environmental impact and risk assessment. However, in most assessments of freshwater organisms, lichens are still neglected although they are included in the concept of “macrophyte” used by the EU Water Framework directive that provides the main policies for freshwater monitoring. This weakness is at least in part due to the fact that, in spite of their limited number, freshwater lichens are often difficult to identify by non-specialists. Stimulating perspectives are however related to the continuous effort and new results with regards to refining pragmatic approaches to species recognition and delimitation based on molecular phylogenies and to the fact that we are now close to entering a new period with field trials of functional group-based assessments in collaboration with Citizen Groups outside of the core lichenological communities.

S03.8 - A NEW EUROPEAN STANDARD FOR LICHEN BIOMONITORING: RESEARCH SUPPORTS APPLICATION

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Lichen biomonitoring is widely used to assess the impact of anthropogenic activity, particularly the effect of atmospheric pollution. A new CEN (European Committee for Standardization) European Standard has been recently developed aiming at providing a reliable, repeatable and objective method for assessing epiphytic lichen diversity (CEN/TC 264, EN 16413:2014). In the last years, the standardization process was supported by several research topics in Lichenology that have improved the quality and the applicability of biomonitoring of effects of air pollution using lichens. In particular, 1) Reducing the subjectivity in the selection of the sampling sites and in fieldwork activities, by assessing the efficiency of several probabilistic approaches. 2) Investigating the spatial variability of lichen diversity for optimizing the sample size. 3) Exploring the within- site variability for defining the background noise and to perform a better interpretation of the data. 4) Defining Quality Assurance procedures to evaluate and minimize the non-sampling errors due to operators.

S03.9 - PLANT STRATEGIES AS BIOLOGICAL INDICATORS OF ECOSYSTEM SERVICES

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Ecosystems provide services essential to human welfare that have been broadly classified into four types: provisioning, supporting, regulating and cultural. The main aim of the present study was to develop a method whereby plant strategies can be used to quantify ES . Sixty herbaceous plant communities were used to quantify differences in community-weighted mean (CWM) functional trait values, above and below ground biomass, and quality of the species present. Provisioning services were estimated as a function of the CWM values of above-ground biomass, canopy height and leaf dry weight. Supporting services were estimated as a function of leaf nitrogen content and seasonality. Regulating services were calculated from the amount of carbon sequestration. Cultural services were calculated from the relationship between presence of threatened species and proportion of plant species in flower. Values for each ES type were compared with the CWM values of CSR plant strategies. C strategy was found to be highly representative of the degree of provisioning. The extent of R in the plant community was found to indicate the extent of supporting services, while the extent of S the extent of regulating services. Cultural services were not related to the plant strategies present. These findings underline the utility of plant CSR strategies as readily-applicable indicators of ES.

S03.10 - SOIL FAUNA IN HEALTH AND SOIL QUALITY MONITORING

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Human, by changing the global environment, are causing a dramatic reduction in the level of biodiversity in many areas of the earth. These changes can modify the resistance and resilience of ecosystems to environmental change. The fluctuation of the soil health and quality can be related to the direct human inputs or to long-term processes such as climate change. Relationships between biodiversity and ecosystem functioning are particularly important in soil because soils provide a high number of ecosystem services, dues to the complex communities of organisms living there. The need to adopt soil biodiversity monitoring programs is induced by both the increasing pressures on soil biodiversity and the limited knowledge up to now obtained. Over the past 20 years, the importance of soil faunal diversity for many ecosystem services has received increasing recognition. Furthermore, the increasing recognition of problems derived from soil degradation has contributed to identify soil fauna research as a priority in soil quality assessments. Several invertebrate groups have been proposed for monitoring purposes, either alone or in combination. Many studies have analysed soil quality using different indicators but only a few have used the obtained results to establish a soil quality index.

THE SOUNDSCAPE ECOLOGY: A NEW FRONTIER OF THE ECOLOGICAL INVESTIGATION

S04.1 - THE ROLE OF NATURAL AND ANTHROPOGENIC SOUNDS IN THE ECOLOGICAL DYNAMICS OF ANIMAL COMMUNITIES

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Sounds ranging from infrasound to ultrasound frequencies are a fundamental semiotic tool used by several terrestrial and aquatic animals to communicate at the individual species and population levels. However, sounds have recently been proved to also be important for structuring and regulating animal (acoustic) communities. The ensemble of abiotic (geophonies), biotic (biophonies) and anthropogenic (technophonies) acoustic sources creates distinct and unique acoustic signatures or sonotopes in a location. Such characteristic sonic contexts play an active role in shaping local communities and driving their dynamics. Furthermore, mechanisms of interspecific acoustic cohesion produce inside each sonotope distinct acoustic aggregations or soundtopes that mainly depend on: the specific composition of the biological assemblages, species abundance, and the resulting interspecific interactions that vary across the seasons. According to the niche acoustic hypothesis, it is believed that species that comprise an acoustic community have adapted their acoustic repertoire in order to minimize the spectral overlap of their sounds and maintain the effectiveness of their individual signalling. This condition may be altered by external events like climatic changes or noises of human origin, both of which can have severe consequences on the structure and dynamics of acoustic communities.

S04.2 - SOCIO-ECOLOGICAL SOUNDSCAPES – PORTRAITS OF REALITY

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In making wildlife films there is the opportunity to create a positive soundscape. In vivo soundscapes are manipulated, edited and enhanced. Distractors are removed sounds are added to place emphasis on certain aspects of the film thereby enhancing the experience for the viewer. The result is often far from reality. What are the implications of this hyper-realism on our interpretation of soundscapes? This question is heightened in cities. The soundscape of a city is a complex system of tones and amplitudes. There is little clarity. No single focus. Bird song is hidden. It is difficult to detect in the socio-ecological soundscape of a city. In this presentation the concept of a socio-ecological soundscape will be explored and contrasted with that of depictions of the natural environment that are presented in wildlife films. Ways in which both urban socio-ecological soundscapes and wildlife film soundscapes are manipulated will be discussed.

S04.3 - INTERSPECIFIC ACOUSTIC INTERACTIONS WITHIN A FOREST BIRD COMMUNITY. AN EXPERIMENTAL APPROACH

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Multi-species acoustic displays, such as the bird dawn chorus, are complex and widespread collective behaviours that are still poorly known. Such complex displays provide an excellent opportunity to study interspecific acoustic interactions and selective constraints potentially driving community structure and dynamics. Based on the novel approach of ecoacoustics, this study reports species interactions in forest bird assemblages during dawn chorusing activity. The temporal patterns of one bird species (Parus major) within dawn choruses were experimentally altered using playback. The stimuli emission (80-82 dB SPL RMS) started around 25-40 min before the time of the first song of P. major recorded the previous day and lasted 1h. Acoustic community analysis revealed that playback stimuli influenced on the temporal patterns of species composing the choruses. Specifically, six of eight study species began significantly earlier their singing activity during the days with presence of the acoustic stimuli, in comparison with pre- and post-stimulus days. Our findings suggest that the dawn chorus is an acoustic communication network where heterospecific signals may act as cues that provide information to species and determine the timing of vocal activity in bird communities.

S04.4 - SOUNDSCAPE OF DIFFERENT MARINE COASTAL ECOSYSTEM

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One year underwater acoustic data from two Marine Protected Area placed in Lampedusa island (central Mediterranean Sea, 35°N) and in Kongsfjorden (Arctic Sea, 79°N), and 8 days data from coral reef in Maldives (3°N) are presented. Octave analysis is applied to study seasonal and circadian trends of acoustic energy in different frequencies band. Below 150 Hz the high-density traffic in Mediterranean Sea produce higher sound level in comparison to the arctic sea. In the band below 15 kHz, ice calving and the ice melting noise dominate the soundscape of fjord during the spring until the autumn, instead in Maldives and Lampedusa Island snapping shrimps produce a loud impulsive noise. Seasonal variation in soundscape is observed in Mediterranean and Arctic sea, otherwise circadian variation is noted only in Mediterranean and Maldives sites, where is also notable fish chorus during the sunset and sunrise. Despite the relevant ecological value for marine ecosystems of the recordingsites,the vessel passages overlay several times per days the “acoustic niche”.

S04.5 - THE SOUNDSCAPE OF POSIDONIA OCEANICA ECOSYSTEM: TEMPORAL AND SPATIAL PATTERNS

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In recent years, many research pointed out the key-role of soundfor orientation, recruitment and habitat selection of fishes and crustaceansin marine environment. Despite this, still littleis known about the soundscape of coastal shallow waterespeciallyin the Mediterranean Sea. Here, *Posidonia oceanica* is the dominant coastal seagrass species and providesrefuge, nursery and food source for fish and invertebrate species. The aim of this work is to compare the temporal and spatialpattern of the soundscape in a mosaic of *Posidonia* meadows andsandypatches along the South-Western coast of Sicily (Italy). We used six acoustic passive recorders following a duty cycle of 33% and a sampling frequency of 48 kHz. The results showed that in *Posidonia* habitat the frequencies over 3 kHz are dominated by impulsive sounds of snapping shrimps with higher values of energy during the night than during daylightcomparedtothesandy habitat. At low frequencies (<1 kHz), the sandy habitat soundscape is characterized by higher intensity both during day- e night-time than the *Posidonia* environment, while, within both habitats, the daytime is characterized by more intense energythat the nighttime.Nevertheless,furtheranalysis are necessary to fully interpretthese results.

S04.6 - ANTHROPOGENIC NOISE IN THE CENTRAL MEDITERRANEAN SEA: MODEL, DIRECT MEASUREMENT AND MANAGEMENT INDICATIONS

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The present work aims to characterize the spatial distribution of the acoustic noise levels caused by shipping traffic in two areas of the strait of Sicily. The first study area, the Gulf of Catania, is affected by intense shipping traffic due to the presence of three important harbors: touristic, commercial and military. The second area, instead, is the Gulf of Capo Granitola where the massive maritime traffic is attributable to the Strait of Sicily. This large temporal scale work is based on a simple sound transmission model. The system used to assess the cumulative underwater acoustic energy from shipping traffic is a custom-written MATLAB scripts, that from AIS data (Automatic Identification System), is able to calculate the Maps of acoustic noise distribution. The results obtained are validated with the analysis of acoustic data acquired through a hydrophone for the detection of low frequency. The antenna and the receiver AIS receive the real-time identification data, position and navigation of ships transiting in both areas. The results obtained show a worrying level of cumulative underwater acoustic energy produced by shipping traffic. Considering that the anthropogenic noise is now recognized as one of the major 21st century pollutant, emphasized by international legislation like the Marine Strategy Framework Directive 56/2008 CE, these data want to be a useful tool for the characterization of the phenomenon in the study areas.

HIDDEN & DARK BIODIVERSITY - FORM MOLECULES TO MACROECOLOGY

S05.1 - OBSERVED AND DARK DIVERSITY OF PLANTS AT THE EUROPEAN SCALE

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Knowledge of observed large-scale biodiversity distribution is essential to macroecology and conservation planning. However, we can understand large-scale biodiversity patterns better if we can also quantify dark diversity – the absent portion of site-specific species pools. A species can belong to dark diversity if it has a reasonable likelihood to disperse to our study site (i.e. is present within the region), and if it can cope with the environmental conditions in the study site. We used plant distribution data from the Atlas Florae Europaeae (50x50 km grid cells) and eight different European regions (10x10 km grid cells). We estimated dark diversity by identifying ecologically suitable absent species from species co-occurrences or species distribution modelling. Both methods gave comparable results. We quantified observed diversity at a relative scale by calculating the completeness of site diversity: logistic expression of observed and dark diversity. Both observed and dark diversity adhered to the well-known latitudinal gradient, but completeness of site diversity varied throughout Europe. We distinguished alien and native species at each site. Alien completeness was correlated to native completeness but differences between them indicated areas with greater invasion risk. In summary, dark diversity adds valuable information to broad-scale biodiversity studies.

S05.2 - TRACKING BIODIVERSITY VIA DNA METABARCODING

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Abstract: After a brief overview of the technologies, I will introduce the metabarcoding approach that takes full advantage of next generation sequencers for high-throughput and simultaneous taxa identification based on short but informative DNA fragment. Then, I will present a brief review of the landmark studies on DNA metabarcoding, before focussing on the different topics where DNA metabarcoding can provide key information for solving ecological questions. The first and easiest to implement area were DNA metabarcoding could provide invaluable data is trophic interactions. The second is biodiversity assessment and monitoring (both in aquatic and continental environments). The third area concerns biogeographic studies. Finally, DNA metabarcoding also represents a new approach for reconstructing past environments. I will conclude on power and limitations of the DNA metabarcoding approach, and on future improvements.

S05.3 - DARK MATTER OF FACT - HOW MOLECULES ELUCIDATE EVOLUTION AND ADAPTATION IN POLAR BEARS

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To fully understand patterns and drivers of biodiversity, we must elucidate genomic variation within populations, as well as among species. Here, we present a case study of how molecules can be used to uncover hidden pattern and process in the emergence and evolution of Earth's biota. We use large-scale population genomic analysis and document recent speciation and rapid adaptation in polar bears, a species uniquely adapted to life in the High Arctic. We estimate when polar bears emerged as a species, and characterize the population-level changes that present the framework upon which evolution has acted. We determine the suite of top candidate genes under positive selection in the polar bear lineage, characterizing the genetic underpinnings of polar bears' drastic physiological changes in response to Arctic climates and a hyper-lipid diet of primarily marine mammal prey. Our work demonstrates how population genomics can be used to (i) address the timing and process of speciation, (ii) reconstruct demographic history, and (iii) detect signals of natural selection and evolutionary adaptation in a large mammal.

S05.4 - REVEALING PLANT BELOWGROUND DIVERSITY – DO KNOWN PATTERNS REMAIN?

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Variation in plant species richness along environmental gradients is a key predictor of structure and function of plant communities, but empirical data exclusively originates from studies on aboveground vegetation. However, the majority of biomass in many ecosystems occurs belowground as roots and rhizomes. Belowground structures are often more long-lived than shoots, possibly contributing to higher persistence and richness of plant species belowground. Recent development of molecular tools have made it possible to include roots and rhizomes – otherwise hidden in the soil – in richness measurements of natural plant communities. In this talk, I will ask whether the well-known richness patterns described for aboveground vegetation also hold for the large belowground component? I will summarize my recent work revealing important differences between above- and belowground part of vegetation based on examples from temperate grasslands in Europe and North-America. Utilizing next-generation sequencing I have found up to 50% higher species richness belowground compared to aboveground, and contrasting patterns of above- and belowground richness with increasing area, productivity and grassland management intensity. I show that belowground plant richness can be important for diversity conservation in situations when aboveground richness declines due to eutrophication or changes in management practices.

S05.5 - DARK HORSES AND BLACK PANTHERS ECOLOGICAL AND CONSERVATION PERSPECTIVES ON DARK MEGAFAUNAL DIVERSITY

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I will discuss the nature of dark megafaunal diversity from a Quaternary biogeographic perspective, its ecological implications, and its relevancy for conservation in the Anthropocene. Until the Late Pleistocene or early Holocene, most regions and ecosystems had high megafaunal diversity. Since then much of this diversity has been lost via global extinctions and regional to local extirpations. The drivers of especially the prehistoric part of these losses has been much debated, but recent macroecological work show a clear link to the expansion of Homo sapiens. The human role in the later losses is also clear. As a result, much world is now characterized by high dark megafaunal diversity and low realized megafaunal diversity. This is true not just for species diversity, but also for phylogenetic and functional diversity. This erosion of realized megafaunal diversity has important consequences for the structure and functioning of ecosystems, as documented both ecological and paleoecological studies. Now, dark diversity megafaunal is playing an increasing role in conservation discussions and projects, reflecting continuing megafaunal losses in many areas, more or less spontaneous megafaunal comebacks in a few regions, as well as proposed or actual introductions of missing megafauna species or their functional analogues.

S05.6 - GLOBAL ASSESSMENT OF ARBUSCULAR MYCORRHIZAL FUNGUS DIVERSITY REVEALS VERY LOW ENDEMISM

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In contrast to the well-studied diversity patterns of macroorganisms, the global biogeography of microorganisms remains largely unknown. We used arbuscular mycorrhizal fungus (AMF) DNA from 1014 plant root samples collected worldwide to determine the global distribution of the microscopic symbionts, which strongly influence plant performance and shape entire ecosystems. AMF communities responded to local environmental conditions and to the spatial distance between sites. However, despite AMF apparently possessing limited dispersal ability, we recorded 93% of species-level virtual taxa (VT) on multiple continents and 33% on all six continents surveyed. This pattern contrasts strikingly with the high spatial turnover of many other microbial taxa and with the endemism displayed by plants at the global scale. We suggest that the biogeography of AMF is characterized by far more efficient dispersal than previously recognized.

S05.7 - THE MAGNITUDE OF DARK DIVERSITY ACROSS TAXA AND SCALES

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Identifying species that can live in a locality but fail to do so can be used to reveal constraints on community assembly. However, quantifying this 'dark diversity' has proven difficult. To allow a first order distinction of dark diversity, I utilize the multivariate trait composition of the local assemblage. I define as belonging to the ecological pool the set of all regional species that are bounded within the trait combinations of locally occurring species. Then, the differences between the ecological pool of species capable of living in a locality and the actual local assemblage capture dark diversity and hence the processes that exclude species suited to local conditions from entering the local assemblage. The utility of this approach depends on the assumption that the traits considered are relevant for survival in the local environment. I illustrate the use of this method using both birds and mammals globally and across a range of scales.

LIGHT POLLUTION SYMPOSIUM

S06.1 - THE NEW WORLD ATLAS OF ARTIFICIAL SKY BRIGHTNESS

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I illustrate the steps toward the second World Atlas of Artificial Sky Brightness (WA II). The computational technique has been improved to take into account both sources and sites elevation from USGS GTOPO30 global digital elevation model. The upward emission function used in the computation has been constrained by night sky brightness measurements to get a better calibration of the final maps. We maintained the same atmosphere parameters used for the first Atlas (vertical extinction at sea level of 0.33 magnitude in the Johnson V band) in order to avoid local bias due to varying atmospheric conditions that may alter the light pollution propagation. The Visible Infrared Imaging Radiometer Suite Day-Night Band (DNB) on the Suomi NPP satellite provided the radiance data, giving an increased real resolution over the 2001 atlas. The DNB data used for the input data were chosen centred in the summer months in order to avoid possible bias by snow coverage in higher northern latitudes. The WA II calibration advantage of the databases of sky brightness measurements obtained mainly with Sky Quality Meters and with more precise CCD measurements from us and from National Park Service Sky Team.

S06.2 - DAY-TIME AND NIGHT-TIME PLANTPOLLINATOR INTERACTION NETWORKS

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Interactions among species drive the ecological and evolutionary processes in ecological communities, and networks provide a systematic way of describing these interactions. Over the last decade, research on plant-pollinator interaction networks has increased exponentially. However, this research has focused only on diurnal pollinators and has excluded nocturnal pollinators. Consequently, our current understanding of plant-pollinator interaction networks is very incomplete. I will present the structure of full plant-pollinator networks by including for the first time day-time as well as night-time pollinators, and I will show how important network parameters are altered if only day-time pollinators are considered. I will further show at which time during night most pollinators are active. Finally, I will discuss how nocturnal plant-pollinator interactions might be disturbed by the increasing light pollution world-wide.

S06.3 - THE EFFECTS OF INCREASING INTENSITY OF LIGHT AT NIGHT ON GENE EXPRESSION IN THE BRAIN, LIVER, SPLEEN AND TESTES OF BIRDS: IMPLICATIONS FOR THE HEALTH OF WILD ANIMALS

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Light pollution is increasingly recognized as a threat for human health as well as wildlife and ecosystem processes. Although our knowledge on the ecological consequences of light pollution has recently improved, we still are poorly aware of the physiological and molecular mechanisms underlying such effects. We have exposed male great tits (*Parus major*), a songbird species commonly found in light polluted areas, to four different treatments which were equal in photoperiod but of increasing light intensity at night: 0, 0.5, 1.5 and 5 lux. Birds were kept under these treatments for three weeks and subsequently organs were collected and immediately snap-frozen at -80°C. After that RNA was extracted, we deployed real-time RT-qPCR to study gene expression in the brain, liver, spleen and testes, using a candidate approach targeted at genes involved in circadian rhythms, metabolism, immunity and reproductive physiology, respectively. Our data indicate that light at night above 1.5 lux can profoundly altered the expression of circadian and metabolic genes, and increase the expression of genes involved in reproduction, resulting in an earlier growth of the reproductive system. The results suggest that mid- to high levels of light pollution can affect important molecular pathways, potentially leading to relevant health consequences.

S06.4 - DARK-NIGHT ECOTONES: THE ECONOMICS OF GLOBAL NIGHT SKY CONSERVATION

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This paper examines the interfaces of differentconservation efforts. It will look at how cultural, ecological, and dark-sky conservation efforts have complementary, but often overlooked, effects. While light pollution is increasingly recognized as having serious ecological consequences, dark-sky conservation often focuses on preserving areas where the night skies are (for the modern world) unusually dark. Similarly, some conservation areas meticulously protect or restore flora and fauna but pay little attention to the radically altered levels of ambient light in nocturnal habitats. The goal of the paper is to help identify areas where it might be fruitful for stakeholders to pursue conservation efforts when multiple parameters such as biodiversity, habitat variety, night sky quality, and cultural considerations are considered simultaneously. This paper will utilize GIS techniques to identify two types of areas, globally, where further consideration might be warranted. One scenario would be to identify areas where, for example, existing wildlife conservation areas might be leveraged to achieve alternative, yet complementary, conservation goals such protecting dark skies. A second category identifies areas that have been previously overlooked because their multifaceted benefits go unrecognized when focusing on one type of conservation goal.

S06.5 - EMERGING POPULATION EFFECTS OF LONGTERM ARTIFICIAL ILLUMINATION OF A FOREST EDGE ECOSYSTEM

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Across different species and taxa, a variety of direct responses to artificial light are known, such as attraction or deterrence by light and changes in behaviour and physiology. The effects of artificial light on long timescales are however virtually unknown while we would expect that the effects on the individual level of different species must – eventually – have consequences on the population and ecosystem level. With the global increase in artificial illumination, it is crucial to better understand these responses of ecosystems to a prolonged presence of artificial light. To experimentally address these questions we have set up experimental lighting with light posts with different spectral composition in forest edge habitat at eight different locations in the Netherlands. The presence of birds, bats, mice, insects and plants has been assessed with standardized protocols repeated over the past four years, with data collected by scientists and with a citizen science based approach. Our results clearly show a strong variation in responses of species and species groups to the presence of artificial light and a progression in the response of species to prolonged presence of light at night.

S06.6 - MICROBIAL DIVERSITY AND COMMUNITY RESPIRATION IN FRESHWATER SEDIMENTS INFLUENCED BY ARTIFICIAL LIGHT AT NIGHT

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An increasing proportion of the Earth's surface is illuminated at night. In aquatic ecosystems, artificial light at night (ALAN) may influence microbial communities living in the sediments. These communities are highly diverse and play an important role in the global carbon cycle. We combined field and laboratory experiments using sediments from an agricultural drainage system to examine how ALAN affects communities and alters carbon mineralization. Two identical light infrastructures were installed parallel to a drainage ditch before the start of the experiment. DNA metabarcoding indicated that both sediment communities were similar. After one was lit for five months (July – December 2012) we observed an increase in photoautotroph abundance (diatoms, Cyanobacteria) in ALAN-exposed sediments. In laboratory incubations mimicking summer and winter (six weeks each), communities in sediments that were exposed to ALAN for 1 year (July 2012 – June 2013) showed less overall seasonal change compared with ALAN-naive sediments. Nocturnal community respiration was reduced in ALAN-exposed sediments. In long-term exposed summer-sediments, we observed a shift from negative to positive net ecosystem production. Our results indicate ALAN may alter sediment microbial communities over time, with implications for ecosystem-level functions. It may thus have the potential to transform inland waters to nocturnal carbon sinks.

S06.7 - ARTIFICIAL NIGHT-TIME LIGHTING AND SPECIES INTERACTIONS

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The introduction of artificial lighting into the nighttime environment constitutes an anthropogenic pressure on species that has no natural analogues. It has doubtless had a diversity of ecological impacts on individual species, including on their abundance and distribution. However, whilst predicted to do so, the extent to which these impacts ramify through communities as a consequence of species interactions remains largely unknown. This presentation will explore the ways in which such effects might occur, and some of the empirical evidence for them.

SCALE NON-LINEARITY OF DRIVERS OF ENVIRONMENTAL CHANGE, AND SCALE MISMATICHES IN NATURE CONSERVATION GOVERNANCE

S07.1 - TEMPORAL BIODIVERSITY CHANGES ACROSS SCALES

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Increasing evidence shows that global biodiversity decline is not associated with consistent species loss in local assemblages. This calls into question the motivation of biodiversity conservation based on its link to ecosystem functioning. Different temporal patterns of biodiversity across scales are believed to result from on-going biotic homogenization, but actual tests remain scarce. Here we use data from a metacommunity of invertebrates from ten streams monitored over 30 years to assess temporal changes in taxonomic and functional biodiversity at local, metacommunity and regional scale (Wales, UK). We show that although taxonomic diversity did not change over time across scales (local to regional), local assemblages displayed a systematic decline in specialist species. Also, this form of functional homogenization was independent from taxonomic homogenization at any scale. The observed decline of specialists species appeared driven by lower re-colonization probability rather than by higher extinction rates, suggesting a role for dispersal limitation. This study shows how taxonomic measures are insufficient for understanding biodiversity changes through time, highlighting the need for including species functional identity. The systematic loss of specialists at local scales calls for more effort into assessing the ecosystem level consequences of functional homogenization that are independent from decline in diversity.

S07.2 - SPATIAL STRUCTURATION OF ANTHROPOGENIC DRIVERS OF ENVIRONMENTAL CHANGE IN COASTAL AREAS

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Anthropogenic driving forces of environmental changes are particularly strong in coastal areas. They affect lansdcape structure, natural habitats distribution, ecosystems functioning and conditions of human well being. Even though anthropogenic pressures are recognized as one of the most important societal challenges, their spatial structuration have not been addressed directly by geographical research. This paper will address the issue of scale and spatial distribution of anthropogenic drivers of environmental change in coastal areas. With a data set at NUTS 3 scale, we analyse the intensity and distribution of drivers in coastal areas defined as zones of different width (0 to 10 km width from the coastline, 0 to 20 km width etc... ; up to 100 km width). The results show three main interesting results: 1) ad hoc definition of coastal areas do not capture the specificity of coastal areas socio-ecological particularity; 2) analysing the spatial distribution of anthropogenic driving forces shows that different sets of drivers operate at different scales; 3) there is a strong disparity of anthropogenic driving forces intensity within the 0-10 km coastal zone. The overall interest of the analysis underlines the interest of a policy design based on more precise spatial characterizations and categories.

S07.3 - INTERGOVERNMENTAL FISCAL TRANSFERS TO SUPPORT LOCAL CONSERVATION ACTION IN EUROPE

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Against the background of ongoing biodiversity loss and ecosystem degradation, there is a need for more conservation efforts at all governance levels that also take into account the needs of subnational governments, cities and other local authorities. This paper presents a rationale for including ecological indicators in intergovernmental fiscal transfers that redistribute public revenue from national and regional state governments to decentralised governments. Although recommended for introduction in a number of European countries (such as Germany and Poland), to date only Portugal and to some extent France have implemented fiscal transfers for biodiversity conservation in Europe. In this presentation we provide, first, a review of existing and proposed schemes across Europe, classifying them in relation to the stages of a policy cycle. Second, we identify critical design features of ecological fiscal transfers (EFT) in order to develop recommendations for improving existing or introducing new EFT schemes.

S07.4 - SCALE MISMATCHES OF BIODIVERSITY GOVERNANCE – HOW TO SUCCESSFULLY COMBINE VOLUNTARINESS AND ECOLOGICAL TARGETING OF CONSERVATION

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Scale mismatches occurring in current biodiversity governance can be overcome by improving the integration of landowner acceptance and ecological optimization into operational conservation knowledge production and policy implementation processes. In this study, we focus on solving scale mismatches in voluntary conservation in Finland, where voluntary initiatives are at the heart of the ongoing Forest Biodiversity Programme (2008-2025). The program aims to halt the loss of biodiversity in southern Finland, by encouraging private non-industrial forest owners to make permanent or temporary conservation contracts with regional environmental or forestry authorities. Taking the practice of biodiversity conservation and the experience and the views of local actors as starting points, we analyze survey data and focus group material as well as run Zonation optimization, to target conservation across forest and agricultural habitats at regional, landscape and farm scales. We ask how forest owners who have valuable sites perceive conservation efforts at the landscape level and how the forest owners' perceptions (disapproval and approval of conservation) affect conservation optimization. Finally, we assess how more effective and legitimate conservation outcomes can be reached through a trans-disciplinary dialogue among stakeholders and which elements are relevant in achieving such success.

S07.5 - BIODIVERSITY OFFSETTING IN ENGLAND: GOVERNANCE RESCALING, SOCIO-SPATIAL INJUSTICES AND THE NEOLIBERALISATION OF NATURE

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The creation of marketized forms of offsetting is a key aspect of the emerging biodiversity markets. Offsetting typifies the neoliberal emphasis on the privatization, commodification and financialization of non-human nature. In this paper, we center our analysis on the construction of equivalence that lies at the core of the offsetting discourse and practice and is a prerequisite to allow ecosystems and places to be exchanged. In particular, we explore how the creation of 'equivalent natures' creates socio-spatial injustices while paying particular emphasis on the key role of governance rescaling in the process. We use primary empirical data obtained through interviews in selected case studies around England. Our results show that offsetting involves technical definitions and calculations to construct equivalences between ecosystems, places and conservation credits treating environmental harms and goods as something that can be relocated via a market to facilitate efficient development. Biodiversity offsetting, like carbon offsetting, is not designed to halt or avoid biodiversity loss but rather to move biodiversity losses and gains from one place to another in order to achieve an 'efficient' overall balance between preserved nature and permitted development. We conclude that biodiversity offsetting ultimately brings unevenness and injustices deepening the conceptual and material separation between society and nature.

S07.6 - SCALE, HABITAT BANKING, GREEN INFRASTRUCTURE AND NIGHTINGALE ECOLOGY: THE STORY – SO FAR – OF THE LODGE HILL DEVELOPMENT SITE IN THE UK

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There is a growing interest within environmental governance and policy circles for studies that explore the articulation of scale – both as physical space and as governance level – with processes of regulatory change. Moreover, while it is becoming increasingly recognised that rescaling processes are tied to nature neoliberalizations, less attention has been paid to how these processes unfold 'in-the-wild', especially regarding nature conservation. For this piece of research, we trace how mitigation banking, as a neoliberal policy par excellence, came to be viewed as the solution to a wildlife vs growth antinomy. The Lodge Hill development case allows us to bring together three decades ofnature conservation, Thames Gateway ('the biggest regeneration project in Europe'), huge real estate companies and the UK Ministry of Defence with the vertical and horizontal rescaling processes of British environmental governance. We discuss our findings along three axes: the emergence of private consulting companies as key shapers of conservation policy; the constant cycle of scale creation/abandonment/fuzzification as a defining characteristic of neoliberal policies; limits to scale as an analytical tool, and a brief consideration of how it can be enriched by other spatial metaphors (territory, place and network).

FRONTIERS IN ECOLOGICAL ECONOMICS

S08.1 - MARKET AND POLICY SHOCKS IN ECONOMIC SYSTEMS: INTERRELATED DYNAMICS IN THE SUSTAINABILITY TRANSITION

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This note addresses the issue of market and policy shocks in the transition to sustainability. Market Shocks may be driven by price volatility; policy shocks are likely to occur either given contingent conditions of policy feasibility - a concept that shifts over time – or in reaction to extreme climatic events. The paper questions the role of 'events' as drivers of change, with a focus on innovation responses. In doing so, it broadens the perspective on environmental policy's role and effects. Environmental policy is connected to institutional and market dynamics. It is not limited to the Pigovian rationale – the mere minimization of current costs - but rather tied to a 'standard and cost approach' which attempts to incorporate efficiency concepts in a dynamic scenario, where learning and adaptation through technological and behavioral changes are crucial.

S08.2 - PATTERNS OF SUSTAINABLE CONSUMPTION AND PRODUCTION IN EUROPEAN COUNTRIES

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Recent strategic actions of the EU (e.g. Circular Economy, Europe2020, 2020 Climate and Energy Package, 2030 Framework for Climate and Energy Policies) have emphasized the potential win-win-outcome of the green economy in terms of growth potential and reduction in environmental pressures. These strategies, however, mostly focus on the environmental performance of production occurring in the EU and devote little consideration to how changes in the EU economy and environmental performance influence global environmental pressures through pressures embodied in imports. The aim of this paper is to provide evidence about long run patterns of environmental pressures arising from production and consumption of EU countries of the period 1995-2009. Evidence, based on the World Input Output Database, shows that while direct environmental pressures from production activities has slowed down and even reduced, global environmental pressures to satisfy the demand of EU consumers has continued to rise for most environmental pressures. Moreover, we show substantial differences in these patterns across different environmental domains, including air emission, water use, land use and material use.

S08.3 - NATURE FROM SUMAK KAWSAY TO BUEN VIVIR: FROM COSMOVISION TO NEOEXTRACTIVISM

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This work will try to trace the evolution of the relation between nature and human well-being from the original indigenous cosmovision of Sumak Kawsay to the recent Ecuadorian Buen Vivir politicies. The harmonious relation between nature and human communities is at the core of the indigenous cosmovisions of Sumak Kawsay, while the primacy of the human well-being is at the basis of the recent neo-extractivist policies, where the exploitation of the nature is conceived as a means to develop human societies. Different understandings of nature are at the basis of different economic paradigms. Conclusions should therefore be drawn on the way human welfare is pursued in a context of environmental sustainability: fascinating visions (such as those on which the indigenous cosmivision of Buen Vivir are based) need to be translated into practice.

S08.4 - THE ECONOMICS OF CARBON COSTING

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Evaluating climate change (CC) policies raises the issue of the unit value of mitigation efforts, or the cost of carbon emissions. Different approaches have been developed to deal with the issue of putting a price on carbon. One is using the market price of emission allowances in emission trading systems as a proxy of the economic value of a unit of carbon. The equilibrium price of emission permits, in an efficient market, is equal to the aggregate marginal abatement cost. The cost of carbon amounts to how much it costs us not emitting it. A second approach estimates Marginal Abatement Cost curves, that show how much the reduction of an additional ton of carbon costs in each sector. A third approach, the Social Cost of Carbon (SCC), looks at the future costs imposed on humankind by uncontrolled emissions, i.e. the net present value of the long-term impacts of 1 ton of carbon emitted today. A forth option is using a shadow price based on the value of the unit carbon tax required to stabilize emissions at an atmospheric concentration compatible with moderate CC scenarios. This paper provides a survey of the methods employed to date in the economic literature.

S08.5 - VULNERABILITY, HAZARD, RISK, LOSS AND RESILIENCE: A SOCIO-ECOLOGICAL FRAMEWORK FOR NATURAL DISASTERS

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The number of natural disasters, the overall losses as well as insured losses and the number of fatalities seem to be increasing in the last 30 years.

Evaluating the (potential) socio-economic lossess is becoming a vital need for policy makers, planners and private agent as insurers and banks. However, measuring socio-economic impact and costs of disasters, especially ex-ante, is not an easy task. Nevertheless, public policies aimed at facing and/or reducing the impact of natural disasters have to keep in mind the chain of (re)actions that occur when a given area is affected by extreme events. Moreover any human action and any institution are integral to nature and therefore the integration between these two areas has to be considered.

Any disaster chain might be thought as a sequence where natural systems and human systems are both interrelated. In considering the impact of disasters on socio-economic activities, five concepts stem from disaster literature: Vulnerability, Hazard, Risk, Loss and Resilience.

The paper reviews any single aspect mentioned before to buiild a general framework of evaluation of economic losses due to extreme events and to provide a general tool for policy makers for facing catastrophic events in an ex-ante and ex-post perspective.

S08.6 - ECO INNOVATIONS IN A SYSTEMIC AND EVOLUTIONARY VIEW

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The talk will provide a discussion on Eco-Innovations, broadly defined as any innovative activity that leads (intentionally or not) to the reduction in the use of natural resources (such as energy, water or materials) and/or to the decrease in the releases of harmful and toxic substances throughout the entire lifecycle, either in air, water or land. Environmental gains have to be coupled with economic benefits, as Eco-Innovations are meant to furthermore improve competitiveness of the adopters, and to help decoupling economic growth and environmental pressures. To obtain such win-win situation in which economic and environmental gains get coupled, it is crucial the diffusion for radical and systemic eco-innovations, rather than simply of incremental ones. What do we mean by systemic Eco-Innovations would thus be the first pillar of the discussion. Second pillar would be the exploration of the potential for systemic Eco-Innovations to lead to large scale transformation than encompass the economic, technological and social sphere, potentially bringing to a reconfiguration of, respectively, markets, technological systems and trajectories and consumer behaviours.

08.7 - ENVIRONMENTAL INEQUALITY AND MORTALITY RATE: AN EMPIRICAL INVESTIGATION ON ITALIAN MUNICIPALITIES

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This paper aims to analyse the effect of environmental inequalities on health. It investigates whether mortality rate differently affects population groups in relation to their socio-economic status and air pollution exposure. Using an original panel dataset on Italian municipalities, the analysis tests if population groups discerned by gender, age, income and employment status, bear different environmental burdens, and therefore, health risks. We employ, as dependent variable, mortality rate data gathered by the Italian Ministry of Health that we discern using International Classification of Diseases Codes in order to collect non-incidental deaths that are related to pollution exposure. This allows us to enhance the specificity of the study and to fill gap in the related literature that commonly employs province-level data. Our statistical analysis confirms that the mortality rate is higher in municipalities characterised by lower socio-economic status. In addition, our findings confirm the positive relationship between concentrations of different air pollutants and the mortality rate.

S08.8 - PROJECTING THE FUTURE POTENTIAL OF SHELLFISH SECTOR IN THE MEDITERRANEAN SEA AND POSSIBLE ECONOMIC REBOUNDS

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Aquaculture is becoming a crucial activity to ensure the sustainability of seafood demand worldwide; it is expected to increase further in the proximate future. Shellfish culture has wide development perspectives, as it does not require external trophic resources and contextually it could have important rebounds on socio-economic local conditions. However, as other food production processes, aquaculture is sensitive to climate conditions and to date, many attempts are being done to sustain aquaculture and to contain potential environmental impacts. Combining a coupled climatic-mechanistic model based on A1B scenario with a bio-economic dynamic model, we explored the relationship between climate change and shellfish industries, and described the ecological and economic feedbacks in the production from aquaculture by using the commercial mussel *Mytilus galloprovincialis* as a model species. Shellfish industry as presently organized in Italy, seems to offer room for more rational use of resources, more efficient coordination among producers, and a refinement of the decision-making process. As some of the effects are starting to be registered in sensitive areas, environmental change studies call for the adoption of integrated approaches, involving European marine spatial planning strategies, that in turn will require a coordinated effort in developing an appropriate informational basis.

ENERGY AND MATERIAL FLOWS MEGACITIES

S09.1 - THE ELECTRIC CITY AS A SOLUTION FOR SUSTAINABLE URBAN DEVELOPMENT

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RReducing the pressure of the global urban system on the environment is key for tackling the challenge of sustaining the future urban growth of the next decades. Several frameworks of urban sustainability have been proposed, both from Academia and institutions such as the World Bank, OECD, and UNEP. We review the main institutional and academic frameworks, analyzing their main aspects and highlighting weaknesses and strengths. Starting from this preliminary review, we discuss the foundational elements composing framework for urban sustainability based on the thermodynamics of cities, i.e. a systemic vision where flows of material, energy and information are the main engines of urban growth and sustainability. Within this view, we propose a multi-layer urban metabolism model based on Material Flow Analysis, key performance indicators, information and digitalization of infrastructures. In particular: Urban sustainability is achieved through the fruitful cooperation among private companies, citizens, research institutions, and policy makers.Urban metabolism as a key concept in understanding and comparing how cities use resources.Electricity as a highly efficient source Electrification of cities as a long-term strategy to reduce global emissions, and as a short-term strategy to reduce urban GHG emissions.Digitalization and integration of infrastructuresIntegration of urban metabolism with key performance indicators (e.g socio-economy, quality of life, information flows) Finally, important characteristics of the future cities (such as resilience and climate change adaptation are discussed.

S09.2 - TRANSFORMATION OF MEGACITIES THROUGH LOW CARBON ELECTRIFICATION

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This paper provides an overview of the Metabolism of Megacities project – and assesses the challenges ahead for cities seeking sustainability through low-carbon electrification. The overall goals of the project is to provide a road map and strategies by which megacities can develop in sustainable low carbon ways, while providing high quality of life. Several studies, at various scales, point to low-carbon electrification of cities as the route to sustainability. Through our studies of the urban metabolism of 27 megacities, we are able to assess their progress towards the goal of becoming electric cities. Assessing the potential of electrification in cities requires a balanced understanding of benefits and challenges. The benefits of low-carbon electrification are numerous and wide-ranging: lower spending on fuels, improved air quality and human health, reduced environmental impacts, and new employment opportunities. The challenges of electrification are similarly wide-ranging: inaccessibility of slums and informal settlements, insufficient electricity storage, currently high costs and low capacity of EV batteries, spatial and temporal variability of solar receipt, “energy-density mismatch” in large cities, and lack of local influence over utility-scale electricity supplies. The use of information technology and smart infrastructure has been posited as a possible way to overcome these challenges.

S09.3 - URBAN METABOLISM OF MEGACITIES: A COMPARATIVE STUDY

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The flows of energy, water, materials, and wastes through cities are crucial to their sustainable development. The rates and efficiencies of these flows indicate the 'urban metabolism,' whether it is high or low, efficient or inefficient. In the world's largest cities, urban metabolism studies are rarely undertaken due to the formidable challenges of data collection at the metropolitan level. To help ease this work, we developed a standardized data-collection form to retrieve basic-level metabolism data from 'megacities' (i.e., agglomerations with more than 10 million people). Here we report results from 27 megacities using the new data form. Globally, megacities account for 7 percent of the world's population, 13 percent of its solid waste generation, 10 percent of its electricity and gasoline use, and 3 percent of water use. These percentages vary considerably when the flow data are disaggregated into geographic regions: huge disparities exist among metabolic rates of megacities in Asia, Africa, Europe, and the Americas. Quantitative analysis reveals statistically significant relations between resource flows in megacities and GDP, population density, and heating degree-days. Urban metabolism is also related to quality of life and the role of utilities in megacities.

S09.4 - DOWNSCALING LONDON'S URBAN METABOLISM

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Aggregate accounts of urban metabolic flows of energy, water, and other resources are increasingly available for a variety of world cities. In contrast sub-urban resource data is not widely available and yet local decision-makers may require this detailed information in order to understand the variations of resource consumption within the city and to plan resource efficiency policies. In this talk I present the results of a recent assessment of statistical downscaling methods for urban metabolism. Using the example of domestic energy consumption in London, I will examine the prediction accuracy of these methods, their usefulness for scenario analysis, and recommendations for improved local data collection strategies.

S09.5 - PRESENTATION OF THE VOLUME “CITIES IN THE 21ST CENTURY”

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Cities today are engines of production and trade, forges of scientific and technological innovation and crucibles of social change. Together with economic globalization, the struggle for resources and energy, and climate change, urbanization is a major driver of change in contemporary societies. It is a process that involves acute social inequalities and serious environmental problems, but if we are able to govern it, also offers opportunities to move towards a future of greater prosperity, environmental sustainability and social justice.

The volume “Cities in the 21st Century”, published by Routledge and edited by Renata Mele (Enel Foundation) and Oriol Nel•lo (Autonomous University of Barcelona) provides an overview of contemporary urban development and sheds light on the most relevant hot topics related to urbanization. It is a collection of 22 essays and 22 short papers (“Outlooks”) written by about forty major academic specialists from different countries, writing about topics like the global network of cities, changes in urban form, environmental problems, the role of technologies and knowledge, socioeconomic developments and, finally the challenge of urban governance. Brief case studies on 30 cities in five continents and a selection of infographics complete the volume.

The book will be available starting from March 2016.

CELEBRATORY SYMPOSIUM FOR ESA CENTURY ANNIVERSARY

S10.1 - PUTTING PEOPLE INTO ECOLOGICAL MODELS TO UNDERSTAND PAST AND FUTURE HUMAN ECOLOGY

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Human ecology has a long history, but only recently have we begun to put people directly into ecological models as a way of understanding, and projecting, human ecology. The array of ecological models that directly include people range in scope from behavior and population dynamics to community and ecosystem dynamics and from rather simple conceptual and analytical approaches to detailed systems models. These models seek to understand current conditions and their causes, to project socioecological futures, and to understand the past, often in an effort to inform current actions and mold future conditions. I will discuss recent developments in this explicit modeling approach to human ecology, as presented in the Ecological Society of America Centennial Meeting and from my research.

S10.2 - WORLDWIDE NITROGEN MANAGEMENT CHALLENGES FOR A CROWDED PLANET

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Nitrogen is essential for life on Earth, yet human activities since the Industrial Revolution have produced far more available reactive nitrogen than all natural sources combined. In much of the world too much nitrogen in the environment harms human health, reduces biodiversity, causes hypoxia in freshwaters and estuaries, and contributes to global warming. The North American Nitrogen Center (NANC) carries out three main charges: 1) conducting assessments on nitrogen flows within Nort h America and the consequences for human health, water resources, biodiversity, and greenhouse gas emissions; 2) facilitating efforts to develop solutions to the problem of excess nitrogen in agricultural, institutional, and natural resource management sectors; and 3) presenting these results to policy makers. There are formidable challenges in reducing N loss from all parts of the North American food production and supply chain, including consumers. The North American Nitrogen Center is working with producers, trade groups, universities, and supply chains to develop effective practices for minimizing loss of Nr to the environment. The NANC is also helping public land management and regulatory agencies prepare effective policy approaches toward minimizing ecological damage from atmospheric Nr deposition.

S10.3 - PLANTS AND INSECTS IN A CHANGING WORLD

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During the century of the Ecological Society of America's history there has been great progress in how ecologists view and understand the interactions between plants and insects. These interactions are both antagonistic (e.g., herbivory) and mutualistic (e.g., pollination). We now have a much greater understanding of how these interactions are structured, and how they are influenced by plant chemistry, phenology, and evolution. We also have insights now into how antagonistic and mutualistic relationships can interact simultaneously in the ecology and evolution of a single plant species. Major contributions have come from both European and American ecologists, and there have been many productive international collaborations. The value of long-term experiments and observations of plant-insect interactions is now well recognized, and there are good examples of these from both continents. We are now beginning to study these interactions in the context of global climate change, especially how phenology is changing. In a few cases we have a good understanding of how plant-insect interactions are being affected by the changing environment and how they may change in the future.

S10.4 - THE EMERGENCE AND RELEVANCE OF URBAN ECOLOGY IN THE UNITED STATES

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Amongst the many fields of ecology that has arisen during the past century in the United States, and in particular the previous 40 years, is urban ecology. From its early roots in urban forestry, to the creation of urban Long-Term Ecological Research (LTER) sites, to recent concepts of sustainability and resilience in urban systems, urban ecology has contributed much to our understanding of nature and how humans are an integral part of it. Given the growing ecological and social importance of urban areas, coupled with the 100th anniversary of the Ecological Society of America, this presentation will highlight the study of urban ecological systems in the United States, how these studies have contributed to the field of ecology, and what the future holds for urban ecology as a discipline and potential contributor to the design and maintenance of sustainable cities. Specifically, I will cover the development of the discipline from the study of ecological systems in the city (e.g., tree and bird populations) to the study of ecology of the city, or as truly integrated socio-ecological systems. Nevertheless, even with an integrated approach, ecologists remain observers from outside the system. Therefore, I will make the case for the “human-centered approach”, which embeds ecologists within urban ecological systems, and how this approach results in greater understanding and more effective decision making.

S10.5 - THE RISE OF ECOSYSTEM ECOLOGY AND ITS APPLICATIONS TO ENVIRONMENTAL CHALLENGES

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As a person who was integrally involved in the development of ecosystem ecology, I will present my perspective of ecosystem science as a legitimate science. During the mid-1960s I discovered "ecology" as a means of explaining the environment. In the late 1960s and early 1970s I became involved the rapidly evolving scientific perspective of systems ecology and mathematical modeling of “ecosystem” structure and functioning at Colorado State University, one of the NSF supported centers of “ecosystem science”. I will discuss issues from the 1970’s for which ecosystem science offered a powerful philosophy and methodology. During the 1980’s ecosystem science addressed issues such as spatial and temporal scales, biogeochemical cycles, belowground ecosystems, plant-animal interactions, ecosystem/social systems, and interactions of the biosphere, atmosphere, and geosphere. Holistic, trans-disciplinary perspectives of ecosystem resilience and sustainability, adaptation to climate change, loss of biodiversity, decline of coastal fisheries, and food security, for example, emerged in the 1990’s and 2000’s as challenges for ecosystem science. Among the next great challenges for ecosystem science is the need to continue contributing knowledge and methodologies toward solving important environmental, educational, societal, and political problems faced by society today.

S10.6 - FUTURE EARTH: INTEGRATIVE SOCIO-ECOLOGICAL FRAMING OF THE RESEARCH STRATEGY TO ADDRESS GLOBAL ENVIRONMENTAL CHALLENGES

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Future Earth is an international program with an aim to provide an integrative framework to understand earth system dynamics and to meet the challenges these represent to society. The Future Earth program represents the largest global research endeavor ever formed to meet these global societal environmental challenges of the 21st Century. Future Earth seeks to meet the profound and mounting challenges of global environmental change and the transition to global sustainability, by harnessing the capacity of the global research community across multiple disciplines and engaging with a wide array of stakeholders. The primary mission of Future Earth is to align the global change research community with decision makers and innovators of change to co-develop pathways for sustainable development and transformation to sustainability. Future Earth provides a platform to analysis and development of strategies to enhance resilience and preparedness to global change in regions and ecosystems across the globe. Future Earth has enhanced trans-disciplinary research and engagement activities across a suite of issues (e.g., food security, energy, public health, water, biodiversity loss) and public and private sector partners related to development, risk reduction, and strategies to more sustainable use of ecosystem services and natural capital.

PHYTOPLANKTON TRAITS, FUNCTIONAL GROUPS AND COMMUNITY ORGANIZATION IN THE PERSPECTIVE OF GLOBAL ENVIRONMENTAL CHANGE

S11.1 - TRAIT-BASED APPROACHES TO PHYTOPLANKTON ECOLOGY AND EVOLUTION

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Phytoplankton account for about half of global primary productivity, form the baseof the most aquatic food webs and play important roles in major biogeochemicalcycles. Changing environmental conditions shift community composition withconsequences for higher trophic levels and biogeochemistry. I propose that trait-based approaches provide a mechanistic foundation for understanding how phytoplankton communities respond to interacting abiotic and biotic drivers. Idiscuss examples of how functional traits can provide insights into communityassembly and dynamics. The new frontiers in trait-based research include looking at intraspecific trait variation due to genotypic differences and phenotypic plasticityand comparing it to interspecific variation to predict patterns in community responses. Investigating trait evolution due to interacting environmental pressuresand incorporating it into predictive models of plankton communities andbiogeochemistry is another experimental and theoretical challenge facingphytoplankton ecologists. Trait-based approaches can also be useful for appliedissues such as ecological assessment and ecosystem restoration.

S11.2 - PHYTOPLANKTON SIZE: DO MARINE PHYTOPLANKTON FOLLOW BERGMANN'S RULE?

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Global warming has revitalized the interest in the relationship between body size and temperature, as proposed by Bergmann's rule already more than 1.5 centuries ago, one of the oldest manifestations of a "biogeography of traits" (sensu Barton et al. 2013). We will review biogeographic evidence and recent micro- and mesocosm experiments with naturally mixed phytoplankton communities which have studied the response of phytoplankton body size to temperature, either as a single factor or in combination with other experimental factors such as grazing, nutrient limitation, and ocean acidification. Where available, we will also focus on the comparison between intraspecific size shifts and size shifts resulting from shifts in species composition. For the sake of comparison, we will also include Atkinson's et al. (2003) extensive meta-analysis of single species experiments and the well-known latitudinal trend in phytoplankton cell sizes in the global ocean in our review. Taken together, biogeographic evidence, community level experiments and single-species experiments support the hypothesis, that phytoplankton average cell sizes tend to become smaller in warmer waters, though there are also some exceptions.

S11.3 - DO PHYTOPLANKTON TRAITS DO WHAT WE HYPOTHESIZE IN TRAIT BASED ECOLOGY?

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Trait-based research successfully promotes the understanding of community organization and dynamics based on empirical and modelling studies. Here, we test the realism of some underlying assumptions based on temporally highly resolved long-term measurements of phytoplankton abundances and traits in temperate water bodies exhibiting pronounced seasonality. As postulated, we found a recurrent seasonal pattern in the dynamics of the community mean trait value in a multidimensional trait space. Interannual variation in this overall pattern was linked to climate variability and changes in trophic conditions. Thus, trait changes match with the well-established differences in environmental conditions and ecological interactions. As assumed by all trait based modelling approaches, we found small trait variability and high rates of trait changes (i.e. pronounced movement in the trait space) under strong unidirectionalselection pressure, e.g. during the clear-water phase. However, in two different water bodies, Lake Constance and Saidenbach Reservoir, the shapes of the trait distributions at a given sampling date often deviated substantially from normal or even unimodal distributions, depending on the trait, season and habitat considered. This is in conflict with assumptions underlying a frequently employed modelling approach, the dynamic trait or gradients dynamics approach, questioningits reliability of when applied to phytoplankton communities.

S11.4 - MIXOTROPHY IN BACTERIVOROUS FLAGELLATES - SHEDDING LIGHT ON A NEGLECTED TRAIT

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Mixotrophy - the combination of photosynthesis with phagotrophy in one organism - is widespread among phytoflagellates. Moreover, numerous field studies show that mixotrophic flagellates may be the dominant consumers of heterotrophic bacteria in oligotrophic surface waters. Apparently themixotrophic strategy cannot be ignored in the phytoplankton. To date, however, mixotrophy is largely ignored in trait-based models of phytoplankton communities. In order to achieve a meaningful representation of mixotrophic algae in trait-based models, their growth kinetics need to be quantified. We show empirical data from monoculture experiments with different bacterivorous chrysophytes which allow to approximate their growth kinetics in terms of resource requirements and attainable growth rates. We propose a conceptual model how the ecological niche of mixotrophic bacterivores can be defined based on their growth kinetics, and provide empirical evidence from experiments with artificial and natural communities.

S11.5 - PHYTOPLANKTON DIVERSITY, PRODUCTION, AND COMMUNITY COMPOSITION IN RELATION TO NUTRIENT AVAILABILITY AND IMBALANCE

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We analyzed relationships between phytoplankton diversity, productivity, and composition, and relations of these community properties to nutrient availability and imbalance by studying natural phytoplankton communities originating from 4 locations along the Finnish coast. Our results support the Species Energy Theory, since both biomass and production were the highest when more nutrient resources were available. Diversity and evenness were not explained by resource availability. Nutrient imbalance explained both biomass and production, but combined limitation did not correlate positively with biomass, production, diversity, or evenness, as suggested by the Resource Ratio theory. Low diversity and evenness correlated with high biomass and productivity, on the contrary to the results from terrestrial studies showing positive correlation between diversity and production. The negative correlation between biomass and productivity with diversity and evenness was consistent, even thoughthe species-level community composition differed clearly between the study locations.Thus, independent of species composition, certain rules of resource monopolization seem to exist in the phytoplankton community. And on the other hand, metacommunities are relevant also in phytoplankton communities. We conclude that the coastal phytoplankton communities have intertwined, significant local and regional components, which requires taking regionality into account when using phytoplankton monitoring data for environmental status assessments.

S11.6 - PHYTOPLANKTON RESPONSES TO GLOBAL WARMING AND INCREASING HUMAN EXPLOITATION OF INLAND AND COASTAL WATERS

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Through the recent 20-30 years phytoplankton has changed composition worldwide. Harmful and/or toxic blooms of cyanobacteria and mixotrophic dinoflagellates turn up frequently in lakes, ponds, rivers, and coastal areas of the sea (Olrik et al. 2013). In slightly brackish inland and coastal waters small fish-toxic flagellates has become a nuisance (Hambright et al. 2015). This happens concomitant by increasing temperature, increasing desiccation in the subtropical zone, increasing bottom anoxia,and increasing imbalance in the optimal N/P ratio for phytoplankton growth. Examples of the long-term changes in phytoplankton from two temperate lakes with increasing blooms of cyanobacteria and mixotrophic flagellates are demonstrated. The mutual impacts on phytoplankton and humans of the combination of large-scale climate changes and the intense use of water-bodies from by the fast-growing human population on Earth are discussed.

S11.7 - SIGNAL OF BIOTIC INTERACTIONS IN THE PHYTOPLANKTON COMMUNITY COMPOSITION

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We analyzed the role of ten morphological and ecological functional traits (ability to fix atmospheric nitrogen, combine auto-and heterotrophic nutrition, regulate buoyancy, form chains or colonies, swim around, the possession of three different accessory pigments, mean size and size variation), in the assembly of marine (Baltic Sea) phytoplankton communities (10 000 samples, 639 species). A null model that simulated expected community composition from species-specific environmental preferences was used to separate the signal of environmental variability and biotic interactions in the community composition. Average functional dissimilarity, combining all traits simultaneously, increases during summer months in a temperate coastal system, when nutrients are depleted, water column stabilized and herbivorous pressure is strongest.Traits that relate to acquisition of alternative resources, e.g. possession of different accessory pigments, or ability to fix atmospheric nitrogen or use both auto- and heterotrophic mode of nutrition, showed more frequently divergence, whereas the traits related to behavior or morphology of species (e.g. colony formation, motility) were more often convergent. Study also demonstrates a numerical solution of estimating mean functional dissimilarity, or divergence and convergence from null model, in single binary traits, using the biomass proportions of species with different trait values.

S11.8 - PATTERNS OF PHYTOPLANKTON COMMUNITY IN THE LAGOON OF VENICE: A TRAIT-BASED ANALYSIS

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The Venice Lagoon is the largest Italian lagoon and is one of the research sites of the Italian Long Term EcosystemResearch network (LTER-Italy).Although scattered data on phytoplankton and related abiotic factors are available since the 70s, repeated and consistentobservationsstarted in 1998. Based on this regular time series,a taxonomically based phytoplankton description showed the main spatial, seasonal and pluriannualpatterns at the mesoscale. A “phytoplankton calendar” could be filled out emphasizing the importance of diatoms at both temporal and spatial scales.In this work we give a further insight in the lagoon phytoplankton, by using a trait-based approachin order to describe the community. Does a “traits calendar” of the Venice Lagoon phytoplanktonexist? The spatial and temporal - seasonal and pluriannual – trait-based patterns are analyzed in relation with the main abiotic factors and human impacts influencing the phytoplankton community. Our starting hypothesis is that morphological traits capture ecological functionsof phytoplankton in the Venice Lagoon.

S11.9 - ASSESSMENT OF SURFACE WATERS QUALITY BASED ON MONITORING OF PHYTOPLANKTON COMMUNITY STRUCTURE IN SIX APULIAN ITALY ARTIFICIAL LAKES

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From September 2010, in the Apulia Region (Italy) a monitoring program was developed with the purpose to evaluate water quality status according the 2000/60 EC Directive in six water reservoirs. According to the Italian Ministry decree n. 260/2010, these are included in the macro-types “I1” (reservoirs of Mediterranean Ecoregion with depth >15 m), “I3” (reservoirs with depth <15 m) and I4 (polimittic reservoirs). The same decree provides indications for the environmental classification purpose including the BQE to be used, the ecological indices to apply and EQRs status classes boundaries. Specifically to reservoirs, only phytoplankton was included as BQE for water quality assessment.

One sampling station was localized in each reservoir. Water samples, for the analyses of the phytoplankton taxonomic composition and size structure, were collected bimonthly at three different depths within the euphotic zone, while phytoplankton biomass, as chlorophylla, was estimated *in situ* by a multiparametric probe.

Data of phytoplankton taxonomic composition, size structure and chlorophyll a were used for the estimation of ecological indices values and relative EQRs. Based on the results of three years monitoring program, diversity patterns of trait-based phytoplankton functional groups and ecological quality status assessment of the six reservoirs are reported and discussed.

S11.10 - PHYTOPLANKTON ASSEMBLAGE SELF-ORGANIZATION EMERGING SPECIES TRAITS AND COMPETITION UNDER A PULSED NUTRIENT REGIME

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According to theory,a natural assemblage that self-organizes under a nutrient pulseof an intermediate frequency results in co-existing species followingdifferent strategies and thus presenting trade-offs between traits such as the maximum growth rate (μ_{max}) andthe competitive ability for the limiting nutrient (K_s). To test this, as well as the outcome of competition of the species inmixtures we self-organizeda natural marine phytoplankton assemblageunder nutrient pulses of 6 daysinterval,isolated the four dominant species, and measured their traits (μ_{max}, K_s). The species were then cultured inmixtures using all possible combinations. Our findings indicate that the 6 day pulse promoted the coexistence of species with trade-offs between growth rate and competitive ability for phosphorus- the limiting nutrient. In particular, under high PO_4 concentrations they followed this rank in their competitive abilities: *Nitzschia >Extubocellulus>Nannochloris>Cryptomonas*. Under low PO_4 they rank: *Nannochloris>Extubocellulus>Nitzschia>Cryptomonas*. And from faster to slower growing they rank: *Nitzschia>Extubocellulus>Nannochloris>Cryptomonas*. These rankings suggest that the temporally variable PO_4 concentration within the 6 day interval between pulses favors the dominance of species that are fast growers (e.g. *Nitzschia*) despite the fact that they are poor competitors under PO_4 limiting conditions.

S11.11 - USE OF MORPHOFUNCTIONAL CLASSIFICATIONS IN PHYTOPLANKTONIC COMMUNITIES OF EUTROPHIC LAKES

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Morphofunctional classifications have been widely used because of its potential to predict phytoplankton dynamics in aquatic biomonitoring. This study used two approaches considered appropriate tools to explain changes in phytoplankton on the main environmental factors:functional group (FG) andanother based on morphology (MBFG). The aimwas to compare two approaches in 22 eutrophic shallow lakes of Rio Grande do Norte, Brazil. Among the lakes, 11 are artificial lakes in the semi-arid and 11 are natural lakes in coastal area. Coastal lakes were greater in water transparency, while the semi-arid lakes highlighted values of pH and total phosphorus, showing theirgreater vulnerability to hydrological regime irregularity. Both approaches provided a useful technique to predict such differences. Therefor, the classification according to functional traits (FG) provided more accurate information of the lakes studied, sinceit is a tool with greater functional information, allows more detailed community description. While, the approach based on morphology (MBFG), due to its relative objectivity and simplicity, did not take into account important detailsof the species, such as mixotrophic flagellated and small cyanobacteria colonies in clear lakes, that could better determine the characteristics of the system.

S11.12 - DIURNAL LIGHT OSCILLATION AS A CONTRIBUTING PROCESS FOR NICHE CREATION AND BIODIVERSITY PATTERNS

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Empirical studies have revealed general biodiversity patterns across many taxa, e.g., the latitudinal biodiversity gradient and the unimodal relationship between productivity and diversity. While autotrophic communities often seem to follow those patterns the driving mechanisms are not clear yet. Diurnal light oscillations are generally ignored in models investigating patterns of biodiversity. However, this process is able to create temporal niches among autotrophs, and can lead to different outcomes of competition compared to conditions of constant light. In this study we use a simple phytoplankton model using a gleaner-opportunist trade-off, and perform simulations under diurnally oscillating light as well as under constant light conditions. We found that diurnal light oscillations can drive a switch from gleaner to opportunist dominance, associated with nutrient load/productivity. This switch from low to high nutrient load is related to the gradual shift from nutrient to light limitation. Higher chances for coexistence are found at intermediate productivities, indicating a unimodal relationship of productivity with diversity. Simulations for light conditions representing different latitudes show that seasonality can disturb phytoplankton niches during daily oscillations, leading to decreasing diversity with latitude. Finally, we try to evaluate these results with an evolutionary approach, investigating if species in spontaneously emerging communities can adapt to different temporal niches along the daytime, which would support our hypothesis for the generation of biodiversity patterns.

S11.13 - PHYTOPLANKTON NETWORKS EMBEDDED WITHIN REGIONAL SPECIES POOLS AS A KEY FACTOR SHAPING BETA DIVERSITY

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Phytoplankton compositional turnover is related to the individual characteristics of species (functional traits) that in turn influence mechanisms shaping phytoplankton assemblages. In the present study phytoplankton beta diversity in coastal areas of the Aegean sea (890 assemblages from 6 coastal areas) was related to the characteristics of the network of species embedded within the regional species pool of the Aegean. The method is based on social network analysis, a modern strategy for investigating patterns of relationships (based on structure, interaction or competition) through the use of network and graph theory. Each species forms a node in the network and the strength of interaction between nodes is defined by the number of co-occurrences of the corresponding species in the assemblages under investigation. A number of metrics can then be estimated for the network (degree, betweenness, closeness, diameter and clustering coefficient) based on species coexistence, the strength of interactions and possible indirect links between species through common nodes. The identification of such direct or indirect relations between species and possible formation of species groups within the network form the basis for the investigation of the functional characteristics of each group and therefore of the mechanisms formulating phytoplankton assemblages in space and time.

S11.14 - AUTOMATED DETERMINATION AND QUANTIFICATION OF FILAMENTOUS TOXIC CYANOBACTERIAL GENERA BY SPLINE CURVES, PATTERN RECOGNITION AND MACHINE LEARNING

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Toxigenic *cyanobacteria* are one of the main health risks associated with water resources worldwide as their toxins can affect humans and animals exposed via drinking water, aquaculture and recreation. Microscopy monitoring of toxic *cyanobacteria* in waterbodies is a routine operation for water quality control. The detection and quantification of filamentous *cyanobacteria* in light microscopy is time consuming and affected by non-optimal manual or semi-automated methods. Here we show a new automated method able to overcome these problems. First, we developed a pre-processing algorithm to highlight filaments of interest from the background that may contain other phytoplankton and dust. Then, we developed a spline-fitting algorithm to recombine interrupted sections and crossing filaments. The same spline curves were used to perform accurate morphometric analysis of every single filament and to extract specific patterns from cyanobacterial surface. We identified 18 specific pattern indicators used to tune a machine-learning algorithm for the recognition of five toxic genera: *Aphanizomenon, Cylindrospermopsis, Dolichospermum, Limnothrix* and *Planktothrix*. The validation was performed using samples from Italian volcanic lakes, comparing automated versus manual data. Results show that the algorithm outperforms traditional approaches and well meets the need to rapidly assess water quality and cyanobacterial presence in the environment.

We acknowledge the European Cooperation in Science and Technology COST Action ES1105 CYANOCOST for networking and knowledge transfer support.

S11.15 - SPECIES AND SHAPE DIVERSITY OF PHYTOPLANKTON ALONG SPATIAL AND TEMPORAL GRADIENTS IN THE FLORIDA KEYS

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Measures of abundance, variation and distribution of phytoplankton over space and time in taxonomic and morpho functional terms are useful tools to assess conditions and trends of biodiversity globally or sub-globally, to provide valuable information about ecosystem processes and responses to environmental variations, global warming and other human-mediated changes. In this study the goal was to use taxonomic and morpho-functional approaches to explain temporal and spatial changes in phytoplankon community depending on potential driving factors, such as temperature, wave energy, irradiance, nutrient concentrations and algal substrates. Two season and four sampling sites in the Florida Keys (FK) were selected. Phytoplankters were determined microscopically. Water column parameters measured included salinity, temperature, light, total phosphorus and nitrogen. One hundred and seventy nine taxa belonging to 12 classes, 7 phyla and 20 shapes were identified. In taxonomic terms, diatoms showed higher contribution to biovolume, whereas in morphological terms simple shapes dominated. From a temporal and spatial perspective, the FK is characterized by significant differences in taxonomic and morpho-functional composition and abundance. To use these two approaches represents an important tool for understanding the behavior and dynamics of the species and community structure in response to a combination of variable factors over time and space, influenced by local and regional characteristics.

S11.16 - EVOLUTIONARY PRESSURE ON DIATOM LIFE FORMS

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Robust evidence is accumulating on the autoecological relevance of the size in plankton communities. Less in known on the adaptive role of morphology in unicellular organisms. In diatoms, size and morphology are both affected by chain formation, which may be driven by the abiotic hydrodynamic forcing and/or by the biotic grazing impact. Evidence in support of either bottom-up or top-down control on diatom chain formation is generally inconclusive and, in most of the cases, does not take into account cell morphology. We analyzed a long-term time series (1984-2011) of diatom abundance (about 130 taxa) at station LTER-MC in the Gulf of Naples (Mediterranean Sea) in relation to abiotic variables and biotic data (plankton community structure and traits) to characterize the patterns of occurrence of different diatom life forms. Our preliminary results indicate the presence of eco-evolutionary factors that favor the presence of certain life forms, as already suggested by past pioneering studies, though often mismatching with previous inferences. The present study is aimed at testing the two prevailing hypotheses on diatom life forms and will propose a new theoretical frame that may reconcile the observed discrepancies.

S11.17 - IMPERFECT PREY SELECTIVITY OF PREDATORS PROMOTES BIODIVERSITY AND IRREGULARITY IN FOOD WEBS

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Ecological communities are often characterized by many species occupying the same trophic level and competing over a small number of vital resources. The mechanisms maintaining high biodiversity in such systems are still poorly understood. Here, we revisit the role of prey selectivity by generalist predators in promoting biodiversity. We consider a generic tri-trophic food web, consisting of a single limiting resource, a large number of primary producers and a generalist predator. We suggest a framework to describe the predator functional response, combining food selectivity for distinctly different functional prey groups with proportion-based consumption of similar prey species. Our simulations reveal that intermediate levels of prey selectivity can explain a high species richness, functional biodiversity, and variability among prey species. In contrast, perfect food selectivity or purely proportion-based food consumption leads to a collapse of prey functional biodiversity. Our results are in agreement with empirical phytoplankton rank-abundance curves in lakes.

S11.18 - FUNCTIONAL DIVERSITY DIFFERS AMONG LIFE DOMAINS AND MAJOR PHYLOGENETIC GROUPS IN THE FRESHWATER PHYTOPLANKTON

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Phytoplankton major phylogenetic groups (MPG; e.g. Cyanobacteria, Bacillariophyceae) have been traditionally used to aggregate phytoplankton species in continental and marine aquatic ecosystems. Functional diversity is the community suite and variability of functional traits, and affects both the organisms responses to environmental changes and their effect in ecosystems processes. However, an up-to-date revision of these aspects for MPG is lacking in freshwater ecosystems. Here we compare MPG morphological variability, physiological rates, and ability to thrive and dominate under diverse environments. Data included a bibliographic search for physiological rates and samplings from ca. 200 lakes (800 species) spanning subpolar to tropical regions. We found that MPG differ in their functional diversity. Cyanobacteria are more diverse and can be dominant under a wide spectrum of conditions. Within eurakiotic representatives, Chlorophyceae showed a higher diversity, similar to Cyanobacteria. Differently, groups such as Chrysophyceae had a more restricted distribution and morphological variation. The antiquity, high genetic diversity and morphological plasticity exhibited by Cyanobacteria and some eukaryotic algae may explain their higher functional diversity. A revision of genetic relatedness to generate standarized phylogenetic groups is needed as well as a discussion about the applicability of current MPG to summarize phytoplankton responses in freshwater ecosystems.

S11.19 - INSIGHTS FROM A MODEL OF PHYTOPLANKTON COMMUNITY PROPERTIES

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We developed a model to study the mechanisms that shape the size structure and functional diversity of phytoplankton communities in environmentally contrasting regions of the Atlantic Ocean (tropical and temperate). The model describes changes of three phytoplankton community properties: total biomass, mean cell size, and size variance, the latter reflecting the functional diversity of the community. Under changing environmental conditions, the simulated size structure of the phytoplankton community dynamically reorganize as a result of a trade-off between phytoplankton cell size and: 1) phytoplankton nutrient acquisition, 2) zooplankton grazing, and 3) phytoplankton sinking. Our results indicate that the stable environmental conditions of the tropics favour communities with small mean cell sizes and low functional diversity. Whereas, the seasonally changing conditions of the temperate region favours communities with relatively bigger mean cell sizes and higher functional diversity. Our modelling application highlights the importance of environmental variability as a key structuring mechanism of marine plankton communities and calls for a reassessment of the current understanding of phytoplankton diversity patterns across latitude.

S11.20 - A HIERARCHICAL INDIVIDUAL-BASED APPROACH TO PHYTOPLANKTON COMMUNITY ORGANIZATION

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A central goal in ecology is to understand and possibly, predict the effects of environmental change on biodiversity and the consequences of biodiversity change for ecosystem functioning by searching for common patterns and decoding patterns into underlying mechanisms.In this context, microbial ecologists face the challenge of linking individual level variability in functional traits to larger-scale ecosystem processes. Phytoplankton is a classical model in ecology and detailed knowledge about its most relevant ecological traits exists. Cell size and shapeare key traits appeared to be under selection by environmental filters and species interactions, and affecting growth, access to resources, and susceptibility to grazing.Spatial differences in resources availability shape species diversity along environmental gradients according to their resources use efficiency. However, more species coexist than number of limiting resources, knows as paradox of plankton.Niche partitioning promotes plankton diversity by differential use of nutrients and light, predator-mediated coexistence and non-equilibrium dynamics.How size and shape enter this game? How are taxonomical vs non-taxonomical components relevant in the organization of phytoplankton communities? We test the hypothesis by a biogeographical snapshot from natural phytoplankton communities in patchy lagoon ecosystems taking the challenge of exploring individual level variability in taxonomical and non-taxonomical traits.

S11.21 - MODELLING DARK RESPIRATION IN MARINE PHYTOPLANKTON

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We investigated the relationship between photosynthetic activity and dark respiration in three marine phytoplankton species (*Heterocapsa rotundata*, *Rhodomonas salina* and *Thalassiosira weissflogii*). Dark respiration rates were measured after 1 to 3 hours of light exposure in 12 bottles where incubation irradiances ranged from 0 to 600 µmol photons m-1 s-1. We found that the dark respiration increased after light exposures (both irradiance and duration) in all exponentially growing cultures. This relationship could be described by a linear model for all species relating respiration to the previous accumulated photosynthetic activity with a slope of about 0.035 h-1 indicating a growth related respiration of 3.5 percent pr. hour of the newly fixed carbon. Furthermore, ratio of new carbon turnover rate to maintenance carbon turnover rate found to be 5 for *H. rotundata*, 11 for *R. salina* and 17 for *T. weissflogii*. These results show that diatoms increase their respiration rates more than other cryptophytes and dinoflagellates when there is available intracellular carbon. Overall, this study suggests a diel periodicity of phytoplankton respiration driven by accumulation of newly fixed carbon in light. The consequence is a decreasing respiration rate during the night or during long dark incubations.

INTEROPERABILITY TOOLS FOR E-BIODIVERSITY

S12.1 - TOWARDS SEMANTIC INTEROPERABILITY FOR PLANT FUNCTIONAL DIVERSITY

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Plant biodiversity research is increasingly including functional aspects and is progressing to big data science: this requires access to distributed data sets of different kinds, e.g., taxonomy, species occurrence and plant traits. The wealth of data collected over the last decades creates exciting new research possibilities, but it comes with the challenge of accessing and integrating data from disparate sources with low degree of harmonization. Terminology standards and tools that allow both scientists and computers to communicate more effectively with one another are therefore imperative. Here we present the recent development of a community agreed controlled vocabulary of plant traits for biodiversity research: the TOP-Thesaurus (www.top-thesaurus.org). The TOP-Thesaurus is a joint development of experts from the plant biodiversity domain, computer science and information technology. TOP relies on Semantic Web standards and SKOS, it builds on the Extensible Observation Ontology (OBOE) framework and whenever possible, the traits defined in TOP are linked to existing standards, mainly the Plant Ontology (PO) and the Phenotypic Quality Ontology (PATO). In combination with the ongoing consolidation of plant trait data (www.try-db.org), plant taxonomy (www.theplantlist.org) and species occurrence (www.gbif.org) we expect the TOP-Thesaurus to provide a long missing cornerstone towards improved data interoperability in plant functional diversity research.

S12.2 - SEMANTIC TOOLS FOR FUNCTIONAL TRAIT-BASED APPROACHES: DEVELOPMENT AND APPLICABILITY

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Functional trait-based research has undergone an extraordinary expansion in the last thirty years, producing a large quantity of heterogeneous and distributed data to be harmonized and standardized in order to support and facilitate the research in this field. A first step toward this challenge is to define the set of concepts that form the basis of this particular domain of knowledge, thereby developing semantic tools as thesauri for functional trait-based approaches. Here we present the recent development of two thesauri concerning functional traits: PhytoTraits and FishTraits thesaurus. Thesauri reflect the agreement of a scientific expert community to fix semantic properties (e.g. definition) of approximately 100 phytoplankton traits and 60 fish traits. Thesauri are built using TemaTres, a web-based tool, open-source, for the collaborative development and management of a thesaurus and they are defined through the SKOS format. As a consequence, such thesauri will serve as a stable reference resource, specifically when available as linked data on the web. Additionally, we present a use case showing how these thesauri could significantly reduce the barriers to data discovery, integration, and exchange among biodiversity resources (e.g. LifeWatch Dataportal), if adopted as a standard and rigorously applied and enriched by the scientific community.

S12.3 - THE LIFEWATCH ITALY E-INFRASTRUCTURE FOR BIODIVERSITY AND ECOSYSTEM RESEARCH

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Italy is a biodiversity hotspot. The issue of biodiversity is an high priority in the political agenda at the national level since we have realised that our quality of life depends on biodiversity and the related ecosystem services and also because tourism is an important component of the economic balance in many Italian regions, due to their beautiful natural landscapes. However, scientific research on biodiversity has different flaws: fragmentation of sciences, of research institutions and among scientists, fragmentation of knowledge and lack of actual availability of existing data, fragmentation of research funding and low efficiency if the use of available economic resources. The commitment of Italy to LifeWatch, the European Research Infrastructure on Biodiversity, creates the conditions for the development in Italy of an E-Biodiversity Research Institute. The ICT Platform of the Institute supports the infrastructure to reduce the fragmentation in the scientific community, to promote the integration of the existing data and to enhance their availability to the scientific community itself and to the whole stakeholder community. I introduce the first ICT Platform release focusing on how the Italian team is working on topics like data interoperability and data quality to overcome the limit of the actual scientific research.

S12.4 - LEVERAGING BIODIVERSITY INTEROPERABILITY THROUGH LIFEWATCH SEMANTIC RESOURCES

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"Creating a scientific world based on e-infrastructures will not be easy. (…) how will users from a wide range of backgrounds understand the data they are accessing? (…) Diversity is a dominant feature of scientific information – diversity of data formats and types, but also of the people and communities that generate and use the data". [1] The final report of the high level Expert Group on Scientific data suggested a whish list for scientific e-infrastructure, highlighting the importance of supporting data with metadatation, persistent identification and interoperability. LifeWatch, the e-science european infrastructure for biodiversity and ecosystem research, is taking into account these issues. Semantic technologies (ontologies, thesauri, linked data) have been successfully adopted in other fields (biomolecular studies, environmental abiotic data management, astronomic data) to fix problems of identifying specific communities concepts and to enhance interoperability, data discovery and re-usability. Within LifeWatch Italy, following past experiences of related research projects and communities (e.g. LTER network, EnvEurope project) we promoted the definition of semantic resources, to be published as Linked Data [2] and through SPARQL [3] endpoints that will be maintained by the LifeWatch Service Centre. We will present some example of use of these resources and we will discuss our proposal of adoption of GeoNames Ontology [4] for referencing toponymic and geographic features.

S12.5 - ON THE OPPORTUNITY OF EXPLOITING OPEN GEOSPATIAL STANDARDS FOR BIOTIC DATA MANAGEMENT

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Numerousness of formats characterizes the state of the art in biodiversity data management. If compared to other research field, there is a lack in harmonization and standardization of these data. If on the one hand data from traditional biodiversity collections (from museums, national parks, etc.) can be easily represented by existing de-facto standard, on the other hand the growing number of field observation, for instance by VGI activities (e.g. iNaturalist [1]) or from automated systems (e.g. animal biotelemetry), would at least require upgrades of the currently used formats. Moreover, in an eco-informatics perspective, the usage of data from different scientific fields is to be expected (abiotic data, geographic information, etc.) and the possibility to represent this information and biodiversity data in a homogeneous way could be an advantage for interoperability. We will discuss the opportunity of exploitation of the standard for observation data by Open Geospatial Consortium, namely Observation and Measurements (O&M) [2], a model developed for sensor data but with strong analogies with the biodiversity-oriented OBOE ontology [3]. The applicability of OGC O&M has been yet suggested by INSPIRE Cross Thematic Working Group on Observations & Measurements [4] and New Zealand Environmental Information Interoperability Framework [5]. In our opinion, could be an advantage for the biodiversity community. We will propose some example and the advatages offered by O&M with respect to other representation format.

S12.6 - BUILDING BRIDGES – A UNIFYING ARCHITECTURE FOR LTER EUROPE BASED ON COMMON DATA SERVICES

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To assess changes in and pressures on ecosystems and their underlying processes, as well as addressing future scenarios along different gradients (e.g. geographic, climatic) long-term ecological data are needed. In-situ process oriented ecological observation is coordinated through the LTER Europe network integrating data and knowledge from different distributed resources throughout Europe. This leads to a number of challenges inter-alia the technical capabilities of data providers as well as the online availability of data being the most prominent ones. Starting with developments done in projects like ALTER-Net, EnvEurope and ExpeER, continuing with the eLTER project (H2020), a service-based data infrastructure is being established leveraging data from distributed locations. A core component will be the provision of sufficient metadata integrating the existing DEIMS Research Site and Dataset Registry. The aim of building a service oriented data architecture is to allow the interlinkage of data beyond the respective networks via common international standards. One of the challenges will be the integration of data providers with very different data management and data publication skills into one spatial data infrastructure using elements of the OGC Sensor Web Enablement framework in order to establish semantic links across diverse data sources.

S12.7 - LIFEWATCH GREECE: TOWARDS DISTRIBUTED E-INFRASTRUCTURES FOR SUPPORTING SCIENCE-BASED SOLUTIONS FOR BIODIVERSITY MANAGEMENT

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LifeWatch is the European e-Science Research Infrastructure for biodiversity and ecosystem research designed to provide advanced research and innovation capabilities on the complex biodiversity domain. The capabilities offered by LifeWatch, as an e-Science infrastructure, allow users to tackle the big basic questions on biodiversity, as well as to address the urgent societal challenges concerning biodiversity, ecosystems and other crosscutting issues (http://www.lifewatch.eu/web/guest/home). The LifeWatch Greece Research Infrastructure (http://www.lifewatchgreece.eu/) is part of that distributed e-infrastructure, and propose to develop several applications as e-services and virtual research environment called vLabs. These applications can use data and datasets that are stored in the repository that users can query and access through a semantic-based technology metadata catalogue. Five vLabs are being developed: MedOBIS Regional Node, GBIF Greece National Node, R Statistical Marine Ecology vLab, Ecological Modeling, Molecular Biology for Marine Microbial Communities, and Semi-Automated Extraction of Data/Information from literature. These vLabs can call e-services like: Data Services, Greek Taxon Information System, the GIS and mapping visualization tool, Genetics and Genomic, MicroCT virtual galleries, Biological Specimens Collection.

Examples will be presented where the interoperability issue within LWG or with external facilities has been particularly addressed.

ISLAND AT THE CROSSROADS: CONSERVATION DILEMMAS UNDER GLOBAL CHANGES

S13.1 - CROSS ARCHIPELAGOS BIODIVERSITY STUDIES: SADS AND SARS

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Island biogeographical and ecological theories are dominated by patterns and processes related with species diversity. We have some understanding about processes of species diversification and the roles of area, habitat diversity and island age on species richness on islands. However, there is no theory relating island geographical variables with species abundance and community assembly. In this contribution we use standardized arthropod and vascular plant datasets from the Azores, Madeira, Canary Islands and La Reunion to investigate the impact of habitat (land-use) island characteristics on species abundance distributions (SADs). We found that in the Azores a large number of communities are bimodal, comprising a mode of very rare species and a mode of relatively common species, the rarer mode containing a higher proportion of satellite taxa, introduced species and species that are more adapted to anthropogenic land uses surrounding native forests. We also found that SADs change as a function of sample size, or in other words to their scaling properties. From this respect, island species composition is more important than trophic groups in the properties of SADS. Consistent differences in the shape and parameters of SAD models demonstrate that their study is potentially useful for biogeographical purposes.

S13.2 - INSECTS AND THE CITY: WHAT ISLAND BIOGEOGRAPHY TELLS US ABOUT INSECT CONSERVATION IN URBAN AREAS

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Habitat fragmentation determined by urbanization is considered a prominent treat to biodiversity. Urban development creates a mosaic of natural fragments which can be occupied by organisms able to survive in small spaces. These fragments are a set of habitat islands separated by inhospitable environments. Because of their isolation, communities of urban green spaces can be investigated using hypotheses developed in island biogeography. The “equilibrium theory of island biogeography” (ETIB) allows the formulation of some predictions about how various characteristics of green spaces (such as their area, shape, level of isolation, environmental heterogeneity, age, etc.) should influence species richness. Many studies found supports for ETIB predictions, but results varied considerably according to the species’ sensitivity to patch size, matrix characteristics, and history of the city. In some cases ETIB predictions were falsified. These contrasting results warn against making generalizations on conservation strategies only based on ETIB models. On the other hand, the ETIB may represent a useful framework for urban conservation, especially for small animals like insects, if the role of other factors, such as the surrounding landscape, the specific needs of the species under study, and the history of the urbanization process, are taken into account.

S13.3 - MOVECLIM – CROSS ARCHIPELAGO EVALUATION OF ALTITUDINAL PATTERNS IN BRYOPHYTES

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Bryophytes, such as mosses, liverworts and hornworts are able to colonize a vast number of substrates and occur in all terrestrial ecosystems, with a successful and long evolutionary history. Notwithstanding, bryophytes remain one of the least included groups of organisms in ecological or conservational studies. It is reasonably asserted that global change will impact Earth differently, with more threatening effects on the most vulnerable areas, such as islands, humid zones, forests or mountains. All these ecosystems need to be thoroughly investigated and model organisms, such as bryophytes, may contribute to the production of well-adjusted restoration and management plans. Project MOVECLIM (Montane vegetation as listening posts for climate change) investigated spatial changes in diversity of bryophytes and ferns along altitudinal transects in four oceanic (La Palma, La Réunion, Pico, Terceira) and one continental island (Madagascar); it addressed issues such as diversity and rarity patterns across elevation gradients and islands, community structure at different spatial scales, and the relative contribution of different factors in shaping species richness distribution patterns. This project may contribute to the Aichi Biodiversity Targets, and to foster the understanding of community assemblages, scale effect and elevation shifts under a changing environment.

S13.4 - WHAT DRIVES RICHNESS AND DIVERSIFICATION ON ISLANDS - ISOLATION VS ENVIRONMENT

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Isolation is a fundamental driver of speciation, and thus biodiversity origination, yet is largely ignored when trying to explain elevational or latitudinal diversity gradient. Here I present results from a multi-author initiative covering entire floras of more than 30 high-elevation islands. We show a strong, globally consistent empirical relationship between elevation and endemism, indicating an effect of topography-driven isolation on speciation whose generality has hitherto been unrecognized. Isolation is locally more important than temperature, biotic interactions and area in influencing speciation rate, on both mountainous islands and continental mountains. We infer that isolation plays a more prominent role in generating diversity gradient than previously thought. This may even represents a mechanism to explain why there are so many terrestrial species overall, and also why they increase in number towards the equator. The study also demonstrates the potential of island systems for enhancing our theoretical understanding of nature.

S13.5 - TOWARDS A CONSTITUTIVE THEORY OF ISLAND BIOGEOGRAPHY

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Island biogeography focuses on understanding the processes that underlie a set of well-described patterns on islands, but lacks a unified theoretical framework for integrating these processes. The recently proposed General Dynamic Model (GDM) of oceanic island biogeography promises a step towards this goal. Here, we present a more formal analysis of causality within the GDM, and investigate its potential for the further development of island biogeographical theory. Further, we extend the GDM to include subduction-based island arcs and continental fragment islands.

S13.6 - THE BIOTIC INTERACTION STRUCTURE OF AN ISLAND LANDSCAPE ESPECIALLY IN RELATION TO LINK MULTIPLICITY

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Insects are, by far, the most species-rich and abundant group of animals in the world and accordingly, serve as a plentiful source of food to many other animals, e.g. more than half of all bird species have insects as their main diet component. This, however, turns into a problem on oceanic islands, which have relatively many insect-eating vertebrates but few insects. Thus to survive, these island insect-eaters must widen or change their food niche. This is often seen in small lizards, which on continents are dedicated insect eaters, but on islands relax their diet requirements by also consuming nectar, pollen and fruit pulp. Doing so, lizards become important pollinators and seed dispersers to many plants, which also suffer from this paucity of insects for their pollination. Many island lizards are even 'double mutualists', serving as both pollinators and seed dispersers and this is particularly so on remote oceanic islands, i.e. they show link multiplicity. Thus many insect-eating vertebrates, birds and reptiles, widen their niche on islands, and include plant food into their diet. However, the role of birds and reptiles as plant mutualists is still poorly known. In the Galápagos, we examined the role of land birds and reptiles as plant mutualists and in the talk, we will document this and compare with other archipelagos.

S13.7 - COMMUNITY STRUCTURE AND COMPLETE PHYLOGEOGRAPHY OF BUTTERFLIES FROM WESTERN CIRCUM-SICILIAN ISLANDS REVEAL BIOGEOGRAPHIC PROCESSES AND SELECTIVE LOSS OF DIVERSITY

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Complex histories of immigration, extinction, long-term persistence, genetic drift and local evolution determine species occurrence on islands. Only a few studies used sufficiently large and complete datasets to disentangle these biogeographic processes. We studied the faunal structure (richness and nestedness) and the genetic patterns (the COI gene) of the butterfly assemblages occurring on South-Western Sicilian islands . GLM analysis of richness revealed that some of the species acquired by the Maltese islands and Lampedusa during the Pleistocene probably survived until recent time. The nestedness pattern clearly showed the existence of (i) a group of "core species" and (ii) a group of less mobile "satellite species" sometimes showing high genetic contrasts. Such contrasts revealed to be a constant pattern separating populations from three main areas: (i) Maghreb-Lampedusa, (ii) Sicily-Maltese islands-Levanzo, and (iii) Calabria, while Pantelleria and Marettimo appear to be mostly inhabited by species with low genetic variability. This pattern highly mirrors the Pleistocene paleogeography The Maltese islands host a series of species genetically identical to those of Sicily but which do not occur on other circum-Sicilian islands. These species apparently required a land-bridge to colonize Maltaand should be considered as priority species for conservation.

S13.8 - A CENTURY OF FLORISTIC CHANGES IN THE TUSCAN ARCHIPELAGO: HUMANS AND SCALE EFFECTS

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The Tuscan Archipelago is made by seven major islands and a number of islets and has been the subject of a huge number of botanical explorations. All the plant occurrences recorded from the end of XIX century to the beginning of XXI century have been stored in a single data base after taxonomic standardization. Such a data base permitted the subdivision of high-quality floristic data into two periods (1880-1950 and 1950-2010) for the seven major islands and eight islets. Such data were used to perform quantitative analyses of the floristic changes in terms of species-area relationships and diversity partitioning across islands and islets. The results allowed the quantification of the changes in plant species diversity and composition due to the land-use changes and the invasion of alien species.

S13.9 - DO DISPERSAL SYNDROMES MATTER? INTER-ISLAND PLANT DISPERSAL IN THE CANARIES, GALAPAGOS AND AZORES

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Vectors of plant colonization of remote islands have been classily “guesstimated” directly from plant diaspores. Alternatively, we use a frequentist approach to explore what traits have been more favourable for LDD of plants across islands within the archipelagos of the Galapagos, Azores and Canaries. The efficiency of different dispersal syndromes varied remarkably between the three archipelagos: only sea dispersal traits (thalassocorous) conferred a tangible advantage for inter-island dispersal in the Galapagos, and only fleshy fruits (endozoochorous) were beneficial in the Azores, while in the Canaries traits for endozoochory, epizoochory and thalassochory all seem to effectively promote inter-island dispersal. Interestingly, traits related to wind dispersal (anemochory) are negatively associated with plant distribution in the three archipelagos. It is yet unclear why LDD syndromes seem more important in the Canaries than elsewhere. We confirmed previous findings that the dispersal of unspecialized diaspores is not significantly diminished and lend further support for the idiosyncrasy of LDD syndromes and to the importance of non-standard dispersal events for island colonization.

S13.10 - PALAEOECOLOGY AND ISLANDS

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A number of environmental assessments highlight the importance of understanding vegetation sensitivity to changes in the environment. In this context, oceanic islands are of particular interest as some of them (mainly small islands) have been identified as vulnerable to the adverse impacts of climate change. In this study, we analise the role of long-term data in generating management information for island ecosystems by asking: How sensitive are the island ecosystems to past climate change? Which was the impact of the arrival of humans and/or invasive species? These questions are of importance in terms of Island biodiversity conservation. Long-term data can expand the temporal frame of conservation land-use policy and has much to offer in light of planning for the uncertainty of climate change which is likely to manifest over longer time-scales.

S13.11 - APPROXIMATE BAYESIAN COMPUTATION REVEALS THE CRUCIAL ROLE OF OCEANIC ISLANDS FOR THE ASSEMBLY OF CONTINENTAL BIODIVERSITY

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In the oceanic island biogeography paradigm, volcanic islands are considered both engines of speciation and evolutionary dead-ends. We investigate whether such a paradigm holds for extremely mobile organisms, using bryophyte species that are disjunct between the mid-Atlantic Macaronesian archipelagos and Western Europe as a model. We compared the genetic structure and diversity observed in island and continental populations with those data simulated under three competing demographic scenarios, according to which: island populations derive from continental ones in agreement with classical island biogeography theory; gene flow from islands to continents and viceversa are recurrent and balanced, providing support to the hypothesis that islands have served as glacial refugia; and island populations are the source of colonists of continental landmasses de novo. Using an Approximate Bayesian Computation framework, we demonstrate that the patterns of genetic variation observed in the species examined are more compatible with a scenario in which continental populations have a Macaronesian origin. Our results therefore indicate that oceanic islands may be a key source of biodiversity for continental regions.

S13.12 - HOSTS AS ISLANDS?

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The idea of applying island biogeography theory, and especially species-area curves, to host-parasite systems (in which hosts are assumed as “islands” and parasites as species “inhabiting” these islands) dates back from the sixties. Although caveats have been posed soon after the first formulation of the idea the central assumption that hosts can be treated as islands has become more and more established over time. Experimental data have often provided contrasting results, thus emphasizing the need for a more thorough evaluation of how and how much the island paradigm can help understanding host-parasite relationships. A better grasp on this issue would be crucial to evaluate how parasites could respond to the disruption of long-standing biogeographical barriers due to climate- and human-driven biological invasions. In this presentation, we will discuss how the peculiar structure of host-parasite networks, the enemy release hypothesis, the possible discrepancy between host and parasite ranges, and the evolutionary tendency of parasites towards specialization can make parasites much different from islands. In addition, we will show how many of the difficulties to test these issues, and most notably the poor availability of parasitological data, can be partially solved by using artificial life simulations and digitally evolving organisms.

PATTERNS AND PROCESSES IN TROPICAL FOREST ECOLOGY

S14.1 - UNDERSTANDING AMAZONIAN BIODIVERSITY: HOW FAR CAN WE GET WITH EXISTING DATA?

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Amazonian rain forests are both intriguing and difficult to study for the same reasons: spectacular species diversity, poorly resolved taxonomies, challenging field conditions and the sheer size of the area. Especially obtaining an accurate picture of broad-scale patterns in species distributions and species turnover is a big challenge. For both purposes, it is important that taxonomical identifications be consistent across the entire Amazon basin, and that the field data are extensive enough to be representative of the existing floristic variation. Field and taxonomic work can be sped up considerably by focusing on indicator plant groups, which allows obtaining more data points with the same amount of effort. Broad-scale standardized data are already available for ferns, Melastomataceae and palms. Generalizing the conclusions from scattered field data points requires ecological understanding on how species occurrences relate to environmental variation, and also the availability of broad-scale environmental data layers. I will give an overview of what has been learned on the basis of existing data already, and outline the most important problems in these data that need to be solved in order to get further.

S14.2 - ON THE ROLE OF HISTORY AND DISEQUILIBRIUM DYNAMICS IN SHAPING TROPICAL FOREST COMMUNITY ASSEMBLY ACROSS SCALES

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In this talk, I will provide a macroecological perspective on the assembly of tropical forest communities, using a key-stone tropical plant family – the palms, Arecaceae – as a study group. I will in particular focus on the role of long-term historical factors – supplementing and interacting with contemporary factors – in shaping current palm diversity palms across spatial scales. Global and continental-scale studies of palm diversity – covering not just species richness and species composition, but also phylogenetic and functional diversity – show strong imprints of regional biogeographic history, partly reflecting long-term cross-Cenozoic dynamics in climate and rain-forest areas, but also idiosyncratic patterns in lineage evolution and migration. Especially at smaller regional scales, there are also clear imprints on the Pleistocene glaciations in contemporary palm diversity patterns, reflecting strong impacts of these cold, dry climatic episodes even in the tropics. In line with the species pool hypothesis, these large-scale historical dynamics also shape the structure of local palm communities, supplementing the effects of local assembly processes. Finally, I will discuss the implications of the strong historical legacies in cross-scale palm diversity patterns for palm diversity responses to future global change, and present new work attempting to quantify these disequilibrium dynamics.

S14.3 - AMAZON FOREST CARBON DENSITY AND DYNAMICS

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In this talk I will present a ground-based perspective of the large-scale patterns and processes in the distribution of biomass carbon and its dynamics in Amazonia. The main information source will be the tree-by-tree records carefully acquired in permanent plots across the Basin, measurements that have been developed by many colleagues for decades. These spatially extensive but locally detailed data help to reveal the importance of soils, tree biodiversity and forest dynamics in determining the spatial distribution of carbon across Amazonia. The long-term records also help us to trace temporal patterns in forest dynamics, revealing significant changes over time in recent biomass dynamics (i.e., growth, mortality, and net biomass balance), and can give insight into the climatic and other processes that may be driving changes in apparently intact forests.

S14.4 - ABOVE-GROUND BIOMASS ASSESSMENT FROM LONG-TERM FIELD DATA

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International policies for climate change mitigation rely on the future capacity of tropical forests to increase carbon capture in biomass and soil. Long-term studies have reported an increase of above-ground biomass (AGB) accumulation in tropical forest trees in recent decades, presumably due to an increase in atmospheric CO2, but this signal is heterogeneous across space and time. Indeed, some climate change scenarios predict that the frequency and intensity of droughts may increase, negatively affecting AGB accumulation in some tropical forests. This heterogeneity limits our capacity to forecast future changes in AGB in response to climate change predictions. Understanding AGB spatial distribution and dynamics is challenging because it requires spatially-explicit long-term data-sets of tree demography over several decades, high-resolution data on environmental covariates, and complex statistical modelling techniques, involving spatio-temporal stochastic processes. In this paper we present a powerful new approach to fitting models with complex dependency structures to evaluate the spatio-temporal dynamics of AGB over time scales using data from the 50 ha CTFS-ForestGEO plot on Barro Colorado Island (BCI) in Panama. When scaled across multiple plots in the CTFS-ForestGEO network, this approach has potential to improve forecasts of future changes in tropical forest AGB in response to anthropogenic global change.

S14.5 - OLD DATA, NEW DATA AND COMPLEX MODELS TO QUANTIFY STRUCTURE AND BIODIVERSITY RESPONSES TO TROPICAL FOREST DEGRADATION

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Tropical forests are displaying significant changes in structure and species composition in response to land use change, the main driver of biodiversity loss in the tropics. Forest fragmentation and selective logging, which can cut deep into forest interiors, are major land use change processes. They affect more than a third of the world's tropical humid forests, acting, non-additively, in concert with climate changes to reduce tropical forest resilience. I will showcase three research projects, established to develop and inform reliable measurements degradation impacts on tropical forests at landscape scales. I present findings from the BIOFRAG project (https://biofrag.wordpress.com/), showing how the creation of forest edges through fragmentation alters abundance and diversity of taxa across tropical realms. I visualise these responses using new image analysis methods developed in our research group. I will show forest degradation and fragmentation alter canopy structure and carbon stocks with impacts on microclimate at local scale using data from the Stability of Altered Forest Ecosystems project (http://www.safeproject.net/). And, I will provide evidence for non-linear responses of canopy structure on the interplay between climate, disturbance and plant functional types across tropical realms using data compiled within the KITE LAI project (http://www.york.ac.uk/environment/research/kite/resources/).

S14.6 - NATURAL ENEMIES SHAPE CHANGES IN PLANT DIVERSITY ACROSS A HUMIDITY GRADIENT IN CENTRAL PANAMA

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Tropical forests are extremely divers. Over 300 tree species can coexist in a single hectare and as many as 16,000 tree species may exist in the Amazon basin alone. Why are tropical forests so remarkably diverse? This is a key, unresolved question facing ecology. One persistent explanation for plant species coexistence in tropical forests, the Janzen-Connell mechanism, postulates that density-dependent mortality mediated by fungal pathogens and insect herbivores, puts locally rare species at an advantage, preventing any one species from dominating. Evidence from vegetation plots suggests that this form of density-dependence plays a key role in the maintenance of plant diversity in the tropics. Still, most theories explaining species coexistence emphasize on local processes, while one of the clearest and best-documented patterns in global plant diversity is the strong correlation between diversity and humidity at regional to global scales. While differential drought sensitivity is an important determinant of changes in plant species composition along humidity gradients, alternative mechanisms are needed to explain positive diversity-humidity correlations. Here, we will show novel findings from a large field-based study in Central Panama where we tested whether humidity drives variations in tropical plant diversity through its influence on interactions between plants and their enemies.

S14.7 - HOST SPECIFICITY ALONG LATITUDINAL GRADIENTS: THE CASE OF ACORN WEEVILS IN THE NEOTROPICS

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An increase in resource specialization towards the tropics is a recurrent hypothesis when attempting to explain the latitudinal gradient of diversity. Concerning phytophagous insects, the results to date have been controversial though tend to support a reduction of diet breadth at low latitudes. Here, we compare the regional pools of acorn weevils in California and Nicaragua, a feeding guild which is particularly data-poor. We molecularly delimited to species level near 1000 weevil larvae collected from acorns of all potential oak hosts available and found that the 11 species of Nicaraguan weevils show a narrower dietary niche with lower host range and higher specialization. Additionally, whereas Nicaraguan weevils were restricted to phylogenetically close hosts and their body size was correlated with the size of the seeds of their hosts, the 3 species of Californian weevils were able to grow successfully in hosts belonging to different *Quercus* sub-genus sections and the matching between their body size with the acorn size was poorer thus suggesting a more flexible ecological interaction. Overall these results point out to a role of host-specificity to explain the higher species richness of weevils in Nicaragua.

S14.8 - WHY RIVERS MAKE THE DIFFERENCE: A REVIEW ON THE PHYTOGEOGRAPHY OF RIVER WETLANDS IN THE AMAZON BASIN

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While the importance of rivers in biogeographic pattern is globally recognized across climates and vegetation zones, little attention has been paid to their role on the phytogeography of the Amazon basin. This is particularly surprising as the Amazonian "wet-scape" - including the largest and most water voluminous rivers on Earth - supports the highest levels of freshwater biodiversity worldwide. It has also been pivotal to human civilization since pre-Columbian times. Here, we review knowledge on the importance of river wetlands on Amazonian phytogeography with special emphasis on trees - the dominant life-form of tropical wetlands. Differing degrees of flooding represent major shifts in predominating ecological filters by altering the immediate abiotic environment through oxygen deficiency and related stressors, as well as by altering the bioavailability of diverse resources through complex physico-chemical processes. In this way river wetlands strongly influence the spatial distributions of species and their functional traits, acting as important corridors for invasion and range expansion of both native and exotic taxa. We content that these processes have shaped the biogeography of the Amazon flora over evolutionary time-scales. We also highlight the role of river wetlands as a prevalent driver of speciation and diversification in the Amazon basin.

S14.9 - WHAT DO WE KNOW ABOUT TROPICAL BIODIVERSITY?

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We aim to evaluate the state of knowledge on tropical biodiversity research by reviewing ca. 3500 papers published from 1997 to 2014 in eight scientific journals, two focused on tropical research (Biotropica, Journal of Tropical Ecology), and six on ecology and conservation (Ecology, Oecologia, Journal of Ecology, Conservation Biology, Biodiversity and Conservation, Biological Conservation). Our review revealed a strong bias towards the Neotropics, with ca. 70% of studies conducted in either Central or South America. About half of them focus on tropical rain forests, whereas other ecosystems such as tropical montane forests, dry forests, savannas or mangroves are poorly studied. Research has been concentrated on just a few countries, where five of them –Brazil, Costa Rica, Mexico, Panama, and Venezuela– have been the subject of almost half of all studies. Contrastingly, the five countries hosting the largest number of tropical researchers where, in descending order, the United States, Mexico, Brazil, Costa Rica, and United Kingdom. Finally, almost one third of the studies focused on woody plants, followed by insects, mammals, birds and herbs. Some of the most diverse groups such as fungi and lichens, nematodes or mollusks accounted for a disproportionally small number of studies.

S14.10 - CORRELATES OF FOLIAR AL ACCUMULATION AMONG POPULATIONS OF THE AL ACCUMULATOR PLANT *MELASTOMA MALABATHRICUM* L. (MELASTOMATACEAE) IN RESPONSE TO SOIL CHEMISTRY AND AL APPLICATION

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Melastoma malabathricum is a woody shrub from Southeast Asia and a known Al accumulator plant. The functional significance and genetic or physiological controls on the Al accumulation trait are currently unknown. In this study we tested the hypothesis that variation in Al accumulation among wild populations of *M. malabathricum* is associated with total and exchangeable concentrations of Al in soil taken from each site. We sampled seeds, mature leaves and soil from 20 source populations of M. malabathricum in six habitats (heath, montane, swamp, coastal, riverine and lowland dipterocarp forest) across Peninsular Malaysia. The seeds were used to generate cohorts of seedlings that were grown in hydroponic solutions comprising 50% Hoagland's solution amended with Al in the form of 1.0 mM AlCl3. After eight weeks the seedlings were harvested and as the result, Al concentrations in the mature leaves of adult *M. malabathricum* individuals and in the soil they were growing in varied significantly among the 20 source populations. However, foliar Al concentrations were not consistently different among habitats and showed no relationship to total or exchangeable Al concentrations in soils collected at the 20 sites. Similarly, foliar Al concentrations in seedlings grown in uniform hydroponic conditions with Al addition differed significantly among source populations, but values did not correlate with foliar Al concentrations in the wild plants or with Al concentrations in soils across the 20 sites. We conclude that differential expression of Al accumulation in *M. malabathricum* populations is uncoupled to local variation in soil Al concentrations.

Keywords: Aluminium accumulation, Aluminium accumulator, Melastoma malabathricum.

S14.11 - POTENTIAL SEED DISPERSAL NETWORK OF THE TUMBESIAN DRY FOREST: THE IMPLICATIONS OF FRUIT AND BODY SIZE

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Tropical dry forests are among the most diverse and threaten ecosystems worldwide. Unfortunately, we lack basic knowledge on regeneration dynamics in which seed dispersal play an instrumental role. The main dispersal syndrome in tropical dry forests is endozoochory. Yet, which are the plant-frugivore interactions shaping the seed dispersal network is still unknown. This information, despite being urgently needed to promote ecosystem recovery & conservation of tropical dry forests, it is highly costly in time and money. Here we provide information on the potential dispersal network of the tropical dry forest using bibliographic and easily-collected field data. Large-sized frugivores are able to disperse a wider array of tree species and seeds to further distances than smaller ones. Thereby it is expectable that large-sized frugivores play a key role in the dispersal of tropical dry forest species. However large-sized frugivores are usually the most threaten in the community, thereby being necessary to account for their conservation status and threats. Overall results showed that “size” of both, fruits and frugivores, shaped the potential dispersal network. Larger-sized frugivores acted as network-generalist as they dispersed most plant species, thereby playing a key role as network connectors.

MULTI-SCALE MANAGEMENT OF PLANT INVASIONS AND OF THEIR IMPACTS ON ECOSYSTEM SERVICE

S15.1 - PLANT INVASIONS AND MULTI-RISK GOVERNANCE: A SOCIAL-ECOLOGICAL PERSPECTIVE

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Biological invasions are a key driver of the global ecological crisis. Invasions, and especially those involving non-native plants, can impact severely on biodiversity and other components of local ecological systems. Invasions also interact with other landscape change processes, such as wildfires or soil degradation. The synergistic action and effects of these hazardous phenomena on landscape processes and services are often not perceived by stakeholders and local communities. Moreover, risk management targeted at one single hazardous process often presents tradeoffs with the management of other landscape change processes. Effectively managing invasions under a multi-risk governance framework thus requires an integrative, social-ecological approach. We provide examples and discuss how such a social-ecological perspective could enhance multi-risk governance and resilience at local and regional scales. We advocate that building up general resilience, rather than specified resilience, would be a more effective approach to reduce social and ecological vulnerability under global change. We analyze how such an approach and its underlying long-term vision could be embedded in the current policy and planning frameworks.

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S15.2 - ASSESSMENT OF IMPACTS OF PLANT INVASIONS: A PAN-EUROPEAN ANALYSIS ACROSS ESTABLISHED PROTOCOLS

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In recent years, many national or regional organisations and research groups have developed various protocols for assessing the impact of invasive alien species in Europe. These protocols are diverse in their objectives (e.g. black list, prioritisation for management, integration into full risk assessments) but also in their content and methodology. In the framework of the COST Action ALIEN CHALLENGE, over 120 European invasive species specialists are presently testing 17 protocols using 72 species belonging to all taxonomic groups of invasive species. The aim is not to compare and rank the quality of the protocols but rather to identify their strengths and weaknesses, taking into account their main utilisation, and test their consistency. We will present the results for the 10 plant species selected in the study. We aim to answer the following questions: a) How consistent is the final result of the schemes across experts? b) Is the expert agreement affected by the species type (i.e. level of spread and prior knowledge of the species)? And c) Within each scheme, which are the questions with lower or higher expert agreement? We will discuss the results suggesting potential improvements for the tested schemes and impact assessments in general.

S15.3 - NATURALIZATION OF CENTRAL EUROPEAN PLANTS IN NORTH AMERICA: SPECIES TRAITS, HABITATS, PROPAGULE PRESSURE, RESIDENCE TIME

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The factors promoting invasive of plants can act at several scales and can have different drivers. It hence is necessary to disentangle the contribution of multiple factors that are interdependent. To this end, we formulated a conceptual model describing the process of invasion of central European species into North America based on a sequence of ‘drivers’. We then used confirmatory path analysis to test whether the conceptual model is supported by a statistical model inferred based on 466 species. The path analysis revealed that invasion success of central-European plants in North America most strongly depends on minimum residence time in the invaded range and the number of habitats occupied by species in their native range. We further identified the effects of various biological traits on several important drivers of the conceptualized invasion process. Biological traits have only an indirect effect on invasion success via their effect on the number of native range habitats occupied and cultivation in the native range. However, the importance of the biological traits is nearly an order of magnitude less than that of the larger-scale drivers and highly dependent on the invasion stage (traits were associated only with native-range drivers). This suggests that future research should explicitly link biological traits to the different stages of

invasion, and that a failure to consider minimum residence time or characteristics of the native range may seriously overestimate the role of biological traits, which in turn may result in spurious predictions of plant invasiveness.

S15.4 - PLANT INVASIONS AT HIGH ALTITUDES AND HIGH LATITUDES: WHAT DRIVES THEM AND HOW TO MANAGE THEM?

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Polar and alpine ecosystems are currently amongst the least invaded in the world, which has mostly been attributed to their harsh abiotic environments. Consequently, the spread of alien plants in these regions and their invasibility have been little studied. I discuss three recent experimental and observational studies we performed in two sub-polar mountain regions (Abisko, northern Sweden and Punta Arenas, southern Chile). A first study showed that alien plants are not uncommon in subarctic mountain areas, where especially roads promote their introduction and spread to the alpine zone. Moreover, we found that alpine communities were easier to invade than lowland communities. A second study indicated that invasibility in tundra depends more on biotic resistance than abiotic stress and that low temperatures do not necessarily limit seedling establishment at high altitudes. A third study showed that alien species can establish above their current upper distributional limits when added as seeds, and that disturbance and fertilization are important for their establishment and growth. Our findings indicate that low temperatures are not enough to prevent alien species from spreading to higher altitudes or latitudes, and that appropriate management strategies are essential to prevent alien plants from spreading rapidly in polar and alpine environments.

S15.5 - MODELLING LAND USE DYNAMICS AND LANDSCAPE INVASIBILITY BY ALIEN PLANTS UNDER CONTRASTING SOCIAL-ECOLOGICAL SCENARIOS

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Alien invasive plants nowadays invade ecosystems in almost every region around the world and their negative impacts on several ecosystem properties can already be seen. The extent and impacts of invasions are predicted to increase under future climate and land-use scenarios. Climate change can increase the ability of alien species to colonize new territories, or force them to modify their physiology and phenology to adapt to the changed conditions. However, the proportion of alien plants in regional pools is mainly determined, at local scales, by the diversity of habitat types, even if climate influences many habitat-related patterns. Climate and land-use changes have the potential to synergistically drive invasion patterns and processes. Accurately forecasting where expansions or new invasions will most likely take place is essential to the development of effective management strategies. Several future climate scenarios have been developed and widely used in ecological research. However, land-use change scenarios are not consistent and vary significantly depending on software and methodological approach, generating different future land cover patterns. Here we explore differences of invasive species distribution predictions using contrasting climatic (IPCC - wordlclim.org) and land use scenarios (Land Change Modeler - IDRISI and CLUE). Our approach is illustrated with a heavily invaded and environmentally heterogeneous region in Portugal, under contrasting socio-ecological scenarios. This work is funded by POPH/FSE, funds and by National Funds through FCT - Foundation for Science and Technology under the Portuguese Science Foundation (FCT) through Post-doctoral grant SFRH/BPD/84044/2012 (Joana Vicente).

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S15.6 - COULD BIOMASS VALORIZATION ENHANCE CONTAINMENT OF WIDESPREAD PLANT INVADERS?

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The use of biofuel has risen in interest due to concerns related to climate change and the growing targets established by countries for the use of renewable energies. However, concern exists about the possibility that some of the plant species used for biomass production might become invasive (e.g. *Arundo donax*). However, for widespread invaders already in place biomass, valorisation might be used as a management tool. Here we make a revision of the studied cases (e.g. *Robinia pseudoacacia*) and present recent research devoted to *Pittosporum undulatum* in the Azores Islands, a widespread invader. No resources are available to control the large extension of the invasion, which threatens native biodiversity. We suggest that the energetic valorisation of this species, if coordinated with the authorities responsible for land management and the private sector, might enhance the possibility of controlling, containing and eventually replacing *P*. *undulatum* in target areas, while using it sustainably as a forest resource. This might eventually allow an integrated management, with areas devoted to eradication, and areas devoted to sustainable use (honey production, compost, and biomass). In this context, the new EU regulation devoted to Invasive Alien Species, and particularly those articles devoted to widespread invaders, are discussed.

S15.7 - THE USE OF MULTIDISCIPLINARY RESEARCH FOR ASSESSING AND MANAGING BIOLOGICAL INVASIONS IN SOCIOECOLOGICAL SYSTEMS - A REVIEW

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Biological invasions are a challenge for socio-ecological systems worldwide, affecting key ecosystem services required for human well-being. The recognition that social, environmental, economic, and political factors are commonly impacted by invasive species calls for integrating multidisciplinary approaches for assessing and managing invasions. However, such multidisciplinary efforts are often less implemented than demanded. A currently lacking synthesis on applied multidisciplinary approaches could support a more integrated operationalization of scientific disciplines that are still hardly applied when dealing with invasive species. Here, based on a comprehensive literature review, we evaluate the extent to which multidisciplinary research has been applied, over the last decades, to address the impacts of invasions, in connection with main socio-ecological challenges. An integrative framework is proposed that discriminates the stages of the invasion process and socio-ecological conceptualization that have been under the focus of multidisciplinary research. Based on this framework we identify the most collaborative research fields and evaluate the research gaps and scientific domains that need to be more deeply considered for addressing invasions. The outcomes of our research are ultimately discussed to support policy and governance mechanisms towards more integrative and collaborative management of biological invasions in a wider socio-ecological context.

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S15.8 - MYCORRHIZAL STATUS HELPS EXPLAINING INVASION SUCCESS OF NEOPHYTE PLANT SPECIES IN GERMANY

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Mutualistic interactions with mycorrhizal fungi (MF) are of great importance in shaping plant species' ecology. Three mycorrhizal statuses of plant species can be defined: (1) obligatory mycorrhizal (OM) species that are always colonised by MF, (2) facultative mycorrhizal (FM) species that are colonised under some conditions, and (3) non-mycorrhizal (NM) species that are never found to be colonised by MF. With the increasing concern about invasive alien plant species, there has been growing interest in studying traits and processes allowing succesful invasion. Incorporating mutualistic interactions may support the understanding of the underlying mechanisms of the invasion process. We analysed whether mycorrhizal status and species functional traits jointly increase the explanatory power of invasion success of neophyte plant species in Germany. FM plant species did show the highest invasion success in regards of largest geographical distribution, although most of the considered neophytes are OM. Furthermore, mycorrhizal status helped explaining invasion success in interaction with other morphological or life-history traits of neophytes, i.e. the additional traits did not initially explain invasion success, but when neophyte plant species were separated by their mycorrhizal status. Consequently, we encourage integrating plant mycorrhizal status as a functional trait in future analyses of alien plant invasion.

S15.9 - ASSESSING IMPACTS OF PLANT INVASIONS IN ALPINE HABITATS OF THE CENTRAL CHILEAN ANDES

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Most of studies on invasive species have been carried out in lowland environments, whereas little attention has been directed to high elevation habitats. Nonetheless, over a thousand non-native species have become naturalized in natural areas at high elevations worldwide, and their spread may pose a significant threat to these vital ecosystems. However, very little is known about the impacts of the presence of these invasive species on the native biota. In this study we assessed if the presence and abundance of different non-native species affect the presence and abundance of native plant species at different elevations in the central Chilean Andes. In particular, we assessed the effects of the non-natives *Tanacetum parthenium, Cynoglossum creticum* and *Taraxacum officinale*, *Cerastium arvense* at 2500 and 3600 m elevation, respectively. In general, the presence of non-natives didn't affect the native species density, although species richness at the community level is decreased by the non-natives. While some native species were affected by the presence of non-natives, others were favored. Thus, a complex network of species-specific interactions and effects was observed, open questions about the real impact of non-native species on the native vegetation and how this can vary in the future. Fondecyt-1130592&F-ICM-P05-002.

STAYING IN THE SAME PLACE OR LAGGING BEHIND? PATHS AND OBSTACLES FOR CRITICAL INNOVATION IN ECOLOGY

S16.1 - GENERATING NURTURING AND COMMUNICATING IDEAS IN ECOLOGY

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Technological advances in communication and publishing open up numerous opportunities to generate ideas; develop them through their early stages of development; bring in initial funding; communicate the findings and further allow those ideas to develop dynamically. Innovation at all of these stages could potentially enhance science and discovery or opportunities could be squandered through adherence to current models. Those involved in the support and communication of science need to lead such innovation but also be open to it and able to adapt to it.

S16.2 - THE ESSENTIAL ROLE OF ECOLOGY IN THE ANTHROPOCENE; A CALL FOR BRIDGING DISCIPLINES

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The world is facing unrecognized challenges; the scale, speed and interconnectedness of human influence on the biosphere are reshaping the role of ecology. Humanity cannot address these challenges a deep understanding of ecology and our interactions with the biosphere. Likewise, ecology can never answer the emerging research questions of the current intertwined systems of people and nature in itself. Instead, a much more, systematic and thorough integration of ecology with other disciplines is needed. Consequently, society needs ecologists to step up to better address how to understand and manage these new relationships. This includes developing new methods and collaborations to address new research questions. I will in my talk explore successes of ecological interdisciplinary innovation, including studies of ecosystem services, social-ecological systems, resilience, ecological economics, planetary boundaries, and the concept of the Anthropocene. I will reflect on what makes interdisciplinary projects succeed, and fail. I will also explore the steps we need to take to ensure that ecologists can be the active part we need to be in the future development of a science that benefits both people and the biosphere, and that builds on a deep knowledge and respect for the fundamental processes that enables life on this planet.

S16.3 - INNOVATION AT THE SCIENCE-POLICY INTERFACE: BUILDING ALLIANCES

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Over recent years there have been numerous initiatives to promote the use of environmental knowledge in decision-making, most notably the creation of IPBES. Silo mentalities and myths, however, hinder the development of more effective science-policy interfaces (SPIs). Based on the results of a recent project (http://www.spiral-project.eu/), we identify a number of ways to improve SPIs. Realising improvement will depend on a complete shift in how we perceive the science and policy domains and their intersection. A shift from “interfaces” to alliances where policy and science know each other and act together for improved research and decision-making. This shift will require incentives for individuals to improve how science and policy operate and interact, increased transparency, quality inter- and trans-disciplinary research, and strategic long-term visions. All this will be dependent on significant changes in training, supporting and incentivising those scientists and policy actors enthusiastic about crossing boundaries and carrying out activities at the science-policy-society interface. A genuine move away from silo approaches is needed to begin building alliances between science, policy and ultimately society. Only then will we see the increase in the quality of both science and decision-making needed to address the societal and environmental challenges of the 21st Century.

S16.4 - CHALLENGES IN GLOBAL BIODIVERSITY MONITORING FOR THE NEXT DECADE

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Recent studies based on global vegetation plot data and assemblage time series data have raised doubts on whether the perceived declines on global biodiversity are real. A problem with those studies is that they use the limited data globally available. These data has been shown to miss some of the areas undergoing faster habitat change. Addressing these gaps requires the development of a global biodiversity monitoring system. Here we present the efforts of the Group on Earth Observations Biodiversity Observation Network (GEO BON) towards this goal. We discuss how the development of the Essential Biodiversity Variables framework facilitates the harmonization of biodiversity monitoring systems. We present the Bon-in-a-Box initiative aimed at providing countries and organizations with a ready to use toolkit for biodiversity monitoring. Finally, we conclude with a discussion on the role of scientists in contributing to the development of such a network and identify some key research questions on biodiversity monitoring.

S16.5 - ANIMALS AS GLOBAL INTELLIGENT SENSING NETWORK

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Modern animal ecology is starting to understand and monitor the wealth of information encoded in the behavior of wild animals on a global level. Especially the study of animal movement is entering a golden age because we now have the technology and the theoretical underpinnings to provide fundamentally new insight into the bio-treasure of collective life on the planet. I will highlight advances and future directions that allow us to understand the enigmas of: 1) Mechanisms and patterns of selection: Where, when and why an animal dies, which will answer the ultimate question about selection pressures, and help advance conservation. 2) Ontogeny: How movement develops during an individuals lifetime. 3) Environmental constraints: The external surroundings upon which an individual decides. 4) Social constraints: How an individual decides based on the decisions of other animals around it. We can and should involve the public in interacting and communicating with animals. Animals are, often in native cultures, already used as indicators and sentinels for biological and earth processes. Modern observational tools allow us to interact with animals in unforeseen ways and change our perception about the connectivity of life on the planet. Thus, wild animals will become the seeing-eye dog for humankind.

S16.6 - SEMANTIC INTEGRATION TOWARDS DATA INTEROPERABILITY

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Ecology is becoming a big data science: this requires access to distributed data sets. The wealth of data collected in ecology over the last decades creates exciting new research possibilities, but it comes with the challenge of accessing and integrating data from disparate sources with low degree of harmonization. As ecological research is spanning several sub-disciplines and as it becomes more integrative and automated, data access, terminology standards and tools that allow both scientists and computers to communicate more effectively with one another are imperative. The availability of harmonized data will expand the horizon of data analyses and pave the way for improved scientific syntheses. Here we present examples of recent progress and future challenges with a focus on plants traits: Highlighting the development of a community agreed controlled vocabulary for plant traits in ecology, initiatives providing access to consolidated trait data and the opportunity of added value by data re-use and integration.

S16.7 - CRITICALLY NEEDED NEXT STEPS FOR INCREASING QUALITY AND EFFICIENCY IN PEER-REVIEWING

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In this talk I will discuss two issues in peer review that deserve consideration and that are the "foundation stones" of Peerage of Science. 1) Peer judgement and scoring of the peer reviews. Academic community, and the publishing industry, needs to have the courage to say out loud that the quality of peer review contributions has a very large variance, and act accordingly. Only then we can begin to give academic recognition for excellence in peer reviewing, and thereby drive improved quality assurance in academic publishing. Peer review of peer review as implemented in Peerage of Science encourages this change. 2) Concurrent, or at least shared, use of peer reviews by journals. The traditional, onerous and slow "slide down the journal prestige ladder" submission practice is not only wasteful, but harmful to scientists, and to science itself. Submission cascade systems are a step forward, but we can move further and make a single set of reviews available from a trustworthy source for any and all journals that want to use them.

S16.8 - ASK NOT WHAT YOUR SOCIETY CAN DO FOR YOU BUT WHAT YOU CAN DO FOR YOUR SOCIETY

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In 2013, at the joint meeting of the British Ecological Society and INTECOL, a week-long academic meeting celebrating the BES centenary, the International Network of Next Generation Ecologists (INNGE) held a meeting nobody anticipated. The organisers in the BES didn't know about it. INTECOL didn't plan it. INNGE held a guerrilla meeting within a meeting. A get off your plush seats, and out of your traditional symposia meeting. A stop listening and start interacting meeting. The future of academic and learned societies lies with the next generation of researchers. It lies with the people who can use technology and disrupt the current platform of "service". It is about transforming the current platforms we use to generate interaction and disseminate knowledge. The next generation must stand up, create, participate and disrupt. And the current generation must open their arms and allow it to happen, and grow the platform for interaction, debate and celebration many generations of ecologists built with commitment and vision.

S16.9 - THE PAST AND FUTURE OF COMMUNICATION AMONG ECOLOGISTS

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Long-distance communication in the field of ecology was historically limited by the medium and process of scientific discourse. For example, communication among early naturalists in the 19th Century took the form of hand-written letters, which could take months for delivery by sea. Communication across longer time periods among generations of ecologists has also been important, in the form of books or journals, but also herbaria and museum collections, that have archived information that can later be retrieved for purposes such as re-surveys to determine how distributions and abundances of plants and animals have changed. The digital revolution in communication facilitated by the Internet and World Wide Web has taken place within the lifetime of most living ecologists, facilitating the speed and distance of scholarly communication, and making possible collaborations of widely-distributed researchers. For instance, the ECOLOG-L listserv list now serves as a means of daily communication among over 19,000 participants, from over 60 countries. Digital communication is also revolutionizing the world of publishing, with the push for open access to digital resources, and the enforced archiving of data, and is likely to result in changes in how ecologists interact for purposes such as grant review panels and professional meetings.

BIODIVERSITY AND ECOSYSTEM FUNCTION EXPERIMENTS WITH TREES

S17.1 - BIODIVERSITY EFFECTS ON FUNCTIONS AND SERVICES OF TREES IN THE FOREST, THE FIELD, AND THE CITY; HOW CAN EXPERIMENTS HELP?

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Biodiversity and Ecosystem Function (BEF) research is now well over 20 years old. Lately, the focus has changed to include more functions than the initial above-ground primary productivity, and the increasingly important idea that functions, and therefore diversity, are linked to the ecosystems services on which humanity is dependant. Focus is also moving from species richness to species functions in an attempt to identify the mechanisms that promote complementarity. Only in the last 10 years has BEF research focused on tree species, following ongoing demonstrations of the effect of diversity in natural forests, in plantation forestry, and in agriculture (agroforestry). Since 2008 humanity has switched to a predominantly urban species, but BEF has not followed this trend, whereas the people most affected by the loss of diversity and its effect on the services they depend on now live in cities. How can urban green infrastructures be included in BEF research, and how can we bring this knowledge to people, in adapting BEF experiments so they also serve educational purposes in cities. Recent developments in the International Diversity Experiment Network with Trees (IDENT) will be presented.

S17.2 - EXPLORING THE FUNCTIONAL SIGNIFICANCE OF FOREST DIVERSITY: AN UPDATE FROM THE LONG-TERM BIOTREE EXPERIMENT

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Manifold global changes are leading to a loss of tree species diversity and the simplification of forest ecosystems worldwide. Whereas decades of research in manipulated herbaceous communities have revealed the important role of plant species diversity for ecosystem functions such as biomass production, much less research has focused on tree dominated systems, in part due to the greater length of time required for interactions among individuals. However, the opportunity now exists in a number of experiments to explore the effects of more than a decade of species interactions. We will provide an update on the BIOTREE experimental site *Kaltenborn* which established in 2004 and re-censused in 2014. Specifically, the Simplex experiment consists of several mixtures with varying proportions (ranging from dominance to even) of *Picea abies, Pseudotsuga menziesii, Quercus robur and Fagus sylvatica*. We will report results of a plot-based, as well as a neighbourhood analysis of tree growth, which aims to test how variation in density and evenness of mixtures influences the balance of intraspecific and interspecific competition and in turn tree growth.

S17.3 - RESPONSE OF BRANCH ARCHITECTURE TO NEIGHBORHOOD COMPETITION IN A YOUNG TREE DIVERSITY EXPERIMENT

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Branch architecture of young trees is important in determining economic stem quality potential. Branch development in young forest stages is crucial for determining stem quality characteristics in later forest stages. Additionally, because effects of neighboring tree diversity and tree assemblage were rarely taken into account, the importance of these factors remains uncertain. The aim of this research is to test tree diversity and tree assemblage effects in branch architecture models of young trees to improve economic guidelines for mixed forest silviculture.We developed species-specific mixed regression models for branchiness, branch occlusion and branch insertion angle of *Quercus robur, Fagus sylvatica, Betula pendula, Pinus sylvestris and Tilia cordata* trees. Data were collected at the Zedelgem site of the FORBIO experiment, a five year old tree diversity experiment in Belgium (www.treedivbelgium.ugent.be). For 400 target trees, we measured variables at tree-level (tree height, stem diameter and crown size) and at branch-level (height, length, diameter, azimuth and insertion angle of first order branches). The target tree's competitive neighborhood was defined by species identities and dimensions of the eight surrounding trees. Provisional results show that the number of first order branches increased along the diversity gradient for *B*. *pendula* but no effect was found for the other species.

17.4 - DO BIRDS SEE THE FOREST FOR THE TREES? SCALE-DEPENDENT EFFECTS OF TREE DIVERSITY ON AVIAN PREDATION OF ARTIFICIAL LARVAE

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The enemies hypothesis states that reduced insect herbivory in mixed-species stands can be attributed to stronger top-down control with increasing plant diversity. Although evidence for this mechanism exists for invertebrate predators, studies on avian predation are rare and none explicitly test effects of diversity at different spatial scales, even though heterogeneity at macro- and micro-scales can influence bird foraging selection. Using a long-term forest diversity experiment in SW Finland, we tested the hypothesis that bird predation rates on artificial larvae would increase with tree species richness and that this effect might vary with spatial scale. Our findings show that, even in the presence of strong foraging preferences for individual tree species, bird predation rates were still higher where trees were located in more diverse neighbourhoods. However, predation rates did not increase with plot species richness and were, instead, negatively affected by tree height variation suggesting that the positive effects of neighbourhood tree species richness are not mediated by changes in structural complexity or niche availability. This study therefore finds partial support for the enemies hypothesis and highlights the importance of spatial scale and focal tree species in modifying trophic interactions between avian predators and insect herbivores in forest ecosystems.

S17.5 - THE OUTCOME OF ECOSYSTEM MANIPULATION BY ELEVATING ATMOSPHERIC CO_2 IS INFLUENCED BY TREE IDENTITY AND MIXTURE

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Free Air Carbon dioxide Enrichment (FACE) has often been used to predict the response of forest ecosystems to a future high CO_2 world. Many of these investigations have been restricted to exposure of single species or genotypes to elevated CO_2. To investigate the interaction between tree mixture and elevated CO_2, *Alnus glutinosa, Betula pendula* and *Fagus sylvatica* were planted in areas of single species and a three species polyculture in a free-air CO_2 enrichment study (BangorFACE). Above ground woody biomass was increased in polyculture under both ambient and elevated CO_2, but the response to elevated CO_2 wassmaller in polyculture than in the monocultures. Fine root biomass and morphology responded differentially to the elevated CO_2 at different soil depths in the three species when grown in monocultures. In polyculture, a greater response to elevated CO_2 was observed in coarse roots, and fine root area index. Our results show that the aboveground and below ground response to elevated CO_2 is significantly affected by intra- and inter-specific competition, and that elevated CO_2 response may be reduced in forest communities comprised of tree species with contrasting functional traits but also that other environmental factors may induce previously unseen effects.

S17.6 - THE ROLE OF MYCORRHIZAE IN TREE DIVERSITY EFFECTS ON ECOSYSTEM FUNCTIONING AND TROPHIC INTERACTIONS - THE MYDIV RESEARCH PLATFORM

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Mycorrhizae play an important role in plant nutrient and water uptake from soil and, consequently, in nutrient cycling of the whole system. Ectomycorrhiza and arbuscular mycorrhiza are characterised by fundamentally different strategies. It has often been found that in plant communities with highly diverse mycorrhizae the utilisation of soil nutrients is more efficient as compared to less diverse ones. However, the roles of the two major mycorrhizal types within the soil food web are still poorly understood. The experimental platform MyDiv aims to study the influence of a crucial plant functional trait – type of tree mycorrhizal association – on the relationship between tree diversity and ecosystem functioning. The experiment focuses on the following main hypotheses: (1) AM fungi and EM fungi are a source of functional complementarity between different tree species. (2) Diverse mycorrhizal associations enhance the positive relationship between tree diversity and ecosystem functioning. (3) Tree communities with diverse mycorrhizal associations foster more diverse soil animal communities compared to communities of only one mycorrhizal type. At the experimental site, tree species were planted as monocultures, 2-species, and 4-species mixtures. At each of the tree diversity levels, communities with only ectomycorrhizal, only arbuscular mycorrhiza or mixtures of both groups were planted.

S17.7 - TREE SPECIES IDENTITY INFLUENCES THE VERTICAL DISTRIBUTION OF LABILE AND RECALCITRANT CARBON IN A TEMPERATE DECIDUOUS FOREST SOIL

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In terrestrial environments, soil organic matter (SOM) is the largest organic carbon (C) pool. The amount of organic matter in soils can be affected by the traits of tree species inputs and outputs. An acid hydrolysis approach was used to quantify three SOM fractions viz. labile (fraction 1 and 2) and recalcitrant (fraction 3). We examined how C stocks were affected by tree species traits in soils under grass or single and a polyculture of Silver birch (*Betula pendula*), Black alder (*Alnus glutinosa*) and European beech (*Fagus sylvatica*). Tree species identity and stand composition had no significant effect on the amount of C stored in different SOM fractions however, in the upper layers of the soil profile, significantly more C held in fractions 1 and 2 was found under F. sylvatica and A. glutinosa. In deeper soil layers the highest storage of recalcitrant organic C was found under tree polyculture. Although clay content was associated with soil organic C (r2 = 0.41) but no strong relationships with labile or recalcitrant C fractions were observed. Our data indicated that in the polyculture of these tree species can have a positive effect on the amount of recalcitrant C in deep soil layers.

S17.8 - RELATIVE IMPORTANCE OF TREE SPECIES AND GENETIC DIVERSITY FOR ANTI-HERBIVORE DEFENCES AND INSECT HERBIVORY IN BOREAL FORESTS

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Both tree species diversity and intraspecific genetic diversity may affect insect herbivory, with diverse stands often being less susceptible to insect damage than monocultures. However, the relative importance of species and genetic diversity for insect herbivory and the role of anti-herbivore defenses in mediating these relationships are still poorly explored. We examined the relative effects of tree inter- and intraspecific diversity on anti-herbivore defenses and insect herbivore damage using two comparable long-term forest diversity experiments established in boreal forests of SW Finland in 1999-2000. Insect herbivory and defensive leaf traits were compared between silver birch trees of different genotypes planted either in monocultures/monoclonal stands or in mixtures with other tree species or other silver birch genotypes. Damage by different insect feeding guilds (chewers, miners, gallers and rollers) was quantified separately and a number of leaf defence traits including leaf toughness, total phenolics and their oxidative capacity were measured. We tested the predictions that (1) insect herbivore damage on birch decreases while anti herbivore defenses decreases with an increasing tree species richness and genetic diversity, and 2) the interspecific diversity effects is stronger than intraspecific diversity effects.

S17.9 - BIODIVERSITY EFFECTS ON SOIL MICROBIAL RESPIRATION IN A GLOBAL NETWORK OF TREE DIVERSITY EXPERIMENTS

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The relationship between biodiversity and ecosystem functioning (BEF) is a hot topic in current ecological research. Many ecosystem functions and services are provided by the belowground system, e.g., decomposition and nutrient mineralization, although BEF research has only recently started to acknowledge the significance of soil organisms. Microorganisms are the main drivers of such processes and understanding their response to changes in plant diversity will help to mechanistically understand the links between plant diversity and ecosystem functioning. A critical step is to come from single observations to deriving general patterns, e.g., by using the same high-throughput analyses in many experiments in different abiotic and biotic contexts. We use the substrate-induced respiration (SIR) method to 1) measure different soil microbial properties (respiration, microbial biomass, carbon use efficiency) in different tree diversity experiments, 2) identify tree species, which may have a strong influence on soil microbial properties, and 3) identify and evaluate other tree diversity- and identity-mediated factors being important for soil microorganisms (plant traits and phylogeny). With this global approach we aim to extract general patterns in the relationship between tree diversity and soil microbial respiration.

S17.10 - EFFECTS OF PLANT GENETIC DIVERSITY ON ARTHROPODS: A META-ANALYSIS

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The effects of plant genetic diversity on arthropods are still poorly understood compared to those of plant species diversity. We conducted a meta-analysis to combine the results of 36 studies on woody and herbaceous plants which have manipulated plant genetic diversity by using single genotype and genotypic mixtures and assessed the effects of plant genetic diversity on diversity and abundance of arthropods. The overall effect of plant genetic diversity on arthropods was significant and positive and increased with the number of plant genotypes in polycultures. Herbivore abundance and species richness were significantly higher in plant genetic polycultures than in single genotype stands. Moreover, effects of plant genetic diversity on herbivore abundance depended on herbivore feeding specialisation and plant type. Higher herbivore abundance in plant genetic polycultures was found for specialist herbivores and for both woody and herbaceous plants, but not for crops. Responses of arthropod predators and parasitoids to plant genetic diversity were not significant. Overall, we showed that plant genetic diversity has significant effects on herbivores and arthropods and as such should be considered when creating and restoring forest and woodland habitats for the potential effects on herbivore abundance and diversity.

S17.11 - PHOTOSYNTHETIC EFFICIENCY OF FOREST TREES IS INFLUENCED BY ECOLOGICAL FACTORS, STAND STRUCTURE AND TREE DIVERSITY IN EUROPEAN FORESTS

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The functionality of forests depends largely from the health and physiological performances of singular trees. There is a large body of literature that evidences functional interaction (competition and/or facilitation) between neighboring trees of different species. These interactions may be at hypogeal (water and nutrient use) or epigeous (light use) level and can be assessed by means of foliar analysis. Among all the parameters retractable from leaves, the photosynthetic efficiency assessed with chlorophyll a fluorescence – ChlF, demonstrated to be very informative. Within the project FunDivEUROPE, ChlF parameters were assessed through two European tree diversity platforms, constituted respectively by experimental and explorative forests. The overall survey covers all the main vegetational and climatic conditions, from Mediterranean to boreal regions. The patterns of ChlF parameters in relation to tree diversity depended from ecological factors of sites and tree species. *P. abies* trees in the Northernmost explorative site decreased their photosynthetic efficiency with increasing diversity, but the opposite trend was observed at the Southern site. The role of climatic and structural factors is analyzed and discussed. *P. abies* responded differently also in two of the experimental sites. Opposite patterns were attributed to the competition for light at different state of development of the stands.

S17.12 - META-ANALYSIS OF TREE SURVIVAL IN BIODIVERSITY EXPERIMENTS ACROSS THE GLOBAL NETWORK TREEDIVNET

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One component of the insurance effect of biodiversity is the prediction that more diverse communities should establish better because they have reduced variation in tree mortality during the early years, thanks to species with lower mortality rates compensating for others with higher rates. We tested this theory using a dataset of the survival of young trees across a global network of field experiments with trees (TreeDivNet: www.treedivnet.ugent.be). These experiments contain plots differing in species richness (SR), so that over the whole dataset the SR gradient goes from 1 to 24 species. We conducted a meta-analysis of tree survival to test i) the insurance effect of tree diversity (looking at whole-plot survival, all species combined), and ii) the effect of interspecific interactions (species-specific survival). Results reveal interesting trends: at the plot-level, the grand mean effect size was significantly positive, meaning that mixtures had better survival than monocultures, whereas the species-specific mean effect size overlapped zero. Full models including several moderators showed significant effect of the SR level (only for species-specific survival), year (only for whole-plot survival), and plot composition. Overall, we did observe an insurance effect of diversity on tree survival across a broad range of tree species and compositions, and across biomes.

S17.13 - COMMON GARDENS OF THE 21ST CENTURY: CONTRIBUTION OF TREE DIVERSITY EXPERIMENTS TO SUSTAINABLE REFORESTATION

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The area of forest plantations is increasing worldwide helping to meet timber demand and protect natural forests. However, with global change many monospecific plantations are increasingly vulnerable to abiotic and biotic disturbances. As an adaption measure we need to move to plantations that are more diverse in genotypes, species and structure, with a design underpinned by science. TreeDivNet (www.treedivnet.ugent.be), a global network of tree diversity experiments, responds to this need by assessing the advantages and disadvantages of mixed species plantations. The network currently consists of 17 experiments, distributed over 33 sites and five ecoregions. With plantations 1 to 15 years old, TreeDivNet can already provide relevant data for forest policy and management. In this talk, I highlight some early results on the carbon sequestration and pest resistance potential of more diverse plantations. Finally, suggestions are made for new, innovative experiments in understudied regions to complement the existing network.

COMBINING EARTH OBSERVATIONS WITH EXPERIMENTAL STUDIES FOR DEVELOPING SUSTAINABLE EOSYSTEM SERVICES AND NATURAL RESURCES

S18.1 - HOW TO USE NATURAL ECOSYSTEMS FOR COASTAL DEFENSE: UNDERSTANDING ECOSYSTEM CREATION & DYNAMICS

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Coastal flood risks is likely to increase over the coming decades, due to the combined effect of increasing storm intensity, accelerating sea- level rise and land subsidence. In many locations, the maintenance of conventional coastal engineering solutions for coastal defense may become unsustainable. Combined with the rapidly growing population in costal areas, this put humanity for the challenge to develop innovative ways to defend our coastlines. Ecosystems may provide valuable services in providing flood safety. Hence, a growing body of literature proposes that flood protection by ecosystem creation and restoration may provide a more sustainable, cost-effective and ecologically sound alternative way to defend our coastlines (*Temmerman et al. 2013 Nature 504: 79-83*). There are however many issues to be resolved, to enable us to move this concept into a realistic plan, both from an safety perspective as well as an ecological perspective, with understanding the long-term ecosystem-dynamics and stability being a key issue to resolve (*Bouma et al. 2014 Coastal Engineering 87: 147-157*). Within this talk, I will highlight

i) promising opportunities for using ecosystems for their coastal defense ecosystem service in the future

ii) recently acquired knowledge relevant for restoration and management of dynamic ecosystems for coastal defense

iii) how to combine different techniques, field based vs. remote sensing, in obtaining a mechanistic understanding of the ecosystem dynamics

S18.2 - USING THE SATELLITE IMAGE ARCHIVES FOR COASTAL AND MARINE ECOSYSTEMS SERVICES MONITORING

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The wide variety of environments ranging from the Po river delta and the adjoining coast in the Northern Adriatic Sea; the Tyrrhenian Sea central Italy dune ridges; the complex land-sea system of the Waddenzee, comprising the Netherland inner coast and the islands in the North Sea, have extensive variety of tidal mud flats, saltmarshes, dune ridges and sandy spits between the mainland and the sea waters. All these ecosystems, support valuable sediment and primary production regulation, as well as they regulate the quality of the waters and the life in it. Interesting mapping products from these test casescan describe spatial and temporal trends of both vegetation cover/typology and sediment/soil distributionand can be associated to the aquatic quality having detailed classification from EO products. Classifications from multisource datasets of images analyzed in terms of spatial (Power law) and temporal (Empirical Orthogonal Function) patterns are progressively selected as indicators for ecosystem services provision. The presentation will show different areas where the biophysical products of mapping are interpreted as suitable to generate ecosystem services mapping. Sediment regulation, primary productivity, water quality and fish harvest will be discussed. The specific addedvalue of the proposed mapping can provide an integrated assessment in terms of coastal and maritime spatial planning and ecosystem services valuation.

S18.3 - COASTAL PROTECTION: A SUSTAINABLE ECOSYSTEM SERVICE

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Given growing human encroachment on coasts, coupled with increasing flooding risks associated with the occurrence of extreme hydrometeorological events, the protection of coasts is becoming a critical issue worldwide. However, there is no consensus on the meaning of “coastal protection”. To some it may mean building structures which halt coastal erosion and protect property; to others it may mean, allowing coastal ecosystems to function naturally and conserve their dynamics. The outcomes of these different perceptions are contrasting. In this paper we first show that, when possible, ecosystem-based coastal defense programs (coastal dunes with native vegetation), would allow natural shifts in beach-dune systems. As a result, the resilience of the coast is recovered and maintained, making this an alternative to conventional coastal engineering, which does not usually leave sufficient space for the dissipation of marine energy. Secondly, we show how non-intrusive tourism can be compatible with the conservation of coastal dynamics. Finally, we analyze scenic beauty and recreation as an additional ecosystem service provided by beaches and coastal dunes. In summary, with some examples, we show how different littoral cells maintain, or not, ecosystem services (protection, habitat and recreational) which may allow dynamic equilibrium between economic necessities and sustainable ecosystem services be achieved.

S18.4 - DATA ASSIMILATION OF REMOTE SENSING IMAGES IN A PORTABLE OPERATIONAL FORECASTING BLOOMS SYSTEM: STUDY CASE ALGAE BLOOMS IN THE NORTH SEA

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The ecological state of the North Sea surface water can be indicated by ocean variables such as the Chlorophyll-a (chlorophyll-a) concentration. Chlorophyll-a is the principal photosynthetic pigment and is common to all phytoplankton and can therefore be used as a measure of phytoplankton biomass. The D-Water Quality (GEM) model developed at Deltares is a generic ecological model that simulates transport of substances in a water system along with various ecological processes. This model is able to estimate the chlorophyll-a concentration operationally for the North Sea. Models are always prone to errors due to assumptions made for simplification and the use of numerical approximations. Such errors can be reduced through the use data assimilation and thus can significantly improve the forecast. The use of remote sensing images in improving the forecast is attractive due to its spatial coverage. The model parameters affecting the algae bloom have been optimized with respect to the MODIS remote sensing data of Chlorophyll-a by means of the generic simulated annealing algorithm. The algorithm has been redesigned in an innovative parallel framework that optimizes the searching procedure while considerably reducing the number of iterations. The optimization is carried out for the year2007. Validation of the results on the years 2003-2008, we conclude that the optimization has improved the model results to better match the MERIS data at the surface in all regions, and in particular along the Dutch and the English coast. Validation of the optimised model results to independent in situ data indicates global improvements. The operational forecasting system setup is generically setup that is portable to other study case or other marine or water systems.

S18.5 - DELTAIC MARGINS VULNERABILITY: THE ROLE OF LANDSCAPE PATCHES IN FLOOD REGULATION AND CLIMATE ADAPTATION

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Deltas are widely identified as vulnerable hotspots at the interface of the continental land mass and the world's coastal boundaries. With respect to increasing risks related to global change, the concept of ecosystem services has a capacity to contribute to safety of both, social and natural systems and vulnerability reduction. Here we study the role of the pool of ecosystem services in terms of flood mitigation and vulnerability reduction, in a deltaic margins of the European coast: the complex land-sea system of the Waddenzee, comprising the Netherland inner coast and the islands, North Sea. Extensive tidal mud flats, saltmarshes, dune ridges and sandy spits between the mainland and the chain of islands, support valuable sediment and primary production regulation along the seaside of these ecosystems. The system includes an incentive ecosystem structure (dune system) whereby economic agents would choose development activities that reduce vulnerability (flooding protection and erosion prevention) as well as satisfy production objectives (recreation and tourism). Vulnerability values extracted using remote sensing processors represent an innovative development of systems and methodologies. Using remote sensing observations, we investigate the distribution of spatial vegetation and substrate patterns controlled by changes in environmental variables acting on deltas, and we speculate the conditions under which the Real Elementary area can be defined.

VITO VOLTERRA SYMPOSIUM ON MATHEMATICAL MODELS IN ECOLOGY

S19.1 - MODELS FOR RESOURCE COMPETITION: A BRIEF PERSONAL REVIEW

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In an influential paper Volterra (1926) proved that only one species could persist in a competition model. His analysis was the basis for the principle of competitive exclusion, formulated and verified experimentally by Gause (1935). A proof of competitive exclusion in a general model of resource competition was given by Armstrong and McGehee (1980), where it was also discussed non-equilibrium coexistence can occur under circumstances that would otherwise lead to competitive exclusion. In this talk, after reviewing these results together with recent progress (e.g., Li and Smith, 2003), we present a simple geometric approach to competition for two resources, based on splitting population dynamics from resource exploitation. Using this approach results on coexistence vs. exclusion become very transparent.

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S19.2 - KEY PLAYERS IN ECOLOGICAL INTERACTION NETWORKS: FROM GRAPH THEORY TO CONSERVATION

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Modern conservation biology should be quantitative, predictive and efficient. This direction of research is supported by large databases, novel analytical tools and systems-based approaches. Systems ecology offers a holistic view on nature and it offers new computational tools to quantify the relative importance of species (identifying keystone species) and critically important interactions among them (indicating surprisingly strong indirect effects). The expanding toolkit of network analysis can be the basis for quantitative priority lists of important species, supporting ecosystem management in sustainable fisheries and systems-based conservation. In this talk, I overview the major challenges and illustrate some new techniques on a case study.

S19.3 - THE ROLE OF HETEROGENEITY ON THE INVASION PROBABILITY OF MOSQUITO-BORNE DISEASES IN MULTIHOST MODELS

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Stochastic events play a significant role in vector-borne epidemics, especially in the initial phase of an outbreak. Here, we use multi-type branching process approximations to assess how heterogeneities in transmission among a large number of host groups can affect the probability of major outbreaks occurrence in mosquito-borne diseases. We show that heterogeneities in transmission affect the probability of major outbreaks occurrence in different ways than the basic reproduction number (R_0). While R_0 always increases with the heterogeneity, the probability of major outbreaks after the introduction of infected hosts can decrease with the increase of the heterogeneity, even approaching zero when the number of host groups is large. In addition, we show that the probability of major outbreaks via infected vectors is always larger than via infected hosts when heterogeneous transmission is sufficiently high. Our findings suggest that, for multi-species infections or for single-species infections with patchy host distribution, the introduction of primary infected vectors may represent a higher risk for major outbreaks occurrence than introductions of infected hosts.

S19.4 - FLOQUET THEORY FOR SEASONALLY FORCED MODELS OF WATERBORNE PATHOGEN TRANSMISSION

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Waterborne pathogen transmission is a complex process that is heavily linked to the seasonal variability of hydrometeorological drivers. We study simple, time-varying models for the dynamics of two paradigmatic diseases: cholera and schistosomiasis. The former is an intestinal infection caused by ingestion of water contaminated by a microparasite (the bacterium *Vibrio cholerae*), while the latter is a macroparasitic disease caused by water-mediated contact with the larval form of some trematode worms (genus *Schistosoma*) that also need an intermediate snail host to complete their life cycle. Both cholera and schistosomiasis are neglected diseases with major health, social and economic impacts. Applying Floquet theory, which allows to extend results of local stability analysis to periodically forced dynamical systems, we find conditions for pathogen invasion and establishment in systems characterized by fluctuating environmental forcing. We show that temporal variability may have multifaceted effects on the invasion threshold, as it can either favor pathogen invasion or make it less likely. Some results concerning the extension of the proposed models to a spatially explicit context are also discussed.

S19.5 - MODELLING THE EFFECTS OF TICK-HOST INTERACTION ON PATHOGEN DYNAMICS: TBE AS A CASE STUDY

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Tick-borne encephalitis (TBE) is an emerging vector-borne zoonosis reported in Europe with complex transmission routes that involve key vertebrate host species and a major tick vector. Understanding interactions between ticks and main hosts involved in TBE virus (TBEv) cycle is crucial to quantify TBEv emergence and spread. We used eco-epidemiological models to explore the dynamics of ticks and TBEv infection in relation to the density of two key hosts, deer and rodents. Both hosts may act as tick amplifiers, but at high densities may also dilute pathogen transmission. Results were validated with empirical data from selected foci in Italy and Slovakia. In addition, we explored the effect on TBEv dynamics when using various distributions to describe tick aggregation on rodents. We modelled the number of ticks per rodent observed in Trentino (Northern Italy) with different theoretical distributions. Power Law (PL) distribution better described the heterogeneity observed in our data. Using a stochastic model, we observed that TBEv infection is highly dependent on the capability of the implemented model to describe tick burden on rodents. We found that the epidemic threshold and equilibria obtained with PL distribution are a good approximation of those observed in simulations feed with empirical distribution.

S19.6 - RAINFALL INTERMITTENCY AND SAVANNA DYNAMICS

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Savannas are important and widespread biomes on our planet, and have been carefully studied both experimentally and theoretically. Here I discuss some recent work I have been involved in, devoted to the construction and analysis of a simple ecohydrological model for savannas based on tree-grass competition and coexistence (Baudena et al. 2010). The coupling with a simplified model for soil humidity dynamics allows for better taking into account the role of rainfall intermittency (D'Onofrio et al. 2015). After discussing the specific inferences of this model, I shall delve into some general issues related to the study of coupled vegetation-climate dynamics and cross-scale interactions.

S19.7 - ON THE LOTKA-VOLTERRA POPULATION GAMES

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The Lotka-Volterra predator-prey model is one of the earliest and, perhaps, the best known example to describe predator-prey population dynamics. This model assumes that interaction strength is fixed and independent of population densities. However, empirical evidence suggests that both prey and/or predators change their behavior with changes in population numbers. For example, an increase in predator numbers often decreases prey activity. Such plasticity in animal behavior (that occurs on a fast time scale when compared with demographic changes) leads to variable interaction strength that qualitatively changes predictions of the Lotka-Volterra population dynamics. Evolution of interaction strength can be modeled as a predator-prey game where prey try to avoid predators while predators try to capture prey. Solutions of these games, often expressed in terms of evolutionarily stable strategies, define how interaction strength depends on population densities. As these feedbacks are often multivalued, the corresponding Lotka-Volterra population dynamics are described by differential inclusions. In my talk I will discuss some examples of Lotka-Volterra population games.

S19.8 - BIOLOGICAL CONTROL OF THE CHESTNUT GALL WASP WITH T. SINENSIS: A MATHEMATICAL MODEL

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The Asian chestnut gall wasp *Dryocosmus kuriphilus*, native of China, has become a pest when it appeared in Japan, Korea, and the United States. In Europe it was first found in Italy, in 2002. From 1977, the host-specific parasitoid *Torymus sinensis* was introduced in Japan, in an attempt to achieve a biological control of the pest. After an apparent initial success, the two species locked in predator-prey cycles of decadal length. We have developed a spatially explicit mathematical model that describes the seasonal time evolution of the adult insect populations, and the competition for finding egg deposition sites. In a spatially homogeneous situation the model reduces to an iterated map for the egg density of the two species. While the map would suggest, for realistic parameters, that both species should become locally extinct (somewhat corroborating the hypothesis of biological control), the full model shows that the introduction of *T. sinensis* sparks a traveling wave of the parasitoid population that locally destroys the pest. The latter, by diffusion, is later able to re-colonize the empty area left behind the wave. The two populations do not seem to attain a state of spatial homogeneity, but produce an ever-changing pattern of traveling waves.

LONG-TERM ECOLOGICAL RESEARCH (LTER) - THE EUROPEAN PERSPECTIVE

S20.1 - ELTER – EUROPEAN BACKBONE INFRASTRUCTURE FOR INTEGRATED LONG-TERM ECOSYSTEM CRITICAL ZONE AND SOCIO-ECOLOGICAL SYSTEM RESEARCH

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Collective effort is needed to create the environmental research infrastructure for answering pressing questions in a world of rapid social, economic and environmental change. The overall purpose of eLTER is to provide a European distributed infrastructure of long-term research sites for multiple use in the fields of ecosystem, critical zone and socio-ecological research, and to secure highest quality interoperable services in close interaction with related European and global research infrastructures. Major goals are to (1) comply with user needs for the research infrastructure in relation to major societal challenges; (2) establish a cost-efficient pan-European network, able to address multiple environmental research issues, by integrating approaches from long-term observation to experimentation and remote sensing; (3) providing a framework for data integration and virtual access to the eLTER data legacy; (4) foster the usability and multiple use of information and services. The LTER-Europe network and the Critical Zone research community collaborate to achieve these goals in close interaction with the related RIs, securing synergistic European contributions to a global research market in the scientific area. The step-wise construction of eLTER capitalizes on a pool of about 400 sites in 24 countries, providing data on long-term trends in environmental change across Europe.

S20.2 - AIMS AND CHALLENGES OF THE SCIENTIFIC ANALYSES OF LONG-TERM ECOSYSTEM RESEARCH

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Ecosystem functions providing services relevant to society interact in extremely complex spatial patterns from local to global. The time scale of interactions ranges from microseconds up to phenomena driven by variations in Earth's orbit. Long-Term Ecological Research is a crucial component to disentangle processes and their drivers across the appropriate temporal scales in order to understand the planet or “earth system” in search of answers to the great challenges facing humanity like climate change, loss of biodiversity, eutrophication and pollution. Some key questions for managing and sustaining ecosystem services in the face of continuing global change are: How are ecosystems/biodiversity changing or adapting to global-change stresses? What are determinants of ecosystem resilience? What are threshold interactions resulting in system shifts?How can we respond locally, nationally and at international levels to support systems that are more resilient to global change effects? Nevertheless, to make full use, it is important to implement an appropriate design, covering methodological, experimental, spatial, temporal and instrumentational aspects. In addition, complex analytical tools and procedures are necessary to take full advantage of the wealth of data resulting from such a concerted research infrastructure. Basic requirements and recommendation are given in the presentation.

S20.3 - LONG-TERM ECOLOGICAL RESEARCH ON SOIL CARBON SEQUESTRATION: EVIDENCE FROM THREE EUROPEAN GRASSLAND EXPERIMENTS

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Long-Term Ecological Research can greatly improve our mechanistic understanding of how human-induced environmental change may affect ecosystem functioning including soils' ability to sequester carbon (C). A key driver of ecosystem functioning remains the chronic addition of nutrients to soils and its effects on long-term C sequestration. Here I present results from three long-term grassland experiments established across the UK, which show how inorganic and organic nutrient fertilization can strongly affect the accumulation of C in soils through time. Grassland soils across Europe are considered critical food production systems which could also act as sinks of atmospheric CO_2. We need however to improve our ability to predict how grassland soils will respond to chronic additions of inorganic and organic forms of nitrogen. Here I demonstrate how well-replicated long-term experiments allow to: (1) measure soil C stocks, (2) estimate soil C sequestration rates across several years, and (3) address what biogeochemical mechanisms may affect long-term C accumulation in grassland soils. From a global change perspective, I show that nitrogen inputs to grassland soils can lead to greater C sequestration, a benefit however that has to be weighed against detrimental effects that nitrogen has on biodiversity, ecosystem N cycling and water quality.

S20.4 - LONG-TERM BEE AND BIRD COMMUNITIES OBSERVATION IN AGRICULTURAL LANDSCAPES: WHAT ARE THE DRIVERS OF TEMPORAL CHANGES

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What elements of biodiversity should be monitored? Pereira et al. proposed a hierarchically structured framework for “Essential biodiversity variables” (2013). In our study we cover several of the proposed levels (populations, traits, communities, ecosystem structure) focusing on birds and bees as part of the German TERENO project (Terrestrial Environmental Observatories) and the German LTER network. While there is a wealth of knowledge about national and European-wide trends in bird populations, bee communities are less accessible and thus it is more difficult to tell how they are affected by landscape composition and agricultural practice. Especially wild bees are important pollinators and suggested to respond on local scales (around 1 square km). Birds perceive habitat suitability from the bird’s eye view and their scale of activity is much larger. We analyze the temporal impact of landscape quality and land use parameters on these groups in six agriculturally dominated sites in Central Germany starting in 2001. Bee communities are severely affected by abiotic parameters like weather and show surprising effects in terms of species richness and abundance in different landscapes. In birds, species richness is not affected, but the number of territories declines especially in more diverse landscapes.

S20.5 - CHANGES IN RETENTION OF SULPHUR AND NITROGEN COMPOUNDS AT 18 EUROPEAN LTER/ICP IM SITES IN

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Annual input-output budgets for sulphate (SO4) and total inorganic nitrogen (TIN = NO3 + NH4) in the period 1990–2012 were calculated for 18 LTER/ICP Integrated Monitoring forested catchments across Europe. Trends in fluxes were analysed using the non-parametric Mann-Kendall test. In order to quantify the retention or release of S and N in the catchment, a percent net export (pne) was calculated as: pne = (output-deposition)*100/deposition. Sulphate budgets showed increasing percent net exports (pne) at majority of the sites, indicating a net release of previously stored SO4, particularly during the past 15 years. This process has taken place both in high and low sulphur deposition areas. In a selected set of sites, median values for S pne exhibited a significant increase ($p < 0.01$, 2.3 % yr-1) in 1990-2012. A net release of stored SO4 is acting as a H+ source. The pne of N generally ranged between -98% and -80% at the studied sites during the 2000s, indicating a strong retention of N in the catchment, and 50% of the sites exhibited increase in net retention. The study shows the importance of long-term intensively studied ecosystem sites for evaluating changes in deposition inputs and changes in climate.

S20.6 - INSIGHTS FROM LONG-TERM MONITORING DATA IN FRESHWATER SPECIES DISTRIBUTION MODELS: PREDICTIONS FOR STREAM MACROINVERTEBRATES IN THE GERMAN LTER-SITE RHINE-MAIN-OBSERVATORY

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Data arising from long term monitoring schemes is highly suitable for a wide range of ecological analyses, as standardized sampling provides homogeneous biotic and abiotic records in time and space. Such a dataset for 175 stream macroinvertebrate taxa from the German long-term ecological research (LTER) site Rhine-Main-Observatory was used to set up a high-resolution species distribution model (SDM) in the Kinzig catchment. SDM performance is known to rely largely on the properties of the input data, particularly the occurrence data, and this was reflected by models' good performance indicators across taxa (TSS = 0.83 ±0.09 SD; ROC = 0.95 ± 0.03). Further, the model predictions were used to gain insights on how occurrence data affects SDM performance. Three sources of bias were analyzed: (a) the taxonomic identification of the modeled organisms, (b) the spatial arrangement of sampling sites, and (c) the sampling intensity at each sampling site. While no effects of a taxonomic bias was found, predictions were affected by both spatial and temporal biases. This indicates that well-distributed and long-lasting monitoring schemes are necessary, but it most importantly suggests that heterogeneous and unstructured datasets, widely used in SDMs, bear significant bias.

S20.7 - RIDING THROUGH ECOSYSTEMS AND BIODIVERSITY: LONG-TERM ITALIAN ECOSYSTEM RESEARCH FOR THE CITIZENS

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Italian ecologists who are active in the Italian long-term ecosystem research (LTER-Italy) and in the study of biodiversity (Lifewatch-Italy), walk and cycle together with citizens along three paths organized as events of scientific dissemination. The paths, which are aimed at raising public awareness on ecosystems, biodiversity, and environmental sustainability, connect different LTER-Italy sites. They represent a sort of "Via Francigena" of the ecological research and offer citizens the opportunity to familiarize with the wealth and fragilities of Italian ecosystems. Observing the landscape at the natural speed of human walking or biking is the best way to appreciate the peculiarities of the surrounding environment, its diversity and ecological state. At the LTER sites and along the paths, researchers help citizens in recognizing and estimating the status of the vegetation, identify animals and plants, evaluate the degree of biodiversity, assess the quality of the waters of lakes and marine areas. Besides, citizens could meet researchers at work at the LTER-sites, join them in the fieldwork, understand the importance of the long-term ecological studies and activate initiatives of citizens science within the LTER and Lifewatch context.

S20.8 - LTSER PLATFORM POLONINY (SLOVAKIA) UNDERGOING SIGNIFICANT CHANGES

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The Poloniny LTSER platform represents a marginal region located in NE corner of Slovakia. The region exhibits permanent decrease of the human population since 1960-ties and 1970-ties. Significant changes in the land use during last decades represent a result of substantial politic and socio-economic changes. The remoteness as well as unfavourable economic and living conditions represent further factors causing the overall decline of agriculture. This is reflected in considerable increase of the forest cover land (1949: 65.1%, 2003: 85.4%, 2013: 84.2%) and corresponding decrease of agricultural land. The start of application of Common Agricultural Policy in 2004 hindered further decrease of agricultural land and many grasslands not managed for long time started to be managed again. Despite current AEP supports rather large-scale, intensive farming and we recognised homogenisation of non-forest land, the grasslands of the region maintain their biological quality and diversity. This we document by results of our study of grassland vegetation and invertebrates (mainly spiders and beetles). However, the existence of meadows in mountain ranges (“poloniny”) is threatened due to their remoteness and abandonment. Our results also allow to outline the possible future development of the region with focus to its sustainable development and biodiversity conservation.

THE CHALLENGE OF MANAGING MULTIPLE STRESSORS IN MARINE REGIONS: SUCCESS STORIES, OPPORTUNITIES FOR ACTION AND GAPS OF KNOWLEDGE

S21.1 - CUMULATIVE HUMAN IMPACTS IN MARINE ECOSYSTEMS: SETTING PRIORITIES FOR REGIONAL CONSERVATION PLANNING

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The Mediterranean Sea contains a large fraction of global marine biodiversity, matched by a rich cultural diversity. However, this hotspot of diversity is currently “under siege”. The Mediterranean has been intensely lived and utilized, which has led to major shifts in its marine ecosystems and widespread conflict among marine users. Analyses of the cumulative impact of multiple pressures reveal high impact within several areas. There are still opportunities to avoid future damage in areas that are still relatively unimpacted, off Croatia, Albania, Italy, Tunisia and Egypt, in offshore areas of the central Tyrrhenian, and in several small areas along the coasts of most countries. High impact results from multiple drivers, rather than one individual use or stressor, with stressors associated with climate change, such as increasing temperature and acidification of seawater, fishing techniques that alter the seafloor, such as trawling and dredging, ship traffic, and, in coastal areas, pollution from land, accounting for a majority of cumulative impacts. The future of the Mediterranean may look brighter, but its current dire state requires that the many pressures and demands are regulated through comprehensive planning. Integration of multiple proposed conservation plans for the Mediterranean highlight ten areas, encompassing 10% of the Mediterranean Sea, that are consistently identified among the existing proposals, with an additional 10% selected by at least five proposals. These areas represent top priorities for immediate conservation action.

S21.2 - GAPS OF KNOWLEDGE AND LIMITATIONS IN MARINE/MARITIME SPATIAL PLANNING: A LESSON FROM THE MEDITERRANEAN SEA

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Marine Spatial Planning (MSP) is an integrated process able to explicitly integrate the management of human activities allowing a sustainable use of marine resources. It is broadly applied around the world. Within the Mediterranean Sea, MSP within the EEZ of countries is now mandated by the EU Maritime Spatial Planning Directive and as part of the Marine Strategy Framework Directive. It represents an unprecedented opportunity to include conservation planning in the broader planning of marine uses with the aim of reconciling environmental protection and economic goals. While general lessons and models for implementing MSP can be derived from previous experiences in northern Europe and around the world, comprehensive spatial planning in the Mediterranean faces additional challenges associated with the political and governance complexities of a semienclosed sea shared by 22 countries and rapid demographic, policy and environmental change. Here, I discuss the gaps of knowledge in terms of levels of uncertainty in management interventions, thresholds and trade-offs in management options, and unknown outcomes of non-linear threat interactions when cost-effective threat reduction is implemented. Secondly, I identify concrete actions that should be prioritized for regional conservation planning, for advancing management measures aimed to improve the recovery of Mediterranean vulnerable habitats.

S21.3 - MULTIPLE STRESSORS AND THRESHOLDS IN REAL WORLD MARINE ECOSYSTEMS

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Coastal marine ecosystems represent systems of high value and multiple use. These uses result in environmental effects that often interact in complex ways. Using examples of different kinds of seafloor impacts, I will illustrate how cumulative effects can emerge at different space and time scales. Cumulative effects have the potential to lead to a loss of resilience in valued ecosystems and rapid transitions in ecosystem structure and function. Defining and assessing ecosystem interaction networks in natural ecosystems provides a way of allowing empirical evidence to contribute to our understanding of potential multiple stressors. Changes in ecosystem interaction networks can also provide insight into threshold effects. The implication of this analysis of real world marine ecosystems is that rapid transitions occur and marine governance, policy and management need to be framed to enhance adaptive capacity, multi-functionality and the ability to respond to ecological surprises.

S21.4 - BESIDES MITIGATION AND ADAPTATION: MANAGING FOR SYNERGISTIC INTERACTIONS BETWEEN LOCAL AND GLOBAL STRESSORS AS A RESILIENCE APPROACH TO CLIMATE CHANGE POLICIES

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Even if greenhouse gases were stabilized at concentrations that prevent interference with the climate system, many aspects of climate change and associated impacts will continue for centuries. For this reason, climate change policies focus on mitigation and adaptation as complementary strategies for reducing and managing the risks of climate change. The observation of synergies between local anthropogenic (e.g. local pollution) and global climatic stressors in some ecosystems opens a third family of less explored policy options, as the control of local stressors could work as a (rapid and cost-effective) strategy to limit the adverse effects, help handling the economic challenges posed by the cost and delays of mitigation, and, differently from adaptation policies, it would also directly act to protect ecosystems allow them to adjust more quickly to climate change. A resilience approach to limit the impacts of climate change by managing synergies with local stressors is illustrated with reference to marine ecosystems of canopy algae. Work done within TETRIS shows that reduction in the levels of local stressors (sediment loads and nutrient concentrations) can improve the resilience of canopy algae to projected global climate stressors (high wave exposure and increasing sea surface temperatures). An economic analysis evaluates the cost-effectiveness of the measures required to reduce sediments and nutrient concentrations to a level compatible with preserving ecosystem resilience.

S21.5 - HOW TO APPLY AN ECOSYSTEM-BASED APPROACH USING ECOSYSTEM SERVICES FRAMEWORK TO MARITIME SPATIAL PLANNING. LEARNING FROM ADRIPLAN

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A central challenge for using an ecosystem-based approach (EBA) to the spatial planning of marine areas is to balance diverse human uses of ecosystems without compromise environmental quality. The Directive 2014/89/EU establishing a framework for Maritime Spatial Planning and the Marine Strategy Framework Directive (COM 56/2008), the environmental pillar of the European Integrated Maritime Policy (IMP), suggest the use of an EBA to reach objectives of sustainable uses in the marine domain. Considering as central assumption of EBA that anthropogenic activities both affect the ecosystem and depend on it, management based on EBA should take into account the maintenance of ecosystem services. The paper presents the results from the methodology proposed and implemented for the Adriatic and Ionian Macroregion under the framework of “ADRI-PLAN: ADRiatic Ionian maritime spatial PLANning”, financed by DG MARE. The project reflects on allocating anthropogenic uses in maritime space without altering the capacity of the ecosystems to provide services and maximizing the benefits deriving from marine resources.

The phases of the proposed methodology are: a) mapping of uses and their overlappings; b) identification of pressures and cumulative impacts of uses on the environment, c) construction of planning strategies aimed at maximizing a sustainable use of maritime resources. The results are discussed within the framework of the implementation of the MSFD, Main gaps, barriers and bottlenecks are put in evidence, arising from ADRIPLAN as the first Mediterranean experiment of transboundary MSP.

S21.6 - MSP AS A TOOL TO MINIMIZE CONFLICTS BETWEEN HUMAN ACTIVITIES AND ECOSYSTEM COMPONENTS: EXAMPLES FROM GREEK WATERS

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Competition for maritime space has highlighted the need for efficient management, to avoid potential conflict and create synergies between different activities. Ecosystem-Based Maritime Spatial Planning (EB-MSP) is an integrated planning framework of current and future human activities in the sea that meets ecological, economic and social objectives. The recently adopted MSP Directive creates a common platform for EU Member States according to which each country will plan its own maritime activities; however, in cross-border areas planning needs to be made in a compatible way. This study draws upon outcomes from case studies in Greek waters conducted in the frame of EU research projects (MESMA, ADRIPLAN, CoCoNET) and tackles issues related to data needs, identification of spatial interaction among human uses and their impact on ecosystem components, stakeholder engagement, governance/policy integration requirements. Through the above it aims to highlight gaps and challenges related to the effective implementation of EB-MSP to achieve stated objectives at local, national, and cross-border level, and to contribute to channeling concrete advice to policy and decision-making.

S21.7 - PUBLIC PERCEPTIONS OF BEACH NOURISHMENT AND CONFLICT MANAGEMENT STRATEGIES: A CASE STUDY OF PORTONOVO BAY IN THE ADRIATIC ITALIAN COAST

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Conflicting interests, goals, and value often shape the stakeholders' positions concerning coastal erosion management strategies. Analyses of stakeholders' perceptions of beach nourishment and conflict management strategies are lacking. Since the involvement of key stakeholders is crucial to ensure successful integrated coastal management, the aim of the current study was to investigate the stakeholders' perceptions of beach nourishment and conflict management strategies in the community of the Portonovo Bay in the Adriatic Italian coast. During 2013, detailed, semi-structured interviews were conducted with members of the community and stakeholders regarding beach nourishment and related conflict management strategies in Portonovo Bay. The results revealed that respondents not only reported different perceptions, values, and interests but also their main goals were dissimilar. We found polarized opinions concerning antagonistic value systems shared by the participants, which are associated with quite opposed perceptions of existence and severity of the problem and efficacy and harmfulness of beach nourishment. The perceptions of the respondents were categorized into two major categories that reflect two of the philosophical views of the human-environment relationship: ecocentrism versus anthropocentrism. Four categories of proposed conflict resolution strategies were identified: (a) information, (b) dialogue and contact, (c) compromise, and (d) no solution. The adoption of a participatory approach and the implementation of conflict management skills and technique can be considered important elements of coastal management.

S21.8 - A BIO-ECONOMIC MODEL OF THE VALUE OF THE ECOSYSTEM SERVICES PROVIDED BY POSIDONIA MEADOWS

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The paper presents a cellular automata model, spatially explicit on a VARIABLE TIME HORIZONT The base is a NxM matrix where each cell corresponds to a beam of Posidonia. The matrix simulates a Posidonia meadow and its growth. The evolution of the meadow is affected by a number of factors: radiation, shading (the absorption of light is related to the size of the biomass of the neighboring beams and the effect of coverage by epibiontics), nutrients (N and P in particular). The automata model is accompanied by a bio-economic model built to estimate the value of the ecosystem services provided by the Posidonia meadow. The main ecosystem services considered are: carbon uptake, protection from coastal erosion, nursery for species of commercial interest (sea urchins), biodiversity conservation. Moreover, the model is able to measure the impacts of anthropogenic stressors on the meadow, in particular: trawling, anchoring, industrial and municipal discharges, fish farms and agricultural activities, introduction of alien species (eg. *Siganus luridus*). Finally, the model proposed will provide simulations on the effects of different management strategies aiming at preserving the ability of the meadow to provide ecosystem services.

S21.9 - COMPOUNDED EFFECTS OF OCEAN ACIDIFICATION AND NUTRIENT ENRICHMENT ON THE SEAGRASS POSIDONIA OCEANICA AND THE ASSOCIATED EPIPHYTIC COMMUNITY

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Marine coastal habitats are threatened by multiple stressors operating at hierarchy of spatial scales, from local to global. The compounded effects are still poorly understood. Here, we used shallow water CO2 vents to assess how the effects of ocean acidification on Posidonia oceanica and the associated epiphytic community can be modified by enhanced nutrient loading. The response of P. oceanica and of the epiphytic community to nutrient enrichment were compared between low pH and reference sites. At each location, three levels of nutrient (control, low and high) were established in plots randomly selected inside P. oceanica beds. Preliminary results showed significant effects of low pH value on epiphytic assemblages and storage of secondary metabolites in seagrass leaves, while nutrient fertilization had weaker effects. There were no significant effects of interaction between CO2 and nutrient enrichment for the response variables analyzed.

S21.10 - RECRUITMENT, SAND BURIAL AND THE SPREAD OF INTRODUCED PLANTS REGULATE THE RECOVERY OF SAND DUNE DISTURBANCE PATCHES

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Bare patches in coastal sand dune vegetation are natural features, rising from sand mobility. However, anthropogenic pressure can increase the size and frequency of bare patch formation and maintenance by disturbing vegetation. Three experiments were done to examine the hypotheses that 1) the recovery of bare patches depends on the availability of fresh water, nutrients and sand movement; 2) seed availability of common plant species is homogeneously distributed across the dune; and 3) interaction between the invasive Carpobrotus acinaciformis and sand accumulation impact the resilience of disturbed plant assemblages. Our results suggest that the recovery of bare patches is independent of environmental factors, that seed dispersal is mediated by the presence of vegetation, and that the invasive ability of C. acinaciformis increases in disturbed patches and it is synergistic to sand burial. Our results suggest that sexual recruitment plays a minor role in bare patch plant recovery and the regulation of vegetation resilience mainly occurs through vegetative growth.

S21.11 - APPLYING MOLECULAR TOOLS TO DECISION MAKING FOR MARINE ECOSYSTEM CONSERVATION. THE CASE OF SEAGRASS MEADOWS.

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Developing adequate strategies to manage, conserve and restore marine ecosystems biodiversity and services is becoming a key target of environmental policies. Seagrass meadows rank among the most valuable ecosystems on earth, supporting high biodiversity and local fisheries, protecting the coastline and representing a highy percent of global carbon storage. Molecular approaches can allow understanding the potential meadow resistance and resilience to environmental stressors, through genetic and genotypic diversity metrics and to select a series of early warning indicators, through gene expression approaches. I will illustrate a meta-analysis performed in *Posidonia oceanica*, where we assessed a positive correlation between genetic diversity measures and the level of threat of known human impacts on selected meadows. Moreover, I will present a synthesis of gene expression studies, where we correlate selected environmental stressors to changes in the expression of stress-responsive genes. The combined use of the two types of approaches can allow detecting areas with lower evolutionary potential and providing early warning signal that the system is in distress, long before conditions become irreversible and possibly un-restorable.

SOIL QUALITY AND HEALTH

S22.1 - PLANT-MICROBIAL INTERACTIONS IN A MEDITERRANEAN ECOSYSTEM LEAD TO SHORT-CIRCUITED SOIL N CYCLE

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Plant- soil microbial interaction is one of the least known and deeply investigated aspects among those which control terrestrial ecosystems structure and functions. A particular plant – microbial interaction is the one mediated by allelopathic compounds, which are particularly abundant in Mediterranean sclerophyllous plants and coniferous plants. Little is known on their effect on soil microflora although few available publications suggest that these compounds might be responsible for significant slowdown of litter decomposition and microbial processes involved in the C and N cycle. We present data from a study in a monospecific Mediterranean stand of *Arbutus unedo* (central coastal Italy) which evidence the specific functional and structural microbial features of this woodland which lead to a short-circuiting of the soil N cycle. This phenomenon results in a N cycle mainly centered on reduced form of N (amino acids and NH_4^+) which are used by both microbes and plants due to the inhibition of nitrification by *Arbutus* metabolites and mediated by specific mycorrhizal groups which are efficient at using organic forms of N.

S22.2 - DIVERSITY OF ARBUSCULAR MYCORRHIZAL FUNGI IN HUMAN-IMPACTED AND NATURAL HABITATS

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Arbuscular mycorrhizal fungi (AMF) are essential ecosystem components with functions in nutrient cycling, plant defence, abiotic stress resistance and soil formation. How do human activities affect the diversity, abundance and functioning of AMF is increasingly studied. AMF have been thought to be sensitive to high-intensity land use, but recent studies have demonstrated considerable diversity of AMF also in agricultural habitats. What is the response of AMF diversity and function to human disturbance in such habitats? I will summarise the current status of understanding about the AMF diversity patterns in diverse natural habitats as well as in human-impacted ecosystems in relation to land use. In particular, I will discuss the effects of different types and intensities of land use on AMF communities at different spatial scales. I intend to shed light on the question whether there is context-dependency in the AMF diversity-disturbance relationship and what is the evidence for and against the moderate disturbance supporting the most diverse AMF communities. I will conclude with summarising the knowledge about the functional importance of AMF diversity patterns in natural and man-made ecosystems.

S22.3 - AT THE ROOT OF PLANT HEALTH: THE ROLE OF *ARBUSCULAR MYCORRHIZAS*

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Arbuscular mycorrhizas (AM) are widespread symbioses which allow plants to receive minerals from the symbiotic fungus which in turn gets back carbon completing its life cycle. In poor nutrient conditions, AM fungi improve plant phosphate, nitrogen and sulfur acquisition. The aims of the presentation are to provide an overview on the mechanisms which allow plants to uptake minerals and to reveal how mycorrhizal fungi may have a systemic impact on crops. Using a combination of genetics and molecular approaches we demonstrate how the phosphate transporter of Lotus japonicus (LjPT4) is active in root arbusculated cells as well as in root tips, while the sulfur transporter (LjSultr1:2) is expressed in arbsculated cells, and in non-mycorrhizal roots. The results demonstrate how the symbiotic pathway for nutrient acquisition changes depending on the considered element. To understand the systemic effect of the symbiosis on tomato fruits, we used RNA-Seq to perform global transcriptome profiling on tomato fruits. We found that the fruits of mycorrhizal plants show genes characteristic of a climacteric fleshy fruit, and genes characteristic of mycorrhizal status. In conclusion, by improving the nutritional status and by affecting the source-sink relationships of the whole plant, mycorrhization has a strong impact on plant health.

S22.4 - INHIBITORY EFFECTS OF EXTRACELLULAR SELF-DNA: A NEW MECHANISM FOR NEGATIVE PLANT-SOIL FEEDBACKS AND SOIL SICKNESS

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Negative plant-soil feedback (NF) i.e. the rise in soil of negative conditions for plants induced by the plants themselves, has been observed in a variety of natural environments including grasslands, temperate and tropical forests, where it is recognized as an important factor shaping plant communities, as well as in agro-ecosystems, where NF can contribute to producing soil sickness. NF has been related to several non-mutually exclusive explanatory mechanisms including soil nutrient depletion, build-up of soil-borne pathogen populations, and changing composition of microbial communities. Another hypothesis proposed the release of phytotoxic compounds during litter and organic matter decomposition. Here, we test the hypothesis that extracellular DNA from litter decomposition is involved in plant-soil NF by a multidisciplinary approach integrating ecological, phytochemical, and biomolecular methods. Results showed a general occurrence of species-specific litter toxicity. Extracellular self-DNA accumulation in litter during decomposition is significantly associated with root growth inhibition. Moreover, tests using purified extracellular self-DNA demonstrated the general occurrence of inhibition in plants and various organisms including bacteria, fungi, algae, protozoa, and insects. Such findings provide strong evidence for DNA involvement in plant-soil NF and soil sickness. Further studies are needed to assess the relative importance of this process compared with complementary theories.

S22.5 - MODELING SOIL FUNCTIONS AND INDICATORS OF SOIL HEALTH WITH BIOGEOCHEMICAL MODELS – CURRENT APPROACHES AND KNOWLEDGE GAPS

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Biogeochemical models are widely used for simulating biosphere-atmosphere-hydrosphere exchange processes,e.g. CO2 ecosystem exchange, nitrate loads in leaching water, soil GHG emissions. These models are based on current understanding of key ecosystem processes such as photosynthesis and biomass development, organic matter degradation, microbial formation and consumption of GHGs, etc. Depending on the scope, the details of process description can vary substantially with models, from very simplistic empirical relationships to complex descriptions of individual processes, involving e.g. microbial community dynamics and sequential simulation of enzymatic steps to describe substrate turnover of a given microbial process such as denitrification. Thus, the potential of a model to describe indicators of soil health will vary too. Moreover, the usefulness of a given model to simulate soil functions and indicators of soil health will depend on the temporal and spatial scale the model was developed for, which can go from the microscale of soil aggregates to ecosystem scale. The biggest challenge regarding indicators of soil health remains the bridging of different temporal and spatial scales, especially concerning computing power, and to translate the dispersed and still not fully understood information on the relation between soil processes and microbial community dynamics into algorithms and coherent model approaches.

S22.6 - SOIL FAUNA: KEY TO SOIL ORGANIC MATTER DYNAMICS AND MODELLING

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Soils play a fundamental role in carbon (C) cycling, acting both as source of greenhouse gases and sink (C sequestration). Global C models have historically included abiotic parameters and microorganisms as central players yet hardly ever address soil animals. We point out that soil animals play a marked role in C dynamics through their manifold activities such as digging, litter comminution or grazing on soil microorganisms. The composition of soil animal communities varies extremely with climatic, soil and land use conditions, and the executed effects vary accordingly. We therefore propose that inclusion of site-specific animal activities should fundamentally improve the precision of global carbon models. Finally, we introduce the new COST Action ES1406 “Soil fauna: key to soil organic matter dynamics and modelling (KEYSOM)” which was developed by a core scientific consortium from different European countries. Central objectives are (1) to improve the communication between soil ecology and biogeochemistry, (2) to compile data on soil fauna – soil organic matter interactions and to identify existing data gaps, (3) to review existing global C models according to their potentials and limitations for including fauna effects, (4) to set up a meta-database for further analyses and (5) to disseminate the collected knowledge.

NEW ENERGING DRIVERS OF CARBON AND NUTRIENT CYCLES UNDER A DRIER AND WARMER CLIMATE

S23.1 - BIOTIC ATTRIBUTES AS DRIVERS OF NUTRIENT CYCLING IN DRYLANDS UNDER GLOBAL CHANGE

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The impact of global environmental change (GEC) drivers on the relationships between biotic attributes and ecosystem processes is poorly known. This is particularly true for drylands, which cover over 41% of the total land surface and host ~38% of the global population. I synthesize the results of recent and ongoing studies evaluating how biotic attributes (species richness, evenness and composition, cover and spatial pattern) modulate ecosystem responses (nutrient cycling and carbon storage) to GEC drivers in drylands from local to global scales. The relative importance of plant cover or species richness as modulators of ecosystem responses to GEC drivers varies with the spatial scale considered. At local and regional (~400 km) scales, the effects of species richness on ecosystem functions were largely modulated by other biotic attributes, such as the total cover and spatial pattern of the plant/biocrust individuals. At the global scale, abiotic variables such as annual temperature or aridity largely determined the variation in functions related to nutrient cycling, but attributes such as species richness and composition explained significant fractions of this variation. Our results suggest that biotic attributes such as cover and species richness may partially buffer negative effects of GEC on ecosystem functioning in drylands.

S23.2 - CARBON CYCLING IN LITTER AND SOILS IN A DRIER WORLD: LESSONS FROM ABIOTIC AND BIOTIC PROCESSES IN DRYLANDS

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Drylands are an important component of the global carbon cycle, accounting for approximately 30% of terrestrial net primary production and 40% of soil carbon pools. Our understanding of dryland carbon cycling is limited, however, as factors controlling dryland carbon cycling differ strongly from controlling factors in relatively well-studied mesic systems. These differences are particularly apparent for litter decomposition and surface soil processes, where abiotic processes appear to be of unique importance in drylands. Soil-litter mixing, photodegradation, and thermal degradation, individually and in combination, can influence carbon cycling processes. Furthermore, spatial heterogeneity of vegetation, which is much more pronounced in drylands than mesic systems, is an important influence on surface carbon processes in drylands. This vegetative heterogeneity strongly influences surface carbon cycling by modifying the strength of abiotic drivers and by altering among-patch connectivity and transport patterns. Greater research emphasis on dryland climate manipulations and climate gradient studies are crucial to improving our predictive capacity for carbon cycling processes in drylands. This is particularly important as we move toward the drier, more desertified world projected for the future.

S23.3 - ECOSYSTEM CARBON AND NITROGEN DYNAMICS IN RESPONSE TO CLIMATE EXTREMES

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In the coming decades climate extremes are expected to increase in frequency and severity and have the potential to accelerate climate warming by impacting the terrestrial carbon cycle. In this talk I will first provide an overview of how climate extremes affect the carbon cycle, suggesting that amongst the climate extremes droughts will globally have the most widespread concurrent and lagged effects. I will then demonstrate on the example of mountain grasslands in the Austrian Alps that extreme drought can alter carbon cycle responses to subsequent drought and that land management and land-use change can affect the resistance and resilience of grassland carbon and nitrogen dynamics to drought. Thus, projections of biogeochemical responses to climate extremes need to account for legacy effects from previous extreme events and should consider possible interactions with land-use changes.

S23.4 - MICROBIAL DECOMPOSITION OF PLANT LITTER UNDER DRY CONDITIONS

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During heat and drought events, some of the common drivers of the carbon cycle, such as rainwater, play a minor role, sometimes over an extended period of time. In the absence of rainwater, alternative drivers control carbon cycling, some of which are less considered under regular conditions. In a Mediterranean shrubland, decay processes in plant litter during the dry summer altered chemical composition and contributed up to 30% to total annual decomposition, despite the complete lack of rainfall. Litter decay and CO_2 emissions from litter are controlled by water absorbed from dew and atmospheric vapor during the night, thus enabling microbial degradation. In addition, litter exposed to high solar radiation and temperature in open terrain is abiotically degraded by photochemical and thermal processes during the day. These factors can partly drive decomposition after grazing and in intervals between rain events, as litter desiccates easily in more open landscapes and dries within days after a rain. Climate and land-use change affect litter decay, among others, by enhancing drying of litter, even in mesic regions. Therefore, non-rainwater driven microbial degradation and abiotic processes might play an increasingly important role globally in decomposition of organic materials and related trace gas emissions.

S23.5 - PROCESSES DRIVING THE ECOSYSTEM CARBON BALANCE IN NORTH AMERICAN DESERTS UNDER CLIMATE CHANGE

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Examination of the possible contribution of the world's dry land ecosystems to modulating global atmospheric CO_2 levels has gained momentum during the last decade. Direct measurement of net dry land ecosystem CO_2 exchange (NEE) using eddy covariance and large chamber methods, as well as indirect measurements using isotopic and inverse modeling methods, strongly suggest that these ecosystems may actually be buffering the anthropogenic rise in atmospheric CO_2. These net CO_2 uptake rates, expressed in terms of net ecosystem productivity (NEP), can range from less than 10 g C m^{-2} yr^{-1} to more than 160 g C m^{-2} yr^{-1} in arid shrub-steppe ecosystems. These rates are comparable to those measured in some mesic ecosystems (grasslands, forests), although were achieved through much lower rates of daytime net CO_2 uptake and nighttime net CO_2 respiratory efflux than often occurs in mesic systems. In this talk, I will present results from our own multi-year (2-10) studies, and from the literature, and I will explore how temporal patterns in daytime and nighttime NEE account for larger than expected annual net CO_2 uptake, this could occur using empirical data on arid land (a) net primary productivity (NPP), including native and invasive vascular plant NPP, as well as NPP of cryptobiotic crusts; and (b) respiratory CO_2 losses occurring via autotrophic (Ra) and heterotrophic (Rh) sources account for. Results from ecosystem measurements under and why exposure to multiple years of elevated CO_2 appears to suppress NEE and NEP of net CO_2 uptake as anthropogenic CO_2 levels continue to rise. Findings also show that the relative amount of suppression under elevated CO_2 may be amplified in wetter El Niño years. Considering that arid and semi-arid lands represent ~40% of Earth's terrestrial surface, even a modest rate of annual net CO_2 uptake could be slowing the anthropogenic increase in global atmospheric carbon dioxide and thus be mitigating tropospheric greenhouse gas radiative forcing.

S23.6 - TRADEOFFS BETWEEN ECOSYSTEM CARBON SEQUESTRATION AND SURFACE RADIATION BUDGET UNDER DRY CONDITIONS

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Recent observations from the semi-arid region in Israel showed that conversion of the local sparse shrubland to pine forest resulted in greatly increased surface radiation load due to reduced canopy albedo combined with reduced emission of thermal radiations, which overwhelmed the beneficial effects of the relatively high rates of carbon sequestration. We extended this study across the local climatic gradient, and show that the observations in the dry conditions (290 mm annual precipitation) reflect in fact a gradual transition along the precipitation gradient that represent drying and warming climatic conditions. We used a custom-built mobile laboratory on a campaign basis to compare surface-atmosphere radiative and non-radiative fluxes in three paired sites of pine forest (*Pinus halepensis*) and nearby non-forested ecosystems. The enhanced carbon sink associated with forestation of shrub land decreased from ~190% to near zero, and the albedo effect increased from ~50% to ~150% with decreasing precipitation and increasing temperatures along the climatic gradient. Forests always showed increased sensible heat flux compared with shrub land. The results demonstrate the importance of assessing the combined biological and biophysical effects on the interactions between climate and land cover changes, and the balance between beneficial and detrimental effects of afforestation on climate.

S23.7 - WARMING-INDUCED STIMULATION OF CARBON UPTAKE IN A MEDITERRANEAN GARRIGUE: A POSSIBLE INVOLVEMENT OF NITROGEN CYCLE

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In the Mediterranean basin temperatures have shown an increasing warming trend. In order to investigate the effect of the temperature increase on a Mediterranean shrubland ecosystem dominated by *Cistus monspeliensis*, we increased air and soil minimum temperature by about 1 °C through passive night-time warming. The effects of night-time warming were monitored for two years at both leaf and ecosystem levels. During the study period, we recorded a general stimulation of *Cistus monspeliensis* growth, with an increase in leaf level CO_2 assimilation rates, leaf length, shoot size and shoot relative growth rate. At the canopy level, a clear positive effect on the CO_2 fluxes was recorded in both in gross photosynthesis and net ecosystem exchange. The increased CO_2 uptake observed from leaf to canopy level can be related to the higher leaf nitrogen concentration observed in the warming plots compared to the control. This additional N availability can likely be the result of higher rate of nitrogen mineralization found in the same area in a previous study in the warmed plot. These results suggest a possible positive response of the plant growth to the night-time temperature increase in these early successional stage ecosystems.

HIGH NATURE VALUE FARMLAND: TOWARDS MORE EFFECTIVE CONSERVATION AND MONITORING OF BIODIVERSITY ACROSS EUROPEAN LANDSCAPE

S24.1 - IDENTIFYING AND SUPPORTING HIGH NATURE VALUE FARMING SYSTEMS: AN OVERVIEW

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The High Nature Value (HNV) farming concept recognises that many European habitats and landscapes considered to be of high nature conservation value are intimately associated with the continuation of specific farming systems.The underlying principles behind the development of the HNV farming concept were, and remain, that: market, agricultural policy and social pressures are increasingly making such HNV farming systems economically unviable; any resulting intensification or abandonment of such farming systems would adversely impact on the associated HNV; there is therefore a justifiable case to be made for directing additional financial support to these farming systems to help maintain the HNV.Ensuring the maintenance of the farmland biodiversity value associated with HNV farming systems depends on ensuring the continuation of appropriate low-intensity farming systems. This requires an understanding not only of how the different elements of HNV farming systems interact to maintain the HNV but also of how HNV farming systems can be identified and subsequently supported more effectively. This presentation provides a broad overview of the development of the HNV concept and implementation and is designed to help set the scene for the remainder of the symposium.

S24.2 - LOOKING BACK AND THE WAY FORWARD: ASSESSING THE VULNERABILITY AND RESILIENCE OF HIGH NATURE VALUE FARMLANDS IN TIME

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Shaped historically by farmers and farming practices, many EU landscapes are currently dominated by agriculture. Due to the recognized role in the maintenance of biodiversity and its habitats, extensively managed farmlands – High Nature Value farmlands, HNVf - have been highlighted by scientists and policy-makers as critical to protection of the rural environment by enhancing resilience and providing ecosystem services.While the backbone characteristics of HNVf have been recently reviewed, caveats still persist for a consistent implementation of the concept e.g. the scarcity of adequate datasets on biodiversity, land cover and land use, together with the lack of tested, standard approaches to mapping and indicator estimation. Additionally, difficulties in the establishment of a HNVf baseline hamper the EU's ability to quantify the condition and dynamics of such farmlands, and thus to anticipate impacts of future environmental changes on rural landscapes.Here, preliminary results from ongoing case-studies focusing the dynamics of HNV farmlands in time will be presented. By considering several levels of 'natural value' e.g. provision and dynamics of ecosystem services, and accounting for their vulnerability and resilience in the face of uncertain future, our results are expected to contribute to the optimization of the design, implementation and evaluation of rural development programs. We expect that this would foster the EU strategy of positively discriminating and supporting farmers in their efforts to ensure the conservation and improvement of biodiversity and ecosystem services in the context of economic and socio-ecological change.

S24.3 - HIGH NATURE VALUE FARMING: FROM INDICATION TO CONSERVATION

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Supporting and maintaining High Nature Value (HNV) farming is a priority of the European rural development policy and is considered critical for reaching the target of halting biodiversity loss in the European Union by 2020. Here, we highlight the importance of the HNV farming concept for biodiversity conservation in agricultural landscapes by comparing it to other scientific concepts and strategies. For an efficient targeting of conservation efforts, identification and localisation of HNV farmland and farming systems is necessary. We modelled the spatial distribution of species-rich farmland in Germany by combining field-based survey data on the occurrence of indicator plant species from a biological monitoring programme with agri-environmental variables. The predicted share of species-rich farmland is highest in upland and structurally complex grassland-dominated regions where extensive livestock production is practised. The generated map of the spatial distribution of species-rich farmland makes a contribution to identifying areas with a high probability of being HNV farmland and facilitates the identification of priority regions for conservation actions. In a further approach, we related changes in agricultural land-use to population trends of common breeding farmland birds in order to identify regions that are characterized by either increasing, stable or decreasing breeding bird populations.

S24.4 - SUPPORTING HNV FARMLAND CONSERVATION: LESSONS LEARNT AND FUTURE NEEDS FOR SCIENCE INTO POLICY AND PRACTICE

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Over the last 10 years a range of initiatives have taken place in Ireland to support the sustainable management of High Nature Value farmland (HNVf). The HNVf concept has developed from the recognition that the conservation of a large proportion of biodiversity across Europe depends on the continuation of low intensity farming. In the majority of cases in Ireland, HNVf is coincident with areas dominated by or with a significant proportion of semi-natural vegetation. This presentation will present a snapshot of the various HNVf initiatives including EU LIFE nature projects, development of results based agri-environment schemes and the support under Ireland's Rural Development Programmes (RDP) over the last 10 years. Emphasis is placed on evaluation of these various initiatives, outlining progress made and highlighting issues remaining to be addressed to ensure a sustainable future for HNVf areas. A pressing need for innovation, partnership and locally adapted solutions to realise a vision for the sustainable management of this critical national resource is identified. The presentation will conclude with an overview of the lessons learnt and the next steps utilising existing RDP measures and working towards CAP reform 2020.

S24.5 - DEVELOPMENT OF A RAPID FARMLEVEL NATURE VALUE INDEX FOR PASTORAL FARMLAND IN EUROPE

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As part of the EU strategy towards sustainability Member States are committed to identifying and protecting areas of agrobiodiversity. Identification of the extent and support of High Nature Value (HNV) farmland across the EU was an important policy requirement of Rural Development Programmes (RDP) (2007-2013) but problems defining the extent of HNV farmland have delayed progress to date. Following a five step statistical process, a simple 10 point nature value index based on percentage improved agricultural grassland, stocking density and length of linear habitats per hectare on a farm was developed. This index can be used to highlight farms with low biodiversity allowing targeting of sustainability measures, farms that are already sustainable and could be labelled as such through national programs or even HNV farms that could be targeted through results-based agri-environment schemes. This nature value index has potential to be applied to a range of farmed pastoral landscapes in Europe's Atlantic biogeographic region. The methodology has the potential to be used in other biogeographic zones to develop similar indices of nature value at farm level. This index is a simple to use identification tool based on farm-level data which can be utilised in sustainability indices and HNV farmland identification.

S24.6 - NATIONAL DISTRIBUTION AND TYPOLOGY OF HNV FARMLAND IN IRELAND AND HOW THESE CAN AID TARGETING

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HNV farmland (HNVf) typically comprises low intensity farming that supports high biodiversity and a range of wildlife habitats. Supporting this type of farmland is vital for the conservation of the plants and animals associated with them and the rural communities that farm them. It is an EU policy requirement to identify, assess and support these farming systems through national Rural Development Programmes. This research aims to describe the types of HNVf in Ireland to aid their identification and targeting.The potential national distribution of HNVf in Ireland was mapped using geostatistical methods. Habitat surveys and management questionnaires were then carried out on 102 farms across 10 sites with high HNVf potential during 2013 and 2014. These sites included upland and lowland areas dominated by semi-natural vegetation, floodplains and areas designated as Special Protection Areas. Using principal components analysis and cluster analysis the HNV farmland typologies were assessed and described. Environmental, management and socioeconomic variables including elevation, semi-natural habitat cover, inorganic fertiliser input, off-farm job participation etc. were taken into account. The results show the range of HNVf in Ireland and highlight some key issues that need to be overcome to appropriately target these lands.

Keywords: HNV farmland, agroecology, biodiversity, rural development

S24.7 - THE MAP AND THE TERRITORY — FINDINGS FROM THE CHARACTERIZATION OF HNV FARMING IN FRANCE

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In 2013, the French ministry of agriculture commissioned a study on the characterisation of HNV farming in France, to which the speaker participated. The main expected output of this study was the instruction of the HNV indicator, thus conceptually focusing on the task of mapping HNV farming.However, the study intended to address a wider approach of HNV farming, insisting on the characterization of agrarian systems and their dynamics. Thus moving from a mapping issue to a territory understanding, insisting on geographical and historical features.The communication shall present both the approach undertaken for the characterization and discuss the lack of impact of the study in terms of policy commitment for HNV farming. Why does the map hide the territory?

S24.8 - CHALLENGES IN MONITORING THE HIGH NATURE VALUE OF MEDITERRANEAN EXTENSIVE SILVO-PASTORAL FARM SYSTEMS

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According to the classification proposed by the European Environment Agency, the Portuguese montado, one of the major silvo-pastoral system in Southern Europe, is broadly considered as a High Nature Value Farming System, although studies show that several types of montado can be identified. This diversity results from different natural conditions (soils, climate, and topography) and different management trajectories over time. The high variability underlying these systems, both in biophysical and management contexts, results in different bundles of natural values. In order to support decision-making the challenge is thus to identify how management practices are related to biodiversity thresholds in different montado types. We will present an innovative multi-step interdisciplinary conceptual and methodological framework to assess the relationship between farm management practices and biodiversity values. The first results from an application to the Natura 2000 site of Monfurado will be presented and discussed. Also, the limitations and potentialities of each option taken will be underlined, as well as the technological, institutional and interdisciplinary research challenges and opportunities that rise for a more comprehensive assessment and monitoring of these HNVf systems.

ECOLOGISTS' STRATEGIES AT SCIENCE-POLICY INTERFACES: HOW CAN SOCIAL SCIENCE HELP?

S25.1 - ECOLOGY AND ENVIRONMENTAL CONSERVATION: A LONG HISTORY OF INTERACTION

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In this paper I provide an overview of the historical relations between ecologists and environmental conservation, with special attention to ecologists' rolesin advising on and advocating for designation of protected areas. Over the last century the extent of protected areas has greatly expanded: in some parts of the world, close to 10 per cent of total land area is now under some form of protection. Ecological science has evolved in close association with this expansion of protected areas. This has reflected several factors, including the development of ecological theory and research practices, the role of ecological knowledge in the designation of natural areas (either individually, or as part of larger systems of conservation), and the significance of these areas as sites for ecological research. Several related scientific disciplines have been important in this history: some are well-established, such as biogeography and ecosystem ecology; other disciplines have formed more recently, including conservation biology. Factors beyond the scientific community have also shaped these relations: human activities have transformed landscapes in various parts of the world, social values regarding the environment have changed, and so have ideas regarding the appropriate role of governments (and other institutions) in designating protected areas and regulating land uses.

S25.2 - DIFFERENT IN TERMS OF DISCIPLINES OR DIFFERING ABOUT CONSERVATION GOALS? THE VARIABLE MEANING OF COLLABORATION BETWEEN ECOLOGISTS AND SOCIAL SCIENTISTS

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Biodiversity conservation rests on confrontation, negotiation or cooperation between conservation advocates and operators who deploy activities damaging ecosystems. Except in the case of pure cooperation, knowledge from ecology is used not only as a guide to rational action, but also as a strategic resource in struggles for – or against - conservation. It will lead to successful policy action, only if, on top of being relevant from a rational action point of view, it also passes the dual test of political and organisational viability. Here, social science disciplines may provide important resources, both conceptual and in terms of field work. However, because of the highly interpretive character of social science disciplines, such contributions are tightly bundled with the normative perspectives of social science researchers. When these are at variance with the expectations of ecologists, awkward and counter-productive situations arise in the force field of conservation debates. Taking a strategic management perspective on conservation action, the talk will point to some such situations, underline the necessity of identifying and managing them lucidly, and propose some ideas on how to do so.

S25.3 - INTERFACING CONSERVATION SCIENCE AND BIODIVERSITY POLITICS: WHAT IMPACT THE IPBES, WHAT IMPACT THE INDIVIDUAL RESEARCHER?

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In 2012, the Intergovernmental Science-Policy Platform for Biodiversity and Ecosystem Services (IPBES) was established to fill all gaps previously identified by policy experts and scientists. The debate on biodiversity knowledge rapidly turned into a debate on the institutional formats organising its production and use. The IPBES became a new international institution and a new object of inquiry for scholars from a broad range of disciplines. The IPBES figures as both an emerging institutional arrangement at the interface between conservation science and biodiversity policy and as a role model for evidence-based policy-making in international biodiversity politics. Whilst the first debates on the IPBES were focusing on the relevance, governance and the thematic scope of the new institution, recent debates focus on its potential impact on biodiversity policy, politics and research. The aim of this paper is to assess the potential of the IPBES to influence policy-making and to analyse the mean by which this new science-policy interface could so do. On the basis of a detailed analysis of the historical making of the IPBES this paper will further analyse the impact of the IPBES and of the individual researcher in interfacing conservation science and biodiversity politics in a very particular way.

S25.4 - ECONOMISTS AND ECOLOGISTS AS CONTRIBUTORS IN MULTI-DIMENSIONAL DECISION-MAKING PROCESSES

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Many environmental economists and ecologists share a common implicit perception of the decision-making processthey intend to contribute to. They often cursorily refer to decision-making as an exogenous end-of-the-pipe process, where unidentified decision-makerswill use the inputs provided by scientists to weigh the social costs and benefits attached to thealternatives there are facing and choose the nearest-to-optimum option.

This induces scientists to deliver highly synthetized results, e.g. a single “net present value” or a “cost-benefit ratio” (from economists), or reduced sets of indicators supposedly expressing the essence of a problem or representing the condition of an ecosystem (from ecologists).

Such implicit assumptions regarding decision-making have long-since been questioned, however this questioning has not received all the attention it deserves, especially with respect to its implications regarding our roles as economists and ecologists taking part to multi-dimensional decision-making processes.

The paper expands some of these reflections and discusses their implications for economists and for ecologists. It thus addresses two main issues: (1) what could or should be the role of ecologists (and environmental economists) in multi-dimensional decision-making processes? (2) where should we look for compromises between the extreme simplification of single-metric indicators and the extreme complexity of ecological data and interactions?

S25.5 - EMBEDDING ECOLOGY INTO POLICY CONTEXTS

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Over recent years there have been numerous initiatives at the international, European and national levels to promote the use of environmental knowledge in decision-making. There remains, however, a perception that such knowledge is still under-used due to continued reliance on a 'linear' or technocratic model of communication in which scientific facts are transmitted directly to policy advisers to solve policy or societal problems. Based on the results of a recent project on science-policy interfaces (http://www.spiral-project.eu/), we present a general framework for improving the uptake of environmental knowledge in decision-making and illustrate aspects of this framework with examples including deer management in Scotland, implementation of the Water Framework Directive, and the UK National Ecosystem Assessment. We suggest a number of practical ways forward and highlight the importance of working more closely with policy by jointly framing research and policy, promoting inter- and trans-disciplinary workingthat include both scientists and policy makers and implementing structures and incentive schemes that support interactive dialogue in the long-term.

S25.6 - WHEN GOOD INTENTIONS FAIL: A SYSTEMATIC ANALYSIS OF CONSERVATION OUTCOMES AND SUGGESTIONS FOR IMPROVEMENT

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Anecdotally, evidence is accumulating that conservation outcomes are—as with any other major endeavor—a mixed bag of partial successes and failures, a complex assemblage of simultaneously positive and negative feedbacks. Yet aside from a few well-known examples, descriptions of surprising or negative outcomes appear relatively infrequently in the peer-reviewed literature andthe extent of so-called “unintended consequences” for biodiversity is unknown. This presentation reports on the construction of a comprehensive database of conservation projects (>500 articles identified and analyzed) that exhibit negative feedbacksand related processes by which project results were substantially alteredor diminished from initially expected. Although pooroutcomes are frequently seen as resulting fromfaulty policy, skewed market forces, or miscellaneous “social and political factors,” the database provides evidence that certainscientific research practices themselves consistently are contributing factors. Further, multiple contributing processes were frequently synergistic even though they originated in quite different domains (genetic, epidemiological, economic, social, etc.) The aim of this research is to provide a rich set of systematically-assembled cases facilitating identification of key processes by which conservation science may inadvertently undermine its own scientific and policy goals. As well, this analysis suggests concrete ways ecologists may anticipate and mitigate negative feedbacks.

S25.7 - A STRATEGIC INTERVENTION FOR ENHANCING CONSERVATION NGOS ACTIONS: THE CASE OF AN ECOLOGICAL RESEARCH FOUNDATION, LA TOUR DU VALAT, FRANCE

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Environmental NGOs are major operators of conservation initiatives both in the political sphere and in the field. The context within which they operate can change rapidly and dramatically. As a result, they need to plan new strategies, and do so by taking up the challenges of strategic design like any institutionalised organization. However, the specific characteristics and situations of ENGOs call for new, relevant approaches to strategic analysis and design. Based on successive cycles of case studies and conceptual work drawing on the biodiversity, organisational management, and strategic environmental management analysis literatures, the contribution proposes a new framework to articulate four fundamental dimensions of ENGOs' strategy: the choice of goals in terms of ecological priorities; the choice of how to act and press for change; the development of capacity (i.e. organisation, internal governance and resources); and finally, a strategy to manage an often ambivalent mix of competition and cooperation with other ENGOs. The value of the framework is illustrated here by a case study of the French NGO 'La Tour du Valat' wich is involved in fight for biodiversity conservation through both a scientific and engaged position.

S25.8 - IS STRATEGIC REFLEXIVITY USEFUL FOR RESEARCHERS IN ECOLOGY? THE EXAMPLE OF A PARTNERSHIP WITH A CONSERVATION NGO

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Researchers in ecology are more and more willing to be involved in conservation policies. However, such policies are driven by complex negotiations between numerous stakeholders: the willingness to engage is not enough to act strategically at science-policy interfaces. We conducted an action research for a partnership between an ecology lab and a conservation NGO to 1/ understand how this partnership can strengthen the capacity of both partners to influence public policies for biodiversity conservation and 2/ help them be more efficient in their actions. Using face-to-face discussions with the main contributors of the partnership, semi-directive interviews with stakeholders and collective thinking during a one day workshop, we show that strategic reflexivity can bring several insights to the partners and help them collaborate more efficiently. Some of these insights are specific to the strategic perspective we used in our work, some could be the result of other social sciences. However, we also noticed that strategic reflexivity could endanger the collaboration when some disagreements are disclosed during the process. In the end, the increase in reflexivity enabled by social sciences has a better chance to be useful when all – social scientists, researchers in ecology and conservation NGOs - share the same normative perspective.

LONG-TERM ECOLOGICAL RESEARCH: ENVIRONMENTAL SIGNALS AND LARGE SCALE INSIGHTS FROM A GLOBAL NETWORK - ILTER

S26.1 - EFFECTS OF CHANGING LAND USE AND CLIMATE ON GRASSLAND BIOGEOCHEMISTRY IN THE AUSTRIAN ALPS

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Changes in land use and climate are considered as major determinants of ecosystem structure and functioning in a rapidly changing world. Their effects on biogeochemical cycles feed back to the climate system and exert major impacts on a range of ecosystem services. In the Alps, land-use changes have caused a widespread abandonment of mountain grasslands. At the same time, climate warming has occurred at a higher pace than on global average, increasing the probability of extreme climatic events. In this talk I will give an overview of effects of these global changes on greenhouse gas fluxes, carbon and nitrogen dynamics and the water cycle of mountain grasslands at the LTER site Stubai in the Austrian Alps. Results indicate that in mountain grasslands 1) decreasing intensity of land use causes a decrease in ecosystem CO_2 fluxes, but has only minor effects on non-CO_2 greenhouse gas fluxes, 2) extreme summer drought leads to severe but largely reversible impacts on productivity and carbon and nitrogen dynamics, 3) effects of land-use change and climate change on grassland biogeochemistry are interactive. To adequately adress this complexity and disentangle the processes underlying ecosystem responses to global changes a combination of long-term observations, gradient studies and manipulation experiments is needed.

S26.2 - UNESCO INTERNATIONAL HYDROLOGICAL PROGRAMME – ECOHYDROLOGY, ENGINEERING HARMONY FOR A SUSTAINABLE WORLD

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The International Hydrological Programme (IHP) is filling existing knowledge gaps by addressing issues related to critical water systems, such as in arid and semi-arid zones, coastal areas, estuaries and urbanized areas where ecohydrological processes have not yet been sufficiently addressed. IHP also works to show how better knowledge of the interrelationships between the hydrological cycle and biota can contribute to more cost-effective, socially acceptable and environmental-friendly management of freshwater. Advancing the integration of social, ecological and hydrological research is key for the sound scientific basis in this domain. The Ecohydrology programme also aims at providing system solutions and facilitating technology exchange. As an important component of the Integrated Water Resource Management, Ecohydrology aims at harmonizing society needs with enhanced ecosystem potential through increasing carrying capacity of ecosystems; it therefore expands the concept of balancing social economic needs by harmonizing it with enhanced ecosystem potential. Ecohydrology also calls for maintaining notions of conservation for pristine ecosystems and expands efforts for regulation of ecohydrological processes at novel ecosystems (human modified) in order to increase their ecological potential in terms of water resources, biodiversity, ecosystem services and resilience to global change and anthropogenic stress. As such ecohydrology is compliant with the IWRM concept but also provides innovative potent tools to achieve sustainability.

S26.3 - NITROGEN CYCLE - LTER CHALLENGES AND INI PERSPECTIVES

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Nitrogen is an essential nutrient, but often become pollutant in the environment. The understandings of nitrogen dynamics in changing ecosystems with long-term and large-scale aspects provide valuable insights to develop the sustainable management system of natural resources and environments locally, regionally and globally. The key findings and direction of on-going research projects are presented with possible linkage to the various on-going programs in the International Nitrogen Initiative (INI).

S26.4 - LTER ITALY: A REALLY TRANS-DOMAIN, TRANS-DISCIPLINARY LTER NETWORK

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The Italian network of Long Term Ecological Research sites (LTER Italy) started formally in 2006 after nearly 10 years of construction work. Since the beginning LTER Italy has been characterised as a really trans-domain and trans-disciplinary network that in ten years grown from 17 to 25 LTER Parent Sites. The current 25 LTER Parent Sites are distributed in terrestrial (11 Sites, high elevation meadows, forests, dunes, complex systems), lacustrine (5 Sites), marine and transitional water ecosystems (9 Sites). Most of the Parent Sites have several LTER Research Sites for a total 80 sites (33 in terrestrial, 23 in lacustrine and 24 in marine and transitional water ecosystems). In the ten years of its life, the network has gained reputation and acknowlegibility, and every year there are new request to join the network. The hundreds of researchers, PhDs, Post-Docs and Master students working at the sites produce between 100-150 ISI papers every year, in different fields, from basic to applied research. The network is increasing its outreach activities and the involvment of citizens and is actively working for a more formal recognition from the Ministry of Research. The talk will present the network and some research highlights from its sites.

S26.5 - LONG-TERM ECOLOGICAL RESEARCH AT THE GRAN PARADISO NATIONAL PARK (GPNP), ITALY

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We summarize some of the ongoing long-term research activities on ecosystems, biodiversity and species population dynamics at the Gran Paradiso National Park. In particular, we report on (1) the monitoring and analysis of the population dynamics of Alpine ibex (*Capra ibex*) and the interaction between climate variability, vegetation and ungulate population dynamics; (2) the monitoring and modelling of high-altitude alpine lake ecosystems, including the differences between lakes with or without introduced fish (EU FP7 IP ACQWA); and (3) the monitoring and modelling of invertebrate and avian biodiversity at GPNP and in two other parks in the western Italian Alps. Some of these activities are now included in the EU H2020 project "ECOPOTENTIAL: improving future ecosystem benefits through Earth Observations".

SUSTAINABILITY EDUCATION FOR A NEW CITIZENSHIP

S27.1 - ECOLOGICAL ASPECTS IN FOOD EDUCATION

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One of the most important aspects of our lives is food. It intertwines with our social life, history, the education that we have received and our style of life. The relationship between food and ourselves is an ecological one. It is always an ecological relationship wherever and whenever it would be. Thus, eating and supplying food would be considered a way in which we directly relate to living things that share the planet with us. To this end is important, from a very early age, to develop food education strictly connected with habits of social sustainability. We describe activities involving the history of food and the knowledge of the foods of other peoples. To achieve a really sustainable nutrition we must recognize the intrinsic value of all living species, including those that we eat. These are a full part of life on our planet and we must properly maintain their biodiversity. In addition, traditional eating habits are very much part of cultural identity and are historically and ecologically connected with local environment. Psychological and relational aspects of feeding the planet must not become the shop window in which we see only our wellness without considering that of the future generations.

S27.2 - SCHOOL CHILDREN MONITOR THE ENVIRONMENT AND DEVELOP CARE AND UNDERSTANDING OF NATURE WITHIN THE FRAMEWORK OF THE LTER-EDU PROGRAM

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LTER-EDU (Long Term Ecological Research - EDUcation) is an educational project that offers students in schools all over Israel to play an active role in the global monitoring effort of organisms and ecological processes over an extended timeframe. The students collect meteorological data, and monitor plants and animals, such as birds and butterflies in their school surroundings, and detect changes in climate and species richness and composition over time and space. The research methods and shared information gathered by the participating schools simulate the global LTER network, which serves as scientific basis for this educational program. The program exposes pupils to environmental studies in an experiential and meaningful way, allowing them to learn and practice various monitoring methods and scientific concepts. Going outdoors adds adventure, fun and challenge, as the children get to enhance their knowledge on habitat conditions and organisms. Long term monitoring of the environment prepares pupils to address complex, real world ecological issues. During the process of learning and collecting data, they develop a true understanding of the significance and consequences of human influence on climate, biodiversity and natural resources, as well as concern for the future of endangered species and ecosystems.

S27.3 - TEACHING PRE-SCHOOL CHILDREN ABOUT SUSTAINABILITY THROUGH MOVIES

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This paper presents a methodology through which a teacher can discuss with his students about sustainability,ecological concepts and environmental balance, using as a tool movies for children.Specifically, all the necessary preparation steps for the teacher before approaching his students are presented. Initially, the teacher defines the learning goals, then determines which are the desired results, searches for an appropriate movie and proceeds with its content analysis. After the content analysis is completed, the teacher selects the scenes that could lead to conclusions that relate with the learning goal.Finally, the teacher must determine which questions he should ask in order to stimulate the students interest and how he should answered to their possible questions.Ecological concepts seem to be complex and difficult to understand for pre-school children. The movies for children appear as a very useful tool to teach concepts like these. However, the teacher shouldn't rely exclusively upon the ecological messages that each movie tries to convey, but he should structure the educational process in such a way that he can make good use of the ecological messages of the movie. In this direction we present two real applications that prove the above argument.

S27.4 - DISCOVERING ECOLOGY THROUGH RESEARCH GAME

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The problematic nature of science learning process is stressed by educational literature and underlined in many international works. Young people's science learning difficulties are related to many factors; among those teaching strategies are very relevant. In this regard, a serious game (such as Research Game), showing the process of scientific methodology, could be an effective educational tool to support the learning process, proposing new teaching approaches and pedagogical strategies to learn a methodology useful for all subjects of the scientific research. Research Game has been developed within the Lifelong Learning Programme-Comenius Project 'European Scientific Research Game' (www.researchgame.eu/platform). The game requires participants to build hypotheses, carry on a research, finalize a theory based on their findings, giving them the opportunity to share their research results with people of all Europe. Moreover, applying the scientific method to biodiversity, Research Game introduces young people to the study of ecological subjects. Through Research Game, young people learn more about ecosystems' goods and services, the relationships between human societies and ecosystems, understand the anthropogenic pressures on ecosystems. Research game could also represent a good chance to raise young people's awareness on environmental problems, in order to collaborate with scientists and researchers through citizen science initiatives

S27.5 - WHEN CITIZENS DO SCIENCE: AN OVERVIEW OF PUBLIC PARTICIPATION IN SCIENTIFIC RESEARCH IN ITALY

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Over the recent years citizens have had the opportunity to play a valuable role in contributing to projects conducted in collaboration with universities, government agencies and NGOs. Such initiatives have become increasingly popular and have been given various terms, including citizen science, volunteer monitoring, public participatory research. These initiatives are diverse and don't necessarily require the involvement of the academia. There are worldwide numerous inspiring local projects on land and resources monitoring thanks to the cooperation of citizens, communities and committees. Our goal is to give an overview of the entire landscape of Public Participation in Scientific Research (PPSR) in Italy. A questionnaire has been subjected first of all to international opinion leaders and then to the coordinators of the various Italian participatory projects through the use of social media, blog, email and interviews. The required information concerned the essence of the project, the discipline area, the organisation and the nature of the involvement of volunteers. The results show a growing development of partecipative activities, still with a strong prevalence of projects in strictly natural areas, while are lacking the contributions on other disciplines. Besides most of the projects are yet characterized by a top-down approach for citizens' participation.

S27.6 - AFFECTIVE ECOLOGY FOR SUSTAINABILITY

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Affective Ecology is the branch of ecology that deals with our connecting with Nature. Its epistemological statute is interdisciplinary and founded upon two scientific hypotheses: the biophilia hypothesis and the theory of multiple intelligences (TMI). Biophilia can be defined as a set of innate learning rules that have evolved in the human species to enable individuals to benefit from a wholesome relationship with Nature; while naturalist intelligence (in TMI) is the ability to recognise living organisms and natural objects, and to take care of them. Biophilia and naturalist intelligence can be considered as the two poles of an educational journey about the environment. Biophilia represents the mental energy that nourishes our relationship with Nature; whilst naturalist intelligence is the full realisation of our biophilic potential to connect to the natural world. Starting from this theoretical framework, we have evolved a programme of experimental research that has enabled us to make a number of observations regarding the fascination that Nature exercises upon our psyche. Fascination may indeed account for the affective bond that establishes between human beings and Nature and that may also provide a powerful emotive lever favouring of an ethic of sustainability.

NETWORKS OF MARINE PROTECTED AREAS IN THE MEDITERRANEAN AND THE BLACK SEAS: THE COCONET PROJECT

S28.1 - MPA NETWORKS IN THE MEDITERRANEAN AND BLACK SEAS AND THE FEASIBILITY OF OFFSHORE WIND FARMS

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The institution of networks of Marine Protected Areas in the highly populated Mediterranean and Black Seas is a response to the need of increasing the protection of marine environments, including also the high and the deep sea. The need of reducing carbon emission is an indirect form of protection, since it lessens the gravity of global change. In this framework, the production of clean energy via the installation of Offshore Wind Farms might be a feasible enterprise, reconciling protection and production. The project CoCoNet, involving 22 countries from three continents, is aimed at reaching these two goals. The guidelines for the institution of MPA networks, and the feasibility of OWF installation will be the final products of the project. This will be achieved with the definition of large conservation units, comprising both charismatic expressions of biodiversity (as those protected within MPAs) and the functioning of ecosystems ensuing from connectivity processes, also linked with socio-economic issues related to the international bearing of large-scale networks. The complexity of CoCoNet calls for the holistic integration of the contributions from a vast array of disciplines that seldom interact with each other and represents a true challenge for marine science and technology.

S28.2 - SOCIO-ECONOMIC ASPECTS OF NETWORKS OF MPAS

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While the establishment of an ecologically coherent network of MPAs in Mediterranean and Black seas is an ideal for scientific investigation, in practice most MPAs to date have been designated on a rather ad hoc basis arising from a particular assemblage of socio-economic factors including natural resource usage, legislative conditions, public awareness, cultural heritage, and financial circumstances. Moreover, the very understanding of the terms “network”, “marine” and “protected area” vary considerably among different constituencies such as scientists, politicians, lawyers, managers, and users. These issues, already complicated at a national or sub-national level, become even more difficult to address in a transboundary context. Since MPAs can only be successfully established and managed when both the ecological science and socio-economic conditions are aligned in a holistic and mutually reinforcingway, it is vital to work towards broadly accepted purposes, definitions, standards and practices. In this respect, the Coconet project already provides a significant case study within the conceptual framework developed by the Intergovernmental Platform on Biodiversity and Ecosystem Services.

S28.3 - THREATS TO ENVIRONMENTAL INTEGRITY

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There are a long list of threats in the Mediterranean Sea affecting all ecosystems. Recent regime shifts along with many phisico-chemical and biological trends suggest that the Mediterranean Sea ecosystem has already surpassed the threshold and what we are now currently witnessing is a transitional state of a gradual, but catastrophic regime shift. There are several examples of these shifts. For instance, the regime-shift in algal landscapes is producing a transition between productive macroalgal beds and impoverished urchin barrens. The overexploitation of fish that feed on sea urchins seems to be the main cause of the formation of barrens. Sea urchin overgrazing produces the virtual disappearance of macroalgal cover in shallow rocky reefs that become apparently naked barrens. The barrens are very stable and remain as sea urchin biomass is maintained after the shift, preventing any leap towards the previous state. No-take marine protected areas are useful in maintaining high densities of sea urchin predators. Therefore MPAs are the best natural management tool for protecting macroalgal canopies.

S28.4 - CONNECTIVITY AS THE KE Y FOR NETWORKS OF MPAS

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Marine Protected Area (MPA) networks provide more protection than a set of individual, unconnected protected areas. Thus, one of the main focuses is on how to obtain useful measures of connectivity that can be combined to improve the design and the management of MPA networks. In the context of COCONET, dedicated work has beenperformedin two pilot studies, in southern Adriatic and Black Sea, in order to obtain measures of connectivity based on genetic approaches. Population samples have been collected at 17 sites, mostly representative of existing or planned MPAs, in the two areas of study. Genetic differentiation data have been obtainedfor 18 species with different biology and ecology, including algae, invertebrates and fish. Genetic analyses have been compared with estimates of potentialconnectivity obtained bycoupled physical–biological models that integratewater circulation models and a description of biological traits affectingdispersal. Comparisons among species and basins provided insights about the factors driving connectivity and allowed to gain information, in different environmental settings, about the optimal spacing at which MPAs can potentially act as a network. Collectively, these results indicate that genetic methods can provide useful indications for the establishment of effective MPA networks.

S28.5 - COCONET PROJECT: THE ROLE OF THE ZOOPLANKTON IN THE MPAS CONNECTIVITY OF THE SOUTH ADRIATIC SEA

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Many coastal benthic specieshave pelagic propagules (the mero-plankton). Theyare generally unableto counteract marine currents. The vertical position of pelagic propagulesin the water column could affect dispersal through interaction with depth-varying currents. Thus, connectivity of benthos populations between different locations may be affected by such a tridimensional current frame, and bypropagulesmortality. Understanding the dispersal potential of pelagic propagules is our objective.The present study analyses the pelagicpropagules toinvestigate the demographic connectivity of coastal communities in the South Adriatic Sea and Otranto Channel. The problems of sampling pelagic propagules with enough resolution in the three dimensions of the sea have been resolved with a combination of collecting gears and sampling strategy carried out duringtwo oceanographic cruises.The BIONESS multi-net device for a layered and continuous sampling of the water columnhas been used. Accurate and quasi-instantaneous estimates of propagules have been establishedthroughout the vertical column with a single haul per station. Simultaneously to the tows, environmental parameterswere measured for water masses structure (thermocline, alocline, MCD). Apulian and Montenegro coastal communities resulted connected but propagules exchange has been found to be unidirectional. Larvae of Decapoda, Gastropoda, and Fish have been used for a connectivity preliminary model.

S28.6 - OFFSHORE WIND FARMS AND MARINE PROTECTED AREAS: INTEGRATION IN THE CONTEXT OF THE FP7 COCONET PROJECT

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The development of Offshore Wind Farms (OWFs) and the establishment of Marine Protected Areas (MPAs) in the Mediterranean and Black Seas comprise two main elements for the production of clean energy, while maintaining and protecting biodiversity. Successful coupling of these two elements denotes that the criteria for selecting suitable locations for OWFs installation should not only include technical terms (e.g. high wind energy efficiency, bottom suitability, distance from land, etc.) but also, ecological-environmental (e.g. the least possible impact on biodiversity, ecosystem functioning) and socio-economic aspects (e.g. effects on coastal and marine activities, conflicts between different marine uses, development of marine spatial planning). In the context of the CoCoNET project, the integration between OWFs and MPAs is based on i) the identification of networks of MPAs, focusing on the biodiversity distribution patterns and current legislation, and favorable locations for OWF development, and ii) the design and development of the “Smart Wind Chart”, comprising a convenient and rational tool addressed to scientists and policy makers for the evaluation of maritime policy management schemes. In this way, the selection of potential OWF locations in the Mediterranean and Black Seas encompasses, apart from technical/engineering points of view, the environmental and socio-ecomomic aspects as well.

Keywords: renewable energy, offshore wind farms, marine protected areas, smart wind chart, Mediterranean and Black Seas

S28.7 - MEASURING COMMUNITY CONNECTIVITY IN THE ADRIATIC AND IONIAN SEAS

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Seascape connectivity is a primary factor affecting the spatiotemporal dynamics of marine metacommunities. Understanding how the interaction between the physical environment and the variety of movement strategies characterizing different organisms shapes the assembly of biodiversity at different spatial scales is therefore crucial to marine conservation. Here we use a set of biophysical models to explore, via Lagrangian simulation, multi-specific connectivity patterns across a spatial domain that encompasses the Adriatic Sea and the northern Ionian Sea. We analyze a model community composed by one primary producer (*Posidonia oceanica*), a primary habitat former in the Mediterranean Sea, and three common fish species (*Sarpa salpa*, *Symphodus ocellatus* and *Scorpaena porcus*) characterized by different dispersing features and occupying different trophic levels. The spatiotemporal settings of the models are based on available data on habitat suitability and species-specific dispersal traits. We assess the degree of connection in terms of intensity, efficiency, temporal persistence and distance of propagule exchange across the study area. After analyzing connectivity patterns for each species, we synthesize the results into a set of community connectivity metrics, and show how they can support site prioritization and the assessment of the potential role of existing protected areas in ensuring community connectivity.

S28.8 - BETA-DIVERSITY, CONNECTIVITY AND RESILIENCE POTENTIAL IN SHALLOW SUBTIDAL ASSEMBLAGES

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Quantifying patterns of β-diversity is crucial to link local and regional diversity exploring diversity changes across environmental and biogeographical gradients, and to understand ecological processes such as connectivity. A well-known spatial pattern of b-diversity among communities is the decay of similarity at increasing distance. The distance decay of similarity provides a simple descriptor of how biodiversity is distributed at a given spatial extent, supporting conservation planning strategies. A manipulative experiment carried out on shallow rocky subtidal in the south Adriatic Sea contributed to assess the potential connectivity across eight locations, from an analysis of distance-decay relationships. Recovery trajectories were analysed to explore correlations between the rates of recovery and small-scale heterogeneity and taxon richness. Results show that this area is characterized by low b-diversity from local to large scale. These results reinforce the idea of a high potential for connectivity in this area derived from oceanographic data. The potential connectivity appears less pronounced in the west side of this area, where a higher habitat fragmentation, a marked human footprint, and geographic barriers could hamper dispersal, even at local scale. Due to this general biological homogeneity, few marine reserves allow protecting the regional biodiversity, without specific constraints related to their spacing.

S28.9 - HEAVY METAL (CU NI CD CR PB) ACCUMULATION IN THE ORGANS OF *SCORPAENA PORCUS* (LINNAEUS 1758) FROM THE ROMANIAN BLACK SEA

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Heavy metals pollution is well monitored in the Romanian Black Sea, showing that it has considerably decreased in the last decade, but it is unclear how it interacts with the marine biota, as each species absorbs these metals differently in their body parts. This study was focused on the investigation of the heavy metals (Cu, Ni, Cd, Cr, Pb) localization in the body of the brown scorpionfish *Scorpaena porcus* and round goby *Neogobius melanostomus* (Pallas, 1814) from the Black Sea at Agigea and Eforie Nord, Romania during 2014. The metals were measured using the GF-HR-CS-AAS method, using a ContrAA600 apparatus. For each analyzed metal, validation methods and QC testing using reference materials were conducted. In the samples of *Scorpaena porcus* only copper and nickel could be identified and quantified using this technique, while Pb, Cr and Cd were below the detection limit. All five analysed metals were identified and quantified in the samples of *Neogobius melanostomus*. Copper was in higher concentrations in *Scorpaena porcus* than in *Neogobius melanostomus*. The results provide important data concerning heavy metals accumulation in different organs for the studied fishes.

S28.10 - GEODATABASE AND WEBGIS FOR DATA MANAGEMENT AND KNOWLEDGE INTEGRATION IN THE FRAMEWORK OF THE COCONET PROJECT (TOWARDS COAST TO COAST NETWORKS OF MARINE PROTECTED AREAS COUPLED WITH SEA BASED MARINE ENERGY POTENTIAL)

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CoCoNET is a European project that will produce guidelines to design, manage and monitor network of MPAs and Ocean Wind Farms (OWF). The Project covers a high number of Countries and involves researchers covering a vast array of subjects, developing a timely holistic approach and integrating the Mediterranean and Black Seas scientific communities through intense collective activities and a strong communication line with stakeholders and the public at large. Within this project we aim at providing a common framework for marine data management and final synthesis of the outcomes of different scientific topics from heterogeneous sources. An integrated Geodatabase and a WEBGIS system will be the linking tool for all partners, regions and thematic research. It will involve the entire consortium at different levels in topics such as data provision and integration, GIS products, GIS interpretation, data archiving and data exchange. This presentation illustrates the architecture of the marine Geodatabases and the structure of the WebGIS, developed with ArcGIS Server coupled with the CMS GIS MOKA (implemented by Semenda in cooperation with Regione Emilia Romagna), to manage network of marine protected areas and Ocean Wind Farms (OWF) in Mediterranean and Black Sea.

STABLE ISOTOPES IN ECOLOGY: CROSSING BOUNDARIES ACROSS DISCIPLINES AND SCALES

S29.1 - STABLE CARBON ISOTOPE LABELING: A VERSATILE TOOL IN RESEARCH ON PLANT ALLOCATION

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Plant carbon allocation across organs and across metabolic pools but also exchanges with symbiotic partners like mycorrhiza and rhizobia have been the subject of research for more than half a century. A great variety of conceptual models have been developed to mimic observed allocation patterns and arebased on the assumption that plants preferentially allocate carbon to tissues that are responsible for the acquisition of the most limiting resource. Such assumptions, termed optimum partitioning, functional equilibrium or balanced growth, are intuitive and logic,but empirical evidence is sparse or absent. Studies on carbon allocation require the manipulation and the assessment of the whole-plant carbon budget and its partitioning into different pools (e.g., respiration, biomass, soluble sugars, starch, metabolites). However, such manipulations are technically challenging and expensive. I will present an overview of research carried out in a unique facilityallowing manipulations of the plant carbon balance by controlling atmospheric [CO_2] and its isotopic signature. The use of isotopic tracers allows investigations on plant allocation responses to changes in carbon supply but also to other stresses like drought. I will report results on carbon allocation in different plant types (trees, herbs and grasses) and in symbiotic systems.

S29.2 - C AND N ALLOCATION ON TRADITIONAL AND MODERN WHEAT VARIETIES UNDER PREINDUSTRIAL, CURRENT AND FUTURE [CO2] USING STABLE ISOTOPES

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C and N allocation were study in order to compare the behaviour and acclimation processes of traditional and modern wheat varieties subjected to different CO_2 scenarios. Plants were grown in three CO_2 levels: future (731.7±6.9 µmol·mol^{-1}), preindustrial (249.4±13.6 µmol·mol^{-1}) and current (409.3±2.5 µmol·mol^{-1}). We conducted a simultaneous double labelling with $^{13}CO_2$ (99.9%) and $^{15}NH_4$-$^{15}NO_3$ (5% enriched in solution) to characterize C and N management. $\delta^{13}C$ and $\delta^{15}N$ in TOM were analysed using an EA-IRMS. [CO_2] and $\delta^{13}C$ in CO_2 respired were analysed by GC-C-IRMS. Blanqueta had higher total biomass, more length and number of stems and spikes and had similar photosynthetic assimilation rate (23.8±2.1 µmolm^{-2}s^{-1}) than Sula (23.3±14.3 µmolm-2s^{-1}), but Sula has bigger spike weight. Blanqueta showed more $\delta^{13}C$ in TOM than Sula. The $\delta^{13}C$ in TOM between CO_2 treatments was higher in preindustrial than in current or future CO_2. The $\delta^{13}CO_2$ respired is higher in Blanqueta than Sula. No large differences in $\delta^{15}N$ for TOM between different CO_2 treatments were found. Results showed that plants grown in preindustrial conditions had less discrimination against ^{13}C than in future conditions because the availability of CO_2 in the environment was lower. The traditional is more ^{13}C enriched than modern variety.

S29.3 - EFFECTS OF EXPERIMENTAL SUMMER DROUGHT ON THE CARBON ALLOCATION OF TWO DWARF SHRUB SPECIES IN THE CENTRAL ALPS

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Climate projections suggest an increased risk of summer drought in Central Europe. While recent studies in mountain meadows demonstrate that drought can alter the fate of recently assimilated carbon, little is known about the drought response on carbon uptake and allocation in dwarf shrubs. To fulfil this gap we experimentally simulated 9 weeks of summer drought and $^{13}CO_2$ pulse-labelled mixed stands of *Vaccinium myrtillus* and *Vaccinium gaultherioides* forming a sparse dwarf shrub community at 1850 m a.s.l. in the Austrian Alps. We traced the effects of drought on the uptake and allocation of ^{13}C in above-ground and below-ground biomass and the respective respiration of these species. Furthermore, we further studied net ecosystem carbon uptake, stomatal conductance (g_s) and water potential (ψw) as proxies for plant water stress. We hypothesized that drought would increase the relative allocation of recently assimilated carbon to below-ground organs and that it would slow-down its transfer velocity. We also expected respiration rates of leaves and rhizomes to decrease under drought. Preliminary results suggest that the imposed summer drought did not have a strong effect on the carbon allocation and respiration of our study species. We discuss the results obtained with stable isotope analysis and their implications.

S29.4 - STABLE ISOTOPE RATIOS OF HYDROGEN SEPARATE MAMMALS OF AQUATIC AND TERRESTRIAL FOOD WEBS

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Hydrogen stable isotope ratios (δ^2H) are increasingly used as endogenous markers to quantify the relative importance of allochthonous input of organic material into aquatic ecosystems. Yet, it is unclear if differences in δ^2H values between aquatic and terrestrial food webs translate into corresponding differences of δ^2H values of consumers. Based on a multiple-isotope approach, we observed that δ^2H and $\delta^{15}N$ values of fur keratin differ between species that trawl insects in aquatic habitats and those that glean terrestrial insects. Indeed, δ^2H values of fur from trawling Myotis species was lower by about 33 to 56‰ in relation to that of gleaning species. We then assessed the relative association of aerial–hawking bat species to the terrestrial food web using trawling and gleaning bats as representatives of consumers in aquatic and terrestrial ecosystems respectively. Isotopic niche dimensions, as estimated by standardized ellipse areas using δ^2H and $\delta^{15}N$ values, varied largely among study species, with largest overlaps of isotopic niches among members of the aerial-hawking bat ensemble. We conclude that δ^2H values of fur keratin is a suitable parameter for evaluating the relative membership of mammals to aquatic and terrestrial food webs and to evaluate niche packing of species within consumer ensembles.

S29.5 - UNRAVELLING WATER SOURCES IN GYPSUM PLANT COMMUNITIES THROUGH THE USE OF STABLE ISOTOPES.

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Gypsum soils occur in arid and semi-arid areas of the five continents. It has been suggested that access to different water sources may shape the distribution and survival of gypsum plants, but experimental data on the water sources used by gypsum plant communities are lacking. We analyzed the hydrogen ($\delta^{2}H$) and oxygen ($\delta^{18}O$) isotope composition of the xylem water of 10 dominant woody species growing in different positions along gypsum hills from the gypsum outcrops of NE Spain during spring and summer 2012 and compared it to the isotopic composition of the different water sources in the ecosystem: the water table, rain water and free and crystallization soil water. Our results demonstrate a clear segregation in the sources of water used by co-existing woody species from gypsum communities, which responds to their root depth and position along gypsum hills. Shallow-rooted plants without direct access to the water table tend to exploit free and crystallization soil water from the first centimetres of the soil. Contrastingly, deep-rooted plants and plants from saline depressions thrive on the water table. These results have important implications for the understanding of the arrangement and functioning of gypsum plant communities.

S29.6 - IS UNCOUPLING BETWEEN SOIL AND XYLEM WATER ISOTOPIC SIGNATURES ACTUALLY OCCURRING?

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The isotopic composition of xylem and soil water presents great potential for characterizing water movement along the soil-plant-atmosphere continuum. However, xylem water does not always show a perfect correspondence with soil water. Here, we designed a series of experiments aimed to determine the causes of the uncoupling in the isotopic signal from soil to xylem. Firstly, to assess whether plants use different soil water fractions with variable matrix potential (which are mixed during custom soil water extraction, i.e. cryogenic distillation) we applied deuterium labelling to seedlings aimed to fill macropores while not replacing tightly-bound water. We sampled xylem and soil water while continuously measuring transpiration water. Although the labelling strength was variable, we found a tendency to recover pre-labelling signal with drought progression, suggesting a shift in water pool. Secondly, we tested the role of branch evaporative enrichment. We measured the evolution of xylem water 1) during twig dehydration after cutting and 2) in well watered seedlings after covering the leaves to prevent transpiration. We found a strong enrichment in twigs, proportional to water loss, and a similar effect in seedlings. We conclude that both processes may occur simultaneously under drought.

S29.7 - TRADE-OFFS AMONG LIFE FUNCTIONS CONSTRAIN ADAPTIVE VARIATION IN *PINUS HALEPENSIS* MILL.: A PERSPECTIVE FROM STABLE ISOTOPES

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Aleppo pine (*Pinus halepensis* Mill.) is the most widely distributed Mediterranean conifer. As a consequence of climatic differentiation, the populations of this species harbor a wide adaptive genetic diversity that may be valuable to face future challenges associated to climate change. However, resource allocation between different life functions can be subjected to tradeoffs preventing the simultaneous maximization of all functions. Environmental limitation, in particular reduced water availability common in Mediterranean region, can increase the strength of these tradeoffs. The aim of this work is to understand the structure of intra-specific variation in terms of drought resistance, reproduction, carbon storage and growth for Aleppo pine. In a common garden trial including 56 populations, we determined 1) plant water uptake patterns using stable isotopes in xylem and soil water as hydrological tracers, 2) water-use efficiency, based on carbon isotope composition in wood tissues, 3) reproductive effort (number of cones), 4) dynamics of storage carbohydrates and 5) aboveground carbon allocation. The integrated analysis of all these traits revealed significant trade-offs between the different traits, leading to distinctive trait syndromes. In particular, populations from xeric sites showed reduced aboveground growth, associated to drought tolerance mechanisms and increased reproductive effort.

S29.8 - STABLE ISOTOPES: A TOOL FOR UNDERSTANDING COASTAL DUNE FORESTS' FUNCTIONING UNDER SCENARIOS OF GLOBAL CHANGE

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The high ecological diversity of sand dune forests, with marine and river influence, are characterized by sandy soils, poor in nutrients and with different levels of salinity and GW, and can occur in different climatic regions of the globe. Such is the case of Tropical, and Mediterranean areas, where future climate change is predicted to reduce water availability. Sand dune plant communities encompass a diverse number of species that differ widely in root depth, tolerance to drought and fluctuations of the water table, and capacity to shift between seasonal varying water sources. In addition to climate changes, biological invasions, are one of the most important sources of changes in ecosystems functioning, with large impacts on biodiversity, ecosystem services, soil nutrient, fire cycles and productivity. Acacia spp. are amongst the most aggressive invading species, with vastly negative effects in Portuguese and Spanish ecosystems. In this study we will present the results of a large climatic scale study, covering Brazil, Portugal and Spain, and how the application of stable isotopes (^{13}C, ^{15}N, ^{18}O), community structure and geostatistical interpolation methods can be used to understand the spatial and temporal component of biological and chemical processes under scenarios of climate and global change.

S29.9 - INTRA-ANNUAL TREE RING Δ 13C ACROSS TIME: TRACKING THE RESPONSES OF *Q. PETRAEA* TO CLIMATIC VARIATION

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The role of forests as carbon sinks is gaining importance given the increasing emissions of CO_2 to the atmosphere. Flux towers are useful to understand the carbon cycle, but still limited data are available. As a consequence, other methods able to record tree functioning are needed. In the present study, we collected cores from *Q. petraea* trees in a temperate forest of northern France. We analyzed their growth and carbon isotopes at an intra-annual scale for the period 2005-2013 and further compared the variations of ring water use efficiency (WUE) with canopy WUE calculated from a flux tower. Moreover, we i) related the annual and seasonal dynamics of $\delta^{13}C$, $\Delta^{13}C$ and WUE with climate, ii) studied the role of carbon reserves in the observed patterns of $\delta^{13}C$ in the earlywood, iii) examined the between-tree variability. The preliminary results denote higher values of WUE in the rings than that in the canopy. Most years were characterized by a tri-phase $\delta^{13}C$ dynamics, but we also found particular years with very high (e.g. 2010) or very low $\delta^{13}C$ values (e.g. 2007), and with different intra-annual shapes (e.g. 2006), which were linked to climate conditions. We further discuss the physiological processes underlying tree ring formation.

S29.10 - CAN WE USE D15N IN LICHENS AS AN INDICATOR OF NITROGEN POLLUTION AND A SURROGATE OF NITROGEN ATMOSPHERIC ISOTOPIC COMPOSITION?

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The synergism between climatic and anthropogenic factors and the superimposition of multiple nitrogen sources still make difficult the use of isotopic signature of lichens to map atmospheric nitrogen deposition. To understand how lichen's isotopic signature is affected by nitrogen, thalli of the sensitive *Evernia prunastri* and of the tolerant *Xanthoria parietina* were exposed for ten weeks to different forms (dry-NH_3, wet-NH_4^+, wet-NO_3^-) and doses (16, 32 and 64 kg N ha^{-1} yr^{-1}) of nitrogen under controlled conditions, and physiological parameters, total nitrogen and carbon, d15N and d13C were measured. In parallel, thalli of *Cladonia portentosa* (moderately sensitive) exposed to the same treatments for 11 years or 6 months were analyzed to investigate the role of time of exposure. Our results showed that: - lichen nitrogen content and d15N were correlated with the nitrogen dose of the N treatments; - lichen d15N tends to become similar to the source's signature; - different species showed different d15N in response to the same treatments, probably due to their cation exchange capacity; - nitrogen content and d15n are well correlated in case of long-term exposure. The potential use of lichen d15N as a surrogate of atmospheric nitrogen isotopic composition is discussed.

ECOTOXICOLOGY

CS01.1 - TOXIC AND GENOTOXIC EFFECTS OF DIFFERENT PESTICIDES AND THEIR MIXTURES ON THE NONTARGET MODEL ORGANISM *EISENIA ANDREI*: LABORATORY AND FIELD STUDIES

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Pesticides are harmful to specific target organisms; however, absolute selectivity is difficult to achieve and pesticides represent a risk also to non-target organisms. Most of the studies have focused on effects at organism/population level; data concerning sublethal effects have been rarely described. In this study we evaluated the toxicity of different pesticides widely used in agriculture on the earthworm *Eisenia andrei* by simulating in the laboratory the processes carried out in the rice- and vine-fields. The results demonstrated that all the studied compounds at concentrations recommended by the manufacturers provoked relevant stress and genotoxic effects on 28 d exposed worms. To verify the results of this laboratory study, we also realized field studies. For this purpose, a method was developed to maintain the earthworms in field for 10/28 d. The animals caged in the sites of rice (during the dry period) and vine cultivation treated with the pesticides (at the doses used in laboratory experiments) survived. However, also in these animals, significant effects on sublethal endpoints were observed. In both crops, the results highlighted genotoxic effects as demonstrated by the increase of the level of the DNA damage and of the micronuclei frequency.

CS01.2 - TOXICOLOGICAL EFFECTS IN SOIL AND WATER BIOINDICATORS EXPOSED TO OLIVE MILL WASTE BEFORE AND AFTER DEPHENOLISATION TREATMENT

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The oil extraction process produces a large quantity of olive mill waste (OMW) that can be re-use in agriculture. They are spread on the bare soil before the planting or seeding or on the fields of olive trees. The disposal of this waste represents one of the most serious problems that olive mill factories face. OMW contains high quantity of polyphenols, potentially harmful for the environment, in fact they seem to be responsible for the phytotoxic and antimicrobial effect of the OMW. The aim of this study was to evaluate the toxicological effects of OMW before and after a specific dephenolization treatment, using a biomarker approach. Specimens of *Eisenia fetida* and *Gambusia affinis* were exposed under laboratory condition at three concentration of olive humid husks and olive mill wastewater before and after the dephenolization treatment and a set of biomarkers: LPO, antioxidant, Comet assay, ENA assay, AChE, MT and LMS were carried on. The main results showed toxicological effect in the organism exposed to the olive mill waste before the dephenolization treatment with evidence of genotoxic, and oxidative stress effect. After the dephenolisation process the results showed a significant reduction of the toxicological effects in all exposed organisms.

CS01.3 - LONG-TERM TOXICITY OF NANOPLASTICS TO MARINE PLANKTON SPECIES *DUNALIELLA TERTIOLECTA* AND *ARTEMIA SALINA*

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Nowadays, plastic pollution has been globally recognized as critical issue for marine ecosystems and nanoplastics constitute the last frontier to fully understand the magnitude of this threat. However, due to the difficulty in sampling and identifying nano-sized debris, their occurrence in the environment has not be quantified yet. Polystyrene nanoparticles (PS NPs) are currently adopted as model for nanoplastics in acute tests, but data concerning long-term toxicity on marine organisms are still lacking. Our study aims at evaluating chronic effects of 40nm anionic carboxylated (PS-COOH) and 50nm cationic amino (PS-NH2) NPs in marine alga *Dunaliella tertiolecta* and brine shrimp *Artemia salina*. PS-COOH did not alter the growth of both marine algae (72h) up to 25µg/ml and brine shrimps (14d of exposure) up to 10µg/ml; nevertheless, high accumulation in the gut was previously observed for 48h brine shrimp larvae. On the opposite, PS-NH2 caused high mortality of brine shrimp larvae (14d) at 1µg/ml as well as inhibition of algal growth (EC50 0.69µg/ml, 72h) was observed respect to control. These findings provide a first insight into long-term toxicity of nanoplastics for marine plankton, underlining the role of surface charge in their toxicity as reported in previous studies using different animal models.

CS01.4 - DDT AND HG CONTAMINATION OF TOCE RIVER (ITALY): STUDIES FOR EVALUATING THE ON-SITE BIOAVAILABILITY (USE OF PASSIVE SAMPLERS AND BENTHIC INVERTEBRATES)

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DDT and mercury contamination in the Toce River was caused by a factory producing technical DDT and using a mercury-cell chlor-alkali plant. In this study, DDT and Hg contamination and bioavailability were assessed in the Toce River by different approaches: 1) direct evaluation of sediment contamination; 2) the assessment of bioaccumulation in native benthic invertebrates; 3) the evaluation of the on-site bioavailability for aquatic organisms using passive samplers.Sampling stations were selected upstream and downstream the industrial plant along the river axis. Results showed an increasing DDT and mercury contamination in sediments and in benthic organisms from upstream to downstream sites. Benthic invertebrates exhibited Hg concentration up to 0.33 mg kg^{-1} d.w., with higher values for collectors and predators. The highest DDT contamination instead resulted in Gammaridae and Diptera with concentrations up to 300-400 ng g^{-1} d.w.. Concentrations in macroinvertebrates and sediments were used to calculate the Biota Sediment Accumulation Factor (BSAF); results showed high values of BSAF revealing the capacity to bioaccumulate of the investigated taxa. The on-site exposure of passive samplers showed increasing concentrations of both contaminants in pore water of sediments from upstream to downstream sites, proving considerable bioavailability of DDT and Hg to benthic organisms.

CS01.5 - EFFECTS OF CONTAMINANTS ON THE AUTOPHAGIC PROCESS IN MUSSELS: NEW INSIGHTS AND POSSIBLE APPLICATIONS

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In this work we show the accumulation and distribution of benzo[a]pyrene (B[a]P), detected by chemical and immunohistochemical methods, in the digestive glands of mussels exposed to 5, 50, 100 µg/L of the xenobiotic. B[a]P stimulates the lysosomal accumulation of neutral lipids and at the higher concentrations, B[a]P accumulates in these compartments. B[a]P also activates the autophagic process as demonstrated by the strong decrease of lysosomal membrane stability and correlated increase in lysosomal/cytoplasm volume ratio. One of the possible processes that could explain the observed effects is the mTOR (mechanistic target of rapamycin) dependent signal transduction pathway. In mammals, the phosphorylated active form of mTOR is involved in the activation of protein translation, reduction of the autophagic activity and activation of fatty acid metabolism. The dephosphorylation of mTOR will, therefore, contribute to decreased protein synthesis, to autophagy activation and to an increase of cellular neutral lipids. Immunohistochemical data demonstrated that in the digestive gland cells of mussels exposed to 50 and 100 µg/L B[a]P, the level of phosphorylated mTOR drastically decreased and, conversely, the unphosphorylated form is significantly enhanced. The role of mTOR in the regulation of the cellular responses to the contaminants has been confirmed in a field study.

CS01.6 - ELUCIDATING THE FREE FATTY ACID PROFILE OF CAGED MUSSELS *MYTILUS GALLOPROVINCIALIS* FOR THE ASSESSMENT OF ENVIRONMENTAL POLLUTION

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Despite the large amount of research devoted to investigating the biological effects of aquatic pollution on sentinel organisms, scarce literature is reported about their lipid biochemistry and the impact of anthropogenic stressors on lipid dynamics. Among the lipid classes, free fatty acids (FFAs) regulate the general metabolic functioning, somatic growth, reproduction and immunocompetence, acting as signalling molecules. Within this context, the present work aims to characterize the FFA profile of *Mytilus galloprovincialis* caged in an anthropogenically-impacted area and in a reference site to assess the biological alterations induced by aquatic pollution. So, an innovative approach based on nanoscale liquid chromatography coupled to electron impact-mass spectrometry was developed and qualitative and quantitative comparisons were carried out. A total of 20 and 17 FFAs were reliably identified in mussels coming from the reference and polluted site, respectively. Significative differences in amounts of omega-6 and omega-3 FFAs along with alterations of other species (i.e. decrement of monounsaturated:saturated fatty acid ratios) may explain adverse and compromising effects (e.g. inflammatory process and oxidative stress) induced by specific contaminants of the area. Such an approach demonstrated to be effective and sensitive for the site-specific assessment of toxicity mechanisms associated with different xenobiotics on bivalve organisms.

CS01.7 - EVALUATION OF THE IMPACT OF ENVIRONMENTAL CONTAMINANTS OF COASTAL AREAS SUBJECT TO PRE- AND POST-BIOREMEDIATION BY THE APPLICATION OF GENOTOXICITY BIOMARKERS IN MUSSELS *MYTILUS GALLOPROVINCIALIS*

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This research is part of a wider national project "The systems biology in the study of the effects of xenobiotics effects on marine organisms for evaluation of the environmental health status: biotechnological applications for potential recovery strategies". The potential genotoxic effects of environmental contaminants in mussels *Mytilus galloprovincialis* caged for 2 months on Italian coastal marine ecosystems with different anthropogenic impact was evaluated. Specimens of mussels were caged in summer and winter along the Augusta and Naples coastlines (Sicily and Campania, Italy). A set of genotoxicity biomarkers (Comet assay and MN test) was evaluated in freshly haemocytes of sentinel organisms. Trace element content (Hg, Cd, Pb, Cr, Cu, Zn, Fe, Mn, Al, Ni), PAHs and OCs were determinate in soft tissue of mussels. The set of biomarkers and the measurement of levels of different contaminants were also applied to experiments with mesocosms where different technologies of recovery will be carried out. This approach can be useful for a integrated assessment of the effectiveness remediation processes of marine water and sediments contaminated by PAHs and heavy metals.

CS01.8 - AN INTERDISCIPLINARY APPROACH TO CHARACTERIZE SEAGRASSES: THE STUDY OF *HALOPHILA STIPULACEA* MEADOWS IN THE GULF OF AQABA BY MORPHOLOGICAL, BIOCHEMICAL DESCRIPTOR AND EPIPHYTIC MICROBIAL COMMUNITIES

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Seagrasses are among the most valuable marine ecosystems on earth, yet they are declining worldwide at an alarming rate. There is a growing interest to develop alternative diagnostic tools to identify changes in seagrasses conservation status at an early stage. In this study, three *Halophila stipulacea* meadows, along a gradient of different human uses and geomorphological features in the Gulf of Aqaba (Red Sea), were characterized using an integrated approach to highlight possible differences in their ecological status. Plant descriptors (leaves morphometrics, photosynthetic pigments and total phenols contents) were coupled with the plants' epiphytic microbial community structure and composition (454 pyrosequencing analysis), and then linked to environmental variables, geomorphological features and human uses of each meadow. The entire suite of descriptors depicted significant differences among the meadows plants eco-physiology and their microbial communities in response to different physico-chemical and geo-morphological features. This is the first time that such descriptors have been used in an integrated approach and they effectively discriminated seagrasses conservation status, even at small spatial scales. This work constitutes a new approach for seagrass monitoring and a stepping stone in the application of microbial communities as a putative marker in a changing environment.

CS01.9 - MACROFAUNAL COMMUNITY AS INDICATOR OF SANDY BEACHES ENVIRONMENTAL QUALITY

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Ecosystems are under the pressure of complex mixtures of contaminants whose effects are not always simple to assess. Among these, sandy beaches environments are one of the most vulnerable and seriously endangered ecosystems in the world; in recent years have been variously disturbed and damaged by human interventions.Biomarkers, acting as early warning signals of the presence of potentially toxic xenobiotic, are useful tools for assessing effects of these compounds and provide information about their bioavailability. In this context, ecotoxicogenomics provides an attractive approach to study changes after exposure to an environmental stressor; variation in gene expression should be taken into consideration when determining xenobiotic mechanisms of action. Our research program foresees investigations at different levels to unravel the biotic effects associated with environmental perturbations. We hence focus on sandy beaches close to the mouth of rivers flowing on the Central Italian Mediterranean coast with the main goal of providing innovative indicators of environmental stressors. For this purpose, we carried out chemical analyses of sand; these results were coupled with the screening of the transcriptomes of the amphipod *Talitrus saltator* (Talitridae, Amphipoda), a key species of sandy beach communities. Finally, we are firstly applying a biomarker of genotoxicity in *T. saltator* to monitor the effects of pollution at a low level of biological organization.

CS01.10 - MACROALGAL SEASONALITY EFFECT ON CARLIT METHODOLOGY

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The CARLIT index (Ballesteros et al. 2007) assesses the coast water quality on basis of macroalgal assemblages. Macroalgal development is known to be strongly seasonal and the late spring (May and June) is the period when macroalgae reach their peak growth. For this reason, the CARLIT methodology is implemented in this period of time. Since the assessment of the CARLIT index in several sites, e.g. at a regional level, may last more than one month (due to sea conditions), the data collected may be affected by the seasonality of macroalgal growth. Particularly, Cystoseira spp., some of them with the highest sensitivity level, show strong variability in their thalli length that can confound the attribution of the correct community category, affecting the CARLIT index calculation. In order to quantify how the seasonality affects the CARLIT index values, we sampled four different sites along the Ligurian coast once a month from March to June. In each site CARLIT data, percentage cover and biomass of macroalgae and sea water temperature were collected and morphometric data of the Cystoseira species were measured in the lab. Data were analyzed in order to highlight the effect of the season in the implementation of the CARLIT methodology.

CS01.11 - A NOVEL BIOTECHNOLOGICAL TOOL TO MONITOR TRACE ELEMENTS AND PAHS BASED ON A DEVITALIZED MOSS CLONE: THE MOSSCLONE OUTPUT

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"Moss bags" are widely employed for monitoring of airborne trace elements and PAHs despite some intrinsic limitations, such as the environmental impact of moss sampling, the heterogeneity of bag-preparation and the incomplete standardization of exposure protocols. To overcome these limits, a new biotechnological tool based on a devitalised moss clone was developed within the EU-FP7 MOSSclone project (www.mossclone.eu). A particularly performing peat moss (*Sphagnum palustre*) was selected, axenically cloned, and characterized in comparison to other mosses; the large-scale production of the clone was optimized; a new concept transplant device, the “mossphere”, was designed and produced; the moss bag exposure was methodologically standardized, and the use of the “mossphere” validated through comparison with traditional techniques (e.g. bulk deposition collectors and airborne particles samplers). As side-products, innovative protocols for PAHs quantification were developed. All the exposures were performed in background, rural, urban and industrial sites of Austria (continental), Italy (Mediterranean), and Spain (oceanic). The clone material is high-performance, and the new device allows a standardized exposure procedure. The results are discussed in terms of material homogeneity, availability and costs. If further developed from a commercial perspective, the new tool might solve some of the problems faced by air pollution biomonitoring techniques.

CS01.12 - GOING BEYOND THE WEEE DIRECTIVE: EXAMPLES OF WASTE MANAGEMENT OPTIONS THAT CREATE ADVANTAGES FOR THE ENVIRONMENT

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The European WEEE Directive lays down measures to protect the environment and human health by preventing/reducing the adverse impacts of the generation and management of waste electrical and electronic equipment (WEEE). This directive sets minimum recovery and recycling targets for different WEEE categories; in particular, 65% of computers, photovoltaic panels and other WEEE belonging to the same category should be recycled by August 2015. WEEE has been attracting attention also for the content in critical raw elements, as an important secondary resource in the global market. In this study, we apply a life cycle thinking approach (LCA) and consider different types of electronic waste as case studies for assessing environmental impacts and benefits determined by a management strategy that goes beyond the WEEE directive. We show that, by increasing recycling efforts to levels higher than the directive targets, advantages for the environment are achieved. Moreover, innovative recycling techniques for recovering also rare earth elements appear to provide environmental benefits only when processing certain typologies of WEEE (e.g. photovoltaic panels with “cadmium telluride” technology). LCA can be effectively used as a tool to assess the environmental sustainability of recycling processes, highlighting the phases that determine burdens for the environment.

GLOBAL CHANGE ECOLOGY

CS02.1 - CLIMATE INDUCED ENVIRONMENTAL STRESS IN INTERTIDAL GRAZERS: SCALING-UP BIOCHEMICAL RESPONSES TO POPULATION –LEVEL PROCESSES

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Living organisms are facing increasing levels of environmental stress under climate change that may severely affect the functioning of biological systems at different levels of organization. Reduction in body size has been proposed as a universal response of organisms to global warming. A still unresolved question is whether climate-related extreme events will impose selection directly on such phenotypic plastic responses. We performed a field experiment to investigate the effects of extreme desiccation events on antioxidant defense mechanisms of a rocky intertidal gastropod grazer (*Patella ulyssiponensis*), and evaluated if these effects scaled up to the population level through changes in a phenotypic trait (i.e. growth). Limpets experiencing extreme desiccation stress showed significant lower levels of reduced glutathione (GSH), and tended to grow less in comparison to individuals living in a more benign environment. Results suggested that phenotypic plasticity allowed biochemical signatures of stress to scale-up to the population level. By reducing individual's body size, such sublethal effects of environmental stress might profoundly affect the ecological interactions to which the invertebrates take part. Unveiling the linkages among different levels of biological organization is key to develop indicators that can anticipate large-scale ecological impacts of climate changes.

CS02.2 - MESOCOSM EXPERIMENT OF INCREASING TEMPERATURE AND EFFECTS ON THE PLANKTON COMMUNITY OF A MEDITERRANEAN LAGOON

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Water temperature is expected to increase in coming decades as a result of global warming and predicting the consequent responses of organisms is a complex challenge. In this work the effects of increase in temperature on the plankton community were investigated. Specifically, two hypotheses were tested: (1) warming increases metabolism of the system and drives it towards a small-species dominated system (bacteria-based foodweb), (2) warming benefits harmful algal species. A 16-days indoor mesocosm experiment was performed in February 2015 incubating water from Cabras Lagoon (Sardinia, Italy). Three treatments were applied in triplicate mesocosms: at 11 °C, i.e. present-day winter mean water temperature, based on long-term data from the lagoon, at 14 °C, i.e. predicted winter temperature in the region after 100 years, and at 17 °C, i.e. predicted winter temperature after 200 years. Preliminary results show a temporal increase in abundance of smaller phytoplankton species outcompeting the larger ones, and a simultaneous disappearance of flagellates in all the treatments. Regarding HAS, Aphanizomenon gracile and Pseudanabaena catenata (potential producers of saxitoxin and anatoxin, respectively) were observed in all the treatments.

CS02.3 - COMMUNITY AND TROPHIC STRUCTURE OF AMPHIPOD ASSEMBLAGES ASSOCIATED TO *POSIDONIA OCEANICA* IN A SHALLOW VOLCANIC CO2 VENT

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Shallow volcanic CO_2 emissions naturally alter local environmental features, having potential negative effects on associated communities. Literature evidence reports that changes occur in composition, but also in nutritional characteristics of primary producers. We questioned whether alteration in abundance and quality of primary producers may in turn affect consumers. We selected amphipods, one of the key groups in seagrass ecosystems, to evaluate their community and trophic structure in a shallow CO_2 vent (Panarea Island, Aeolian Archipelago, Italy). *Posidonia oceanica* and the associate amphipod assemblages were sampled in meadows from a shallow CO_2 (≈98%) vent and a control area. Significant differences were reported in the nutritional value (C%, N% and C:N ratio) and isotopic signatures ($\delta^{13}C$) of *P. oceanica*, although its biomass, contrarily to epiphytes, did not change. Amphipod assemblages showed differences in trophic group composition with omnivores and scavengers absent in the control and in the vent respectively. Differences in amphipod assemblages were discussed in light of the peculiar environmental features of the vent, and of the differences observed in seagrass nutritional value, inferring the direct and indirect effects of high CO_2 levels on benthic communities.

CS02.4 - WEAK AND SLOW RESPONSE OF HIGH ELEVATION GRASSLANDS UNDER GLOBAL CHANGE

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Global change is transforming mountains ecosystems across Europe at unprecedented rates since the early twentieth century. While forest expansions, shrubs encroachment into subalpine grasslands, and species towards mountain summits are well-documented in response to land-use and climate change, little is known about the impact of these drivers of change on alpine grasslands. In particular, the lack of long-term empirical evidences limits our ability to anticipate such impacts, because some community responses may develop over long periods of time. Even less is known about the potential synergies between the two drivers of changes. Here, we report on the long-term response of alpine grasslands over the last 20 years, by combining data from grasslands resurveys (1990 and 2010) and herbivory exclusion experiments (19-years). Community, species and trait level responses were examined to unravel the separate and interactive effects of the drivers of change. Contrary to expectations, grasslands were relatively stable over the last 20 years, and changes in species and traits were inconsistent with the land-use and climate change. However, we did find synergistic community effects between herbivory cessation and climate warming. Thus, evidencing the role of traditional grazing activities in maintaining highly valuable alpine grasslands under current climatic scenario.

CS02.5 - SHORT AND LONG-TERM EFFECTS OF AN ABSENT SNOW COVER ON BOREAL FOREST PLANTS

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As climate change is reducing duration and extend of snow cover in boreal regions, plants and soils experience more severe frost due to the lack of insulation, which can have important implications for ecosystem processes. Despite time lags and non-linearity in such ecological processes, the majority of our knowledge about ecosystem responses to long-term changes in climate originates from relatively short-term experiments. We utilized the longest ongoing snow removal experiment in the world to simultaneously compare the effects of short-term (1 winter) and long-term (11 winters) absence of snow cover on boreal forest plants. We found reduced vascular plant cover in the understorey, reduced fine root biomass and altered phenology above- and below-ground, as well as reduced shoot growth and tissue damage on two common dwarf shrubs. Thereby, more substantial effects for plant cover and root biomass were seen in the long-term manipulation, whereas other parameters were affected stronger in the short-term manipulation such that the short-term manipulation alone would over predict long-term impacts. These results highlight both the strong ecological impacts of an absent snow cover onto ecosystems characterized by a persistent snow cover, and also the value of long-term experiments in climate change research.

CS02.6 - SEASONAL TROPHIC NICHE SHIFT IN ANTARCTIC BENTHIC CONSUMERS

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We addressed the trophic niche shift of two dominant Antarctic benthic consumers, *Adamussium colbecki* and *Sterechinus neumayeri*, associated with seasonal sea-ice dynamics and depth at Terra Nova Bay (Ross Sea), by means of isotopic analyses and Bayesian mixing models. We hypothesised an increased contribution of sea-ice algae and plankton to the diet of benthic consumers after sea-ice break up. According to optimal foraging theories, we also hypothesised increased trophic generalism in ice-covered conditions, due to resource shortage. According to our hypotheses, niche width was higher in ice-covered conditions, and both species relied on detritus and benthic producers, overlapping their niches and suggesting high interspecific competition. Inversely, A. colbecky relied mainly on plankton and *S. neumayeri* on ice-algae in ice-free conditions, with no niche overlap. Isotopic signatures of specimens varied with size only in ice-covered conditions, with implications for intraspecific competition. Consumers shifted their diet on alternative resources when available, mediating the redistribution of nutrients along food chains and the benthic-pelagic coupling following changes in sea-ice cover. Although future changes in sea-ice dynamics are difficult to predict, trophic responses of dominant benthic consumers can be crucial in explaining functional effects of climatic changes on the Antarctic food web.

CS02.7 - INTEGRATED ASSESSMENT OF CANADIAN FOREST VULNERABILITY TO CLIMATE CHANGE

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Recent years have seen the multiplication of research efforts to forecast the effects of climate change on the distribution of forest plant species. Based on bioclimatic envelope modeling techniques, they often form the basis of vulnerability assessments. Still, the accuracy of these assessments remains limited, notably because these models rarely incorporate the differential abilities of species to tolerate and adapt to a changing climate. As part of the Forest Change initiative (Natural Resources Canada Adaptation Program), a project was developed aiming at integrating species-specific sensitivity and adaptive capacity with biophysical predictions to better inform decision-making regarding climate change adaptation strategies. A multidisciplinary working group reviewed the state of knowledge of the main mechanisms and traits that underpin sensitivity and adaptive capacity of North American trees to climate change. Trait derived quantitative indices were developed and combined to a set of model inputs. The wood volume projected to experience drought conditions as well as the tree capacity to track climate change under three climate projections was assessed from the integration of climate scenarios, climate moisture index, main species climatic envelope, Canadian forest wood volume and trait indices. This multidisciplinary integration enabled the generation of powerful maps to communicate risks.

CS02.8 - ASSESSING POPULATION-LEVEL RESPONSES IN PLANT COMMUNITIES AFFECTED BY DROUGHT-INDUCED DIE-OFF THROUGH SPECIES BIOCLIMATIC NICHES

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Climatic suitability differs among coexisting plant species in a given location, which partially explains the variation in their demographic responses (e.g., death, growth) to environmental fluctuations or disturbances. This becomes particularly notorious when these fluctuations involve extreme climatic events as evidenced by recent episodes of climate-induced die-off and species mortality in forests and shrublands across the world. Such situation could be aggravated under climate change scenarios, which predict increasing climatic variability, in addition to warming. We use climate envelope models models to estimate the climatic suitability of dominant coexisting species in a given locality severely affected by a recent episode of drought-induced die-off. Then, we correlate species climatic suitability to the impact of the drought episode in terms of canopy cover loss. We also assess whether species replacement resulting from such climatic episode favours species that exhibit higher climatic suitability under warmer and drier conditions. Our studies highlight the viability of species' bioclimatic niche to assess populations' performance in plant communities facing strong climatic fluctuations or along contrasted climatic gradients.

CS02.9 - DISTINCT EFFECTS OF DROUGHT ON PLANT SHOOT AND ROOT TRAITS AND ECOLOGICAL INTERACTIONS

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Environmental conditions are expected to shift to more extreme events due to climate change. More pronounced drought events may have consequences on various traits of plants, which, in consequence, could also affect herbivores feeding on these plants. To test this hypothesis, we used the Asteraceae Tanacetum vulgare, an aromatic plant which shows a high intraspecific variation in its terpene profiles of shoots and roots, forming so-called chemotypes. It is a weedy range-expander, having become invasive in parts of North-America. In response to drought, shoot biomass decreased. Furthermore, leaf terpenoid concentrations decreased only slightly, whereas root terpenoids were significantly induced by drought, with chemotypes differing in their responsiveness. Leaf-feeding herbivores showed only little sensitivity towards the drought treatment but were influenced by both quality and quantity of plant chemistry. The present results offer new insights into the intraspecific plasticity and organ-specificity of plant responses to global change.

CS02.10 - LIFE-HISTORY TRAITS AND RESPONSE TO GLOBAL CLIMATE-CHANGES: INSIGHTS FROM THE PAST

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Global climate change can seriously impact the epidemiological dynamics of vector-borne diseases by affecting the geographic distribution of the vector species. An understanding of how they responded to past environmental change may improve our understanding of their responses to ongoing climatic change. Here, we investigated how generalist arthropod vectors of human and veterinary concern, as the mosquitoes *Aedes caspius*, *Aedes albopictus* and the hard tick *Ixodes ricinus*, coped with Pleistocenic climatic changes. Genetic data and Species Distribution Modelling (SDM) showed that these species did not conform to the general scenario of contraction-fragmentation, but persisted with interconnected populations during glacial phases, likely due to their ability to exploit different habitats, or to their adaptability to exploit different resources or hosts. The climatic niche of I. ricinus was further projected into the future conditions under different scenarios of climate changes. SDM predicted an increase of the climatically suitable area of this species toward northern Eurasian regions, previously unsuitable for it. Taken together, these results highlight the importance of the species life-history traits in affecting how they cope with clime-induced environmental changes.

CS02.11 - DECADAL CHANGE IN ROCKY REEFS: THE IMPORTANCE OF OBSERVATIONAL ECOLOGY

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Marine coastal ecosystems are among the most affected by global change and human impacts. The study of historical data is one of the main approaches allowing the identification of pristine (or at least less impacted) conditions to which refer for the evaluation of changes occurred in the communities. In the NW Mediterranean Sea, the rocky bottoms of the Portofino promontory can claim one of the longest historical traditions of ecological studies and non-scientific observations. Scientific papers, scuba diving guides, bionomical (depth) transects and personal observations by experts, dating back up to the fifties, were analysed in order to collect data on the composition and the distribution of hard bottom benthic sessile communities, from the surface to about 40 m depth. Semi-quantitative data pointed out that several changes occurred in the specific composition and vertical distribution of communities over time, following a general trend already documented in the Mediterranean Sea. The nineties represented a turning point in the evolution of the assemblages, which further experienced, less than a decade later, extensive mass mortalities and the spread of invasive alien species. Beyond the important ecological results linked with wider scale events, the underestimated power of observational research is underlined.

CS02.12 - RESPONSE OF SOIL MICROORGANISMS TO SUMMER FLOODING AS AFFECTED BY PLANT DIVERSITY

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Large areas of Germany were affected by a summer flood in 2013 including the Saale river valley in Thuringia, the location of the Jena Grassland Experiment which was flooded for 24 days. We analyzed the response of soil microorganisms to the flood and explored if the response of microorganisms varied with plant species (1-60) and plant functional group richness (1-4). We measured microbial biomass and microbial growth characteristics after the addition of carbon and macronutrients (nitrogen and phosphorus). The results suggest that microbial biomass is markedly resilient against flooding even in summer, i.e. at high temperature. However, microbial basal respiration and growth response documented that microorganisms sensitively respond to the input of resources by flooding with the response being most pronounced at high plant species and functional group diversity, i.e. if plant-induced nutrient limitation is more pronounced.

CS02.13 - CLIMATE CHANGE INCREASES HERBIVORY IN ECTOTHERMIC OMNIVORES

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Freshwater communities are particularly vulnerable to climate change, as they are mainly composed of temperature-dependent organisms (ectotherms). As nutrient assimilation likely varies with temperature, we predicted that omnivores should increase herbivory at higher temperatures, because carbohydrate-rich diets (plant-based) provide energy faster than protein-rich diets (animal-based). We tested this hypothesis in three anuran species occurring along a temperature gradient, by exposing larvae to warm and heat wave treatments under either a plant diet, animal diet or both. We found that all species increased herbivory in response to warm treatments. Overall, the cold-adapted species was highly carnivorous, survived worse on plant diet and performed poorly in warm treatments. The warm-adapted species was highly herbivorous, survived worse on animal diet and fully compensated warming with accelerated growth and shortened larval period. The intermediate species was omnivorous, accelerated growth and shortened larval period in high temperatures, but did not fully compensate for warming in size at metamorphosis. Additionally, optimal diet for this species varied across temperatures, indicating a higher diet plasticity. Our results suggest that the carnivory-herbivory gradient matched the cold-warm gradient and that diet regulation may play a central role in the capacity of ectotherms to cope with climate change.

CS02.14 - PREDICTING THE LIKELY IMPACTS OF FUTURE AFFORESTATION ON BIRDS OF CONSERVATION CONCERN

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The conversion of natural and agricultural areas to plantation forests is an important element of global change and billions of euros are recommended for forestry for 2014–20 in the EU 2020 Biodiversity Strategy. Landscapes are being rapidly altered by planting of new forests, which consequently affect the composition and abundance of local communities. Using Ireland as a case study we combined the most recent records of afforestation with current and past bird distributions, to examine the relationship between level of afforestation and habitat use by birds of conservation concern. Our results indicate that bird specialists of lowland farmlands and raised bogs are particularly vulnerable to the impacts of afforestation as their current geographic ranges have recently undergone high rates of afforestation. We coupled this information with the identification of areas most likely to be afforested in the future and, with a combination of archived and newly collected data, modelled the impacts of future forest establishment under a number of likely scenarios. These findings will be crucial for providing information on the opportunities and constraints for forest expansion in the context of the EU Birds and Habitats Directives and are also applicable in the wider context of expanding forests globally.

CS02.15 - PREINDUSTRIAL PRESENT AND FUTURE [CO2] EFFECTS ON WHEAT ARE MODULATE BY WATER AVAILABILITY

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Atmospheric CO_2 levels are expected to double in coming centuries because of fossil fuel use, or/and deforestation. Beside, drought is the main constraint on wheat yield in Mediterranean conditions. The plant physiology parameters of durum wheat (*Triticum turgidum*, *L. var. durum*) were compared at three [CO_2] (i.e., depleted 260ppm, current 400ppm and elevated 700ppm) in plants subjected to two water regimes (i.e., well-watered, and mild water stress), during pre-anthesis, post-anthesis and at the end of grain filling. We showed that [CO_2] effects on plants are modulated by water availability. Plants at depleted [CO_2] showed photosynthetic acclimation (i.e., up-regulation) and reduced plant biomass and harvest index, but depleted [CO_2] combined with WS had a more negative impact on plants (i.e. with decreases in C assimilation). Plants at elevated [CO_2] had decreased plant growth and photosynthesis in response to a down-regulation mechanism resulting from a decrease in Rubisco and N content, but plants exposed to a combination of elevated [CO_2] and WS were the most negatively affected (i.e. decreases on plant biomass). In conclusion, plants grown at depleted [CO_2] showed acclimated photosynthetic capacity and at future [CO_2] decreased photosynthetic capacity, however the acclimation processes were clearly modulated by water availability

CS02.16 - A META-ANALYSIS AND AN EXPERIMENTAL TEST OF VARIATIONS IN THE IMPACT OF NON-NATIVE SEAWEEDS ALONG GRADIENTS OF HABITAT DEGRADATION

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Although species interactions are regulated by environmental conditions, few studies have investigated how the effects of non-native species vary according to habitat degradation. We performed a meta-analysis to test if and how the direction and magnitude of the effects on non-native seaweeds on resident assemblages vary in relation to cumulative anthropogenic impact levels. We found a trend for the effects of non-native species on community biomass and abundance and on species abundance to become less negative at heavily impacted sites. The hypothesis of weaker invader' impacts along a gradient of habitat degradation was also tested experimentally by comparing the impact of the non-native alga, *Caulerpa cylindracea*, on rocky reef assemblages among areas subjected to different anthropogenic pressures. Assemblages at urban and pristine sites did not differ when invaded, but did so when *C. cylindracea* was removed. Our study suggests that non-native species are more likely to alter the structure of resident communities at less degraded or pristine sites. Controlling the establishment of non-native seaweeds seems, therefore, key for preserving biodiversity in relatively pristine areas. Control of invaders at degraded sites could be, however, necessary to avoid them functioning as propagule sources.

CS02.17 - REGIME SHIFTS AND THE MAINTENANCE OF ALTERNATIVE STATES ON ROCKY REEFS IN THE NW MEDITERRANEAN

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Regime shifts are increasingly observed in marine coastal environments. A typical example is the transition from algal canopies to barren habitat. Sea urchins are a main force transforming canopy-dominated reefs into barrens. However, algal canopies may also collapse in response to deteriorating environmental conditions and turf-forming algae may become established in areas of high anthropogenic pressure. Although the mechanisms that trigger these shifts have been identified, a clear understanding of the conditions under which they operate has remained elusive. Here, we test alternative hypotheses about the mechanisms maintaining algal canopies, barren habitats and turf-forming algae as alternative states on subtidal reefs in the Tuscany Archipelago (NW Mediterranean). Using data from a long-term sampling program and path analysis we found evidence suggesting that: (1) wave exposure positively affects the abundance of sea urchins that in turn contribute to the maintenance of the barren habitat; (2) anthropogenic pressure is the primary cause of canopy loss and (3) algal turfs become established as a direct consequence of canopy loss. Experiments are in progress to substantiate these findings, but the evidence already suggests that preserving algal canopies will be difficult in the face of increasing environmental degradation.

AQUATIC ECOLOGY

CS03.1 - EFFECTS OF DIFFERENT CLIMATE RELATED EPISODIC EVENTS ON THE BENTHIC TROPHIC STATUS AND BIODIVERSITY OF EUROPEAN CONTINENTAL MARGINS

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Continental margins, being sites of intense exchange of energy and material between the continental shelves and the deep basins, play a key role in global biogeochemical cycles. Information on the effects of climate change on the biodiversity and functioning of continental margins are scarce. We have compared the effects of episodic disturbance events on the biodiversity and ecosystem functions of the Cretan, Catalan and Arctic margins, where climate anomalies at the sea surface resulted in either episodes of dense shelf water cascading (Cretan and Catalan margins) or large current shifts over the continental shelf (Arctic margin). In all areas, irrespectively of the type of climate anomaly at the sea surface, the observed shifts in deep-sea currents exerted significant changes on the quantity, biochemical composition and bioavailability of sedimentary organic matter, whereas the effects on benthic (meiofauna) biodiversity varied among areas depending on the type of climate anomaly, the oceanographic mechanism involved and the strength and duration of resulting deep-sea current shifts. As current climate change is increasingly influencing the strength and intensity of anomalies at the oceans' surface we can anticipate that these will have large consequences on the deep ocean interior, the largest biome on Earth.

CS03.2 - INSIGHTS ON THE TOLERANCE AND RESILIENCE OF MEDITERRANEAN SEAGRASSES TO SHORT-TERM HEAT WAVES

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The aim of the present study was to determine tolerance to ocean warming of the two main Mediterranean seagrass species *Posidonia oceanica* and *Cymodocea nodosa*. To this end, photophysiological and transcriptomic responses of shallow and deep plants were studied during a 5-d exposure to heat and after 5-d of recovery. Photophysiological and transcriptomic (both RT-qPCR and RNA-seq) responses evidenced interspecific differences in heat tolerance in accordance with the biological attributes and ecological strategies of the species, but also intraspecific differences in relation to the depth origin of plants. In any case, plants from both depths were able to recover their physiological status after a recovery period, indicating that they did not suffer lethal injury under the experimental conditions here tested. In conclusion, the study suggests that warming caused by human-induced climate change will likely have significant negative effects mainly on *P. oceanica* populations. The sensibility of the species to heat will finally depend on the local environmental conditions where plants grow (e.g. different depths or latitudes), a fact that must be taken in to account for the establishment of suitable management and conservation strategies.

CS03.3 - TOWARDS A FRAMEWORK FOR ASSESSMENT AND MANAGEMENT OF REGIONAL VULNERABILITY OF MARINE COASTAL PRIORITY HABITATS

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Large-scale syntheses of the distribution and intensity of human activities on marine habitats have been recently carried out, highlighting distinct spatial patterns in the distribution of human pressures. However, they may be insufficient for informing efficient management actions at regional scale. We use the Apulia region (South-Eastern Italy, 1041 km of coast, up to 12 miles offshore) as a case study to provide a vulnerability assessment, aiming to identify areas with overlapping threats on high valuable marine habitats (*Posidonia* meadows, coralligenous outcrops, deep-sea corals and *Cystoseira* spp. canopies), using the approach developed by existing studies on cumulative human impacts to marine ecosystems. Results shows that 1- hot spots of vulnerability represent the 30% of the coastal area, impinging also Marine Protected Areas, 2-high populated urban areas with massive coastal infrastructures, dense fisheries activities and emerging high tourist frequentation represent the most common combination of threats, 3- slightly different methodological approaches in assessing the effects of threats on habitats have relevant consequences on the final outputs. Vulnerability assessment efforts may constitute a valuable tool for decision makers within MSP even though data quality, habitat selection and weighting options should be carefully considered in the process.

CS03.4 - WHEN THE INVASION OF FRESHWATER FAILED: THE CASE OF AQUATIC INSECTS

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Biological invasion emerges as a significant effect of global change and, together with habitat destruction, over-exploitation, climate change and pollution, constitutes one of the major causes of biodiversity loss. In this context, insects are one of the groups with the highest number of invasive species, and freshwaters are among the most invaded ecosystems of our planet. However, even though aquatic insects dominate inland waters, displaying high taxonomic diversity, inhabiting all kind of inland water environments and occupying almost all trophic niches, they interestingly are almost absent as invasive species. It is widely accepted that species invasiveness and ecosystem invasibility depend on the biological and ecological characteristics of species and habitats. Here we present some hypotheses regarding why aquatic insects are not so invasive as their number, richness and distribution could let suppose, suggesting that the scarcity of successful aquatic insect invaders may be the result of some synergic phylogenetic, biological, ecological and human-related constrictions. Biological invasions have different steps (transport, establishment, spread and integration) and particular species-traits or environmental characteristics may have positive or deleterious impacts in these phases. Understanding why aquatic insects are not successful invaders can help to address conservation measures to protect freshwaters from other invaders.

CS03.5 - BIOLOGICAL TRAIT PROFILES OF THE 68 MOST WIDESPREAD NON-INDIGENOUS SPECIES IN THE EUROPEAN SEAS

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The biological traits of the 68 most widespread non-indigenous species (MWNIS) in European Seas -Baltic Sea, Western European Margin of the Atlantic Ocean and the Mediterranean Sea- were examined. The working list of 68 MWNIS includes species belonging to different taxa, from macroalgae to fish. Data for nine biological traits and a total of 41 trait categories was gathered from literature to describe biological and ecological functions of MWNIS. Our analysis has confirmed the validity of some previously observed traits characterising invasive NIS in a variety of environmental contexts: high dispersal ability, high reproductive rate, ecological generalization. The biological traits analysis identified three major profiles characterizing most of the 68 MWNIS: photoautrophic species, zoobenthic species and nektonic predatory species. However, this general definition embraced a wide variety of species representing a variety of taxa and biological trait profiles, making thereby identification of a unique ”identikit of perfect invader” difficult to define. Some traits, like “life form”, “feeding method” and “mobility”, featured multiple behaviours, revealing the ability of these species to switch categories within the same trait.

CS03.6 - EVALUATING THE POTENTIAL OF ECOLOGICAL NICHE MODELLING AS A COMPONENT IN MARINE NON-INDIGENOUS SPECIES RISK ASSESSMENTS

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Marine biological invasions have increased notably with the development of global trading, causing the homogenization of communities and the decline of biodiversity. A main vector is ballast water exchange from shipping. This study evaluates the use of ecological niche modelling to predict the spread of 18 non-indigenous species along central shipping routes and their potential habitat suitability (hot/cold spots) in the Baltic Sea and Northeast Atlantic, using >22, 000 occurrence records and workflow based tools. Results show that, contrary to current risk assessment methods, temperature and sea ice concentration determine habitat suitability for 61% of species, rather than salinity (11%). We show high habitat suitability for non-indigenous species in the Skagerrak and Kattegat, a transitional area for non-indigenous species entering or leaving the Baltic Sea. As many cases of non-indigenous species (NIS) introduction in the marine environment are associated with major shipping pathways, we explore how SDMs can be used in the context of invasions in harbors and along shipping routes, providing valuable information on the potential spread of NIS for ballast water risk assessment.

CS03.7 - *AURELIA AURITA* EPHYRAE EFFECT ON A COASTAL MICROBIAL COMMUNITY

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During the last decade, increasing attention has been paid to the impact of jellyfish blooms on marine communities. Jellies are grazers that affect the abundance and diversity of plankton communities but they are also a source of dissolved organic carbon via faecal pellets and dead bodies, boosting the microbial loop. This study aims to describe *Aurelia aurita* ephyrae dual role of top-down and bottom-up controllers on micro-, nano- and picoplankton communities.We carried out a microcosm grazing experiment where ephyrae were incubated in 200 µm filtered sea water. Samples were taken to characterize biomass of preys, secondary production, extracellular enzyme activity (leucine aminopeptidase), total organic carbon concentration, grazing pressures and viral lysis. SSU rRNA tag molecular approach was chosen to analyze biodiversity shifts among bacterial and protist communities between the beginning and end of incubations both in ephyrae-containing enclosures and controls.. Aurelia aurita ephyrae were responsible for a remarkable decrease in microzooplankton and microphytoplankton biomass, nanoplankton seemed to be unaffected while the heterotrophic prokaryotes shown an increasing enzymatic activity and secondary production. Microplankton taxa composition shown relevant differences between the beginning and the end of the incubation with ephyrae.

CS03.8 - AN INTEGRATED OBSERVATORY FOR THE STUDY OF MARINE COASTAL ECOSYSTEMS

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Marine coastal ecosystems are characterized by high spatial and temporal variability which requires a multidisciplinary and integrated approach. The study of the whole components of coastal ecosystem is fundamental to face potential pollution phenomena and habitat conservation, as expected by Marine Strategy Directive (2008/56 EC). Following these lines, the Laboratory of Experimental Oceanology and Marine Ecology of University of Tuscia has developed a multi-platform observing system (the Civitavecchia Coastal Environment Monitoring System, C-CEMS along the Latium coasts. This contribution shows some applications of C-CEM System, such as the evaluation of dredging activities impacts on Posidonia oceanica meadows and soft-bottom benthic communities. The observing system is composed by fixed stations, in-situ surveys, satellite observations, numerical models and GIS, providing integrated informations to be applied to different case studies. The fixed stations installed are: weather, water quality and wave-buoy stations. In situ surveys are periodically carried out for the monitoring of physical, chemical and biological characteristics of the water column and marine sediments as well as of the benthic biota. The numerical models, validated by in situ observations and satellite data, allow to analyse and forecast different scenarios.

CS03.9 - A NEW FRAMEWORK FOR RELIABLE ESTIMATES OF GAMMA-DIVERSITY

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There is an intimate relationship between beta-diversity and the slope of species accumulation curves (SACs). However, species richness estimators often do not consider variations in beta-diversity within the investigated area. Taking into account patterns of spatial heterogeneity in species distribution is crucial to model species accumulation, as the accuracy of the ensuing estimates of gamma-diversity could be strongly influenced.Since the actual species richness in a given area is often unknown, our ability to determine the reliability of estimators is strongly limited. Although quantifying exhaustively species richness is often unfeasible, the number of families is almost fixed for most taxa and could serve as reference to check the accuracy of SACs. Patterns of variation in beta-diversity at species level may be strongly correlated to those at intermediate taxonomic ranks, up to family level. Therefore, the effect of variations in b-diversity on accumulation of families is likely to affect estimates of species richness consistently. Here, we show that reducing the effects of small-scale patchiness, and including progressively spatial heterogeneity among subareas, habitat heterogeneity, and rarity in SAC models, may lead to more reliable estimates of family richness, thus providing a framework to improve the accuracy of species accumulation curves.

CS03.10 - PHYTOVFP: A NEW BIO-OPTICAL MODEL TO ESTIMATE PHYTOPLANKTON PRIMARY PRODUCTION

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Ocean carbon flux quantification needs an accurate estimation of phytoplankton primary production. In the last 20 years scientific community developed several bio-optical models, which reproduce phytoplankton physiology. This feature is highly affected by photoacclimatation process, which is not yet adequately considered.We present the new version of PhytoVFP (Variable Fluorescence Phytoplankton Production) bio-optical model.This model is classified as a Wavelength- and Depth-resolved (WRDR) model and is based on the implementation of photosynthetic efficiency (Fv / Fmax). It reproduces the daily photoacclimation process varying photosynthetic parameters (Ek, alfa and Pbmax) along the water column as a function of stratification. The PhytoVFP model is structured into three main modules: (1) "PAR estimation "; (2) "Photo-acclimation of marine phytoplankton"; (3) "Phytoplankton primary production estimation".The performance of the PhytoVFP model was evaluated using PAR and 14C primary production measures collected during the SAMCA3 and SAMCA4 oceanographic cruises and compared to the results of Morel model.The phytoVFP model has been applied on in situ and remote sensing data acquired in the Algero Provencial basin, in order to describe the interaction between mesoscale dynamics and phytoplankton primary production

CS03.11 - LARGE SPATIAL SCALE METAGENETIC ANALYSIS OF ZOOPLANKTON OF THE ADRIATIC SEA

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Zooplankton plays a major role in the sea and with this study we provide a comprehensive biodiversity survey from 45 sampling stations distributed in the Adriatic Sea. This survey is part of the monitoring programme within the Ritmare project and all samples were collected during the period August-September 2014. We applied metagenetic analysis using the PGM Ion Torrent technology. We obtained high quality reads that clustered into more than 400 operational taxonomic units distributed in about 25 phyla. Limits of this metagenetic approach were due to the fact that several known species from the Mediterranean are not yet barcoded. Within the Cnidaria, the class Hydrozoa resulted to have very few sequences deposited in the NCBI repository. The taxonomical assignment did not find any match for 1.4% of the sequences under the term of Eukariota. Global analysis at the taxonomic level of Family clustered the sampling sites by depth profiles and dominant sea surface current pattern. The search for presence of alien species detected a few Crustacea, Polychaeta, Macrophyta and Cnidaria that might be new for the Mediterranean / Adriatic Sea. The potential applicative implementation of this large dataset is also provided.

CS03.12 - THE EFFECT A SEAL EXCLUSION DEVICE HAS ON CATCHES IN A PONTOON TRAP FOR SALMONIDS

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A current conflict in the Bothnian Sea is between fisheries and seals. The increasing population of mainly the grey seals (*Halichoerus grypus*), has led to an increase of raided fish and damaged gear. To reduce damage a seal exclusion device (SED), was mounted in the entrance to a pontoon trap. Two hypotheses were tested; (1) that the SED would keep raiding seals out of the trap, but simultaneously deter large fish from entering, (2) that it would extinguish the behaviour of raiding seals. This study showed that there were no significant differences in size of caught salmon (*Salmo salar*) between the experimental trap and the control. An interesting observation was that the largest salmon was caught in the experimental trap. However, it did show differences in size of caught trout (*Salmo trutta*), with significantly larger fish in the control trap, indicating differences in behaviour between the two closely related species. The number of seal visits in both traps was low, with a frequency of 0.01 visits per filmed hour in the experimental trap and 0.02 in the control. This suggests that the predation by seals on salmonids most likely occurs in other parts of the trap.

CS03.13 - THERMAL VARIANCE SETS LIFE HISTORY TRAITS OF THE MEDITERRANEAN TOOTHCARP APHANIUS FASCIATUS

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Temperature is the main factor driving metabolic costs in ectotherms by influencing a number of functional and life history (LH) traits. Recent findings suggested that thermal variance more than mean may increase the understanding of how temperature impacts fitness in ectotherms above all in threatened species living in shallow waters as ponds and lagoons. Here, we have the aim to investigate the relationship between thermal variance and LH traits choosing populations of the Mediterranean toothcarp (*Aphanius fasciatus*) collected from shallow ponds of the most important avifauna stop-over site in the Central Mediterranean. Results showed that water temperature variance was a better effector than mean in driving differences in LH traits of our species. In particular, first maturity and maximum body sizes in each pond were negatively correlated with thermal variance. Understanding relationships between Mediterranean toothcarp biological traits and their natural environment should enhance not only the understanding of future consequences of global warming on shallow water communities but also planning management mitigation strategies to contrast human actions altering the physical structure of shallow waters that, as seen, may have important ecological rebounds on food web structures through (in)direct effects on LH traits of key species.

CS03.14 - USE OF ARTIFICIAL HABITATS WITHIN COASTAL LAGOONS: STRUCTURE AND ECOLOGICAL ROLE OF RESIDENT FISH POPULATIONS

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Coastal lagoons are characterized by high habitat heterogeneity where, often, natural habitats coexist with artificial ones, historically set up to support human activities related to salt production, aquaculture and traditional fishery. Aim of this work is to assess the ecological role of natural and artificial habitats and how this reflects on composition and trophic structure of resident fish assemblages. Fish communities were sampled in Spring and Autumn 2014 using a beach seine net in two habitats within the Stagnone di Marsala (Trapani, Italy): a seagrass meadow dominated by *Cymodocea nodosa* and an evaporation pond in a salt work system. Different fish assemblages occurred between the two study sites, with a higher number of species in the artificial one although it showed a lower habitat quality as indicated by lower values of fish condition factor. Differences emerged also in the trophic structure analysed using stable isotopes of carbon and nitrogen. Indeed community wide metrics highlighted variations in isotopic niche width according to the feeding group. This study allowed to broaden knowledge on how natural and artificial systems support fish populations living within coastal lagoons and results are discussed also in the light of ecological implications for coastal management.

CS03.15 - ESTUARINE SPONGE GROUND: DISCOVERY OF A NEW HABITAT IN THE VENICE LAGOON

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A newly identified habitat, with distinctive communities and ecological features, was found in the Venice Lagoon (Italy). The Lagoon is characterised by a mosaic of habitats and morphologies. Tidal channels, ranging in depth between 2 and 50 m, extend over 40 km2. Their seafloor features and benthic communities are poorly known due to different practical issues, including extreme turbidity, strong currents and vessel traffic. The seafloor of Scanello channel (NE Lagoon, 2-15 m deep) was explored in 2013-2014 with high-resolution acoustic surveys (multi-beam echosounder), video transects, drop-frame photoquadrats and biological samplings. The shallower part of the channel is characterised by dead oyster beds and patches of shell detritus. These hard substrates are colonised by massive, cushion-shaped demosponges with diameter up to 120 cm, together with associated macroalgae and epifauna, mostly filter-feeders. Backscatter acoustic data (function of substrate reflectivity) allowed mapping the sponges distribution. These communities are characterised by high diversity and biomass. The strong tidal currents are a major driving factor. High amount of organic matter is transported. The catabolites export and oxygen input during flood reduce the natural saprobity, enhancing biodiversity. Distinguishing ecological functions are arguably performed. This distinctive habitat appears to characterise the tidal channels seafloor.

CS03.16 - MACROBENTHIC INVERTEBRATE ENERGY CONTENT WITHIN A FRESHWATER TEMPORARY POOL FROM NORTHEAST ITALY

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Invertebrate energy densities (ED) have been used to compare the relative importance of the prey items, explain foraging behavior of predators and determine physiological status of organisms. ED is also commonly used in bioenergetics models. Several studies have been carried out to evaluate the main factors determining the organisms energy content (seasonality, habitat, reproductive stage, reproductive development, and food habits) and models were provided to obtain indirect estimations for this parameter. However, the knowledge of the caloric content is still incomplete for many organisms, especially for aquatic invertebrates, even if they cover a central role in the freshwater trophic webs. In this study, we investigate the energy content of Diptera Chironomidae, tribe Chironomini, as the main taxon of the macrobenthic invertebrate communities living in a freshwater temporary environment within the Natural Reserve of The Isonzo River Mouth (Northeast Italy). Our results point out significant seasonal differences among the observed values. In addition, these values differ significantly from those reported in literature and those obtained from estimating models. We conclude that further studies are necessary to gain more data about a wide list of taxa collected in different habitats, in order to improve precision of predictive models for ED estimation.

CS03.17 - DIRECT OBSERVATION OF INCREASING RECOVERY LENGTH BEFORE COLLAPSE OF A MARINE BENTHIC ECOSYSTEM

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Anticipating sudden catastrophic shifts in ecosystems is a key area of ecological research. Theory suggests that the proximity to a critical threshold in complex systems may be revealed by the decline in recovery rate following a small perturbation. Laboratory experiments with microbial populations have supported this hypothesis under controlled laboratory conditions, but evidence from real ecosystems remains rare. Here, we performed a canopy perturbation experiment to test the hypothesis that the spatial scale at which a system recovers from a perturbation in space should decrease as the system approaches the tipping point marking the transition from the canopy-dominated to the turf-dominated state. Empirical estimates of recovery length, a recently proposed spatial indicator of critical slowing down, were obtained by comparing the spatial scale at which algal turfs propagate from low quality patches, where the canopy algae was completely removed, to high quality regions with decreasing canopy cover. We found that both indicators of recovery length (the Half-point recovery length and the Exponential recovery length) increased markedly along the gradient in canopy degradation, providing field-based evidence of spatial signatures of critical slowing down in naturally fluctuating conditions.

CS03.18 - INTERACTIONS AMONG ROOTS MACROFAUNA AND BACTERIA IN FRESHWATER SEDIMENTS

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We studied an array of benthic processes, including gas (O_2, CO_2, N_2, CH_4) and inorganic nutrient ($NH4^+$, NO^{x-}, PO_4^{3-} and SiO_2) fluxes in bare sediments, sediments with a rooted macrophyte, a burrower and both organisms. We hypothesize that the effects induced by single organisms, when combined, may not be additive. Oxygen release by roots may alter ventilation and bioirrigation rates by the burrower, while sediment reworking may favor the mobilization of nutrients and plant uptake. Our results suggest mutualistic interactions between plants and macrofauna, either enhancing (i.e. methanotrophy) or inhibiting (i.e. N fixation, denitrification, nutrient regeneration) microbial processes. While both radial oxygen loss by roots and bioirrigation depress methane production, plants and burrowers alone have opposite effects on net N_2 fluxes, stimulating N-fixation and N loss via denitrification, respectively. The interactions among plants, macrofauna and bacteria turn sediments net autotrophic (O_2 sources and CO_2 sinks), reduce methane emission and the absolute value of N2 fluxes. They also promote the retention of nutrients within the benthic system, minimizing losses to the water column. More organisms and interactions should be added to the picture, as oversimplified experimental approaches may lead to a partial representation of processes in natural environments.

CS03.19 - LINKING THE WATERSHED WITH THE ADJACENT SEA: THE RIVER-COASTAL SEA CONTINUUM AND THE TRANSITIONAL ZONE FILTER

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Eutrophication and hypoxia of coastal waters under river runoff are expected to depend upon watershed dynamics and exploitation. In the traditional bottom up approach the watersheds areviewed as a source of nutrients (P, N) which impact coastal seas through river discharge from either diffuse farmland or point urban sources. In this contribution we propose a new approach analysing the river basins and the hydrographic networks at different spatial scales. We consider different aquatic ecosystems in the Po river watershed and in its delta, assuming that 1) the aquatic water-bodies are organised as a cascading aquatic system from the mountain ridge to the coastline, 2) the land-water interfaces are metabolic regulators, 3) the so called transitional zone, at the land-sea interface, is the main filter. The land water interfaces in the watershed and the adjacent transitional marine zone can provide nutrient retention and transformation, thus controlling the downstream water quality, element stoichiometry and availability. Key factors in determining the river and adjacent-sea interactions are river and coastal hydro-morphology, soil uses, multiple element stoichiometry (N, P and Si and trace metals), biological and biogeochemical interactions. These local factors can be amplified by climate changes through heavy rainfall and flash floods.

BEHAVIOURAL ECOLOGY

CS04.1 - SEARCHING FOR FOOD IN COMPLEX ENVIRONMENTS: ELUCIDATING ASSOCIATIONAL EFFECTS BETWEEN RESOURCES

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Interactions between consumer and resource organisms are fundamentalcomponents of ecological communities. Quite frequently neighboring organisms areable to influence consumer-resource interactions through associational effects. Forexample, the presence of a specific plant neighbor can decrease or increase insectattraction to a focal plant. Within plant-insect studies it is well known that neighboringplants often affect the strength of interactions between host plants and theirherbivores. However, how processes at between- and within-patch scales interactand determine attack rates on alternative host plant species is not fully understoodyet. By conducting laboratory experiments with Drosophila melanogaster we try todetermine how the density, frequency and spatial arrangements of resources canlead to associational effects between focal and neighboring resources. Firstly, wefound that D. melanogaster has a decreasing relative detection distance withincreasing dilutions of a quantitative odor source. Using this information we createdpatches with different odor sources to test for associational effects between thedifferent resources. We found that D. melanogaster has the ability to distinguishbetween different odor release points and that its search behavior strongly dependson the frequency of available odor sources.

CS04.2 - ASSESSING LANDSCAPES OF FEAR: EFFECTS OF RISK PERCEPTION VERSUS ACTUAL PREDATOR ABUNDANCE ON GROUP STRUCTURE AND BEHAVIOUR IN A GUANACO POPULATION IN SOUTHERN PATAGONIA

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Predation risk, food availability and habitat structure are key factors driving social organization of large herbivores. While the first can be interpreted as an evolutionary fixed factor, the others would be ecological drivers. We studied factors affecting group structure, size and cohesion, as well as vigilance of family groups of guanaco (Lama guanicoe), both inside and outside a protected area in southern Patagonia with pronounced differences in both density of guanaco and predators. We used GLMM to evaluate variation in social structure and group vigilance in relation to several explanatory variables of habitat structure and actual predator density. Results show that both group size and area occupied by the group increased with guanaco density. Habitat type and topography also affected group size, with larger groups found in valley bottoms and wet meadows, probably as a result of food availability. Predation risk increased group cohesion. Group vigilance, however, was only affected by terrain roughness, and not by predation risk, calf number or group size. Since puma hunts by stalking and early detection can be essential to escape, results suggest that guanacos show an evolutionary response to the perceived risk of predation based on habitat complexity rather than predator density itself

CS04.3 - IS THE BEHAVIOUR ASSOCIATED WITH THE MOVEMENT OF *TRIBOLIUM CASTANEUM* (HERBST) (COLEOPTERA: TENEBRIONIDAE) INFLUENCED BY PHOSPHINE RESISTANCE GENES?

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Is the propensity of organisms to migrate from a locality controlled genetically? If so, how do genes actually influence movement? *Tribolium castaneum*, the rust-red flour beetle, has evolved resistance to phosphine fumigation, mainly through genetic changes that affect basic metabolic pathways. We expected that other activities reliant on metabolic enzymes should also be affected, including aspects of their movement. We quantified flight propensity and also aspects of the flight and walking behaviour of beetles from four populations; 1) field derived, 2) laboratory cultured, phosphine susceptible, 3) laboratory cultured, phosphine resistant and 4) a resistant population otherwise genetically identical to the susceptible laboratory population. The temporal pattern of flight was identical across all populations, but resistant beetles took flight significantly less than susceptible beetles, and they also walked more slowly and located resources less successfully than susceptible beetles and beetles from the field. Our findings suggest that a mutation in a metabolic enzyme gene could have significant impact upon the dispersal behaviour of these organisms, and should help, ultimately, to explain how movement could be controlled genetically and what such genetic influences on movement mean for their ecology.

BIODIVERSITY & ECOSYSTEMS

CS05.1 - DO RARE SPECIES MATTER FOR ECOSYSTEM MULTIFUNCTIONALITY?

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The relative importance of common and rare species for ecosystem functioning is controversial and seems to depend on the function or taxa considered. Here we explore this question with a unique dataset containing the abundances of nearly 4000 species across multiple trophic groups (plants, insects, fungal pathogens, bacteria, mycorrhizae, or protists) together with measures of 13 distinct ecosystem functions related to provisioning, supporting, regulating and cultural services. We divide species into rare and common at each trophic level (and pooled into a multidiversity index), based on their abundances across the 150 grasslands, and then analyse their effect on the 13 individual functions and on multifunctionality alongside effects of land-use intensity and other environmental drivers. Initial results indicate that some functions are driven by either rare or common species but a large proportion of the functions studied are co-driven by both. A high diversity of both rare and common species is crucial to ensure high multifunctionality, through their importance change with the level of functioning desired. This analysis constitutes the most comprehensive test of the importance of rare species for ecosystem functioning to date and will help to guide further research and prioritize conservation.

CS05.2 - HERBIVORES SAPROVORES AND NATURAL ENEMIES BENEFIT DIFFERENTLY FROM INTRA-FIELD PLANT COMMUNITY OF WINTER WHEAT

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A functional approach is adopted to assess the relationship between plant functional groups of intra-field plant community (grasses, broad-leaves and legumes) and the arthropod community of winter wheat fields. We try to sample the whole arthropod community combining suction catches with flight-interception trapping. As we wanted to consider as many groups as we can in order to consider the entire community we identified most groups to the appropriate taxonomic level (family, genus or species) in order to classify each taxon based on 7 different form-of-feeding: chewing-herbivores, sucking-herbivores, flower-consumers, omnivores, saprovores, parasitoids, or predators. A richer plant community benefits the diversity of sucking-herbivores, which supports the classical trophic structure hypothesis. The positive effect of grasses cover on sucking-herbivores, saprovores and natural enemies may be understood as plants providing resources directly, indirectly (through support of alternate hosts) or simply offering better shelter places. Nonetheless, the role of legumes enhancing the abundance and richness of the main responsible for natural biological control such as parasitoids and predators leads us to think that more research should focused on cropping systems that guarantees the maintenance of essential ecosystem services of the agro-ecosystems, at the same time that crop production is optimised.

CS05.3 - INCREASE IN PREDATION RATES ALONG AN EXPERIMENTAL PLANT DIVERSITY GRADIENT

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Biodiversity effects on ecosystem functioning have been mainly studied for closely plant associated functions. Many ecosystem functions, like predation, are mediated by consumer species and have important effects for their prey and feedbacks to the producer communities. Recent studies on multitrophic relationships in natural and experimental communities revealed that consumer diversity is affected by shifts in producer communities. However, no studies so far linked plant diversity to predation rates. Here we tested the effect of experimentally manipulated plant diversity on predation rates in grasslands in central Germany. We measured predation rates using aphids, mealworm larvae, and plasticine dummies as baits. We found positive effects of plant species richness and plant community biomass on predation rates of aphids and plastiline dummies. For mealworms plant species richness and plant biomass effects showed opposite patterns in early compared to late summer, indicating shifts in the predator communities during the vegetation period. Together our results show that diversity loss at the producer level affects a ecosystem function mediated by higher trophic levels in grassland ecosystems. Understanding the mechanism linking producer diversity to consumer diversity and the functions they mediate will allow us to better understand cascading effects of biodiversity loss in ecosystems.

CS05.4 - SPECIES PARTITION FINE-SCALE GRADIENTS IN LIGHT AVAILABILITY ON THEIR LEAF FUNCTIONAL TRAITS IN SOUTHERN CHILE

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Ecologists are increasingly using plant functional traits to predict community assembly, but few studies have linked functional traits to species' responses to fine-scale environmental gradients, a potentially important coexistence mechanism. In this study, we tested whether woody species partition fine-scale gradients in light availability based on their leaf functional traits in four temperate rain forests and one Mediterranean forest in southern Chile. We measured leaf mass per area (LMA) of all woody species contained in 60 2–m^2 plots in each forest, totaling 1,900 individuals of 63 species, and determined light availability, computed as the gap light index (GLI). We calculated species pairwise differences in mean LMA (ΔLMA) and median GLI (Δ light response) and tested whether they were positively related using Mantel tests. We found a positive and significant relationship between ΔLMA and ΔGLI across species for all temperate rain forests, but not for the Mediterranean forest. We conclude that in environments subjected to light limitation, the use of a leaf functional trait can explain the fine-scale partitioning of woody species dominance. Further, our finding that species with different trait values respond differently to environmental gradients satisfies a prerequisite for trait-based coexistence via the spatial heterogeneity mechanism.

CS05.5 - ENVIRONMENTAL AND TRAIT VARIABILITY CONSTRAIN COMMUNITY STRUCTURE AND THE BIODIVERSITY-PRODUCTIVITY RELATIONSHIP

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There is still considerable debate about which mechanisms drive the relationship between biodiversity and ecosystem function (BEF). Although most scientists agree on the existence of two underlying mechanisms, complementarity and selection, experimental studies keep producing contrasting results on the relative contributions of the two effects. We present a spatially explicit resource competition model and investigate how the strength of these effects is influenced by trait and environmental variability, resource distribution, and species pool size. Our results demonstrate that the increase of biomass production with increasing species numbers depends on the match between environmental and trait variability: BEF relationships are stronger if functionally different species coexist in a landscape with heterogeneous resource supply. These large biodiversity effects arise from complementarity effects, whereas selection effects are maximized, when broad trait ranges coincide with narrow ranges of resource supply ratios. Our results will therefore help resolving the debate on complementarity and selection mechanisms.

CS05.6 - EFFECTS OF LANDUSE ABANDONMENT ON TAXONOMIC AND FUNCTIONAL BIODIVERSITY IN SEMINATURAL BOREAL ECOSYSTEMS

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Land-use abandonment has caused a decline of semi-natural grasslands and their biodiversity. Predicting how anthropogenic induced vegetation changes affect ecosystems is one of the most urgent tasks in ecology. Effects of land-use change on biodiversity are generally made by assessing the effect on the number of species. However, ecosystem processes and functioning are not necessarily well described by this biodiversity indicator only. Functional trait responses might better predict processes than species richness.In this study the aim is to assess effects of ceased pastoralism on plant richness and functional diversity in Norwegian boreal ecosystems. We have investigated species richness and diversity of leaf, height and seed traits (in total 19 diversity indexes). Climatic, edaphic and biotic drivers of these biodiversity measurements were also identified.We found that abandonment of pastoralism in boreal ecosystems decreased species richness, but several functional diversity indexes increased. Further, responses varied along environmental gradients.

CS05.7 - EXPLORING THE FUNCTIONAL SIGNIFICANCE OF FOREST DIVERSITY: AN UPDATE FROM THE LONG-TERM BIOTREE EXPERIMENT

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Manifold global changes are leading to a loss of tree species diversity and the simplification of forest ecosystems worldwide. Whereas decades of research in manipulated herbaceous communities have revealed the important role of plant species diversity for ecosystem functions such as biomass production, much less research has focused on tree dominated systems, in part due to the greater length of time required for interactions among individuals. However, the opportunity now exists in a number of experiments to explore the effects of more than a decade of species interactions. We will provide an update on the BIOTREE experimental site Kaltenborn which established in 2004 and re-censused in 2014. Specifically, the Simplex experiment consists of several mixtures with varying proportions (ranging from dominance to even) of *Picea abies*, *Pseudotsuga menziesii, Quercus robur* and *Fagus sylvatica*. We will report results of a plot-based, as well as a neighbourhood analysis of tree growth, which aims to test how variation in density and evenness of mixtures influences the balance of intraspecific and interspecific competition and in turn tree growth.

CS05.8 - FUNCTIONAL TRAITS MODULATE THE PHENOLOGICAL ADVANCE OF DRYLANDS SPECIES UNDER WARMING

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Ongoing global warming is affecting the phenology of plants in terrestrial ecosystems worldwide. While numerous studies have documented this process in temperate ecosystems, few of them have assessed the phenological responses of dryland plant species to warming. We conducted a common garden experiment over two years with contrasting environmental conditions (dry vs. wet year) to evaluate how warming affected the phenology of fourteen dryland species and to test whether their functional traits modulated this response. The majority of species showed an advancement of flowering under warming in both years. However, during wet year they produced smaller and less fruits under warming. Results also showed that these phenological responses were modulated by functional traits. Taller plants flowered earlier during both years with warming, and specific leaf area has a positive and negative effect on the flowering and fruit production in the second year, respectively. Functional trait changes flowering onset and fruit productivity that may be relevant in coping with the impacts of ongoing global warming.

CS05.9 - SUCCESSION-DRIVEN CHANGES IN THE FUNCTIONAL DIVERSITY OF XEROPHYTIC SHRUB COMMUNITIES

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Communities can be defined as assemblages of species coexisting under particular environments. The relationship between environment and species are regulated by both environmental requirements –which ultimately determine the species capacity to establish and survive in a particular environment– and the ecological interactions occurring during assembly processes –which also determine community composition by conditioning species coexistence. Plant functional traits are attributes that represent ecological strategies and determine how plants respond to environmental factors and interact with other species. Therefore, the analysis of how traits vary through the dynamics of communities, such as along successions, can give insights about how environmental requirements and species interactions may determine the composition and functional structure of these communities. Xerophytic shrub communities inhabiting inland dunes in Portugal are characterized by successional processes driven by local (edaphic gradients and human disturbance) and regional (climate) processes. Therefore, they constitute an appropriate system for studying species interactions and environment-community co-variations based on functional terms. Using these communities as a model, we evaluate the hypothesis that successional community changes in species composition of xerophytic shrub communities can result in concurrent changes in functional diversity. Additionally, we assess the effect of local and regional processes on those changes.

CS05.10 - SYNTHESIS CENTERS: AN ESSENTIAL TOOL IN OUR COMPLEX DATA-RICH FUTURE

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Scientific synthesis centres have become integral to research efforts in an era of increasingly complex societal and scientific problems, big data, and the knowledge economy. There are now more than a dozen synthesis centres across North America, Europe, China and Australia, spreading from their ecological origins to address the synthesis needs in biomedical sciences, mathematics, earth sciences, and genomics. Synthesis centres foster collaborative research by (i) bringing interdisciplinary groups of specialists together, (ii) creating an atmosphere of stimulating creative thinking, catalyzing insight, and facilitating group learning and (iii) providing the technological expertise to help researchers collect, analyze, and synthesize diverse and disparate datasets to address critical science questions. This talk will introduce the International Synthesis Consortium (ISC¸ http://synthesis-consortium.org) and present evidence that synthesis centers offer highly effective capabilities for generating new knowledge. We moreover outline how centres can provide their unique expertise to funding bodies and science-policy networks such as Future Earth, to tackle grand challenges in science.

CS05.11 - A PRELIMINARY INVESTIGATION OF RECONSTRUCTING A COLUMN-BASED DATA SOURCE FROM AN RDF DATASET

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The W3C R2RML recommendation and its directly extension RML are the main ways to expose different type of data sources as an RDF dataset on the Web of Data. While mapping data to the RDF data model is well exploited, the opposite, mapping an RDF dataset to its original data source, is not, hampering different type of users to use RDF-based data as many of them have not yet developed this capability. In this paper, we investigate how to perform the reverse process for the case of column-based structured data source such as tabular data. In particular, we devise a novel algorithm, reverse RML2CSV, for transforming an RDF dataset into its original data structure, through the use of the same RML mapping rules used to generate the set of RDF triples. Through a comparative evaluation we show that reverse RML2CSV rebuilds the same data content with the same data structure.

CS05.12 - EFFECTS OF SABELLA *SPALLANZANII POLYCHAETA*: SABELLIDAE REMOVAL ON THE DEVELOPMENT OF FOULING COMMUNITIES

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Filter-feeders are important components in fouling assemblages and play a pivotal role in ecosystems ecology, influencing ecosystem functioning and habitat heterogeneity. They are often habitat modifiers and bioengineer, affecting the density and behaviour of the surrounding macrofauna. These organisms are able to assimilate only a small amount of available suspended matter so that a significant part might provide benefit to other species. Thus, both the loss of filter-feeders and the gain in organic matter can have important consequences on ecosystem functioning. A removal experiment of *Sabella spallanzanii* (Gmelin, 1971), a common and abundant filter-feeder polychaete in Mediterranean fouling communities, was carried out with the aim to investigate its influence on community structure. The effect on richness, evenness (Shannon index) and biomass (dry weight) at four-time interval was evaluated, using linear mixed models. *S. spallanzanii* removal does not affect fouling communities that change mainly according to time and space. On the contrary, the removal shows a relevant effect on the biomass, which appears significantly higher where the polychaete is present. These results suggest that *S. spallanzanii*, though not influencing the overall community structure, plays a key role in the realization of high biomass in fouling communities.

CS05.13 - DIVERSITY AND STRUCTURE OF MEDITERRANEAN ROCKY REEF COMMUNITY FROM MACRO- TO MEGABENTHOS

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Sea urchin outbreaks can promote a shift in benthic communities: from a complex state, dominated by assemblage of several erect algae, to a simpler one, the barren, dominated by few encrusting algae. Algal forest is expected to be a diverse and productive system. On the other hand, barren is structurally simple and it seems to be characterized by low productivity and diversity. Although barrens exhibit a low structural complexity, it can provide a high number of microhabitats available for a wide variety of cryptic invertebrate species. In order to assess the effect of local deforestation on the community structure of Mediterranean rocky reef, we evaluated abundance, biomass and diversity from macro- to megabenthos in algal forest and barren systems in two areas of the Central Mediterranean (Croatia and Montenegro, Adriatic Sea). We found strong differences in the biodiversity abundance and biomass of all benthic components in the two systems. As expected, diversity, abundance and biomass of algae and small invertebrates resulted higher in algae forest systems, even if some cryptic species were more present in barren. However, benthic invertebrate megafauna was abundant in the barren system, suggesting that barrens are more diversified and productive system than previously thought.

CS05.14 - MEIOFAUNAL BIODIVERSITY IN MEDITERRANEAN ECOSYSTEM ALTERNATIVE STATES

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In shallow rocky shores of the Mediterranean Sea, overfishing can determine outbreaks of opportunistic species, provoking shifts of complex ecosystems dominated by erectile macroalgae (EMA) to simpler ecosystems dominated by encrusting algae and urchins (ECA). Despite meiofauna have a prominent ecological role in most benthic ecosystems and ECA are widely distributed worldwide, information about their associated meiofauna are inexistent. We hypothesize that the shift from EMA to ECA systems exerts a strong effect on meiofauna, as observed for larger benthic components. We investigated differences in meiofaunal and nematode assemblages between EMA and ECA in six Mediterranean areas. Consistently in all the areas under scrutiny, meiofaunal abundance, biomass, and nematode biodiversity in ECA were significantly lower than in EMA. The composition of meiofaunal and nematode assemblages were significantly different between the two ecosystems at all areas, with nematode species turnover between EMA and ECA within each area higher than that among areas in each ecosystem. Our results confirm that the EMA-ECA transition can have considerable effects also on the meiofaunal and nematode assemblages, irrespectively of the area. These results highlight the need of increasing the surveillance of coasts vulnerable to this recurrent shift of shallow coastal Mediterranean ecosystems.

CS05.15 - TRIGGERS AND THRESHOLDS OF MULTIPLE SHIFTS BETWEEN BENTHIC ASSEMBLAGES OF MEDITERRANEAN SHALLOW ROCKY REEFS

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Benthic assemblages of temperate rocky reefs undergo drastic changes in structure driven by natural and anthropogenic stressors. Assemblages dominated by canopy-forming macroalgae may switch to alternative, less-productive systems: either barrens, dominated by encrusting corallines, or assemblages dominated by algal turfs. We experimentally investigated the separate and combined effects of physical disturbance, grazing intensity, and nutrient addition in triggering the shift from canopy-dominated to alternative assemblages. Following a factorial design, we removed canopies at different density levels (0%, 30%, 70%, 100%) from transects exposed to different grazing regimes (no sea urchins, natural densities or densities enhanced to simulate outbreaks) and nutrient enrichment levels (control, addition). Preliminary results showed significant combined effects of canopy density and grazing regimes on assemblage structure, while nutrient enrichment had limited effects. Also, to examine the relationship between the density of the most common Mediterranean sea urchin species (*Paracentrotus lividus* and *Arbacia lixula*) and the extent of barren patches surrounded by different algal matrices, we performed a correlative study. A hierarchical sampling design at different spatial scales (100s, 10s and <1 km) and habitats (canopy or algal turfs) was used to assess variation in transition thresholds between habitats and whether transitions exhibit hysteresis in both systems.

CS05.16 - ECOSYSTEM FUNCTIONING NEARBY THE LARGEST STEELWORKS IN EUROPE AND THE MAIN ITALIAN NAVAL BASE: THE STUDY CASE OF THE MAR PICCOLO OF TARANTO

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To contribute to promote ecosystem-based management in a densely populated area at high risk of environmental crisis, the ecosystem functioning of the Mar Piccolo of Taranto was evaluated. Primary production (PP) and heterotrophic prokaryotic production (HPP) were measured as proxies of functioning in three sites, chosen at different levels of industrial contamination, during three sampling campaigns. We integrated PP and HPP measured in the water column with those observed in the sediments and discussed this with the potential origin of the organic matter pools based on analysis of stable isotopes. Contaminants were also analysed in the surface (1 cm) sediment layer and related to the overall ecosystem functioning. PP rates peaked in June at the surface layer, reaching up to 20.07 ± 3.12 µg C l-1 h-1 in the centre of the second inlet. HPP rates were about one order of magnitude lower compared to PP ones. Microphytobenthic PP rates were almost negligible while HPP rates in the sediments were comparable to those in the water column. Although the Mar Piccolo is very shallow, the water column is much more productive than the surface sediments where the accumulated contaminants probably interfere with the proper functioning of the benthic ecosystem.

CS05.17 - EFFECT OF ACIDIFICATION ON BENTHIC PROKARYOTES DIVERSITY AND FUNCTIONING IN A SHALLOW-WATER CO_2 VENT FIELD (FAYAL ISLAND, NE ATLANTIC)

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Ocean acidification (OA) is considered as one of the most pressing threats to marine systems. Despite this, information on how OA affects ecosystems, in particular microbial communities and their functions are poor. The 36-40 m deep- Espalamaca CO_2 vent field (Fayal Island, Azores) has been recently established as natural laboratory for OA studies. In order to test the effect of pH on benthic prokaryotic diversity and functioning, replicated sediment samples were collected at vent emissions (pH, 5.32 -7.37), 5 cm-away (pH, 6.31-8.01) and in reference areas (pH, 7.97- 8.09). Additional samples were collected in correspondence of venting rock fractures. Relocation experiments were conducted by transplanting sediments inside experimental bags from the vent field to the reference area and vice versa. Samples were analyzed for biochemical organic matter composition, prokaryotic diversity by 16S rDNA gene mass-sequencing and key functional variables of microbial metabolism (heterotrophic C production and degradation rates). Despite sediments in Espalamaca showed high degree of similarity, possibly due to narrow spatial pH gradients, prokaryotes activities were highest at venting rock fractures, which corresponds to the highest CO_2 emission. Our results suggest that diversity and metabolism are affected by OA, with important consequences for the whole ecosystem functioning.

CS05.18 - BENTHIC DIATOM ABUNDANCE AND DIVERSITY IN URBAN STORMWATER PONDS

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Lack of infiltration surfaces in urban areas might pose a risk of flooding during rainfall events or transport of accumulated pollutants into natural environments. To prevent adverse effects on the receiving environments, stormwater ponds are often implemented, serving as reservoirs for excess rainwater and as water treatment facilities, exposing different pollutants to various physical, chemical and biological processes. In time, stormwater ponds also become habitats for different species of aquatic fauna and flora. However, not much attention is paid to stormwater ponds from the ecosystem point of view. Forming the basis of aquatic food chain and being good indicators of water quality, algae have been selected as the object of this study.As large part of the pollutants reaching stormwater ponds accumulate in their sediments, benthic diatoms have been examined in order to understand their response to contamination. 10 Danish stormwater ponds have been sampled in August 2014. Sediment samples have been collected in 5 locations of each pond. The top 1 cm of sediment was preserved for later taxa identification and enumeration. The main findings of this study will help to describe benthic diatom diversity in stormwater ponds, and to better understand their ability to inhabit such hazardous environments.

CS05.19 - THE WHITE STORK *CICONIA CICONIA* (L. 1758) IN THE WETLANDS OF NORTHEAST OF ALGERIA

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Biodiversity in Algeria is very varied due to its geographical location, its potential wetlands of high ecological value. Indeed the country, has ratified the Ramsar Convention in 1982, conducted since the classification of 50 wetlands, totaling an overall area more than 2.99 million hectares, 50% of the total area Estimated wetlands in Algeria; of which 762 are natural. This interest is primarily bound of the presence of species which has very high concentrations of several protected species including birds. Our study, we focused on the wetlands of the Northeastern of Algeria is recognized by its remarkable number of breeding pairs of white stork, the distribution monitoring of nesting, using a GPS, has been performed in an attempt to explain the functioning of populations and strategies for an overall design of its distribution. The number of breeding pairs has increased considerably, from 174 in 1996 to 475 in 2007 and 968 in 2014, the density of nests increased from 25.22 in 1996 to 84.16 pairs/100 km² in 2014. More endemic pairs appears in the region, this fluctuation is related to local climatic conditions might induce binding conditions for the development of this species.

CS05.20 - LIFE TO A(D)DMIRE; MIRE RESTORATIONS IN SWEDEN

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The LIFE to ad(d)mire project aim to restore 40.000 hectares of peatland and wetlands in Sweden during the period 2010-2015. By restoring diked mires and clearing wetlands the biodiversity och ecosystem services ance agian flourishing.Peatlands and wetlands are one of the fastest disapearing habitats and at the same time the habitats are one of the most important habitats when it comes to GHG and ecosystem services.Peatlands and wetlands have a rich biodiversity and are looked upo as wastelands.Through LIFE+-fundings and the Natura 2000 Network the Life to ad(d)mire project has been able to restore and network to improve the status of mires and wetlands in Sweden, Europe and the world.

CS05.21 - NON-NATIVE SPECIES IN ITALIAN FRESHWATER HABITATS: A MACROECOLOGICAL ASSESSMENT OF INVASION DRIVERS

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The relative role of propagule pressure, abiotic and biotic variables as determinants of non-native species occurrence differs among studies, hindering the synthesis of emergent patterns in invasion ecology and preventing generalisation for conservation actions. In order to produce a broad and general assessment of the occurrence of alien species in aquatic habitats, we proposed a macroecological approach to assess the drivers of occurrence of alien species in all biota (microorganisms, plants and animals) across several natural habitats in freshwater ecosystems in Italy, and we generalised the results of the analysis to provide a risk map of the occurrence of alien species.We determined that climatic variables were good predictors of alien species occurrence. Indeed, these variables, together with propagule pressure, expressed as the proximity to major inhabited areas, and differences in the receiving community, expressed as the native species richness, played a crucial role in determining the number of alien species. Furthermore, we found evidence of an influence of body size in determining the occurrence of the alien species. By using the predictions of our model, we addressed the probability of the occurrence of alien species in freshwater habitats across the whole country and highlighted areas at higher risk.

CS05.22 - BUILD-UP OF VIRTUAL RESEARCH ENVIRONMENTS TO ASSESSING DIFFERENT MANAGERIAL OPTIONS FOR MEDITERRANEAN RIVER BASINS AND ESTUARIES PRESERVATION

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The management of vulnerable ecosystems such as river basins and estuaries in Mediterranean area demands the selection of best practices aiming at mitigating and regulating those human activities affecting them. It should be based on an integral approach considering the overall basin in which they are integrated, and the different components of global change. Virtual Research Environments (VREs) relying on reliable environmental information and the most advanced scientific knowledge are especially suited to this purpose. In this work we present several VREs case studies specifically devoted to address the influence of the population pressure of some Mediterranean cities and their impact footprints on some river basins and estuaries. VREs are constructed over LifeWatch, a distributed e-infrastructure, by integrating existing distributed instrumentation and on-line big and cloud data resources, and enabling the execution of multi-scale models to assess estuarine conditions and nutrient dynamics. It thus provides services for researchers and managers dealing with data retrieval, reliability analysis, real-time model execution and coupling of a set of models enabling an integrated analysis, as result of the provision of certain Biodiversity Ecosystem Functioning LifeWatch e-Services products. Its deliverables are provided through an integrated web portal tailored to specific scientific or managerial demands.

CS05.23 - ALPINE HEADWATERS AS CLIMATE CHANGE OBSERVATORIES

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Headwater streams may be small in size, but they provide habitats for a rich array of species, which provides an enhancement of the biological diversity of the entire lotic system. These water courses are very sensible to climate changes, thus even minor changes of the environmental conditions can have significant consequences on lotic biological communities. This study was focusing on temporal and spatial effects of the melting process of snow and ice on interstitial meiofauna and benthic macrofauna. Analysis were performed within the Saldura stream (South Tyrol, Italy), a perennial glacial alpine water course. The Saldura catchment, due to its particularity dry conditions, is ecologically very relevant and belongs to the alpine LTER sites. The first results have shown longitudinal as well as seasonal distribution patterns: faunal densities as well as number of taxa increased with distance from the glacier. Moreover, the higher discharge due to the snowmelt during June and July corresponds to a decrease of total faunal density and number of taxa. Monitoring activities of such high sensible ecoregions are fundamental especially considering changing climatic conditions.

CS05.24 - RIPARIAN ZONE OF A TEMPORARY RIVER: HOT SPOT FOR CARABID BEETLE BIODIVERSITY IN SUBMEDITERRANEAN KARST

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Temporary rivers are highly dynamic and complex hydrological freshwater ecosystems and a true phenomenon in submediterranean and Mediterranean karst area. Riparian zone along these rivers differs from adjacent karst zone in vegetation composition and structure, soil structure, microclimate and inundation frequency. Carabid beetles were sampled in riparian and karst zones by pitfall traps at 36 sites along the course of the temporary Krčić River (Croatia) during 2014. Overall, carabid beetle species richness and activity density were considerably higher in the riparian zone than in the karst zone. Although some carabid beetle species occurred both in riparian and karst zones, some species were exclusively found in the riparian zone. In particular, highly hygrophilous stenotopic species, such *as Asaphidion, Bembidion* and *Elaphrus* species, were bound to the dynamic riparian zone. Medium and small sized carabid species able to fly prevailed in the riparian zone suggesting that flight ability enables dispersal between suitable habitat patches within this dynamic and fluctuating zone prone to inundation. Spatial patterns in carabid beetle assemblages were associated with changes in vegetation structure and composition, and particularly in soil structure along the river course. Therefore, riparian zone in dry karst environments represents unique habitat harbouring diverse terrestrial biota.

FOREST ECOLOGY & DYNAMICS

CS06.1 - EVALUATION OF THE TRADE-OFF BETWEEN PRODUCTIVITY AND WATER USE EFFICIENCY (WUE) OF TREE SPECIES FOR BIOMASS CROP UNDER DIFFERENT MANAGEMENT STRATEGIES IN MEDITERRANEAN CLIMATE

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Tree crops and forestry practices have been promoted as greenhouse gas mitigation options in the Kyoto Protocol. Growth of trees, however, is inseparably connected to water loss by stomatal control of gas exchange, and thus productivity is dependent upon water availability. It is important that carbon sequestration strategies consider all environmental consequences, especially in regions where water resources are expected to be stressed by climate change, such as Mediterranean Basin. This research project aims at investigating the trade off between carbon uptake and water loss in different forest plantation sites, in order to better match land management decisions with the ecohydrology of local sites. We investigate WUE of tree species (e.g., poplar, oak, olive) with different growth strategies under different tree crops practices, using stable isotopes of carbon ($d^{13}C$) and oxygen ($d^{18}O$) in annual tree rings. Tree rings record information about environmental change, while the combination of the two isotopes $d^{13}C$ and $d^{18}O$ in tree rings can provide more specific information on the underlying ecophysiological processes. Our findings can be used to inform selection of tree species and of management practices, allowing maximization of carbon sequestration for a given water budget and minimizing climate change-induced death of trees.

CS06.2 - STRUCTURE OF ALLUVIAL FOREST GAPS USING LIDAR DATA WITH RESPECT TO INVASIVE SPECIES

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Gaps of alluvial forests offer many niches for invasive species because of their high canopy dynamics. The spreading of invasive species requires up-to-date monitoring and reporting for conservation and management efforts. The aim of our study was to survey and quantify the gaps and their characteristics since the spatial properties of gaps have a large influence upon the species composition and dynamics of the forest. Major emphasis was on the identification of the most endangered gaps with respect to invasion by exotic species, considering forest structure complexity. In the study area (Lake Tisza, Hungary) we have *Acer negundo*, *Fraxinus pennsylvanica* and *Amorpha fruticosa* as the most frequent invasive species, which are found mainly in old and unmanaged gaps. Using LIDAR datasets we analyzed the structure of the gaps from the leaf-off (March) and leaf-on (July) season. The gaps were formed by large fallen trees and management activities. Gap size, connectivity, shape complexity, vegetation height and vertical structure in the gap were mapped and analyzed. LIDAR proved to be a powerful tool to characterize the structure of the canopy and the understory in the gaps fast and accurate for an early detection of gaps prone to invasion by exotic species.

CS06.3 - EFFECTIVE DISPERSAL SERVICES PERFORMED BY A DIVERSE DISPERSAL COMMUNITY LEADS TO FOREST RECOVERY & EXPANSION AFTER LAND ABANDONMENT

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Land abandonment due to increasing depopulation of rural areas is an ongoing trend in developed countries worldwide. Abandoned lands represent an opportunity for ecosystem recovery in which seed dispersal provided by animals is a key feature. Different dispersers may differentially contribute to plant recruitment under different ecological conditions, leading to complementary or redundant dispersal services. We studied seed dispersal effectiveness resulted from the dispersal activity of the main dispersers of the Spanish juniper (*Juniperus thurifera* L.), small-to-medium-sized strongly frugivorous birds nd medium-to-large-sized carnivorous mammals, in remnant forests and old fields. Results showed a clear shift in the contribution to plant recruitment between these guilds, resulting in complementary and non-redundant dispersal services. Birds were the main contributors to plant recruitment in forests (73%), leading to population growth but with a reduced impact on the colonization of old fields where carnivores contributed to 80% of recruitment (42% red fox, 38% stone marten). The combination of short-distance, strongly frugivorous dispersers (e.g. passerine birds) together with big generalist frugivores with long-distance movements (e.g. carnivorous mammals) maintained i. effective seed dispersal services in remnant forests and ii. the connectivity between patches promoting old fields colonization and forest expansion.

CS06.4 - ENVIRONMENTAL CUES FOR MASTING IN *PICEA GLAUCA*

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Many plant species exhibit masting, a phenomenon characterized by the simultaneous production of extremely large numbers of seeds over large, contiguous areas, at intervals separated by years of very low seed production. No large-scale experimental studies on the proximate causes of masting have been performed to date because of the logistical and economic difficulties involved in collecting data over a wide geographical extent over many successive years. Our study examined possible environmental cues for masting in *Picea glauca*, modelling the effects of resource allocation, moisture stress, and light availability on seed production in subsequenct years. At four experimental sites across its northern Canadian range, we tested this model by varying water and light availability and carbon allocated to reproduction (using the removal of open ovulate cones as a proxy), over a four-year period between 2011 and 2014. During this period, a mast year occurred at our Quebec site. Our results provide new insights into the proximate cues of masting, and will be presented in the context of an unprecedented eight-year seed production record for P. glauca over the majority of its North American range (a circuit of 9500 km), quantifying the geographic extent of synchrony in masting.

CS06.5 - CONVERSION OF PINE-OAK FOREST TO OAK SHRUBLAND AFTER HIGH-SEVERITY CROWN FIRE IN THE SOUTHWEST USA

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In the Southwest USA, long-term fire suppression and increased aridity have led to high-severity crown fires outside the natural range of variation. Conversion of pine forest to oak shrubland after these fires is a key land management concern, yet Madrean (Mexican) pine-oak forests have received little attention on the issue. I documented recovery of this community type over 15 years in the Sky Islands of Arizona following the 11,000-ha Rattlesnake crown fire. As a result of their thick bark, pine stems typically survive surface fires indigenous to these ecosystems, whereas oaks are readily top-killed but then resprout. In high-severity portions of the Rattlesnake Fire, both oaks and pines were top-killed, seedling establishment of all woody plants was low even after 15 years, and nearly all oaks resprouted prolifically, rapidly gaining dominance of these sites. One exception to this pattern was the modicum of post-fire resprouting by one of the four pine species, *P. leiophylla* – a response that may promote its persistence at low population levels. By favoring sprouters over seeders, anomalous high-severity fire has the potential to transform structurally and compositionally diverse Madrean pine-oak forest into a largely homogeneous oak shrubland.

CS06.6 - IS PRESCRIBED BURNING A SUSTAINABLE PRACTICE FOR PINE TREES AND SOIL MICROBIAL COMMUNITY IN MEDITERRANEAN BASIN?

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Wildfires are increasingly affecting pine plantations of the Mediterranean Basin. Prescribed burning (PB) is an effective practice to reduce forest fire hazard, but its sustainability needs further ecological monitoring. This study aims to assess PB effects on soil microorganisms and tree growth.PB was applied in four pine plantations of Southern Italy, dominated by *Pinus halepensis* (Cilento, Vallo di Diano e Alburni National Park, PNCVDA), *P. pinaster* (PNCVDA and Vesuvio National Park, VNP) and *P. pinea* (Castel Volturno Natural Reserve, CVNR). In all plantations, the effects of PB on microbial biomass and activity in the fermentation layer and in the 5-cm soil beneath were evaluated. In *P. halepensis* and *P. pinea* plantations the effects on tree growth were assessed by measuring tree-ring width.Soil microbial biomass and activity were not affected by PB in CVNR plantation, but they changed in the fermentation layer only, in PNCVDA plantations, and in both the fermentation layer and soil, in VNP plantation. Moreover, the microbial recovery resulted faster in VNP than in PNCVDA (3 months vs > 5 months). No negative effects on pine growth were observed in the first 2 years after treatment.

CS06.7 - EFFECTS OF DEGRADATION IN WEST AFRICAN TROPICAL FORESTS

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The main degradation source in West African forests is selective logging, which also represents an important industry in the region. Local communities rely since centuries on forest resources and West African ecosystems result from a long history of human-nature interactions. Previous research recognized the negative effects of selective logging on carbon stocks, but few studies analyzed effects on other forest resources. Furthermore, West Africa is especially threated by climate change, with reported effects on forests too. More research is needed to fully understand degradation effects on forest dynamics. We compared forest resources in four sites in Ghana, having different disturbance and protection history, using both field and remote sensing data. Disturbance seriously affected structure, soil carbon content and biodiversity, which distributes according areas protection level. Functional attributes (guilds and wood density) and richness distrobuts according latitudinal moisture gradient, irrespectively of disturbance. A 30-years analysis of productivity in the region revelaed a slight but significant increasing trend, highest correlation with solar radiation, and more resiliency in drier forest types. We concluded evaluating these results in the light of sustainable management of West African forest resources.

CS06.8 - INVESTIGATING THE INTERANNUAL VARIABILITY OF ABOVE-GROUND WOOD GROWTH IN A TEMPERATE MATURE OAK FOREST

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Carbon (C) stored in woody organs ultimately originates from photosynthesis, and represents from 10% to 25% of the annual forest gross primary productivity (GPP) in the temperate zone. The dependence of aboveground wood growth on GPP is still under debate. There is growing evidence that C is not systematically, at least at scales from days to years, the most limiting factor for growth. Environmental drivers, such as temperature and water stress are expected to modulate (the timing of) C investment to wood. In this paper, we aimed at elucidating the determinants of the interannual variability of aerial wood growth of a mature temperate Oak forest over a 9-year period (2006-2014). At scales from weeks to years, wood growth appears not to be correlated with GPP. Instead, the interannual variability of wood increment is explained by a combination of (1) the date of cessation of wood growth, and (2) the maximum growth rate during the growing season, both of which appear to be strongly correlated to seasonal variations of soil water content. Incorporating these dependences in the CASTANEA process-based model of ecosystem functioning is key for a sound simulation of the interannual variability of wood growth.

EVOLUTIONARY ECOLOGY

CS07.1 - SEEDS OF MORPHOMETRICS FOR THE ORIGINS OF AGRICULTURE

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The transition from a mobile hunter-gatherer lifestyle to one of settled agriculture is arguably the most fundamental change in the development of human society. The establishment of agricultural economies requires the domestication of crops, and ancient plant remains recovered from early farming sites provide evidence for this process of domestication. Remains are typically preserved through charring, partial to complete carbonisation through exposure to heat, and have been collected by archaeobotanists for decades. We here present the first results of a global morphometric analysis of their shape. Ancient cereals (notably wheats and barley) and pulses dating from ca 13000 to 9000 years before present, and originating mainly from the Fertile Crescent region of Western Asia, were photographed in three orthogonal views. Modern morphometrics, namely elliptical Fourier transforms implemented in the R package Momocs, were used to turn outline coordinates into multivariate variables. Morphological differences, which arose potential due to differences in domestication, were compared between sites and mapped both in time and space. Modern morphometrics allows long-debated hypotheses to be tested and paves the way for new insights into the evolutionary origins of agriculture in the Near East.

CS07.2 - PLANTS AGAINST HERBIVORES: TRADE-OFFS BETWEEN DEFENCE STRATEGIES

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Plants have two main strategies of defense against herbivores: resistance and tolerance. Neither of these lines of defense comes cheap, they both have a cost. Therefore, it is assumed that there must be a trade-off between the two. However, such trade-offs have turned out to be hard to prove. Negative genotypic correlations between resistance and tolerance – considered to be the most reliable indicators of trade-offs – have been found in some studies, while others have yielded positive or no correlations. The problem may lie in the use of negative genotypic correlations: if some genotypes have inherently higher fitness in a given environment than others, they may be able to invest more than others in both defense strategies, thus producing a positive correlation, even if the trade-off exists. I performed an experiment with a wild plant species (*Fragaria vesca*) to find genotypic indices for resistance and tolerance and demonstrate if accounting for genotypes' average fitness in statistical models that test for genotypic correlations can shift the resultant correlations towards more negative values.

CS07.3 - TRANSCRIPTOMIC AND PHENOTYPIC DATA FROM COMMON GARDENS REVEAL ADAPTIVE GENETIC VARIATION IN A MEDITERRANEAN ALPINE PLANT

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Adaptation plays a critical role in the responses of species to the new environmental conditions imposed by climate change. *Silene ciliata* Pour. (Caryophyllaceae) is a Mediterranean alpine plant threatened by global warming. Previous studies on this species revealed that populations situated at the low-edge of the elevational range experience most stressful conditions, which constrains seedling establishment and reproductive performance. Common garden experiments, however, showed evidence for local adaptation in seed germination and seedling survival in these low-edge populations. To elucidate the genetic basis of these responses we sequenced the transcriptomes of seedlings. Genes that were constitutively differentially expressed between low- and high-edge populations were identified and we examined their genetic diversity patterns. Preliminary results suggest that genes involved in stress responses might play an important role in adaption to low altitude. These results point to an adaptive potential for an adjustment to environmental change. The combination of both transcriptomic and phenotypic data in common garden experiments might help us to understand local adaptation and its underlying molecular basis.

CS07.4 - GYNODIOECY-GYNOMONOECY IN SILENE CARYOPHYLLACEAE: FREQUENCY GENDER VARIATION AND SEXUAL DIMORPHISM

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Species of *Silene* show a high diversity of sexual systems as hermaphroditism, dioecy, gynodioecy, gynomonoecy or andromonoecy. Some gynodioecious species have hermaphroditic, female and gynomonoecious plants coexisting in the same population, and should be considered as gynodioecious-gynomonoecious species. Here, we first estimate the frequency of sexual systems in *Silene* species. Second, we specifically analyse the incidence of gynodioecy-gynomonoecy and the reproductive differences among sexual morphs in the section Psammophilae. In a comprehensive literature search, we found that, in *Silene*, hermaphroditism was the commonest sexual system (58.2%), followed by dioecy (14.3%), gynodioecy (13.3%) and gynodioecy-gynomonoecy (12.2%). We found all these sexual systems in both phylogenetically supported subgenera (*Silene* and *Behenantha*), suggesting their multiple origins. In species of the section Psammophilae (*Silene littorea, S. psammitis, S. adscendens* and *S. cambessedesii*), most of the 28 studied populations were gynodioecious-gynomonoecious, with the hermaphrodites being the most common morph. The percentage of female flowers per population was low and female plants generally produced smaller numbers of flowers than hermaphroditic or gynomonoecious plants. Interestingly, all these species showed a strong flower dimorphism: hermaphroditic flowers showed larger flowers, with a higher number of ovules and pollen loads compared with female flowers.

CS07.5 - INTERREGIONAL HYBRIDS AND HERITABILITY OF INCREASED COMPETITIVE ABILITY OF AN INVASIVE SPECIES

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After introduction to non-native regions, exotic species often experience changes in resource allocation trade-offs ensuing dramatic improvements in competitive ability (EICA), which are often key in invasion success. However, little is known about the heritability of increased competitive ability, or on the role of reinforcement from the native regions in the maintenance of competitive ability in the non-native regions. We used Centaurea solstitialis from both the European native and the American non-native regions and grew them in common garden conditions, manually crossed them in controlled reproduction experiments, and used the F1 generation of pure and inter-regional hybrid individuals to run one-to-one competition experiments with a generalist competitor grass present both at the native and non-native regions. Our preliminary results suggest that inter-regional hybrids present intermediate competitive ability, with moms being slightly more important in determining competitive success than dads. Our work is pioneer in using inter-regional hybrids to assess the heritability of competitive ability, and suggest that reinforcement with new seed from the native region should not result in dramatic decreases in competitive ability of C. solstitialis in California, thus resulting in a minor selective force towards the potential development of reproductive barriers between native and non-native regions

CS07.6 - REPRODUCTIVE TRAITS AFFECT THE GEOGRAPHIC RANGE OF AMAZONIAN ANURANS

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Species traits are among the most important factors that play role in how species are spatially distributed. However those factors interacts in a complex way and this may difficult our interpretation of the observed patterns. Thus, a more mechanistic method is needed to access simultaneous interactions among species characteristics. Here we aim to understand the factors that lead to a variation in geographic range size and how species traits interacts each other. We constructed a database of amphibians that includes the dietary, reproductive and evolutionary data of 47 amazonian frog species. To further test our hypotheses we performed a phylogenetic confirmatory path analysis, which enable us to analyze the direct and indirect path of influence among species traits. After choose the best fitting model, we test the relationships between our variables and we found that the clutch size and the type of breeding habitat have a direct effect on rage size. Despite that several studies reveal a positive relationship between body size and range size; our results show that body size affects range size only indirectly. Thus, species that laid more eggs and that reproduce in lentic habitats are more widespread.

CS07.7 - LIFE ON THE BEACH: VARIABLE ACCUMULATION OF ANTHOCYANINS AND OTHER FLAVONOIDS IN REPRODUCTIVE AND VEGETATIVE TISSUES OF SILENE LITTOREA

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Anthocyanins in flowers are commonly associated with pollinator attraction, whereas in vegetative organs, anthocyanins and other flavonoids may carry out protective functions. Silene littorea is annual species growing on coastal dunes of the western Mediterranean. We examined the accumulation of anthocyanins and non-anthocyanin flavonoids (flavons and flavonols) in floral (petals and calyxes) and vegetative tissues (leaves) throughout 18 populations of the species' distribution range. In calyxes and leaves, anthocyanins and non-anthocyanin flavonoids concentrations were highly correlated, whereas in petals the correlation was weaker. At the plant level, the flavonoid concentration in petals, calyxes and leaves was not correlated in most of the populations. However, at the population level, the mean concentration of anthocyanins in all parts of the plant had a positive correlation. Considering the latitudinal gradient of the west coast, anthocyanin and non-anthocyanin flavonoids had geographical clines in calyxes and leaves, with higher concentrations in southern latitudes. This pattern corresponds to a progressive increase of solar radiation, temperature, and decrease of rainfall toward the south. However, populations along the southern coast, exposed to similar climatic factors, showed different flavonoids concentrations, suggesting that genetic and/or other environmental factors may play a role.

CS07.8 - LOW PHOTOSYNTHETIC PLASTICITY IN THE SEAGRASS *P. OCEANICA*. IMPLICATION FOR RESTORATION AND CONSERVATION STRATEGIES

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Plasticity in photosynthetic acclimation in different light conditions is undoubtedly a fundamental trait to take into consideration for assessing resistance and resilience of plant populations and species. At sea, marine angiosperms, key species in costal marine habitats, are able to cope with the continuous change of light along the water column, where irradiance and the spectra are rapidly altered. There are few studies which have investigated the differences in photo-physiological and genetic features of seagrasses along their bathimetric distribution. *Posidonia oceanica* grows from the surface to 40 m depth, and genotypes can persist *in situ* for long time. Here we present results from a mesocosm experiment in which *P. oceanica* plants collected at two depths (-5m and -25m), almost at the boundary of specie's bathymetric distribution, were exposed to reciprocal light regimes, to investigate the capability of genotypes to switch their phenotypes in response to light regimes. Gene expression and photophysiological data were collected along the experiment in four consecutive time points. Collectively, results showed a limited phenotypic plasticity, which has important implications for the evaluation of the adaptive potential of *P. oceanica* in term of fitness and survival, and to plan adequate restoration strategies of the species.

AGRICULTURAL ECOLOGY

CS08.1 - RECONCILING PRODUCTIVITY AND BIODIVERSITY CONSERVATION IN DRY LAND ARABLE FIELDS IN THE MEDITERRANEAN REGION

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This communication analyses the importance of plant diversity in dry land arable fields and the effects of the intensification of agricultural practices and the complexity of the landscape on plant diversity. A review of several studies conducted by the research team shows that agricultural intensification, at field and landscape scales, negatively affects the abundance and richness of the flora. The comparison of weed communities from the 50s to the present reflects the reduction of weed flora, especially characteristic and rare arable weeds, and the decline in abundance of functional groups such as legumes and insect-pollinated species. The effect of both agricultural practices and landscape complexity depends on the studied flora. Thus, landscape complexity is the main factor shaping vegetation of field boundaries whereas the intensity of agricultural practices is the most important factor in explaining differences in the weed flora in the centre of the fields. The communication discusses several proposals for farmland management aiming at reconciling crop production and conservation of biodiversity and ecosystem services.

CS08.2 - FARM MANAGEMENT AND LANDSCAPE STRUCTURE DETERMINE THE FREQUENCY OF ARABLE SPECIES CHARACTERISTIC OF DRY LAND CEREAL FIELDS

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Many arable plant species that inhabit almost exclusively in cereal fields have undergone severe population declines owing to agricultural intensification. These species, indicators of sustainability in agricultural systems, should be considered in conservation programs, but their conservation must be based on the maintenance of cropping activities. Therefore, it is required a deep understanding of the effects of farming practices and their interaction with the landscape characteristics to promote an adequate balance between crop production and species conservation. We assessed which farming practices and landscape characteristics favour the presence of these species, both common and rare, at the edges of a large number of organic fields. The promotion of autumn-sowing cereal crop varieties after non-inversion tillage and the adjustment of the fertilization should benefit the presence of characteristic arable species at the field level, whose effects scale up at the farm level. Landscape structure effects are less important, but larger fields tend to concentrate more overall characteristic arable weeds together with more rare arable species. Nevertheless, stochastic factors at field and farm levels have a strong effect on the presence of rare arable species. Therefore, fields and farms where these species are still present should be prioritized for conservation.

CS08.3 - PROMOTING WEED REGULATION SERVICES IN ARABLE LANDSCAPES

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The move to reduce herbicide use in farming raises general questions of weed control and regulation. Although there is evidence that weed seeds are consumed by naturally occurring predators, such as carabid beetles, little is known about the internal and external factors that drive the intensity and stability of weed depletion in arable fields. Here, we present an overview of the relationships between the carabids and weed seeds in arable fields derived from results from different large-scale surveys conducted in the UK and in France. These studies highlight the key role of generalist predators in regulating the weed seed bank, illustrate that interactions between the different carabid trophic guilds, weed seeds and alternative prey can vary greatly across the seasons and suggest at systematic changes in the diets of these predators. Our results also highlight that in-field management and the composition of the landscape surrounding arable fields affect the amount of predation, through changes in the composition and total abundance of carabids within fields. Combinations of local and landscape management options, used by individuals or groups of farmer-stakeholders, either support or limit seed predation and thus determine the efficacity of biological control of weeds.

CS08.4 - THE EFFECT OF MASS FLOWERING CROPS AND FIELD MARGIN DENSITY ON POLLINATORS AND POLLINATION SERVICES IN ARABLE-DOMINATED LANDSCAPE

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In intensive agricultural landscapes, the decrease on the number of pollinators has been often reported. It is hypothesized that floral resources on the field margins may have a positive effect on the abundance of pollinators, which may deliver improved pollination service, though not all insect groups may respond similarly. However, mass flowering crops may represent a much more important resource for pollinators. The present study analyzes the effect of the density of field margins on pollinators and pollination in Mediterranean arable-dominated landscapes, in relation to the presence of a mass-flowering crop (canola) in an otherwise cereal-dominated landscape. To this end, we evaluated the abundance and the diversity of pollinators; and the reproductive success of insect-pollinated target plants with affinity for different pollinator groups (*Raphanus sativus* and *Onobrychis viciifolia*) at the edges of 42 cereal and canola fields embedded in landscapes differing in field margin density. The abundance of pollinators was favored by the presence of the canola, which translated into a higher reproductive success of both target species in the vicinity of the canola, irrespective of the specialization in different pollinator guilds. Field margins in intensively managed landscapes do not contribute significantly to pollinator abundance and pollination service.

CS08.5 - LANDSCAPE COMPLEXITY ORGANIC AGRICULTURE AND REWARD CROPS: WHAT IS GOOD FOR POLLINATORS IS GOOD FOR PLANT POLLINATION?

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Agricultural intensification at field and landscape levels has caused a general decline of pollinators across Europe. Lower farming intensity, higher diversity of crops particularly in cereal-dominated land, and shorter distance to non-cropped neighboring land tracts may promote the abundance of pollinators. However, it is not well known whether the potential increase in pollinators may increase pollination services. We analyzed the effects of landscape (through the percentage of arable land, PAL), management intensity (organic vs. conventional farming), distance to non-cropped land tracts (field edge vs. field center) and type of crop (legumes vs. cereals) on the abundance of pollinators, and on the pollination success of a generalist insect-pollinated target species, in a cereal-dominated area. The effect of PAL was negative, and larger than the positive effects that management and distance to field margins had on pollinators. However, the differences between farming systems disappeared on the edges. Legumes had a positive effect on pollinator abundance, but this effect was only evident in landscapes with low PAL. These effects varied among groups of insects, a variation that may be behind the lack of direct correlation between the effects on pollinators and the effects on the pollination of the target plants.

CS08.6 - IMPACT OF AGRICULTURAL LANDSCAPE ON BUTTERFLY COMMUNITIES IN FRANCE

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In Europe, land-use changes induced by agriculture represent one of the main factors impacting biodiversity. Providing large amounts of data collected nationwide and over long periods, citizen science are a great opportunity to assess potential impacts. We used here data from four participatory butterfly monitoring schemes, representing ca. 1,800 sites spread all over France. We performed a cross-scale study to assess the combined impacts of local characteristics and landscape structure on abundance and diversity of butterfly communities. The impact of local habitat quality, proportion of land use types and length of linear elements within buffers around each site was tested on groups of species based on ecological or behavioral traits. Our results reveal that the impact of local habitat quality, including pesticide use, proportion of intensive agricultural patches and urbanization on butterfly abundance varies with species traits, especially mobility and habitat preferences. The scale best describing co-variable effects was positively correlated with species mobility. These results suggest that management at small scale may mitigate the negative impact of landscape changes, and that properly assessing land-use change impacts implies distinguishing species according to functional traits. They also highlight the potential of citizen science for large-scale and long-term biodiversity monitoring.

CS08.7 - EFFECTS OF AGRICULTURAL PRACTICES ON SOIL MICROBIAL BIOMASS CNP CONTENT: A PRELIMINARY CASESTUDY

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To overcome the predominant intensive agricultural production trend in the past fifty years organic farming has been increasing in several countries around the world. Soil microbial communities are extremely diverse, the relation between their diversity and function influences soil stability, productivity and resilience and microbial biomass is considered a sensitive indicator of soil fertility and sustainability. However, little is still known on the effects of agricultural practices on soil microbial biomass C:N:P ratios. The objective of this work was to assess the effect of conventional and organic agricultural practices on soil microbial C:N:P ratios. Soil and microbial C, N and P contents were determined using the fumigation-extraction method on similar soils from one field under conventional farming and from one certified organic farming field. The results show that the soil under conventional farming practices is P limited and that microbial biomass has greater N and P availability in soils under organic farming. However, the differences were more related with the previous crop and organic fertilization method rather than with agriculture type, since P-limited soils and P-limited microbial biomass were also found in soils subjected to organic farming previously cultivated with N-rich crops incorporated in soil before plantation.

CS08.8 - AFFORESTATION EFFECT ON THE SOIL MICROARTHROPOD COMMUNITIES IN THE FORMER AGRICULTURAL LANDS IN VIDZEME UPLAND

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Afforestation and overgrowing of abandoned agricultural lands with shrubs causes the loss of arable lands and changes in soil quality and fertility. So far there is insufficient information on changes in soil animal communities according to this process. Field studies on soil microarthropods (Collembola, Mesostigmata, Prostigmata, Oribatida) were carried out within eleven sample plots on abandoned agricultural lands in Vidzeme Upland (Latvia). Former fields there are overgrowing with gray alder (*Alnus incana*), spruce (*Picea abies*), and aspen (*Populus tremula*) forests of different age. Soils are sandy loam and loamy sand with pH 4,7 - 5,0 (KCl). From each plot in October 2014 five soil samples (19,6 cm2 x 10 cm) were collected. Soil microarthropods were extracted by using Tullgren funnels. Gray alder forest stands had positive effects on density of springtail populations. Microarthropods were also affected by age of forest stands (especially soil mites) as well as by soil texture and terrain. Interaction between soil predatory mites and their potential prey – oribatids was also observed.

CS08.9 - SPATIAL DISTRIBUTION OF GREENHOUSE WHITEFLIES IN TOMATO CROPS

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Control of pest insects is a persistent challenge in crop production. Insect dispersal is recognized as a key point for understanding the spatiotemporal dynamics of the insects and for planning management strategies. To better understand dispersal modes of the greenhouse whitefly, we tested the effect of different movement rules on their spatial distribution and population growth. To this end, we developed a spatially explicit, individual based simulation model. We tested three types of movement rules. (1) When adults follow cues from plants, whiteflies tend to stay in the same plant or move to the eight nearest-neighbor plants, and thus form patches of infestation. (2) When adults follow an empirical probability distribution for finding a new plant, they tend to be more spread out in space. However, the original population patch with its high density of individuals is still evident. (3) Random movement alone cannot explain the spatial distribution of whiteflies. However emigration rates could affect the size and spatial distribution of the population. In summary, the cues from plants and probability to disperse play an important role in explaining the insect population distribution.

CS08.10 - THE BIOPRINT PILOT PROJECT: CILIATED PROTOZOA COMMUNITIES AS A TOOL TO ASSESS SOIL QUALITY IN AGROECOSYSTEMS AND NATURAL SITES OF MARCHE REGION ITALY

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In the framework of the *BioPrint Pilot Project* and for the first time in Italy, we have investigated the community structure of soil ciliates from agroecosystems and natural sites of Marche Region. The aims were: i) to evaluate the capacity of ciliates to discriminate between different land uses; and ii) management practices; iii) to assess relationships among ciliate communities and abiotic parameters. Soil samples were collected twice from 10 sites (5 natural sites: FORest; and 5 arable field: 3 ORGanic and 2 CONventional). Ciliate communities were studied by means of qualitative and quantitative methods. Soil chemical-physical parameters were measured. Qualitative ciliate analysis allowed us to identify a total of 59 species. Multivariate analysis showed statistically significant differences between natural sites (FORest) and agricultural sites, as well as between the ORGanic and CONventional management farming systems. CCA analysis showed correlations between the distributions of species with environmental parameters indicating the importance of these parameters in shaping the ciliate communities in the different sites. Altogether, these results showed the bioindicative potential of ciliate communities in discriminating between natural sites and agroecosystems, as well as their capacity to discriminate, at *least preliminary*, between different management systems (ORG vs CON).

CS08.11 - A MAIZE TROPHIC CHAIN INDICATOR OF AGRICULTURAL MANAGEMENT CHANGE ON BIOLOGICAL CONTROL

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Tritrophic interactions can be used to monitor changes in biological control function in response to agricultural management. Maize leafhopper *Z. scutellaris* and anthocorid predator *Orius spp*. have been identified as representative taxa for detecting these impacts in maize-based agroecosystems. When designing a monitoring program it is vital to assess indicator adequacy and the magnitude of indicator variation throughout the territory for a number of years. For that, we monitored for three years the abundance of *Z. scutellaris* and *Orius spp.* in commercial maize fields and related farmland habitats (alfalfa and semi-natural) in three agricultural regions in NE Spain. Our results show that the baseline variation in maize populations of Z. scutellaris due to region characteristics is greater than the year-to-year variation, and the opposite trend is found for *Orius spp*.. Regionally, *Z. scutellaris* captures are a good descriptive for *Orius spp.* despite year-to-year variation. Landscape characteristics modulate indicator abundance in maize fields: 1) Maize leafhopper populations are enhanced by edge density and cereal crops, and suppressed by semi-natural habitat 2) *Orius spp*.. numbers in maize are mainly influenced by edge density. We discuss the selection of the most suitable regions to develop specific monitoring based on statistical power analysis.

CS08.12 - CROP GENETIC DIVERSITY BENEFITS FARMLAND BIODIVERSITY AND ECOSYSTEM SERVICES IN CULTIVATED FIELDS

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During the 20th century, agriculture experienced major gains in productivity via intensive use of inputs but also homogenization. The use of a few genetically homogeneous crop varieties (inbred lines or hybrids) in intensive farming systems has particularly resulted in a widespread erosion of crop genetic diversity both at the field and landscape scales, with potential impacts on biodiversity and ecosystem services in the field. Here, we tested the effects of crop genetic diversity in bread wheat (*Triticum aestivum*) on biodiversity and ecosystem functioning using an experimental setup inspired from biodiversity-ecosystem functioning experiments. We compared the (1) structure and composition of communities of plants, above- and belowground invertebrates and (2) several ecosystem services (yield stability, biological control of pests, weeds and diseases, soil fertility) in experimental plots containing 1 to 8 wheat varieties. The first results show a positive impact of crop genetic diversity on below and aboveground arthropod diversity at field scale in agroecosystems, which may be caused by a wider variety of food resources or more complex crop architecture. I will present the consequences of higher species diversity for ecosystem functioning, and discuss the baskets of ecosystem services available in crop fields containing variety mixtures.

CS08.13 - THE EFFECT OF LANDUSE CHANGE ON ECOSYSTEM SERVICES IN SEMINATURAL BOREAL ECOSYSTEMS

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In boreal ecosystems, traditionally diverse agricultural landscapes were composed of a mosaics of intensively used fields (monocultures), low intensively used vegetation types such as semi-natural grasslands and forests. Several of the semi-natural grasslands are now abandoned due to changed agricultural practices. Agricultural landscapes are potential suppliers of ecosystem services such as aesthetic, biodiversity conservation, pollination and agricultural production. The ongoing process of landscape change will influence provision of ecosystem services but little is known about in which directions. The aim of this project is to assess potential effects of land-use change (abandonment) on ecosystem services in agricultural boreal ecosystems.In this project we have developed ecosystem service indicators from plant trait databases and botanical surveys and assessed potential losses or gains due to ceased low intensive management.The results indicate that abandonment of land-use management causes declines in ecosystem services assessed in this study such as aesthetic, biodiversity conservation and agricultural production.

CS08.14 - ASSESSMENT OF CARBON SEQUESTRATION IN OLIVE ORCHARDS USING EDDY COVARIANCE TECHNIQUES – WITH AND WITHOUT WEED COVER

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Olive groves have a great environmental, social and economic importance in the Mediterranean basin and especially in Spain, which possesses the largest area dedicated to this crop. In the past decades, conventional practices such as tillage and use of chemical fertilizers have caused important problems including erosion and the loss of soil fertility. Conservation management practices such as the maintenance of plant covers in between tree rows have been implemented to reduce organic carbon (C) losses and improve physico-chemical soil properties. While the effects of this practice on the increase of soil organic C content is widely known, few studies have quantified its effect on the C balance accounting for ecosystem carbon inputs and outputs. The objective of this study was to analyse the influence of weed covers, versus soil management for weed suppression, on the C balance in an olive orchard in SE Spain, through measurements of CO_2 exchange using the eddy covariance technique. Water use efficiency, defined as the ratio of Net Ecosystem CO_2 Exchange (NEE) to evapotranspiration, was evaluated in both management treatments. Our study demonstrates the feasibility of using eddy covariance techniques for characterizing differences in C balance in croplands under different managements

CS08.15 - THE EFFECT OF INSECTICIDE USE ON THE AERIAL FOOD WEBS OF OLIVE CROPS

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Olive agro-ecosystems have been defined as relatively stable, compared to other cultivations, due to permanent cropping which encourages the presence of complex arthropod communities, with a lower number of pests actually damaging the yield. Nevertheless, different management systems (conventional, integrated and organic), characterized by a decreasing use of insecticides, must determine the complexity of the food webs of the cultures. Insecticides are generally unselective and, if used without caution, damage most of the arthropods of the aerial food webs. Our goal with this study is to evaluate the effect of a scaled use of insecticides on the aerial food webs of olive agro-ecosystems and more specifically to know how this may damage the natural biological pest control exerted by arthropods. To analyze this fact from a holistic perspective, we built topological aerial food webs from olives under decreasing insecticide treatments, based on the abundance of different species and bibliography about their functional position in the web. Although proportions of different guilds are maintained in different management systems, the number of nodes in each trophic niche and the connectivity and complexity of the aerial food web is much higher in organic than in conventional olive farms.

CS08.16 - ENHANCED USE OF CROP VARIETAL DIVERSITY TO MANAGE PESTS AND DISEASES IN AGRICULTURAL ECOSYSTEMS

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The negative consequences of planting large areas to single, uniform crop cultivars has led to devastating crop loss. A research partnership in China, Uganda, Ecuador, and Morocco, revealed high levels of diversity within traditional varieties of staple crops for specific pests and diseases: (i) maize: northern leaf blight, stem-borer; (ii) common bean: ALS, anthracnose, rust, bean fly; (iii) faba bean: aphids, chocolate spot; (iv) banana/plantain: black sigatoka, fusarium wilt, nematodes, weevils; (v) durum wheat: Septoria leaf blotch, rust; (vi) rice: rice blast, rice plant hopper. Resistance of traditional and modern varieties was assessed from both participatory diagnostics of farmer knowledge and from cross-site on-farm and on-station trials. Experiments identified traditional varieties with more effective resistance to pest and diseases when grown outside their home sites. Increased diversity of crop varieties, measured by number of varieties and their evenness of distribution across farmer's fields corresponded to a decrease in average damage levels and a reduction in disease damage variance. Intra-specific (crop-variety) mixtures with non-uniform resistance were tested; specific cases where mixtures out-performed their component monocultures

are described. Including intra-specific crop diversity in ecological agriculture management strategies is a viable option for reducing current crop loss and vulnerability to future loss.

CS08.17 - ASSESSING THE BIODIVERSITY VALUE OF WET GRASSLANDS: CAN SELECTED PLANT AND INSECT TAXA BE USED AS RAPID INDICATORS OF SPECIES RICHNESS AT A LOCAL SCALE

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Sixty percent of the land surface of the Republic of Ireland is farmland. Twelve percent is estimated to sustain high species richness. This farmland is predominantly pasture-based and the ecological status of semi-natural grasslands is particularly important for biodiversity. Recent studies indicate that those grasslands with high nature value (HNV) in the north-west of Ireland are wet grasslands. We investigated seven taxa as potential bioindicators of species richness of wet grassland habitats and examined how this information could be used in rapid assessment methodologies to identify areas of high nature value. Grasses, sedges, rushes, ground beetles (Coleoptera) and marsh flies (Diptera) were identified to species and Diptera to parataxonomic units (PTU). Sedges was the most significantly correlated taxon with overall species richness of the remaining taxa. As a combination sedges & carabids showed the strongest correlation. Our data indicate that the use of a single taxon or a combination of two taxa has a useful role to play in the rapid identification, protection and future monitoring of species-rich wet grasslands where taxonomic and financial resources for rigorous studies are limited. We discuss this in the context of agri-environmental schemes and High Nature Value farmland identification.

ECOLOGICAL MODELLING & BODY SIZES ALLOMETRIES AND PATTERNS

CS09.1 - THE SPEED OF BIODIVERSITY DECAY IN FRAGMENTED LANDSCAPES

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If an ecological community suffers isolation or loss of area through habitat destruction, it may find itself with a large extinction debt. The community will reestablish equilibrium at a lower level of biodiversity, a process which may proceed rather slowly. Through conservation actions, such as restoring degraded habitat to its former condition, it may be possible to reverse the process so that irreversible damage to the community is forestalled. However, there exists a finite window of time for such interventions. We use a simple extinction model, parameterised with published data for avifauna, to estimate the scaling of this time under plausible conditions. This model foresees that the relaxation process in time will follow a power law rather than an exponential decline. It also expects the relaxation time to increase with area. The temporal size of this window has important conservation implications.

CS09.2 - STOCHASTIC DIFFERENTIAL EQUATIONS AND OUTBREAKS MODELING

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In this work a study for the use of stochastic differential equations towards a robust detection and parameterization of population outbreaks is presented. More specifically different classes of stochastic differential equations modeling the passage of population densities from stable to the outbreak dynamic regime are studied. It is proposed that the stable regime for population density may be modeled by the well known Ornstein Uhlenbeck process while initial stages of outbreak regime may be robust modeled by means of a generalized random walk process. To this end, a certain variable transformation is studied in order to treat the timely outbreaks detection. Moreover, within the proposed framework a specific stochastic algorithm is formulated leading to a robust estimation of the corresponding outbreak rate. A validation of the proposed algorithm in olive fruit flies outbreaks is also presented. Indeed, time series of olive fruit flies population data from past field collected data were used where outbreaks are present in different time and space realizations. In all cases the proposed algorithm was able to detect and correctly predict the time of outbreak initiation and its rate, correspondingly.

CS09.3 - NON-LINEAR POWER LAW APPROACH FOR SPATIAL AND TEMPORAL PATTERN ANALYSIS OF SALT MARSH EVOLUTION

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Salt marshes vegetation distribution can self-organize in patterns over time and space. Self-organized patchiness of vegetation can often give rise to power law relationships in the frequency distribution of patch sizes. In cases where the whole distribution does not follow a power law, the variance of scale in its tail may often be disregarded. Deviation from power laws represents stochastic effect named emergent property that can be hybridized on the basis of a fuzzy Bayesian generative algorithm to show the influence of channel sinuosity on patch size. Evolution of vegetation patches detected by the hybrid model considering channel sinuosity can then be used to forecast potential deviation from steady states in intertidal systems, taking into account the climatic and hydrological regimes. As observed from the proposed model, the sinuosity has a greater effect on smaller patches that are subject to pulse-disturbance but at the same time, they are especially encouraged to leave the steady state because they often are more influenced by the changes of water level and salinity. We propose this new hybrid approach for study of complex estuarine dynamic, and potentially as future scenarios builder useful in decision-making regarding adaptations to climate change in coastal areas.

CS09.4 - ASSESSING THE PREDICTIVE ABILITY OF MECHANISTIC MODELS FOR THE HAITIAN CHOLERA EPIDEMIC

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Predictive models of waterborne epidemics need to resolve at suitable aggregation levels spatial data pertaining to local communities, epidemiological records, environmental drivers, waterways and patterns of human mobility. The still-ongoing epidemic that stroke Haiti in October 2010 (the largest and deadliest cholera outbreak in recent history, with more than 730,000 cases and 8,900 casualties as of February 28, 2015) represents a natural testbed to quantitatively assess the explanatory and predictive abilities of modeling approaches characterized by different spatial aggregation levels and coupling mechanisms. We show in a formal model comparison framework that spatially explicit models accounting for spatial connections have better explanatory power than spatially disconnected ones for short-to-intermediate calibration windows, while parsimonious, spatially disconnected models perform better with long training sets. On average, spatially connected models show better predictive ability than disconnected ones. We suggest limits and validity of the various approaches and discuss pathways towards the development of case-specific predictive tools in the context of emergency management.

CS09.5 - BODY SIZE - ABUNDANCE SCALING RELATIONSHIPS IN BENTHIC COMMUNITY: A DEEPER INSIGHT

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The inverse relationship between average individual body size and individuals abundance is one of the most fundamental patterns in ecology, with large implications for community structure and ecosystem functioning. The criteria used to group organisms (e.g. taxonomic or distributional, grain of data aggregation), and to fit the relationships (e.g. central, upper and segmented models) have different ecological interpretations and statistical implications. A comparative investigation is needed to clarify the influence of the analytical procedure on estimated scaling parameters. We here provide a systematic analysis of size-abundance relationships, using already existent data on macrozoobenthic organisms inhabiting 15 Mediterranean lagoons. We decompose the dataset at different levels to evaluate the consistence of the allometric model across different data aggregation and model fitting criteria. We show that the most used and simple approach to size-abundance regression (linear model fitted on the overall dataset) often led to underestimation, while alternative models are closer to theoretical expectations. Scaling relationships are rather invariant respect to 1) the spatial and taxonomic level of data aggregation and 2) across different taxa and functional groups, bracing the hypothesis that size-abundance relationships follow universal ecological constrains.

CS09.6 - THE INTERACTING EFFECTS OF PARAMETER UNCERTAINTY AND DEMOGRAPHIC STOCHASTICITY ON THE ESTABLISHMENT SUCCESS OF INTRODUCED SPECIES AND OUR ABILITY TO PREDICT THEM

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Invasive species are an important component of global change and a serious threat to biodiversity. Knowledge of the typical strength of competition between resident and introduced species is one of the ingredients needed to predict the establishment of an introduced species. Many other factors affect the outcome of an introduction, including environmental and demographic stochasticity, Allee effects and spatial effects. Demographic stochasticity is potentially quite important, since introduced species are typically at low abundance. We focus on the competitive interaction between residents and potential invader using a stochastic version of the classic competitive Lotka-Volterra (LV) equations. We assess the effect of demographic stochasticity on inferring the strength of competition and on our ability to predict the probability of an introduced species to establish. We show how having a prior knowledge of the single species demographic parameters can improve the precision of the estimates of the competition parameters of at least one order of magnitude. Finally we assess how our ability of predicting the establishment of an introduced species depends on demographic stochasticity. Our results provide a first step in disentangling the combined effects of demographic stochasticity and parameter uncertainty in our ability to predict establishment success.

CS09.7 - CAN I TRUST MY MODELS SENSIC : AN R PACKAGE FOR MODEL DIAGNOSTICS IN COMPARATIVE BIOLOGY

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Considering the phylogenetic relationships among species is important when it comes to analyze distributions and traits. Phylogenetic comparative methods have thus become central in ecology and evolution analyses. However, like any model, comparative analyses are subject to uncertainty. Sample size and quality of available data can strongly affect model estimates. Does the relationships still hold when the amount of available data changes? Are there any points that influence the regressions more than others? Phylogenies used in comparative methods also come with a degree uncertainty that should be taken into account. How does phylogenetic uncertainty affect model estimates in phylogenetic linear regressions? Finally, in analyses considering species characteristics, intraspecific variation is a source of variation rarely considered. How does intraspecific variation influence model results? We propose a set of new tools grouped in an R package (sensiC) to evaluate the robustness of comparative analyses. The functions implemented in sensiC provide diagnostics for phylogenetic generalized least squares by various simulations methods: data removal, leave-one-out deletion, random sampling of phylogenies and data. A graphical output with several plots for model diagnostic is provided for each package function. We show on real and simulated datasets that model diagnostic are crucial in comparative analyses.

CS09.8 - OPTIMAL FLOW FOR BROWN TROUT: HABITAT – PREY OPTIMIZATION

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The correct definition of ecosystem needs is essential in order to guide policy and management strategies to optimize the increasing use of freshwater by human activities. Commonly, the assessment of the optimal or minimum flow rates needed to preserve ecosystem functionality has been done by habitat-based models that define a relationship between in-stream flow and habitat availability for various species of fish. We propose a new approach for the identification of environmental flows summing up the limiting factor approach and the evaluation of basic ecological relationships, considering the appropriate spatial scale for different organisms. We developed density-environment relationships for three different life stages of brown trout that show the limiting effects of hydromorphological variables at habitat scale. In our analyses, we found that the factors limiting the densities of trout were water velocity, substrate characteristics and refugia availability. We used these relationships within habitat based models in order to select a range of flows that preserve most of the physical habitat for all the life stages. We also estimated the effect of varying discharge flows on macroinvertebrate biomass and used the obtained results to identify an optimal flow maximizing habitat and prey availability.

CS09.9 - SPECIES DISTRIBUTION MODELLING APPLIED TO THE OPEN OCEAN: GLOBAL TRENDS AND UNCERTAINTIES IN PHYTOPLANKTON RICHNESS PATTERNS

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Phytoplankton comprise a phylogenetically diverse array of taxa, yet their diversity patterns on the global scale are currently poorly understood. We provide a global description of phytoplankton diversity by means of quantifying species richness as a function of environmental parameters using species distribution models (SDMs). Model setups of differing complexity are used to depict richness of functional (e.g., 'silcifiers', 'calcifiers') and taxonomic groups of varying size (e.g., 'diatoms', 'cyanobacteria') so as to compare emergent patterns and drivers of taxonomic versus functional diversity of phytoplankton. Patterns may change from monthly to annual timescales, and are compared to those arising from raw data of corresponding temporal resolution. Our results based on 349'000 archival data records (GBIF; www.gbif.org) show that the ecological niches of major phytoplankton groups are sequentially shifted along the temperature gradient and that richness gradients for diatoms versus coccolithophores respond differently as a function of latitude. SDMs are strategic tools to address data scarcity and will foster an understanding as to what extent current observational data can be used to depict aspects of global phytoplankton diversity across major taxa and temporal detail.

CS09.10 - MODELING OF *OSTREOPSIS CF. OVATA* BLOOM EVENTS FROM METEO-MARINE DATA

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Ostreopsis cf. ovata is a toxic benthic marine dinoflagellate recorded along Italian coasts since the '90, although large bloom events have been reported only in recent years. Time series of cell abundances have been collected for several sites along the Ligurian coast, together with a set of related environmental variables. The aim of the present study is to investigate correlations between cell abundances and environmental variables, in order to realize an automatic tool for the prediction and classification of *Ostreopsis* blooms. The main challenges in the development of an efficient predictive tool is the choice of the environmental matrix to consider for bloom accounting, being *Ostreopsis* a benthic species. For this reason we propose a combined approach, modeling first *Ostreopsis* cells on macroalgae (source) and, as a second step, cell abundance in the water, using modeled cells on macroalgae as predictor. The tool will be able to predict expected cell abundances along the coast and to alert Regional Agencies in order to implement emergency procedures.

POPULATION & COMMUNITY ECOLOGY, FOOD WEBS NETWORKS AND COMPLEXITY

CS10.1 - SPATIAL SELF-ORGANIZATION STABILIZES DYNAMICS OF PLANT COMMUNITIES

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To date all biodiversity experiments in grasslands showed positive diversity-productivity relationships that have been attributed to complementarity effects. Unravelling the mechanisms behind these effects may provide an important step forward in our understanding of the processes that stabilize or destabilize the dynamics of plant communities. Two hypothesized mechanisms are: (1) plant-species-specific impacts of root pathogens and (2) vertical root stratification. We performed an 11-year garden plot experiment to test these hypotheses. During 11 years the average yield in the monocultures of the field experiment strongly declined, while it did not in the diverse mixtures, suggesting that the development of specific soil pathogen communities was responsible for the observed complementarity effects. The results of a greenhouse inoculation experiment confirmed this hypothesis. There were also asymmetric reciprocal effects between species belonging to the same family which might result in complicated interaction networks within communities. The root studies revealed that all species were able to exploit the whole soil column in monocultures without striking differences among species. But in mixtures we observed clear spatial separation between plant species with different rooting patterns. This spatial self-organization has strong stabilizing impacts on the dynamics of competing species in stochastic environments.

CS10.2 - UNDERSTANDING COMMUNITY ASSEMBLY MECHANISMS AND FUNCTIONING THROUGH INTEGRATIVE APPROACHES

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Numerous studies have been focused on understanding diversity and functioning of ecological communities which are shaped by ecological differences of species and stochastic processes. Testing these mechanisms of species coexistence and community assemblage is limited by the demands for long-term temporal data sets which are thus rarely collected in plant/animal communities. Such time-series can be easily obtained with microbial communities, which, however, have not been well acknowledged so far. In our study, we constructed spatially implicit microbial communities that contain competing bacterial species under presence/absence of a protist predator. The communities were maintained under a continuous regime by diluting the batch cultures and were sampled daily to track dynamics of each single species within the assembled communities and a selected microbial function. Results show that both equalizing (e.g. stochastic mortality) and stabilizing (e.g. anti-predation strategies, adaptive trajectories) processes may operate simultaneously on the communities affecting the functional responses. Since, both ecological and economic systems are complex systems comprised of autonomous agents and individuals, econometric techniques will be possibly used besides modeling approaches for inferring the causalities of these mechanistic processes. Our study will thus add significant theoretical and methodological insights for mechanistic understanding of community dynamics using integrative approaches.

CS10.3 - FUNCTIONAL VS PHYLOGENETIC PERSPECTIVES OF THE ASSEMBLY PROCESS IN GYPSUM COMMUNITIES ALONG AN ARIDITY GRADIENT

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Edaphic plant communities growing on special soils are known to be resistant to climatic variation since most specialists have “stress-tolerant” functional attributes. Our study was based on phylogenetic and functional perspectives and tested to what extent a large aridity gradient exerted changes in community assembly. Functional patterns give insights on processes occurring at short time scales, whereas phylogenetic patterns on historic processes related to speciation. The joint use of phylogenetic and functional patterns in species assembly may help us to improve knowledge on the historical and ecological causes of community diversity. Gypsum perennial vegetation of 89 locations was sampled along an aridity gradient from the center to the south-eastern of Spain. Gypsophily indices proposed by Mota etal. (2009) were used to characterize perennial species and we combined this index with tools developed to describe trait diversity patterns (CWM, functional richness, evenness and Rao), together with null models to identify environmental filters (assembly rules). Three phylogenetic diversity indices were used: Phylogenetic Species Variability (PSV), Richness (PSR) and Evenness (PSE). Our results suggest that at higher aridity conditions plant assemblies had greater share of soil specialists and that the species forming the local community were phylogenetically closer than at milder conditions.

CS10.4 - VEGETATION SPATIAL PATTERNS IDENTIFY ALTERNATIVE MULTIFUNCTIONALITY STATES IN GLOBAL DRYLANDS

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Vegetation attributes, such as patch-size distributions and cover, have been proposed as indicators for detecting abrupt changes in ecosystem functioning associated to dryland desertification. Their practical use is, however, hampered by the lack of studies evaluating the simultaneous provision of multiple ecosystem functions (multifunctionality) over multiple ecosystems and geographical regions. Using a global empirical study, we found that perennial plant cover was the best predictor of changes in multifunctionality. However, changes in the patch size distributions detected a critical shift between two stable states on multifunctionality. Such transitions are associated to sharp changes in the processes driving ecosystem dynamics and to a decoupling between functions associated to the phosphorus cycle from other ecosystem processes. Our results provide strong empirical support for the use of patch size distributions to detect catastrophic shifts in multifunctionality.

CS10.5 - ALLELOPATHIC EFFECT OF *A. HERBA-ALBA* ON SOIL SEED BANK IN A SEMIARID PLANT COMMUNITY, NE SPAIN

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Allelopathic activity of *Artemisia herba-alba* cause a repulsion of diversity nearby *A. herba-alba* individuals. It is unclear if this repulsion could be a consequence of an inhibitory effect during seeds germination, or whether it could be due to different composition of the soil seed bank. We germinated in a greenhouse, soil samples collected under the canopy of 20 individuals of *A. herba-alba*, 20 individuals of *Salsola vermiculata* (a nurse shrub) and in 20 open bare soil areas, applying two watering treatments (fresh water and aqueous extract of *A. herba-alba*). Preliminary results showed that species richness of soil seed bank was similar between *A. herba-alba* and *S. vermiculata*, and higher than in open bare soil. Moreover, seed bank under *A. herba-alba* had more seeds than under *S. vermiculata*. Aqueous extract of *A. herba-alba* significantly reduced the number of species and the amount of seeds that germinated. These results suggest that *A. herba-alba* have an inhibitory effect during seed germination, whereas no evidence of differences in richness of soil seed bank was found between plants. Further research should explore changes in species composition of soil seed bank to better understand the importance of allelopathy in plant community dynamics of semiarid environments.

CS10.6 - TROPHIC CHANGES AND FOOD WEB DYNAMICS IN LAKE MAGGIORE (ITALY)

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The aquatic ecosystem of Lake Maggiore has undergone important changes in response to reoligotrophication there occurred from late 1970s. Fishery catch has in fact strongly declined since then, and the composition of both zooplankton and phytoplankton compartments has been altered consistently. We model the dynamics of Lake Maggiore food web by focusing on the relevant pelagic fish species: the European whitefish and the Alpine landlocked shad. To attempt a realistic description of their ecology, we account for all major taxa in the diet of said fish, which include herbivorous and predatory zooplankton species. These are in turn closely dependent on three phytoplankton size groups. We calibrate the food web model with data concerning all compartments between 1981 and 1995. By using standard model selection techniques, we compare different functional forms that may be used to describe the food web. In particular, we discuss whether or not the dynamics of the whole ecosystem can be better described by explicitly incorporating the trophic status of the lake. Finally, we discuss the performance of the model in predicting fishing catch after 1995, so as to analyze the robustness of model parametrization and their potential use as an ecosystem management tool.

CS10.7 - PARASITE INTRODUCTION BY TRANSLOCATION OF INFECTED FISH: THE CASE OF *ACANTHOCEPHALUS RHINENSIS*

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Fish parasites are an integral part of aquatic biodiversity sometimes ignored since they are often “hidden” in the hosts. Their interactions with other components of the ecosystem would be evaluated, especially when a parasite species is introduced in new areas and/or hosts. Human actions, including fish translocation for stocking, facilitate the parasites overcoming of biogeographic barriers and improve their dispersal ability. An example of human-aided circumvention of barriers, which contributes to homogenization of aquatic parasite fauna, is described. In 2010, the parasite *Acanthocephalus rhinensis*, previously found only in German Rhine River, was recorded in Piediluco Lake (Central Italy). In this new ecosystem, *A. rhinensis*, a heteroxenous parasite trophically-transmitted, uses eel *Anguilla anguilla* as definitive host (like in Rhine) and the amphipod *Echinogammarus tibaldii* as intermediate new host. Prevalence and abundance indicate that *A. rhinensis* population have found the conditions necessary not only for its survival but also for a firm establishment, dominating the eel intestinal community. The parasite don’t affect significantly eels health, but reduces the reproductive potential of *E. tibaldii* females. Considerations on how this parasite species has been introduced, the ecological factors which allowed a successful colonisation and the impact on host populations will be presented.

CS10.8 - DEEP DWELLING POPULATION OF MEDITERRANEAN RED CORAL: BACK TO THE FUTURE

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Mediterranean red coral, *Corallium rubrum*, is a long-living habitat-forming gorgonian, considered among the most precious corals worldwide. Historical records of red coral fishery date back to 1200 b.C. and, nowadays, due to the protection measures applied to shallow water populations, deep dwelling populations (> 50 m depth) represent the current target of professional fishery. First explorations of deep environments showed a population structure with low density and big size of the colonies, opposed to high density of small colonies found in shallow populations. Recent technological advances allowed to considerably extend data collection on deep dwelling populations by means of non-destructive sampling. Our results showed that deep populations exhibit a continuous range of colony density from a few individuals up to 70 individuals per sampling unit, with less than 18% of observed variance explained by depth and sediment accumulation excluding coral presence. The wide range of population densities recorded in deep populations and the inverse relationship observed between density and mean individual size, suggested that self-thinning processes are acting in shaping population structure. Finally, young populations dominates in vertical walls while old populations were only found in horizontal beds, emphasizing the role of geological setting in shaping red coral populations.

CS10.9 - INTERSPECIFIC DENSITY-DEPEDENT HABITAT SELECTION AND THE ROLE OF SECONDARY HABITATS IN STEPPE BIRDS

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Interspecific competition is a recognized major force which structures animal communities and habitat partitioning is one of the main processes mediating on species coexistence. Although theoretical models implicitly assume that heterospecific competitors coexist by completely segregating in their preferred habitats, here we evaluated whether a weaker competitor may still use the competitor's preferred habitat in its presence employing multi-specific isodars, an approach which reflects evolutionary stable strategies of habitat selection. We used population densities of two endangered steppe birds, the *little* and the *great bustards*, which often co-occur and share preferences for some habitat types. Multispecific isodars revealed asymmetrical interference competition between both species operating in the secondary habitat of the inferior competitor. The *little bustard* behaved like a specialist subordinate species, being displaced towards its preferred habitat as the *great bustard* density increased in the secondary habitat but still able to exploit it even in the competitor's presence. The study of density-dependent habitat selection patterns should aid in identifying the effects of competition on community assemblage with relevant implications on species conservation. Isodars are a promising method to gain clear insights in interspecific competition for species in which experimental manipulations are not feasible.

CS10.10 - INFLUENCE OF SOIL MICROBIAL COMMUNITIES ON PLANT COMPETITION

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There is growing evidence on the critical role soil microbes play in regulating plant communities. Soil microbes compete among them as well, likely leading to the demise of some species and the dominance of others. We hypothesized that the outcome of competition between two plant species would depend on the outcome of competition between microbial communities in their rhizosphere. We used two shrub species from a coastal community in Southern Spain, *Maytenus senegalensis* and *Lycium intricatum*, in a greenhouse experiment where we kept saplings of both species under intra- and inter-specific competition. We measured plant survival and growth and characterized soil microbial enzyme activity and bacterial community composition in the different competition treatments.All *Lycium* individuals and all *Maytenus* individuals survived in the intra-specific treatment. However, half *Maytenus* individuals died when growing with *Lycium*. By the end of the experiment there were significant differences in soil community composition in control, *Lycium* and *Maytenus* soils. However, *Lycium+Maytenus* soils had communities similar to *Lycium* soils, suggesting competitive displacement of *Maytenus* soil communities by *Lycium* soil communities. Microbial activity was depressed when both species were present, compared with intra-specific treatments. These results suggest strong competition between rhizosphere communities which influenced plant competition outcome.

CS10.11 - ON THE SEASON-DIVERSITY RELATIONSHIP

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A conspicuous Species-Time Relationship can be seen in species diversity in seasonal environments. We hypothesize the relative balance of abiotic-limited growth (resources, temperature) and biotic-limited growth (interactions) determines the phenological strategy of different species and the resultant species diversity patterns. We assembled and analyzed empirical datasets on species diversity through time in seasonal environments. We conducted a modeling study in conjunction with this data analysis to replicate the seasonal patterns observed in the data. In our modeling, we compared alternative dynamical models to explain the patterns and selected the models that have support for the assumptions and match the patterns in the data. This model selection generated novel predictions about species niches and occurrences in time which we tested in the data allowing us to confirm and reject specific model predictions and general hypotheses. We identified key similarities and differences between terrestrial and aquatic habitats and taxa in what processes drive similar seasonal patterns in species diversity. We predict under what conditions we can expect to observe a pattern in species diversity and the general shape of that pattern, increasing our general understanding of ecological communities.

CS10.12 - THE ROLE OF LOCAL BIOTIC ADAPTATION IN STRUCTURING PLANT COMMUNITIES

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The success of invasive plant species often stems from a lack of co-evolution between the invader and biotic components of the invaded community. However, little is known about the importance of co-evolution for interactions between native co-existing species at the local scale. The aim of this study was to examine how the history of long-term co-existence influences interactions between native plants within a single geographical region. Eight species from three calcareous grasslands separated from each other by 35-150 km were examined. Species mixtures were established using seeds originating either from the same site or from two different sites to create “natural” and “novel” communities, respectively. Activated carbon and soil sterilisation treatments were used to investigate the roles of root exudates and soil microbes. The effects of activated carbon suggest that root exudates promoted productivity and species co-existence in natural but not novel communities. Soil sterilisation treatment showed that soil biota promoted species co-existence by improving the growth of subordinate forbs but restraining the growth of dominant graminoids, with the effect being stronger in natural than novel communities. Our results suggest an important role of biotic interactions for community structuring in natural assemblages but a reduced role in novel settings.

CS10.13 - ASSESSMENT OF ECOLOGICAL THRESHOLDS BETWEEN AND WITHIN MACROINVERTEBRATE METACOMMUNITIES OF LOTIC SYSTEMS

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We propose an approach for assessing the ecological thresholds between metacommunities (MCs) of macroinvertebrates based on the effects of the stronger natural and anthropogenic stressors, which regulate their turnovers in lotic systems. Hydrographic networks are usually shared in both uplands and lowlands leading to community turnovers strongly regulated by altitude. The existence of distinguished communities along an altitudinal gradient can be advantageous since their common species, which constitute the link between MCs, are less affected by altitude and more from other environmental stressors (e.g. pollution). Thus, they can be used as indicators to assess ecological thresholds between metacommunities inside watersheds where the altitudinal gradient is dominant. Moreover, the non-common species can be used to define ecological thresholds within each MC. For the implementation of this approach, the responses of both common and non-common species obtained by 585 sampling stations in northern Italy (Po valley and Italian Alps) were analyzed. The approach is performed in three steps using: a) detrended correspondence analysis (DCA) to define the spatial distribution of MCs (MCs altitudinal zonation), b) redundancy analysis (RDA) to define the stronger environmental gradients and c) Threshold Indicator Taxa Analysis (TITAN) to define the between and within ecological thresholds of MCs.

CS10.14 - POPULATION DYNAMICS OF HOKKAIDO VOLES LEADS TO TAYLOR'S LAW

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Taylor's law (TL) asserts that the variance in a species' population density is a power-law function of its mean population density: log(variance) = a + b × log(mean). TL is widely verified. A major question about TL is what demographic elements generate the power-law relationship. Here we showed that empirical time series of density of the Hokkaido vole, *Myodes rufocanus*, repeatedly surveyed at multiple locations, satisfied both temporal and spatial forms of TL. The slopes (b ± standard error) of the temporal and spatial TL were estimated to be 1.61 ± 0.14 and 1.43 ± 0.13, respectively. We also identified demographic elements that were essential to generate TL. A population-dynamic model previously demonstrated to describe these populations successfully generated time series of density which satisfied both temporal and spatial TLs. The slopes (b ± standard error) of the temporal and spatial TL in simulated time series were 1.99 ± 0.16 and 1.74 ± 0.11, respectively. A density-dependent component of the model was essential for the temporal TL. In addition, correlation among the density-independent elements of the modeled time series was required for the spatial TL.

CS10.15 - WHEN THREE ’S A CROWD: EFFECTS OF PARASITISM ON SYMBIOTIC ORGANISMS

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Despite the evident ecological consequences of parasitism on ecosystems, host-parasite interactions between lichenicolous fungi (parasites) and their lichen hosts have been scarcely studied. Apparently, highly specific fungal parasites are commensalistic because they only modify lichen thalli due to gall induction when the parasite reproduces. However, whether these parasites occur in vegetative phase and which are the effects on the fitness of both interacting organisms are unknown questions. Thus, we aimed to test whether (1) asymptomatic lichens host the fungal parasite in its vegetative phase; and (2) the parasite influence the growth rate (as a surrogate of fitness) of visibly infected thalli. To asses these questions we selected two *Lobaria* species (lichens) with and without galls of their respective *Plectocarpon* parasites (Ascomycota) as model system. We used specific molecular markers to detect the presence of the parasite, and a 3-weeks growth chamber experiment to evaluate lichen growth. We expect that (1) the parasites do not occur in the asymptomatic lichens, and that (2) the presence of parasitic galls negatively impact the fitness of the host by dropping the lichens’ growth rates due to the reduction of photosynthetic surface of the lichen and/or carbon stealing from the lichen primary metabolism.

CS10.16 - HOW DISTINCT IS THE NEGLECTED DENGUE VIRUS CIRCULATION AMONG *AEDES AEGYPTI* MOSQUITOES IN NATURES?

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DENV is widespread in most of Brazil, as well as in the city of Rio de Janeiro. In 2013, Rio de Janeiro reported a dengue outbreak with 66,278 cases. For this study mosquitoes collected were examined for DENV infection by RT-PCR of October 2012 to July 2013 in this city. A total of 2822 *Ae. aegypti* and *Ae. albopictus* were collected. Only *Ae. aegypti* females were found infected, except for a single pool of males. The peak of DENV positive individual mosquitoes was registered in February-April 2013, and coincided with that of human dengue cases. However, the frequency of serotypes detected was intriguingly differed from that found in humans. The rate of natural mosquito infection was only 0.7% and the serotype frequently detected was DENV-1(35%), DENV-3(30%), DENV-4(25%) and DENV-2(10%). The number of dengue cases being more than 93% of the laboratory confirmed cases due to DENV-4, followed by DENV-1(3,6%) and DENV-3(3,1%). The qualitative discrepancy between the frequency of DENV serotypes infections in mosquitoes and humans combined with the detection of DENV positive *Ae. aegypti* males suggests the occurrence of silent transmission maintenance of DENV serotypes that can reemerge in epidemic form at any time.

CS10.17 - ANALYSIS OF ENVIRONMENTAL MATCHING FOR THE PREDICTION OF INVASION RISK

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Biological invasions present significant environmental and economic costs when alien species become established. One key contributing factor in determining invasion risk is whether environmental conditions are suitable in a new location for an alien species to survive and breed. For a particular species, environmental niche models can be used to predict the suitability of a new habitat based on environmental conditions in the species historic range. For biosecurity risk assessment, however, it is often necessary to determine establishment risk between two regions across a broad range of different exotic taxa. In this study, we developed a method to quantify environmental similarity between geographic regions by comparing a broad range of environmental variables. We calibrated this environmental matching method through an analysis of environmental conditions over the native ranges of a global collection of mammalian, reptilian, and avian species. Our method performed well when validated on predicted regional matches for a range of alien species that have become established in Australia, and better than existing techniques, including bioclimatic classification. Environmental matching techniques, such as the one developed here, are critical for the effective construction of integrated invasion risk models, and the subsequent application of ecological knowledge to biosecurity policy decisions.

CS10.18 - INTENSIVE AGRICULTURE NEGATIVELY AFFECTS THE HERBIVORE CHANNEL IN SOIL

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Intensive agriculture can significantly affect the soil food web and cause changes to its functioning which may impair the delivery of ecosystem services. Here by using Generalized Additive Models we study how the soil nematode food web is affected by agricultural intensity. Specifically, in four countries with varying climatic conditions (Sweden, UK, Czech Republic and Greece) we investigated the effect of three different land use intensities on the lifetime amount of carbon utilized by nematode trophic groups (metabolic footprint). To account for spatial heterogeneity we calculated spatial filters and for model selection we followed a hierarchical procedure adding variables sets with the following order: spatial filters, bioclimate parameters, soil properties and land use intensity. Among predictors, spatial filters significantly contributed to the metabolic footprint variation of all trophic groups except predatory. The same holds for bioclimatic variables with the exception of bacterivorous and omnivorous nematodes. Soil properties and land use intensity affected the variation in the metabolic footprint of only the herbivorous nematodes and especially the parasitic ones. Overall, our result showed that intensive agriculture differentially affected the major carbon channels, but only the herbivore channel was negatively affected.This work was supported by the FP7 EU project SOILSERVICE.

CS10.19 - RESPONSES OF NEMATODES TO CLIMATE: A TRAIT-BASED APPROACH

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Trait-based approaches are being used to unravel the responses of various organisms to environmental perturbations or climate change. Usually, these studies focus on plants or larger animals while studies on smaller organisms like those composing soil food webs are scarce. Here we used a GLM based fourth corner analysis to identify significant interactions between biometric or functional traits of nematodes and bioclimatic variables. We applied this method on three datasets varying by land use (forests, grasslands, agricultural soils) and spatial scales (local and European). We found that nematode traits showed significant associations with bioclimatic variables especially those related to seasonal variation, but association varied according to combination of variable and trait. Temperature seasonality showed positive associations to nematodes with high Surface/Volume ratio and plant parasitic nematodes of longer life spans. Fungivorous nematodes were positively associated with high temperatures (>20 °C), while the opposite was observed in the case of omivorous nematodes of longer life spans. Isothermally was positively associated to predatory nematodes of longer life spans. Our results indicate that trait-based approach may serve as a tool for evaluating the response of soil food webs to environmental perturbation and climate change.

CS10.20 - DISPERSAL LIMITATION OF AN EPIPHYTIC LICHEN IN A MANAGED BOREAL MIXED-WOOD LANDSCAPE

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The extent to which sessile organisms are dispersal vs establishment limited is key information for assessing species landscape dynamics. Here, we present a pair of studies, one observational and one experimental intended to estimate the relative importance of dispersal and establishment limitation on the colonization of the epiphytic lichen *Lobaria pulmonaria* in a boreal managed forest landscape. We first estimated the rate of colonization-extinction based on a re-survey in 2008 of the species originally sampled in 1997. Secondly, we tested the establishment success of the species by evaluating recruitment in 2014 after propagules being experimentally transplanted on non-occupied but presumably suitable trees in the study area in 2004. Among the 3671 trees mapped in the first survey, we recorded less than ten *L. pulmonaria* colonizations in the second survey in 2008. On the other hand, ten years after sowing experiments*, L. pulmonaria* had established on 8% of 99 experimental trees, but no establishments were recorded in clear cut or dry forests. Our study provides empirical support for the importance of propagule availability on the colonization dynamics of the study species.

CS10.21 - WHAT ARE THE DRIVERS THAT SHAPE COMPOSITION AND DYNAMICS OF THE PLANT COMMUNITIES AROUND STREET TREES IN URBAN ZONES?

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Many studies show how quality of biodiversity influences well-being of citizens. Nevertheless, little is known about the drivers that shape it in urbanized zones.Our objective was to determine the factors influencing composition and dynamics of spontaneous vegetation around street trees. The plants of 1,500 tree bases were surveyed annually from 2009 in Paris (France). An analysis of the species distribution showed how the characteristics of the tree bases and the distance to green spaces impact the species richness. The analyses of plant traits such as pollination systems and seed characteristics stressed the role of pollinator availability and dissemination chance on composition and dynamics of the vegetation. Insect pollinated species were more present near the Vincennes forest and the Seine River. Species with light seeds were more homogeneously spread among tree bases than plants producing heavy seeds. The results of a software modeling metapopulation dynamics showed that for most of the species, tree bases were sinks for source populations growing in larger sites (e.g. parks) but for some other species, they also participate to the movement of species across the city (stepping stones).The results will find applications in the definition of the best management plans for urban biodiversity.

CS10.22 - TROPHIC GROUPS AND MODULES: TWO LEVELS OF GROUP DETECTION IN FOOD WEBS

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Within food webs, species can be partitioned into groups according to various criteria. Two notions have received particular attention: trophic groups, which have been used for decades in the ecological literature, and more recently, modules. The relationship between these two group concepts remains unknown in empirical food webs. While recent developments in network theory have led to efficient methods for detecting modules in food webs, the determination of trophic groups (groups of species that are functionally similar) is largely based on subjective expert knowledge.We develop a novel algorithm for trophic group detection. We apply this method to empirical food webs, and show that aggregation into trophic groups allows for the simplification of food webs while preserving their information content. Furthermore, we reveal a 2-level hierarchical structure where modules partition food webs into large bottom-top trophic pathways whereas trophic groups further partition these pathways into groups of species with similar trophic connections. This provides new perspectives for the study of dynamical and functional consequences of food-web structure, bridging topological and dynamical analysis. Trophic groups have a clear ecological meaning, and are found to provide a trade-off between network complexity and information loss.

CS10.23 - COMPARING THE CONSERVATISM OF ECOLOGICAL INTERACTIONS IN PLANT–POLLINATOR AND PLANT–HERBIVORE NETWORKS

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Conservatism in species interaction, meaning that related species tend to interact with similar partners, is an important feature of ecological interactions. Studies at community scale highlight variations in conservatism strength depending on the characteristics of the interaction studied. However, the heterogeneity of datasets and methods used prevent to compare results between different type of networks. Here we perform such a comparison by taking plant–insect communities as a study case, with data on plant–herbivore and plant–pollinator networks. Our analysis reveals that plants acting as resources for herbivores exhibit the strongest conservatism in species interaction. Conservatism levels are similar for insect pollinators, insect herbivores and plants as interacting partners of pollinators, although insect pollinators tend to have a slightly higher conservatism than the two others. Our results thus clearly support the current view that within antagonistic networks, conservatism is stronger for species as resources than for species as consumer. Although the pattern tends to be opposite for plant–pollinator networks, our results suggest that asymmetry in conservatism is much less pronounced between the pollinators and the plant they interact with. We discuss these differences in conservatism strength in relation with the processes structuring plant–insect communities.

CS10.24 - TRAWLING DISTURBANCE EFFECTS ON COEXISTENCE PROCESSES: EVIDENCES FROM STABLE ISOTOPES

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The Intermediate Disturbance Hypothesis is one among the most influential theory in ecology. IDH proposes a pattern of peaked diversity at intermediate levels of disturbance and this should support both the concept of diversity maintenance and coexistence generation. Rarely, trawling has been used as source of disturbance (TD) to test the IDH at large scale and never has been combined with Stable Isotope Analysis to study the cascade effects generated along a disturbance gradient on the coexistence of two demersal consumers. Through a very high resolution dataset, VMS data, we investigated patterns of coexistence processes of two fishes (*Mullus barbatus barbatus* and *Lepidotrigla cavillone*). Results showed that sediment's isotopic profiles depended on TD intensity and it was resembled on the diversity of trophic spectrum potentially available for two consumers. Changes on tropho-space complicated trophic interactions but increased trophic plasticity of the two predators (trophic niche wideness and overlap). Results suggested that TD could mediate the coexistence processes representing the main driver by increasing the likelihood of niche's differentiation between the two fish species; generating local shifts in feeding strategy from specialist to generalist in one out two species; inducing resources partitioning and the emergence of storage mechanisms.

CS10.25 - COMPARISON OF THE TROPHIC ECOLOGY OF TWO MAMMALS: THE WILD BOAR *SUS SCROFA* L 1758 AND THE PORCUPINE *HYSTRIX CRISTATA* L 1758 IN THE NORTHERN SLOPE OF DJURDJURA (NORTH OF ALGERIA)

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The feeding habits of two mammals the wild boar *S. scrofa* and the porcupine *H. cristata* were studied in the National park of Djurdjura (Algeria) by the analysis of 315 feces collected from September, 2011 till August, 2012. Both mammals present a very wide diet and a tendency to be frugivorous. Other fleshy fruits (wild cherries / cherries, figs and apples / pears) for the greater part complete the diet of the wild boar and the porcupine. Fruits occupy respectively more than 36,33 % and 34,34 % at the wild boar and the porcupine. We notice, also that both species prefer acorns in winter to the detriment of the other food items. Several differences inter seasonal workers of the diet to both species have been proved significant. It appears that the wild boar presents a high and regular consumption of earthworms along the year (global rate of 37,5 %). A strong overlapping of trophic niches between both species is observed particularly in autumn and winter (Pianka's index = 0,96 and 0,95). This is partially due to the over-representation of the air and subterranean vegetables at the porcupine and that of mushrooms and earthworms at the wild boar.

MICROBIAL FOOD WEB DYNAMICS IN COASTAL WATERS OF THE SOUTH EASTERN BLACK SEA: MIXING VERSUS STRATIFICATION PERIOD

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This study provides recent results regarding microbial food web throughout annual cycle (January 2011-December 2011) in coastal waters of the South Eastern Black Sea. During the winter mixing period, autotrophic nanoflagellates and diatoms were the major contributors to the autotrophic biomass. Mean daily removal of primary production (PP) showed that nearly half of the daily production was being channelled through heterotrophic nanoflagellates and microzooplankton. During the stratification period, dinoflagellates and coccolithophores dominated the autotrophic biomass. Low mean daily removal of PP when the water column was fully stratified showed much of the PP was not grazed and most likely removed by aggregation and sedimentation. At the same time, the continuous supply of dissolved organic carbon from crashing stocks of phytoplankton sustained rapid growth of heterotrophic bacteria under stratification. High mean daily removal of bacterial production provided evidence of an active microbial food web. Overall, heterotrophs prominently dominated total carbon biomass during 2011 (Hetero-C to Auto-C ratio mean 2.9± 1.5). The most likely explanation for the dominance of heterotrophs throughout the year might be related with consumer regulation of autotrophic biomass and production as well.

LINKED ENVIRONMENTAL NICHE MODELS AND TRAIT GRADIENT ANALYSIS UNCOVERS DIVERGENT PATTERNS IN SPECIES RESPONSES TO ENVIRONMENTAL GRADIENTS

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Trait-environment relationships provide a physiological basis for understanding species distributions and community variation along abiotic gradients. Theory predicts that community-weighted mean traits (CWMs) reflect optimal strategies in particular abiotic conditions. However, the typically high amount of trait variation among co-occurring species challenges the predictive ability of this theory. We tested the hypothesis that habitat suitability is negatively related to a species' deviation from the local CWM (delta CWM) for 173 tree species in Puerto Rico. We measured three functional traits (wood density, LMA, and maximum height) and characterized the CWMs of plots along a strong precipitation gradient. CWM trait variation followed physiological expectations. A majority of species exhibited significant negative relationships between habitat suitability and delta CWM, offering some support for the CWM-optimality hypothesis. However, we also identified more species than randomly expected with positive relationships between habitat suitability and delta CWM, indicating the success of alternative life history strategies. Our study demonstrates that while community-level variation of key traits explains a large portion of community variation along environmental gradients, the success of alternative trait combinations helps maintain local functional diversity. Future work quantifying physiological and demographic variation along abiotic gradients will clarify the mechanisms underlying these patterns.

MACROECOLOGY & SCALING

CS11.1 - LINKING AND PREDICTING BIODIVERSITY PATTERNS FROM FINE TO LARGE SPATIAL SCALES

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A key challenge for ecologists is the prediction of species richness and abundances across spatial scales. However, as species richness is not additive, it is difficult to translate from the scale of measurement to the scales of interest. Here, we present a new general framework that allows such scale predictions. We introduce a methodology that links and predicts the profile of the species-area relationship and the species abundance distributions when a limited number of fine-scale scattered samples are available. Using the correlation in species' abundances between pairs of samples as a function of the distance between them, we are able to link the effects of aggregation, similarity decay, species richness and species abundances across scales. Our approach allows one to draw inferences about biodiversity scaling without restrictive assumptions pertaining to the nature of interactions, the geographical distributions of individuals and ecological processes. We demonstrate the accuracy of our predictions using data from well-studied forest stands and also demonstrate the potential value of such methods by examining the effects of management on farmland insects across scales. The framework has important applications to biodiversity research and conservation practice. These findings have been recently published in *Methods in Ecology and Evolution*.

CS11.2 - MAPPING FORESTED AREAS WITH MOST UNIQUE FEATURES. ARE THEY HOSTING MOST ENDEMIC FOREST BIRD SPECIES?

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A major challenge in conservation biology is the identification of areas in greatest need of protection. The places defined as most irreplaceable in an ecological sense usually present a high biodiversity value, with a higher number of threatened and endemic species to preserve. However, explicit links have never been established between the ecological uniqueness of an area and species endemism at the global scale. Forests are highly biodiverse habitats. Here we propose a screening method to analyse the ecological features of these forests before to study the correlation between bird endemism in forests and ecological characteris that highlight how unique they are. Using multivariate analysis based on a 50 x 50 km moving windows approach, we identified the most unique forested areas using a Habitat Replaceability Index (HRI) and characterized their particular features. The HRI quantifies the likelihood for each pixel to find areas that are similar to any reference areas corresponding to the moving windows using a set of 9 environmental variables. Our preliminary results show significant correlations at continental scale between the HRI and a bird endemism index in forested areas.

CS11.3 - DO BIOCRUSTS NEED TO BE CONSIDERED IN DRYLANDS MONITORING (BY MEANS OF REMOTE SENSING TECHNIQUES)?

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Multi-temporal spectral indices have been extensively used in numerous studies to monitor ecosystem functioning and surface-energy budgets. However, most of these indices showed problematic results in areas covered by sparse vegetation, like most of the Drylands. Open spaces between plants in these ecosystems are often covered by biocrusts, which are complex communities of cyanobacteria, algae, microfungi, lichens and mosses, growing in intimate association within the uppermost millimeters of the soil. Biocrusts may cover up to 70 % of these ecosystems and, due to their darker color, influence surface reflectance. For this reason, we quantified how biocrust cover and water status modify some of the most widely used spectral indices, like the Normalized Difference Vegetation Index (NDVI), the Enhanced Vegetation Index (EVI), the Water Index (WI) and the albedo. Biocrusts cover and water status exerted a considerable effect on NDVI, EVI and albedo, whereas WI was mostly affected by vegetation. These results highlight the impact of biocrust cover and water status on the spectral response of dryland surfaces, and emphasize the necessity to consider their presence in multi-temporal studies aimed at analyzing dryland water status, phenology, productivity and energy budgets.

BIOGEOGRAPHY AND LANDSCAPE ECOLOGY

CS12.1 - THE EFFECTS OF LANDSCAPE DIVERSITY AND LANDSCAPE CHARACTER CHANGES ON LANDSCAPE FUNCTIONS

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Ahir Mountain which is located in the Eastern Mediterranean Region of Turkey is one of the "Important Plant Ares“ in Turkey, du to its reach ecosystem and landscape potential. On the other hand, some activities such as transhumance, recreation, hunting, grazing, and agriculture, and the lack of a nature conservation plan lead to irreversible destruction of the mountainous area. Given these facts, a project has been posed with the aim of investigating natural structure of Ahir Mountain and developing nature conservation strategies, based on landscape character analysis. Within this research, it is aimed to analyze the landscape character types, and landscape diversity in Ahir Mountain by using remotely sensed data and geographical information systems. Climatic data, geological and geomorphological structure, land cover data, and major soil groups have been used to analyze the landscape character types. Landscape types has also been analyzed by using Shannon Diversity Index which is frequently used in the determination of landscape diversity. The index displays an important advantage for possibility to obtain numeric values that can subsequently be easily compared. Finally, landscape based nature conservation strategies have been developed with the help of analysis results, and environmental pressures. It is predicted that this study will display a new approach for development of landscape based nature conservation strategies for “Important Plant Ares”.

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CS12.2 - CLIMATIC STABILITY, EVOLUTIONARY HISTORY AND GLOBAL PATTERNS IN MAMMAL FUNCTIONAL DIVERSITY

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Understanding how geographical patterns of diversity are influenced by historical climatic conditions and species' evolutionary history is a fundamental question in Biogeography. However, the influence of these factors on present-day patterns of functional diversity patterns remains little investigated. In this study, we examined how climatic oscillations and species' evolutionary history affect global patterns in mammal functional diversity. Using past climatic recontructions from three time periods (10 mya, 3 mya and 0.021 mya) and a newly-updated species-level phylogeny we quantified the relative importance of climatic stability and phylogeny over contemporary environment. We found that contemporary environment is generally a strong determinant of functional diversity, although the variance explained by phylogeny and climatic stability varies considerably between clades and regions. In particular, phylogeny alone explained a significant fraction of the variation in functional dispersion for individual clades. Important contributions were also found for the fraction of the explained variation shared between contemporary environment, climatic stability and phylogeny. Overall, our findings suggest that functional dispersion in mammal assemblages are the result of a complex inter-play between shared ancestry linked to regionally unique processes of environmental filtering and climatic stability.

CS12.3 - SPATIAL STRUCTURATION OF ANTHROPOGENIC DRIVERS OF ENVIRONMENTAL CHANGE IN COASTAL AREAS

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Anthropogenic driving forces of environmental changes are particularly strong in coastal areas. They affect lansdcape structure, natural habitats distribution, ecosystems functioning and conditions of human well being. Even though anthropogenic pressures are recognized as one of the most important societal challenges, their spatial structuration have not been addressed directly by geographical research. This paper will address the issue of scale and spatial distribution of anthropogenic drivers of environmental change in coastal areas. With a data set at NUTS 3 scale, we analyse the intensity and distribution of drivers in coastal areas defined as zones of different width (0 to 10 km width from the coastline, 0 to 20 km width etc... ; up to 100 km width). The results show three main interesting results: 1) ad hoc definition of coastal areas do not capture the specificity of coastal areas socio-ecological particularity; 2) analysing the spatial distribution of anthropogenic driving forces shows that different sets of drivers operate at different scales; 3) there is a strong disparity of anthropogenic driving forces intensity within the 0-10 km coastal zone.

The overall interest of the analysis underlines the interest of a policy design based on more precise spatial characterizations and categories.

CS12.4 - ANALYZING SPATIAL DISTRIBUTION OF PLANT SPECIES IN A MEDITERRANEAN ISLAND: A GEOSTATISTICAL APPROACH

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Geostatistics provides a comprehensive analytical framework for modeling and interpreting spatial patterns in geospatial data. Focusing on biodiversity, the geostatistical analysis of plant species distribution aims at identifying spatial patterns of (dis)similarity for individual species, pairs of species, as well as species groups. In this case, the concept of empirical variogram and cross-variogram offers a useful methodological tool for studying single and paired species spatial (dis)similarities, while the variogram matrix enables the multivariate geostatistical analysis of biological diversity. The island of Crete (Greece) was selected as the study area, using presence/absence data of its 1647 plant species recorded on 162 grid-cells (8.25km x 8.25km). Four different types of empirical variograms were considered: auto-, cross-, complementarity and species richness. An analysis of species spatial (dis)similarity with respect to distance was performed for all species and for species subgroups with emphasis to woody plants. In addition, the above variograms were also computed with respect to gradients of environmental parameters such as altitude and land-cover, to investigate the links between plant spatial patterns and environmental controls. The empirical variogram of complementarity as a function of altitude differences identifies the most significant spatial patterns of dissimilarity, especially in woody plants.

CS12.5 - LANDSCAPE METRICS AS INDICATORS OF COASTAL MORPHOLOGY AND ITS USE IN ECOLOGICAL NICHE MODELLING OF SEAGRASS SPECIES

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Dependence of some species on landscape structure has been proved in numerous studies. So far, however, little progress has been made in the integration of landscape metrics in the prediction of species associated with coastal features. Specific landscape metrics were tested as predictors of coastal shape using three coastal features of the Iberian Peninsula (beaches, capes and gulfs) at different scales. We used the landscape metrics in combination with environmental variables to model the niche and find suitable habitats for a seagrass species (*Cymodocea nodosa*) throughout its entire range of distribution. Landscape metrics able to capture variation in the coastline enhanced significantly the accuracy of the models, despite the limitations caused by the scale of the study. We provided the first global model of the factors that can be shaping the environmental niche and distribution of *C. nodosa* throughout its range. Sea surface temperature and salinity were the most relevant variables. We identified areas that seem unsuitable for *C. nodosa* as well as those suitable habitats not occupied by the species. We also present some preliminary results of testing historical biogeographical hypotheses derived from distribution predictions under Last Glacial Maximum conditions and genetic diversity data.

CS12.6 - MOUNTAIN BIOGEOGRAPHY: DOES THE TEMPORAL EVOLUTION IN "SKY ISLAND" AREA MATTER?

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The idea of considering higher elevation areas as islands with own, unique biological communities and surrounded by an "ocean" of unsuitable lands is not new in biogeography. However, a quantitative assessment of the effects of past climate fluctuations on islands' dimension is crucial in view of climate warming. During the Holocene, islands' boundaries experienced repeated altitudinal fluctuations due to climate changes. As a consequence islands' areas were subject to variations of different intensity and alterations in inter-island connectivity. During the warmer phases some islands reduced strongly or disappeared, provoking the partial or complete extinction of local biotas. The subsequent cooling allowed a new rise and expansion of these islands, but, depending on the distance from a stable source and on the dispersal abilities of the species, the failure in the recolonization process could have provoked strong immigration credits. Aim of the present contribution is to discuss the combined effects of landscape and historical factors in shaping the current communities of mountain islands. Specifically, we modelled past island dynamics at a millennial scale in the last 11000 years in Italy and analysed the effects of mountain islands fluctuations, by using montane butterflies, ground beetles, grasshoppers and crickets as biological models.

CS12.7 - THE IMPORTANCE OF PRIVATE GREENSPACES FOR ECOLOGICAL CONNECTIVITY IN PARIS: THE EXAMPLE OF PIPISTRELLUS PIPISTRELLUS

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An increasing number of cities carry out management policies of the public green spaces with the aim to promote biodiversity, however private green spaces are not concerned by these policies and their importance for the urban biodiversity stays largely unknown. We studied the relative contribution of private green spaces of Paris for connectivity, taking the common pipistrellus as model. We calculated the resistance of each pixel of the city, modeling the abundances observed on 239 monitoring points with variables of vegetation and buildings configuration and height. Then, using the Circuitscape software, we build a reference connectivity map accounting for public and private green spaces. A second map was based only on the public green spaces. The difference between the global resistances of these two maps gave the relative importance of the private green spaces for connectivity. Private green spaces occupied 28% of the total area of green spaces, but contributed to the half of the global connectivity. We explain this result by a more homogeneous distribution of these small areas, connecting the biggest green public spaces. These results emphasize the importance of the private spaces in cities, suggesting that local policies should also be developped toward private owners.

CS12.8 - DIACHRONICAL ANALYSIS OF RIVER MESOHABITAT AND RIPARIAN VEGETATION EVOLUTION: (PANARO RIVER CASE STUDY)

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From the sixties the Panaro river (northern Italy) has been deeply modified by anthropic use: big weirs, gravel mining and changes in landuse leaded to overdeepening, channel narrowing and modification of river form.Vegetational communities then have evolved to populate new and different kinds of habitat, as indirect response to changes driven by human pressure. Extended availability of high resolution aerial imagery allows to carry out a habitat recognition at mesoscale level (woods, shrubs, herbaceous vegetation, bars, channel habitats etc.) using GIS tools.The most recent evolution from year 2000 to 2012 has been studied.Objectives of this study is to analyze: the evolution of channel and bank mesohabitat and his relationships to river channel adjustment due to anthropic pressure, and integration of GIS analyses with field vegetation

BIOGEOCHEMISTRY IN TERRESTRIAL & AQUATIC ECOSYSTEM

CS13.1 - SOIL CO_2 EMISSIONS CHANGE AFTER CLIMATE CHANGE EXPERIMENT IN THE ARCTIC

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Arctic tundra soils store large amounts of carbon (C) that could be released through enhanced ecosystem respiration (ER) as the Arctic warms. Over time, this is likely to change the quantity and quality of available soil C pools, as labile C substrates are generally mineralized faster than more recalcitrant compounds. Thus, short-term increases in ER rates due to experimental warming may not be sustained over longer periods. Using snow fences, we increased soil winter temperatures in Arctic Svalbard and Canada. As expected, deeper snow enhanced cold season ER while having negligible effects on growing season ER during the first years of the experiment. However, growing season ER rates were significantly reduced after 5 and 8 years in Svalbard and Canada, respectively. We suggest that these reductions in ER that became apparent only after several years of experimental manipulation may be due to prolonged depletion of labile C substrate as a result of long-term soil warming over multiple cold seasons. Long-term changes in winter climate may therefore significantly influence annual net C balance not just because of wintertime C loss but also because of 'legacy' effects on ecosystem respiration during the growing season.

CS13.2 - ANALYZING PULSE-DYNAMIC OF CO2 FLUXES ON BIOCRUSTS

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In drylands CO2 exchange is determined to a large extent by soil moisture. Biocrusts are major components of these systems and due to their occurrence at the surface of the soil, they are very responsive to moisture pulses, even small ones. Therefore, the lower water availability at a site, the greater importance of biocrusts on CO2 fluxes at ecosystem scale. In two arid ecosystems, from SE Spain, we have analyzed how rainfall (amount, temporal distribution, and previous precipitation history) regulates C fluxes on different biocrusts. Continuous CO2 efflux on different biocrusts was obtained from GMM222 CO2 sensors for more than one year and net CO2 flux and soil respiration were measured using infrared gas analyzers. We found that CO2 fluxes (efflux and fixation) on biocrusts depended on the magnitude of rainfall but also on the antecedent rainfall pattern. In general, CO2 efflux and fixation on biocrusts increased with rainfall amount until soil saturation. Very small rainfall pulses (less than 1.5mm) were able to restore respiration activity on well-developed biocrusts, provoking a flux increase higher than those recorded under plants. Even lower rainfall pulses, were capable of reactivating biocrust photosynthesis, especially when antecedent conditions were not very dry.

CS13.3 - NITROGEN SOURCES, EXPORT AND INTERNAL BUFFER IN WATERSHEDS WITH MULTIPLE ANTHROPOGENIC PRESSURES: COMPARISON AMONG TRIBUTARIES OF THE PO RIVER SYSTEM (NORTHERN ITALY)

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Open questions in human-impacted watersheds concern the fate of nitrogen excess (permanent loss via denitrification vs temporary retention in groundwater) and the recovery time from pollution. Relationships between land use and N sources and sinks were investigated along multiple gradients of anthropogenic pressures in several Alpine (Oglio, Mincio, Agogna), Apennine (Parma, Enza, Crostolo, Secchia, Trebbia), and deltaic (Po di Volano) tributaries of the Po River, the largest hydrographic system in Italy and a strategic area for the national economy. N surplus in agro-ecosystems results mainly from livestock manure, while input and output across agricultural lands are more balanced where the synthetic fertilization is adopted. The discrepancy between surplus and export via river discharge (i.e. missing N) is quite different among sub-basins confirming heterogeneous capacity to buffer N excess, likely connected to some peculiar aspects such as hydrological regime, irrigation practices, and presence of aquatic environments (wetlands, paddy fields, drainage system). Denitrification in aquatic ecosystems is thought to contribute substantially in explain the fate of missing N. Several evidences suggest that an extremely developed canal network, an artificial feature characterizing highly productive areas, can assume a relevant role as metabolic regulator and provider of Ecosystem Services.

CS13.4 - EFFECTS OF NITROGEN FERTILIZATION ON MICROBIAL ENZYME ACTIVITY AND THE CARBON SEQUESTRATION ABILITY OF GRASSLAND SOILS

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Soils are vital human-life support systems and represent the largest pool of terrestrial carbon (C). Soils' ability to sequester C is influenced by multiple anthropogenic activities including chronic nutrient fertilization which is aimed to increase soils productivity. Despite N fertilization can greatly influence soil C sequestration our understanding of the underlying biogeochemical mechanisms responsible for N-induced effects on soil C is still limited. Here we use data from a long-term grassland fertilization experiment in the UK to show how chronic N fertilization has influenced (1) soil C sequestration, (2) the activity of microbial extracellular enzymes, and (3) the interaction between enzyme activity and the C content of mineral soils. A key finding of our study is that a chronic N fertilization determined greater soil C sequestration and that this positive N-induced effect on soil C was associated with an increase of the activity of beta-glucosidase (BG), an enzyme involved in the degradation of cellulose. We found that BG activity was significantly and positively related to the C content of stable organo-mineral fractions. Overall our study suggests that changes in the activity of C-acquiring enzymes such as BG may help explaining changes in the C sequestration ability of fertilized grassland soils.

CS13.5 - THE Δ15N SIGNATURE OF POLLINATING INSECTS ALONG AN URBANIZATION GRADIENT IN THE ILE-DE-FRANCE REGION

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Urban environments are characterized by a biogeochemistry of nitrogen (N) that is strongly influenced by anthropic activities, especially through atmospheric depositions of nitrogen compounds. Available data in the literature suggest that these urban depositions tend to be enriched in 15N,and these patterns are reflected in plant and soil δ15N. This “urban signal” for δ15N has never been described in animals. However, we can make the hypothesis that trophic links between plants and primary consumers should induce a transfer of this signal to the animal compartment of urban ecosystems. Here we wanted to test this hypothesis by focusing on three species of wild bees with specimens collected along an urbanisation gradient in the Île-de-France region. These species are strictly phytophagous and have a relatively limited foraging range for pollen and nectar. We analyzed the δ15N isotopic signature of all collected individuals and studied the link between δ15N and urbanization intensity, measured through the increase in the proportion of impervious surfaces at the landscape scale. We found a significant increase of the δ15N signature with increasing urbanization in all three species. The poster will present these results and discuss their implications for our understanding of nitrogen biogeochemistry in urban ecosystems.

ECOLOGY & SOCIETY

CS14.1 - ECOLOGY & SOCIETY: APPLYING EVOLUTIONARY BIOLOGY TO ADDRESS GLOBAL CHALLENGES

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Two categories of evolutionary challenges result from escalating human impacts on the planet. The first arises from cancers, pathogens, and pests that evolve too quickly and the second, from the inability of many valued species to adapt quickly enough. Applied evolutionary biology provides a suite of strategies to address these global challenges that threaten human health, food security, and biodiversity. This talk highlights both progress and gaps in genetic, developmental, and environmental manipulations across the life sciences that either target the rate and direction of evolution or reduce the mismatch between organisms and human-altered environments. A framework for socio-ecological governance of these global challenges is presented.

CS14.2 - BRINGING TOGETHER SCIENTISTS AND "REINTEGRATED GARDENERS": THE USE OF CITIZEN SCIENCE TO ENHANCE CONSERVATION EDUCATION

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The application of citizen science to biodiversity issues has both a scientific purpose, i.e. the collection of large amount of standardized data, and an educative one, i.e. increasing biodiversity awareness through the observation of nature. Most of these projects involve people already interested in ecology or conservation. A challenge is to attract people without scientific background or previous interest, and to adapt schemes to their expectations. Here, we investigated the involvement of thirty-four reintegrated employees, working on the maintenance of green spaces, in five biodiversity monitoring schemes over one year. Through an ethnographic inquiry, our study aimed at understanding the appropriation of the citizen sciences protocols by the participants, the knowledge they gained and the influence on their perception of their environment. We demonstrated that the central stake of such a project is the encounter between scientific culture and another social world. The participation to this program increased participants' knowledge and led a few to question their management practices. Ethnography also revealed that they developed their own modes of appropriation, according to their personal and cultural background. Finally, we highlighted the changes in their perception of animal presence around them, thanks to an education of attention.

CS14.3 - MONITORING THE INSECTS AND PUBLIC INVOLVEMENT: THE CHALLENGE OF THE LIFE PROJECT "MIPP"

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The recent springing up of citizen science projects has increased the citizen interactions with nature. Currently, the insects and their key role in ecosystems are unknown to the public, being neglected respect to other animal taxa. The Life "MIPP – Monitoring Insects with Public Participation" (LIFE11 NAT/IT/000252) is the first Italian project that involves the public on survey of rare and endangered insects. MIPP focuses on ecological tasks, development of standard monitoring protocols for Habitats Directive species, and on "citizen science", involvement the public as surveyors. The dissemination of the project is based on a network of events at local and national scale, integrating the technical actions, with public seminar and workshops, school didactics, social web, press and media releases, and comic strips. Currently, the dissemination network reached about 5000 citizens, through 200 events; 250 citizen scientists participated with 630 contributions. Moreover, 30 field assistants joined the monitoring actions in the study areas. The records from citizens have been used to improve the knowledge at larger spatial and temporal scales about the occurrence and distribution of target insects, implementing a national database. The citizen data will be analyzed to clarify the specific scientific questions, this is the next step.

PHYSIOLOGICAL ECOLOGY

CS15.1 - ROLE OF DEW IN DESERT PLANTS

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In arid environments, the importance of dew lies in its reliability and availability as a stable source of water throughout the year. There is however, an ongoing debate about the importance of dew in ecosystems in general, and especially in plants as a water source. Dew in plants is especially important in water limited environments, such as the Negev in Israel. The Negev is an arid ecosystem, which receives rain only during the winter (March through October). In contrast to rainfall, there are measured on average 200 dew days a year that account for over 30% of the annual precipitation in the region. However, the contribution of dew in plants still remains a mystery. We seek to determine the fraction of dew absorbed directly by three different plant species in the desert; two perennials: desert sage - *Artemisia sieberi* Besser (Asteraceae), and *Haloxylon scoparium* Pomel (Chenopodiaceae) and an annual, - *Salsola inermis* Forssk (Chenopodiaceae) to examine the importance of dew to the development and survival of plants in the desert. Understanding the mechanisms of plant water use and adaptation to stress are necessary to preserve the plant productivity and efficiency as well as sustainable use of water globally.

CS15.2 - SEASONAL DYNAMICS OF CARBON STORAGE IN SOUTHERN SOUTH AMERICAN TREES

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To meet fuel demands during the most active period of growth, winter deciduous tree species are thought to rely on mobilization of C-storage from perennial tissues. In contrast, evergreen trees would be less dependent on storage as they always have photosynthetic area. Recent studies on wild winter deciduous species have found, however, that the amount of carbohydrates withdrawn from major C-storage sites in spring is actually a very small fraction of the total C-storage, and that annual variation in C-storage is similar between broadleaved winter deciduous species and evergreen conifers. Here I examined the seasonal dynamics of C storage in broadleaved temperate species of Southern Chile to determine if winter deciduous species experience stronger reductions of C-storage in spring than evergreens. In four sites, I sampled coarse roots, cores, branches, and shoots in six mature trees of at least two winter deciduous and four evergreen species, during winter, spring, summer, and autumn. Pooling all tissues together, I found that winter deciduous showed lower maximums in C-storage, higher minimums in C-storage, and lower annual variation in C-storage than evergreens. These results are consistent with the hypothesis that winter deciduous species keep high levels of storage in spring to tolerate herbivory.

CS15.3 - IMPRINT OF SHORT TERM MEMORY FROM CIRCADIAN OSCILLATORS ON LEAF TO ECOSYSTEM FLUX DYNAMICS

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Molecular clocks drive ~24 h oscillations in leaf photosynthesis, stomatal conductance and other cell and leaf level processes under controlled laboratory conditions, and these oscillations depend upon past conditions. The influence of such circadian “memory” over ecosystem fluxes has been overlooked, and diurnal CO_2 and H_2O vapor flux dynamics in the field are being interpreted as resulting almost exclusively from direct physiological responses to concurrent variations in light, temperature and other environmental factors. Here we show ecosystem flux dynamics result from additive effects between circadian memories and direct environmental responses. Additionally, circadian rhythmicity in the ratio between CO_2 and H_2O fluxes challenges core predictions from theories on optimal stomatal regulation, and the addition of the clock in gas exchange models substantially improved their performance. Our results demonstrate that memory from circadian regulation is a driver of ecosystem fluxes as important as temperature and vapor pressure deficit.

CS15.4 - THE ECOPHYSIOLOGY OF PHOTOSYNTHESIS IN MIXOTROPHIC PLANTS

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The existence and the evolutionary implications of compensatory photosynthesis in partial mycoheterotrophic (mixotrophic) plants was demonstrated by our research team (Bellino et al., 2014; Oecologia 175:875-885) using a mixotrophic orchid, *Limodorum abortivum*, as a model species. However, the ecophysiology of this process was still largely unexplored. Here we performed the first in-depth study of photosynthesis ecophysiology in L. abortivum, employing chlorophyll fluorescence. Analyses were performed on leaves, stems and ovaries of either plants in which fungal supplies were artificially impaired to trigger compensatory photosynthesis, or untreated plants. The maximum quantum yield (Fv/Fm), electron transport rate (ETR)-irradiance relationships, non-photochemical quenching (NPQ) and dark-light/light-dark transition kinetics were analysed weekly on 42 specimens during 35 days. Ovaries showed higher Fv/Fm and ETRs than leaves and stems, irrespectively of the treatment. Conversely, the ETR-irradiance relationships were similar among the organs and comparable to those of photoautotrophic C3 plants, whereas the transition kinetics showed unusual features. Compensatory photosynthesis in ovaries was quickly triggered by the treatment (enhanced Fv/Fm and ETRs), confirming its importance in buffering fungal carbon limitation and supporting seed development. Our findings strengthen the evolutionary theory we developed for the mixotrophy-mycoheterotrophy transition.

CONSERVATION ECOLOGY

CS16.1 - THE DIFFERENT MEANINGS OF LAND USE AND LAND USE INTENSITY FOR MAMMALIAN CONSERVATION ACROSS THE WORLD

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How land use and land use intensity affect biodiversity globally is not fully understood. It is accepted that converting land for human use threatens populations –and ultimately species– due to habitat loss or deterioration. However, whether land use intensification leads to further biodiversity threat has been recently debated. In the present work, we explore how the extent of different land uses and different measures of intensity associate with abundance of threatened mammals globally. We show that the observed distribution of threatened mammals is driven by different factors in different parts of the World. For instance, in areas of the Indomalay realm, numbers of threatened species are a mirror of the total mammalian richness; whereas in areas of the Neartic, numerous threatened species are found in relatively anthropized areas such as grazing lands. Land use intensity is region-dependent, for example, maize yields are quite relevant in the Neartic and palm oil in the Indomalay, whereas other general measures of intensity (e.g. irrigated area or tons of fertilizer) are not that relevant. This study depicts some complex relationships between human activities and species' conservation, and warns about the importance of considering the particularities of different areas when assessing impacts on biodiversity.

CS16.2 - HUMAN DISTURBANCES AND PLANT RESPONSES ACROSS ELEVATIONAL GRADIENTS OF SELECTED PHILIPPINE MOUNTAIN FORESTS: A PROPOSAL FOR BIODIVERSITY EDUCATION USING OPEN AND DISTANCE ELEARNING

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Human-forest interaction was studied across elevational gradients in Mount Pulag, Mount Akiki, Mount Makiling, Mount Mayon and Mount Tabunan in the Philippines. Standard methods in vegetation ecology were used. Results indicated that lower elevation dominants were migrating or encroaching to upper altitudes with intensifying human activities like shifting cultivation and tree harvesting in their original zonal habitats. Dominance analysis revealed that these migrants were becoming dominants as well, in the upper elevations, suggesting that migrants had adopted to the agro-climatic regimes of the new habitat. A number of strategies are discussed to enhance sustainability and resiliency of the forest landscape for a sustained ecosystem services for the surrounding communities. These include proper zonation and land use planning by the local government, establishing landscape corridors, and an effective community biodiversity education. The Open and Distance e-Learning (ODeL) platform and worldview is proposed as the framework for this massive biodiversity education. This worldview combines the principles and philosophies of distance education, open education and e-learning.

CS16.3 - THE INDUSTRIALIZATION OF A FROG: DETERMINING THE FACTORS INFLUENCING AN ENDANGERED AMPHIBIAN'S DISTRIBUTION TOWARDS INDUSTRIALIZED LANDSCAPES

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Although habitat disturbances often result in a loss of biodiversity, it can also benefit species which are better able to adapt to these environmental conditions. Given the globally declining status of amphibians, understanding why some are found in disturbed environments is of considerable interest. The endangered green and golden bell frog (*Litoria aurea*) was used to investigate the factors influencing distribution in landscape which is favored toward industrial waterbodies. Results indicated that the number of permanent waterbodies within a kilometer radius of surveyed waterbodies was the best predictors of *L. aurea* occupancy, abundance and reproductive activity. Permanent hydrology is important for amphibians to avoid desiccation, especially during periods of drought, which occurs regularly in this area. Thus, the unlikely consequence of industrial activity from dredging and waste disposal is that it inadvertently created refuge habitat for *L. aurea* to fortuitously survive in this landscape. Future conservation plans for this species should mimic this process by increasing the number and connectivity between permanent waterbodies, especially in areas threatened with drought containing many ephemeral waterbodies. Understanding why endangered species persist in heavily disturbed landscapes can help us create successful management plans that help us prevent and reverse future declines.

CS16.4 - RELATIVE IMPORTANCE OF HUMAN DISTURBANCE AND NATURAL ENVIRONMENT FOR RABBIT ABUNDANCE ON MOTORWAY VERGES

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Anthopogenic alterations in the landscape create new conditions for wildlife, with different effects on species. To understand the response of wildlife populations and to manage it in an effective and optimal way, it is important to assess to what extend wildlife response depends on the introduced changes. Roads are well known drivers of change in ecosystems. Among their effects, they provide new habitat for some species like the European rabbit (*Oryctolagus cuniculus*). Here we study how much of the rabbit abundance in motorway verges is due to environment or motorway variables. We analyzed the importance of each group of variables on rabbit abundance using variance partitioning technique. Infrastructure variables explained around 50% of the variance in rabbit abundance, while environment only explained around 20%, being a 12% shared between both. Traffic volume and the width of the verges were the most important ones, with rabbits increasing with lower traffic and wider verges. These results show that human alterations are the most important factor explaining rabbit abundance in disturbed landscapes, within environmental conditions that favor rabbits. Furthermore, results point to variables that can be easily modified to manage rabbit abundance, as they depend on the infrastructure characteristics.

CS16.5 - REWILDING THE LANDSCAPE: EFFECTS OF LARGE-SCALE RESTORATION AND MANAGEMENT OF GRASSLAND AND MARSH ECOSYSTEMS ON ANIMALS

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Ecosystem restoration is an important target in biodiversity policy but also offers good opportunities to test ecological theories. We monitored successional changes in several animal groups after the largest active grassland restoration on croplands in Europe, and measured animal responses after large-scale marsh management by livestock grazing and fire. After restoration, arthropod communities decreased in richness but became more similar in composition to communities of natural grasslands. In contrast, orthopteran richness doubled and abundance increased ten-fold compared to croplands. Amphibians and birds increased in abundance after restoration, whereas small mammals depended on both local management and the proportion of grasslands in the landscape. Marsh management increased habitat diversity in previously homogeneous reedbeds, and grazing had a longer-lasting effect than fire on reed structure. Amphibians were abundant in areas burned the previous summer. Non-passerine birds (ducks, geese, shorebirds, gulls, terns) also preferred these areas, while farmland birds preferred grazed areas, and reed passerines preferred non-grazed and control areas with old reed. Our results from these two large-scale experiments have direct applicability in ecosystem restoration and management but also contribute to the understanding of ecological concepts such as succession in animal assemblages, community assembly, habitat diversity and disturbance gradients.

CS16.6 - THE PHYSICAL FEATURES OF THE *SABELLARIA SPINULOSA* REEF IN THE NORTHERN GARGANO PROMONTORY (ADRIATIC SEA, SOUTHERN ITALY)

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Sabellaria spinulosa (Leukhart 1849) is a suspension feeder which builds tubes by cementing together sand and shell. Interactions between sedimentological parameters and ecological features in the recently discovered Torre Mileto *S. spinulosa* reef along the northern Gargano coast are shown. The sedimentological sampling was carried out during different seasons of the year and along three transects perpendicular to the coast. In order to evaluate the kind of terrigenous particles that are involved in the worm tubes constructions, detailed granulometric and petrographic analyses were carried out on both reef and soft-sediment samples. *S. spinulosa* seems to have not preferences on the grain composition while it seems to prefer grains with a 120 - 250 µm mean diameter. However, among adjacent tubes, larger and smaller grains are also trapped. In the whole reef area, the same modal composition was measured in the worm tubes and surrounding soft-sediments (mainly quartz, carbonate lithoclast and bioclast). Image analysis about the shape factor of tube grains indicate the preferential use of elongate and ellipsoidal particles in the worm tubes. The role of *S. spinulosa* reefs as physical barrier for the storm wave action and as temporary storage of sands in the coastal environments is discussed.

CS16.7 - A HABITAT SUITABILITY MODEL FOR THE LOGGERHEAD TURTLE *CARETTA CARETTA* L. 1758 ALONG THE APULIAN COASTLINE

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Caretta caretta has been steadily declining over the years mainly because of the scarcity of safe nesting sites. Computing higher-probability maps of both occurrence and nesting choice is a useful tool in conservation ecology. Here we present a predictive model realized using ensemble modeling procedures applied to the Apulian coastline. Data gathered from all the 10 nesting sites known from Apulia were returned in a cartographical grid and linked to 18 environmental parameters, physical and hydrographical, together with data from 22 nesting sites from the rest of the Mediterranean basin. The model (suitability min: 0; max: 10) has been further implemented with the Apulian stranding's data from 1994 to 2013 (assigning 1 point if the number of the stranding units are greater than 40), and with radio-telemetry data of 10 marked specimens (1 point for each animal registered in each unit of grid). Therefore, we created a habitat suitability map with grid units square (side: 10km). The Jackknife test shows that the variables most influencing the model are those geomorphological (depth and distance of the coastline from the -3200m bathymetric). The results of our model fit quite well with nesting data collected from the Apulian coastline.

CS16.8 - TRACKING AND ANALYSING FISHING EFFORT IN SPACE AND TIME: STATE-OF-THE-ART SOURCES AND METHODS TO INVESTIGATE AND CONTROL FISHERIES IMPACTS TOWARDS SUSTAINABLE MANAGEMENT

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A series of different geo-positioning devices have been used to track and analyse the spatio/temporal allocation of fishing effort and, then, to assess fishing impacts on resources and abiotic environment (i.e. seabed morphology). In particular, the Vessel Monitoring System (VMS - introduced in 2005) and the Automatic Identification System (AIS - introduced in late 2010) represent the most interesting and fertile data sources for fisheries investigations. Although these tracking devices were not devised to support fisheries sciences, they are the sources of invaluable information about fleet behaviour. Thus, this study presents an open source software platform conceived to handle and combine multiple data from different sources (e.g. VMS and AIS) in order to produce integrated assessment of fishing effort. In addition, a short overview of the main challenges related to the use of spatial fishing effort data. Namely, we summarize current opportunities and difficulties in some applied research topics: 1) the management of fishing effort by means spatial ban; 2) the assessment of anthropogenic alterations of seabed morphology by towed gears; 3) the assessment of spatial origin of catches and landings when logbook data are scant or unreliable.

CS16.9 - ECOLOGICAL CONSEQUENCES OF SPATIAL AND TEMPORAL VARIATION OF FREQUENCY AND INTENSITY OF DISTURBANCE

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The understanding of disturbance effects and related processes represent a longstanding issue in ecology and evolution. Clarify the ecological consequences of chronic disturbance in structuring communities and producing biological rebounds on populations can represent a useful tool for conservation and management strategies. Therefore, different diversity disturbance relationships (DDRs) can be generated both depending on the magnitude of considered components of disturbance (frequency or intensity) and on the scale of phenomena observation (downscaling). Taking advantage from the use of the most reliable and high resolution database actually available (Vessel Monitoring System data), this study aims to analyse the regimes of frequencies and intensity of trawling disturbance along the Italian coasts. Data between 2012 and 2013 have been analysed to investigate temporal and spatial aggregation patterns and fleet's dynamics, according to the fishing fleets behaviour mainly in conjunction with seasons and seabed features. The analysis of different combination of frequency and intensity allowed discerning of differences along the disturbance gradient providing useful insight in assessing the detrimental impacts and ecological effects on biodiversity loss and habitat fragmentation.

CS16.10 - HOW SMALL IS AN ECOSYSTEM PROCESS?

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Ecosystem processes form an intermediate concept between functional traits and ecosystem services. While traits are features of species and can be mapped from the scale of an individual to global distributions, ecosystem processes and services are usually quantified at watershed, regional or global scales. A question that remains under-explored is the smallest scale at which ecosystem processes can be resolved. This is relevant because conservation of ecosystem processes and their services may often operate at sub-landscape scales, such as individual landholdings. The relationship between the smaller spatiotemporal scales of the ecosystem process and smaller sizes of conservation area may thus be relevant to the design and uptake of many conservation actions. However, the individual spatiotemporal dynamics of functional traits and other ecosystem process inputs mean that fine-scale estimation of ecosystem processes is challenging. I review some existing approaches, as well as others that my colleagues and I have explored in the mediterranean habitat of central Chile. We show that semi-fossorial rodent colonies predict avian-mediated ecosystem processes, and demonstrate an inductive, non-spatiotemporally-explicit method to estimate exchange of ecosystem processes across habitat mosaics. I discuss future directions for improving the resolution of measurements of ecosystem processes at sub-landscape scales.

ECOSYSTEM SERVICES & SOCIETAL BENEFITS

CS17.1 - DEDUCTIVE AND INDUCTIVE APPROACHES TO IDENTIFYING, MAPPING AND VALUATING OF ECOSYSTEM SERVICES IN RURAL LANDSCAPE

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Ecosystems, their biodiversity, ecosystem processes, as well as ecological functions (sensu Eliáš, 1983) determine / represent the capacity of the ecosystem to provide, and contribute to ecosystem services. When the ecological functions (the capacity) are actually used, they become social or socio-economic functions (sensu Eliáš, 1983), called "ecosystem services". Different research approaches to identifying, mapping and valuation of ecosystem services have been used. Deductive approaches („top-down") are concerning with deducing ecosystem services in a landscape from current categorizations (e.g. MA, TEEB, CICES); more general levels and methods are used for the service assessment. Inductive approaches („bottom-up") are based on observations of ecosystems which occur in a study area, on collecting relevant data, and geographical (spatial) distribution of the ecosystems in the area. Ecosystem services are identified by ecosystem types (structure, biodiversity), and ecological functions. The atomistic approaches are applied in the service assessment. The research approaches are quite different, but they can also be complementary. We compare the approaches to recognize their advantages and disadvantages; empirical data collected in different regions of Slovakia, Central Europe, were used. The data presented are related to the research project of VEGA ,Ecosystem and their effects - Ecosystem services in a rural landscape.

CS17.2 - POLICY IMPACTS ON REGULATING ECOSYSTEM SERVICES: LOOKING AT THE IMPLICATIONS OF 60 YEARS OF LANDSCAPE CHANGE ON SOIL EROSION PREVENTION IN A MEDITERRANEAN SILVO-PASTORAL SYSTEM

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Policy decisions form a major driver of land use change, with important implications for socially and environmentally susceptible regions. It is well known that there can be major unintended consequences, especially where policies are not tailored to regionally specific contexts. In this paper we assess the implications of 60 years of agricultural policies on soil erosion prevention by vegetation, an essential regulating ecosystem service in Mediterranean Europe. To assess these implications we produced and analysed a time series of land cover/use and environmental conditions datasets (from 1951 to 2012) in relation to changing agricultural policies for a specific region in the southern Portugal. A set of indicators related to soil erosion prevention allowed us to identify that land use intensification as increased soil erosion in the last 60 years. Particularly in the last 35 years the agricultural policy had a significant effect in the density and renewal of the tree cover, resulting in drastic effects for the provision of the soil erosion prevention service. The results show some unintended effects of agricultural policy mechanisms on ecosystem service provision and highlight the need for context-based policies, tailored to the environmental constrains and potentials of each region.

CS17.3 - THE FUTURE OF SOME ECOSYSTEM SERVICES IN CENTRAL EUROPEAN FARMLANDS

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Ecosystem services (ES) are the benefits of biodiversity to humans. The general wisdom suggests that the effectiveness of ESs is correlating with biodiversity. To provide evidence for this in a Central European context is essential, as these evidences can help to convince local decision makers to target biodiversity conservation. This may provide an opportunity to avoid the similar collapse of farmland biodiversity happened in west of Europe in the 20th century. Our research results provide the following evidences: (i) wild bees were the most abundant group, and were key players in the pollination network of traditionally managed farmlands in Transylvania; (ii) pollination success of apple trees in Hungarian orchards correlated only with wild bee species richness from all pollinator groups; (iii) landscape complexity positively influenced wild bees and hoverflies in the same orchards; (iv) forest naturalness positively affected insectivorous bird abundance, which provided higher predation rate on forest pest caterpillars; (v) soil decomposition was affected by soil properties rather than landscape structure or direct climatic effects in Transylvanian grasslands. The synthesis and understanding of these and other ES studies from Central Europe in an interdisciplinary context can enhance regionally specific, more effective conservation actions than copy-paste Western European schemes.

CS17.4 - AIR QUALITY IMPROVEMENT BY URBAN AND PERIURBAN VEGETATION IN THE METROPOLITAN AREA OF ROME. AN ECOSYSTEM SERVICE PERSPECTIVE

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Urban pollution, caused in particular by tropospheric ozone (O3) and particulate matter (PM), is a current topic of primary concern, since these pollutants adversely affect ecosystems and human health. Several findings show the effectiveness of green infrastructures in mitigating pollutants concentrations through both dust adsorption and gas absorption. The extent of this ecological process rely on environmental factors, pollutant concentrations and vegetation structural and functional parameters like Leaf Area Index (LAI). In our study, we assessed the influence of vegetation cover on PM10 and O3 concentrations in the metropolitan area of Rome, through the analysis of Landsat remote sensed images, the application of a deposition flux model (Nowak, 1994) and a stomatal flux model (Ball et al., 1987). The ecosystem service of pollutants removal was then mapped in a GIS environment, evaluating the contribute of each vegetation class in the air quality improvement. Our findings, accordingly to previous studies (Manes et al., 2012; 2014; Nowak et al, 2014) confirm the effectiveness of urban forests in enhancing air quality, highlighting the pivotal role of tree diversity. These results provide useful information about the most efficient species in pollution abatement and should be considered by stakeholders into vegetation management strategies.

CS17.5 - ENVIRONMENTAL PERCEPTION AND LIVELIHOOD KNOWLEDGE IN A PAYMENT FOR ENVIRONMENTAL SERVICES PROJECT IN THE BRAZILIAN ATLANTIC FOREST

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The “Water Conservation” project based in Extrema, Minas Gerais, Brazil, is the first Payment for Environmental Services (PES) in the country to be implemented by a local government. It pays farmers to fulfill the federal environmental law through the forestation of protected areas surrounding headwaters and rivers, and to move beyond it restoring what is left from the Atlantic Forest. This case study research aims to analyze stakeholders’ environmental perception of local changes and the influence of driving forces in the decision-making process and the behavioral change related to the environment. From July to August of 2014, data was collected through interviews with actors from local government, public and private institutions, and farmers that are participating or not in the project. Most of the farmers interviewed could establish a positive relation between water and forest, as well as forest and soil. Farmers also reported the wear of the soil decreasing the production and the cattle production. For most of the interviewees, food or cattle production drive deforestation, while the forestation could increase with some type of incentive, such as financial, and also with information and awareness. Every interviewee perceived alterations on the quantity and frequency of the rain.

CS17.6 - A WORKING TOOL TO SUPPORT NATURAL CAPITAL ESTIMATION AND DECISION MAKING IN MARINE COASTAL AREAS

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Marine coastal areas are characterized by the co-presence of both ecological conditions favourable to life and strategic business.In particular the Civitavecchia coastal area (northern Lazio) is an outstanding example of multiple superimposed uses of marine resources (ie. tourism, fisheries, industry, shipping and ports, historical and cultural heritage, ecosystem protection).Our work is focused on the creation of a decision-making supporting tool for marine areas and surrounding territories: the SeaUseMap.This tool includes both uses and values of marine ecosystems, which have the benthic biocenosis like spatial reference unit.The benthic biocoenosis are the basic ecological units that, in the Mediterranean Sea, have been analyzed since the 50s, classified in a benthic zonation system (Perez & Picard 1964), and finally defined as a working tool by Boudouresque & Fresi (1976). According to Costanza 2008, for the marine areas we calculated these values on the basis of services and benefits produced by the different benthic biocoenosis. Indeed we base our strategy on the ability of the benthic biocenosis to provide excellent information on ecological processes from which ecosystem benefits arise. SeaUseMap application examples are shown in this highly populated study area.

CS17.7 - INTERPLAY BETWEEN ECOLOGICAL AND SOCIO-ECONOMIC SYSTEMS: A SYSTEMS PERSPECTIVE INTEGRATING ENVIRONMENTAL ACCOUNTING AND ECOSYSTEM SERVICES ASSESSMENT

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Ecosystem services assessment is a growing research field addressing the evaluation of the benefits that ecosystems provide to human economy and well-being. Socio-economic systems are highly dependent on the ecological systems in which they are embedded and from which they gain several goods and services. The whole human economy is supplied (and also constrained) by the availability of stocks of natural capital and flows of ecosystem services. A sustainable economy should therefore consider the existence of limits to growth and biophysical constraints to human activities. A comprehensive understanding of interlinked ecological-economic systems requires integration of different theoretical frameworks and assessment methods. In this paper, we propose a conceptual framework integrating environmental accounting and ecosystem services assessment to highlight three main possible windows of attention to be investigated when focusing on ecosystem services provision and exploitation: (1) sustained economic and environmental costs, (2) received benefits, and (3) generated impacts. Finally, we conclude that an ecological-economic and systems perspective to ecosystem services assessment could play an important role in investigating the interplay between ecological and socio-economic systems, allowing a more comprehensive understanding of the benefits gained from ecosystems and the costs due to their exploitation.

CS17.8 - NATURAL IMMUNITY: GREEN SPACE, YOUR MICROBES, AND YOUR HEALTH ARE RELATED

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The incidence of inflammatory disorders—such as allergies, asthma, diabetes, obesity, etc.—is increasing rapidly in developed countries. This megatrend has been linked to alteration in diet and life-style, but also to reduced contact with the natural environment and its rich microbiota, especially in the soil. It is becoming clear that our microbiota plays an active role in the development of our immune system. We have studied the association between allergic sensitization and land-use around the homes of study subjects in several cohorts in Finland and Estonia. In one of the cohorts, the interaction between commensal skin microbiota and immune function was examined. The results show that increased exposure to green environments tends to protect against atopic sensitization in children. Increasing cover of green environments was associated with increased diversity and relative abundance of Proteobacteria on the skin of healthy individuals. The patient material, cell assays, and a mouse model indicate that the skin microbiota mediates the balance between anti-inflammatory and Th1/Th2 -gene expression. These results support the hypothesis of a strong environmental effect on the commensal microbiota, and that skin commensals play an important role in tuning the balance of Th1, Th2, and anti-inflammatory responses to environmental allergens.

CS17.9 - DO TREE CROPS ENHANCE SOIL C SEQUESTRATION AND C ALLOCATION TO MORE STABILE SOM FORMS COMPARED WITH NON-TREE CROPS?

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Due to the key societal and environmental role that agroecosystems play, recent EU environmental policies focus on increasing knowledge on management options which can improve soil quality, reduce environment impact, enhance climate mitigation functions. Agricultural ecosystems are generally considered as a net source of C, exception made for permanent grasslands. Although many tree crop systems might represent in theory a relevant management to improve C sequestration in soil, no data are available to support this hypothesis. Within the context of the CARBOTREES project, we analyzed the C sequestration potential and mean residence time and the C allocation in SOM forms with different stability in soils from olive orchards of Central Italy, by means of SOM physical-chemical fractionation followed by C quantification and radiocarbon dating. Changes in C quality, quantity and allocation were analysed along the years (chronosequence), comparing also different managements (intensive vs super-intensive), and were referred to a baseline control represented by a close-by agricultural land with non-tree crops. The experimental approach allowed to quantify variations of new C inputs which could not be appreciated by standard C measurements and gather indications on the soil C sink long term potential of the tree crops.

CS17.10 - ENLARGING THE ECOSYSTEM SERVICES FRAMEWORK

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"Ecosystem services" analysis is a tool for motivating conservation efforts, successfully promulgated in particular by the Millennium Ecosystem Assessment (2005). In some cultural settings, this consequentialist ethical approach may be counter-productive, and even within the scientific community there is disagreement about its merits. The Faith-in-Scholarship Working Group on Ecosystem Services (FISWES) is exploring how a reformational-Christian perspective may assist in communicating across cultures to clarify conservation objectives and agendas. By combining virtue ethics with a non-reductionistic philosophical framework, we offer an enlarged view of conservation in which the ecosystem services concept may be contextualised, critiqued and reformulated. We illustrate this with examples of practical conservation initiatives from around the world.

CS17.11 - DEVELOPMENT OF INTELLIGENT GIS TOOLS IN SUPPORT TO MSFD: ACHIEVEMENTS OF IRISSES PROJECT

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IRIS-SES Project (Integrated Regional monitoring Implementation Strategy in the South European Seas) aimed at building a new approach and to develop decision making tools for an integrated marine monitoring for the MSFD, in order to support an effective management of anthropogenic activities in the marine waters of the Mediterranean and Black Seas.The development of a software/GIS platform has been achieved during the lifetime of IRIS-SES as follows: (1) design and construction of a Geo-database comprising main geographic, thematic features and metadata of national (6) monitoring programmes; and (2) development of a set of intelligent tools specially designed for MSFD descriptors D5, 8 & 9.A GIS toolbox has been developed to calculate the environmental status of a study area using station-based, time and depth integrated data in order to calculate the eutrophication-related (D5) indices: Chl-α, nutrients, Eutrophication Index (EI) and TRIX. In respect to contaminants (D8-D9), baseline and threshold values for metals and organic contaminants in sediment, seawater and seafood were defined according to literature and legislation. The tools design was based on minimal user input and the interface has been developed with care for simplicity and minimal user interaction.

ECOTOXICOLOGY

PS01.1 - DOES PERFLUOROOCTANOIC ACID REPRESENT POTENTIAL RISK TO FISH FECUNDITY?

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Endocrine disrupting (ED) chemicals act in very small amount and in subtle ways, adversely affecting reproduction of wildlife. The ED activity of perfluorooctanoic acid (PFOA), an emerging pollutant ubiquitously found, was studied in adult common carp, *Cyprinus carpio*. The effects of waterborne 56-days exposure to PFOA were evaluated at 200 ng/l, a concentration reported in the field and thus of environmental relevance, and at 2 mg/l, taking into account different levels of organization (i.e. organismal, histocytological, molecular/transcriptional). There were no significant differences in gonado-somatic index among the groups. Gonads of carp exposed to 200 ng/l, similarly to those of control fish, had PFOA levels under the limit of detection (LOD=0.4 ng/g ww) and no signs of histopathological changes. Oocytes degeneration and altered spermatogenesis were found in carp exposed to 2 mg/l, which gonads showed PFOA concentrations > LOD. The expression levels of aromatase gene (ARO), coding for the steroidogenic-key enzyme converting testosterone to estrogens, were altered in carp exposed at both concentrations: expression increased in testes and decreased in ovaries. In conclusion, environmental PFOA concentration did not elicit histological damages in the gonads but affected ARO expression, raising concern that exposure to this pollutant may lead to reproductive impairment.

PS01.2 - EFFECTS OF NANO-TIO_2 AND VANCOMYCIN ON SEED GERMINATION

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Plant nanoecotoxicology is an emerging area of research. The understanding of interaction mechanisms among nanoparticles (NPs), pharmaceutically active compounds (PhACs) and biological systems is still lacking. Seed germination and seedling growth can be either inhibited or enhanced by NPs, whereas the effects of PhACs are primarily dependent on their chemical characteristics and on the biological system. Therefore, the release of NPs and PhACs into the environment and the agricultural reuse of contaminated sludge from wastewater treatment plants is a critical issue. For this reason, the potential bioaccumulation and transfer of these pollutants through the food chains must be investigated. The present study aimed at assessing the phytotoxic effects of nano-TiO_2 (0-5000 mg/L) and vancomycin (0-22 mg/L), both alone and as a mixture, on seed germination of four different crops (*Lycopersicon esculentum cv. Crovarese*, *Lycopersicon esculentum cv. San Marzano*, *Eruca sativa*, *Diplotaxis tenuifolia*). Root and shoot emergence and final length, root elongation rate and total biomass were employed as descriptors of seed germination. Nano-TiO_2 did not affect crops, neither alone, nor in mixture. Conversely, vancomycin inhibited seed germination of *L. esculentum* and *D. tenuifolia* only at low concentrations, whereas germination of *E. sativa*. was enhanced by vancomycin.

PS01.3 - ANALYSE OF FLORISTIC COMPOSITION OF ABANDONED CU-DUMPS FIELD PIESKY (STAROHORSKÉ VRCHY MTS, SLOVAKIA)

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Cu-dumps field Piesky is an important historical abandoned mining area in the region of Central Europe, well known for the high content of heavy metals in soil, especially of the copper (Cu), the content of which is here within the range 933.40-1485.40 mg.kg-1. The extraction of the copper ore in this locality extends into the end of the 4th millenium B.C. The estimated volume of these dumps is 267 967 m^3. In 2010 part of the dump field was recultivated, which was reflected also on the floristic composition. Floristic and phytosociological research was realized here during the growing seasons 2011-2014. Altogether 156 taxa of vascular plants were found, which we evaluated in terms of representation of metalophytic, alien and synanthropic species. We realized 11 phytosociological reléves which were selected in order to capture the variability of plant communities through the topographical and ecological variability, various successional stages and human impacts. The dump-field Piesky is a suitable locality for comparison of the flora succession on the recultivated localities as well as on the localities with long-term spontaneous succession. Acknowledgement: This work was supported by the Slovak Research and Development Agency (APVV-0663-10) and Scientific Grant Agency (VEGA 2/0099/13).

PS01.4 - COMPARISON OF BIOACCUMULATION PROPERTIES IN *PINUS* SP. AND *QUERCUS* SP. AT THE SELECTED EUROPEAN CU-DEPOSITS

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Heavy metal contamination of *Pinus* sp. and *Quercus* sp. was studied at several abandoned historic Cu-deposits of Italy (Libiola, Caporciano), Portugal (São Domingos) and Slovakia (Ľubietová). The highest Cu and Mn contents in soil/technosoil were described in Libiola and Caporciano, whereas the highest Pb, Zn, As and Sb contents in São Domingos. The soil/technosoil in Ľubietová show highest Co contents. The lovest pH values in soil/technosoil were determined at São Domingos. The bioconcentration factor – BCF (Mehes-Smith et al., 2013) and translocation factor – TF (Kisku et al., 2010) for Fe, Cu, Pb, Ni, Co, As, Sb show both in *Quercus* sp. as well as in *Pinus* sp. (sensu Baker, 1981) that the studied plants are excluders (they concentrate the mentioned heavy metals preferentially in roots). Interesting is the preferential Pb, Ni and Co content in *Pinus* sp. needles at Ľubietová dump-field. The same plants are indicators for Mn, Zn and Cd (the mentioned metals are concentrated preferentially in leaves/needles). Acknowledgement: This work was supported by the Slovak Research and Development Agency under the contracts No. APVV-0663-10 and Scientific Grant Agency VEGA 1/0538/15.

PS01.5 - EFFECTS OF IONIC, MICRO- AND NANO-SIZED IRON ON *LEPIDIUM SATIVUM* AS A REFERENCE BIOLOGICAL MODEL

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Engineered nanomaterials are at the forefront of ecotoxicologist agendas due to their widespread use in a broad range of industrial and domestic sectors. Nanoscopic zerovalent iron started to be used in various countries around the world for land and groundwater remediation presenting, apparently, encouraging removal rates particularly with organic compounds. We reported on the effects of ionic ($FeCl_3$), micro- and nano-sized zerovalent iron (nZVI) about the development of three macrophytes: *Lepidium sativum*. Four toxicity indicators (seed germination, seedling elongation, germination index and biomass) were assessed following exposure to each iron concentration interval: 1.29-1570 mg/L (FeCl3), 1.71-10.78 mg/L (micro-sized iron) and 4.81-33560 mg/L (nano-iron). Results showed that no significant phytotoxicity effects could be detected for both micro- and nano-sized zerovalent irons, including field nanoremediation concentrations. Biostimulation effects such as an increased seedling length and biomass production were detected at the highest exposure concentrations. Ionic iron showed slight toxicity effects only at 1570 mg/L and, therefore, no median effect concentrations were determined. By microscopy, ENPs were not found in palisade cells or xylem. Macroscopically, black spots and coatings were detected on roots of all species especially at the most concentrated treatments.

PS01.6 - NICKEL TOXICITY: COMMON REED RESPONSE TO OXIDATIVE STRESS

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Plants, like all other organisms, have evolved different mechanisms to maintain physiological concentrations of essential metal ions and to minimize exposure to non-essential heavy metals. In this context this study investigates the effect of nickel chloride (24 ppb – 77 ppb - 120 ppb) on Common reed a plant widely used for treatment of waste water containing heavy metal, morphological parameters also the antioxydativ enzyme activity of Glutathione-S-Transferase (GST) are measured. Our results show that the height of the plants tends to decrease with increasing concentrations of $NiCl_2$. We recorded the lowest rate of growth 3,56 Cm in plant treated with $NiCl_2$ (120 ppb) against 5.3 cm for the control plants. For growth in root length results showed that only the highest concentration of $NiCl_2$ (120 ppb) have a significant negative effect. The effects of nickel chloride on enzymatic activity in roots showed an increase activity of GST. The increase activity of Glutathione-S-Transferase (GST) in roots was probably a mechanism in response to $NiCl_2$ effects, effectively this enzyme are biomarkers of stress regularly used to characterize the physiological state of plants. These findings may contribute to a better understanding the response mechanism of common reed to heavy metals.

PS01.7 - COMBINATION EFFECTS OF NANO-TIO2 AND WATER ACCOMMODATED FRACTION OF CRUDE OIL (WAF) ON BIOTRANSFORMATION IN THE LIVER OF EUROPEAN SEA BASS (*DICENTRARCHUS LABRAX*)

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The aim of the study was to investigate the influence of nano-TiO_2 on water accommodated fraction of crude oil (WAF) dependent biotransformation in liver of European sea bass *Dicentrarchus labrax*. An in vivo 48h waterborne exposure was performed with nano-TiO_2 (10mg/L), WAF (1,36g/20L), singly and in combination. mRNA expression of aryl hydrocarbon receptor repressor (Ahrr), estrogen receptor (erβ2), ABC transport proteins as abcb1, abcc1-c2-g2, cytochrome P450 (cyp1a), glutathione-s-transferase (gst), glutathione reductase (gr) and engulfment and motility (ELMO) domain-containing protein 2 (elmod2) were investigated. 7-ethoxyresorufin-O-deethylase (EROD) in liver fractions and bile PAH metabolites were also measured. WAF exposure up-regulated cyp1a, gst, erβ2, elmod2, abcb1 and abcc1 in single and in co-exposure with nano-TiO_2. Co-exposure caused a reduction of ahrr, abcg2 and abcc2 genes expression compared to single WAF. Abcg2, abcc1 and abcc2 genes resulted down-regulated by nano-TiO_2 compared to controls. EROD activity was significantly induced by WAF while co-exposure with nano-TiO_2 caused a significant reduction, also evident for cyp1a but not significant. B(a)P and pyrene metabolites increase significantly in WAF and co-exposed fish. Overall results suggest an interaction of nano-TiO2 with crude oil able to affect phase I of biotransformation in liver of European sea bass.

PS01.8 - BIOAVAILABILITY AND BIOACCESSIBILITY OF LEAD IN SEDIMENTS FROM COASTAL AND INLAND WETLANDS WITH DIFFERENT HUNTING ACTIVITY

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Lead from spent shot dispersed in wetland by the hunting activity, undergoes slow transformation increasing Pb bioavailability throughout the aquatic ecosystem. We investigate the relative bioavailability and bioaccessibility of Pb in sediments from two Italian wetlands Diaccia-Botrona (coastal wetland) and Padule di Fucecchio (inland marsh) considering different degree of Pb shot pellet densities, including shooting ranges, hunting estates and natural reserves. The relative Pb bioavailability was evaluated using the Community Bureau of Reference (BCR) sequential extraction procedure, whereas the relative avian Pb bioaccessibility was estimated by using an “in vitro” digestive tract simulation. Despite of the similar pattern of BCR partitioning of Pb, results of “in vitro” avian digestive tract simulation showed Pb bioaccessible percentage in gizzard phase (pH 1.5) two order of magnitude higher for Padule di Fucecchio than for Diaccia-Botrona with similar reluts in intestinal phase (pH 6.5). The sediment geochemical properties, determining a less acidic conditions in the coastal wetland, likely affect the Pb bioaccessible in addition to the total Pb concentration in sediments. The use of this combined approach (BCR sequential extraction and “in vitro” avian gizzard-intestine system simulation) can be used for assessment and management strategies in wetlands.

GLOBAL CHANGE ECOLOGY

PS02.1 - STRONG RESILIENCE OF SOIL RESPIRATION COMPONENTS TO DROUGHT-INDUCED DIE-OFF RESULTING IN FOREST SECONDARY SUCCESSION

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Under a climate change context forests face drought-induced perturbations influencing soil respiration in combination with other environmental and biological drivers. We studied total soil respiration (RS) and its heterotrophic (RH) and autotrophic (RA) (fine root [RR] and mycorrhizal respiration [RM]) components in a mixed Mediterranean forest where Scots pine (*Pinus sylvestris* L.) is undergoing drought-induced die-off and is being replaced by Holm-oak (*Quercus ilex* L.). Soil respiration and its components were measured biweekly during one year under non-defoliated pines, defoliated pines, dead pines and healthy Holm-oak, using the mesh exclusion method. Drought-induced pines die-off was not reflected in RS or in its components, denoting a high functional resilience. Nevertheless, the succession from pines to Holm-oaks resulted in a reduction of RH and thus in important decrease of total respiration (RS diminished 36% in Holm-oaks in relation to non-defoliated pines). RS and all its components were strongly regulated by the interaction between soil water content and temperature. The functional resilience of the soil system over die-off events combined by changes due to the subsequent succession could have direct consequences on the carbon balance of these ecosystems, particularly under the drier and warmer conditions expected for the climate change scenarios.

PS02.2 - CLIMATE CHANGE AFFECTS BIOCRUST ABILITY TO MODULATE SOIL MOISTURE DYNAMICS

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Soil water dynamics in drylands are built on precipitation pulses. Despite its proved importance, the effect of soil communities dominated by mosses and lichens (biocrusts) on modulating soil moisture dynamics in drylands has been poorly studied. In particular, little is known about how climate change (increase in temperature and reduction in precipitations) will affect the ability of biocrusts to modulate soil moisture dynamics. We analysed six year of soil moisture data gathered from biocrustand bare soil areas in a climate change (warming and rainfall exclusion) experiment located in a semi-arid grassland in Aranjuez (central Spain). We classified data in rain pulses and we analysed soil wetting/drying dynamics through the different treatments of the experiment. Soil moisture was lost faster after rainfall events in biocrust vs. bare soil areas. These differences disappeared under warming. This study concludes that climate change will substantially affect the ability of biological soil crusts to modulate soil moisture dynamics in drylands.

PS02.3 - EFFECTS OF CLIMATE WARMING ON FOREST SOIL MESOFAUNA SPECIES RICHNESS

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Effects of climate warming on soil mesofauna (*Collembola*, *Oribatida*, *Gamasina*, *Enchytraeidae*) were studied from eleven-year data (1992-2002) collected from the Latvia LTER site - Scots pine forest of the North Vidzeme Biosphere Reserve. Three sample plots of different age were used. From each plot once a year soil samples (n=100, 5 cm^2 x 10 cm) were collected, and soil microarthropods were extracted by using modified high gradient extractor. Enchytraeids were extracted from soil samples (n=30, 23 cm^2 x 10 cm) by using wet funnel techniques. Data from the local meteorological station were used. Sums of positive temperatures (>+ 4ºC) (SPT) showed statistically significant increase during the period of study. In total, 67 species of *Collembola* (1800-28000 ind/m^2), 109 species of *Oribatida* (2000-140000 ind./m^2), 46 species of *Gamasina* (1000-6000 ind/m^2) and 7 species of Enchytraeidae (80300-11 000 ind./m^2) were recorded. Species richness of *Collembola* and *Gamasina* decreased during the period of investigations while that of *Oribatida* showed slight increase for the youngest forest site. Statistically significant correlations with soil moisture were recorded for the total numbers of Enchytraeidae. Species richness of *Collembola* and *Gamasina* correlated negatively and that of *Oribatida* positively with SPT.

PS02.4 - FERTILIZATION RESPONSE TO OCEAN ACIDIFICATION IN THE ANTARCTIC SEA URCHIN STERECHINUS NEUMAYERI

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Raising atmospheric CO_2 levels cause ocean acidification (OA), which is known to be a major threat for marine organisms. Some taxa, such as echinoderms, are particularly sensitive, both in their calcifying and non-calcifying life stages. We tested the fertilization response of the Antarctic sea urchin *Sterechinus neumayeri* to OA under near-future scenarios (IPCC 2014). After acclimating adults for one month at pH 8.1, 7.8 and 7.6, we induced spawning to assess fertilization success at these pH levels and across a wide range of sperm concentration, normalized as sperm:egg ratio. Results show a significant effect of the interaction between pH and sperm:egg ratio (ANOVA, $F_{6,24}=3.12$, $p>0.05$). Even at the highest sperm:egg ratio, percentage of fertilization was significantly reduced at the two lower pH treatments. Differences in fertilization among sperm:egg ratio levels occurred only at pH 8.1, suggesting a much stronger effect of reduced pH than sperm:egg ratio, therefore fertilization success at lower pH seems not to be modulated by sperm concentration. This study shows that fertilization success in *Sterechinus neumayeri* is significantly impaired at pH conditions forecast by 2100, and further studies are necessary to understand how this ecologically important species will cope with OA conditions.

PS02.5 - VULNERABILITY OF AMPHIBIANS AND BIRDS TO CLIMATE CHANGE

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Increasing evidences show that recent climate change has already impacted species globally, but the way species will respond to further global warming is still unclear. We present the first study able to demonstrate that species vulnerability could be determined by biological and ecological factors leading to different responses to climate change. Through a bibliographic research we collected information on the observed impacts of climate change on 77 amphibian and 570 bird species, we evaluated the response of each species and we analysed, using logistic regression, the connection between the classes of response and the available biological and ecological traits. Our results showed that, for amphibians, the traits most correlated with vulnerability to climate change are minimum altitude at which a species lives, altitudinal range, eggs clutch, development strategy and living environment; for birds, we obtained, as significant predictors, range of precipitations in breeding areas, number of habitats occupied, generation length and mean clutch size. This study proves for the first time the existence of intrinsic and extrinsic factors able to determine vulnerability of amphibians and birds to climate change, and these characteristics can be used to predict which species are likely to be most at risk in the future.

PS02.6 - AN ANALYSIS OF CLIMATE CHANGE IMPACTS IN THE GULF OF THAILAND

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One of the difficult challenges in coastal zone management in a changing climate is the lack of understanding on how and the severity of climate change impacts affecting marine and coastal resources in a certain area. We present here the possible impacts on the marine and coastal resources and their vulnerability to climate change. Literature review with the field surveys were conducted in the coastal areas in the Gulf of Thailand. The results showed that sea level rise and elevated sea water temperature would be the main climate change-related drivers which generate severe impacts on coastal resources. Mangroves and tidal flats are more severe to sea level rise while coral reefs are more severe to anomaly elevated sea water temperature. Moreover, fluctuation in freshwater input would affect seagrass beds and coral reefs located near the coasts because of a changing water quality such as salinity, sediment and nutrients. Anthropogenic drivers such as coastal development, population growth and urbanization may synergize the higher magnitude of those impacts and increase the vulnerabilities of important coastal resources. Mitigation plan and adaption measures should be properly and immediately established in order to deal with climate change impacts in the present and future.

PS02.7 - VULNERABILITY OF *CYMODOCEA NODOSA* TO INCREASED SEDIMENT BURIAL AND NUTRIENT AVAILABILITY: IMPLICATIONS IN A CHANGING CLIMATE

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Seagrass populations provide numerous valuable ecosystem services, but are declining worldwide due to anthropogenic pressures under climate changes. Some components of global change could interact in their effects making it difficult to predict the consequences. Many studies have examined plant responses to single potential stressors, but little is known on how plants will respond to the effects of multiple, simultaneous alterations. Projections suggest that storms and precipitation events will increase in their occurrence, leading to more frequent sediment deposition (burial) episodes accompanied by increased nutrient loads. We examined the individual and combined effects of enhanced burial and nutrient deposition on early development of patches of *Cymodocea nodosa*, a fast-growing seagrass of the Mediterranean. Doubled frequency of burial, even of modest intensity (4cm), substantially reduced biomass production and net shoot recruitment only in one site. Nutrient enrichment increased net shoot recruitment, biomass production, branching and horizontal rhizome elongation in both sites. Under burial conditions, nutrient supply had not effect on horizontal rhizome growth and shoot recruitment while it significantly reduced vertical rhizome internode growth independent on site. These findings indicate that patches could benefit from enhanced nutrient supply, but this benefit could be offset by the co-occurrence of frequent burial episodes.

PS02.8 - TROPHIC NICHE OF A DOMINANT BENTHIC PREDATOR *ODONTASTER VALIDUS* (*ASTEROIDEA*) ASSOCIATED TO SEA-ICE COVER AT TETHYS BAY (ROSS SEA, ANTARCTICA)

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Marine biodiversity in Antarctica is coupled with sea-ice dynamics, which controls light and nutrient inputs to the shallow water benthic consumers. Changes in resource availability for organisms at the base of the food chain can affect upper trophic levels. We assessed changes in the trophic niche of a dominant invertebrate predator, *Odontaster validus* (Asteroidea), associated with ea-ice cover and resource inputs in Tethys Bay (Ross Sea). *O. validus* is a generalist predator able to feed on detritus and species at the base of the food web when in conditions of resource shortage. Trophic niche descriptors were obtained both at the population and specimen level by means of C and N isotopic analyses and Bayesian mixing models. We investigated whether changes in ice-cover and resource availability through space and time were reflected in variations of the trophic position and niche width of *O. validus*. Our results showed isotopic variations of *O. validus* related to different ice cover conditions, demonstrating the ability of this predator to feed across different trophic levels and food web compartments depending by prey and resource availability. This suggest a high potential of adaptation of this species to future climatic changes impacting the Antarctic marine food web.

PS02.9 - C AND N ALLOCATION STUDY WITH STABLE ISOTOPES IN CEREALS AT PAST, PRESENT AND FUTURE [CO2] MODULATED BY NITROGEN AVAILABILITY

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This study of behaviour of durum wheat to future [^{CO2}] (ca. 731,7±6ppm), or past [CO_2] (ca. 249,4±13ppm), compared with present [CO_2] (ca. 409,325±2ppm), will help us to know better as the plants have been behaved in the past and how they will adapt to future environmental changes. In addition, was study the modulation of CO_2 response by high and low nitrogen (HN, LN), having LN 10% of nitrogen than HN. Stable isotope is a good tool to study the behaviour of plants with different treatments. We conducted a simultaneous double labelling with $13CO_2$ and 15NH4-$15NO_3$ in this study in order to characterize C and N allocation during anthesis. Plants at future [CO_2] catch more $13CO_2$ in photosynthesis for that respired higher levels of $13CO_2$, follow for present and past [CO_2]. Plants with LN breathe less 13C than HN treatments. Besides, 13C in TOM is bigger in HN than in LN, and past than present or future [CO_2]. The isotopic composition of 15N in TOM is bigger in LN than in HN and is bigger in past [CO_2] than present. The N is sending from root to other parts of plants especially to the reproductive organs.

PS02.10 - *CYMODOCEA NODOSA* RESPONSE TO SIMULATED CO2-DRIVEN OCEAN ACIDIFICATION: A FIRST INSIGHT FROM GLOBAL TRANSCRIPTOME PROFILING

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The effects of CO_2-driven ocean acidification on seagrass metabolism remain largely understudied. For this work, we built an outdoor mesocosm facility (Centre of Marine Sciences' field station in Algarve, Portugal), to experimentally manipulate CO_2 levels and investigate the effects of high-CO_2/low pH on seagrass metabolism and underlying molecular mechanisms. *Cymodocea nodosa* plants were collected in Cadiz Bay and transported to the mesocosm facility. After a one week acclimation period, plants were either kept under normal (400 ppm) or elevated (1200 ppm) CO_2 concentration for 12 days. Here we present, for the first time in this species, results obtained using Illumina RNAseq technology and de-novo transcriptome assembly. Using *C. nodosa* RNAs extracted at the beginning and the end of the experiment, we assembled more than 70 thousands unique transcripts and were able to annotate more than 90% of them using the Annocript pipeline. Differential expression analysis revealed about 500 transcripts significantly differentially regulated between plants kept under control and high-CO_2 conditions. Pathways showing largest changes included isoprenoid and amino-acid biosynthesis, porphyrin containing compound metabolism, amine and polyamine biosynthesis, lipid and carbohydrate metabolism. Transcriptome sequencing also significantly increases the molecular resources available for *C. nodosa*, almost completely absent before this study.

PS02.11 - EVOLUTION OF PEAT UNDER THE BLACK ALDER FOREST OF DEMNET ERRIHANE (EL KALA NATIONAL PARK - NORTH-EAST OF ALGERIA)

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The El-Kala National Park is a home to a true wetland complex that many of them are classified Ramsar sites. Indeed, black alder in the Eastern Numidia is a fragile environment in perpetual degradation. The main factor in the deterioration of these forests is the water deficit caused by excessive consumption of this resource, which affects balance established over decades, nuisance increasingly marked through the effects of global warming.To better diagnose the status of these ecosystems, we focus our work to analyze the properties of soils that develop under the black alder forest. Soil sampling was conducted by transect method. This method involves analyzing vegetation along an axis whose location is the function of a number of factors homogeneity. Soil samples were described on land then, taken to analysis them.The results show that the black alder forest of Demnet Errihane grows on a fibric histosol consists of organic fragments recognizable with some particularity. As a result the sample is dry from the surface to the depth, This is the brand that groundwater is very closed to the surface previously existed and that it was abruptly retracted because peat forms in an environment saturated with water for prolonged period.

PS02.12 - DECOMPOSITION OF ORGANIC MATTER IN A CLIMATE CHANGE SCENARIO: INVESTIGATING POTENTIAL INTERACTIONS BETWEEN DECOMPOSITION FORCING FACTORS

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The decomposition of plant litter is one of the most important ecosystem processes in the biosphere and is particularly sensitive to climate warming. Aquatic ecosystems are well suited to studying warming effects on decomposition because the otherwise confounding influence of moisture is constant. One of the most commonly used approach for examining litter decomposition in aquatic ecosystems is the litter bag technique, based on several assumptions among which the conditions occurring on and within the bags are not influenced by the amount and quality of boundary litter material. Here, is reported an experimental work carried out under controlled conditions, aimed at describing the combined direct and indect effects of temperature and boundary litter materiaI on detritus decomposition in aquatic environments. Litter decomposition was investigated on discs of *P. australis,* at three temperatures, four quantities of boundary litter material and in absence/presence of benthic guilds of detritivores. A positive effect of the temperature was evidenced on litter decomposition, in contrast the boundary litter material showed a negative influence on the process. The combined effects of all factors highlighted that the influence of the temperature on decomposition was inhibited by high quantities of boundary litter material and presence of benthic guilds.

PS02.13 - HUMAN PRESSURES PREDICT SPECIES' GEOGRAPHIC RANGE SIZE BETTER THAN BIOLOGICAL TRAITS

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Geographic range size is the manifestation of complex interactions between intrinsic species' traits and extrinsic environmental conditions. Past research has primarily focused on the role of biological and environmental predictors of range size, but macroecological patterns can be distorted by human activities. Here we analyse the role of extrinsic (biogeography, habitat state, climate, human pressure) and intrinsic (biology) variables in predicting range size of terrestrial mammals. We evaluated the ability of 19 intrinsic and extrinsic variables in predicting range size for 4,867 terrestrial mammals. We repeated the analyses after excluding restricted-range species and performed separate analyses for species in different biogeographic realms and taxonomic groups. Our model had high predictive ability, and showed that climatic variables and human pressures are the most influential predictors of range size. Interestingly, human pressures predict current geographic range size better than biological traits. These findings were confirmed repeating the analyses on large-ranged species, individual biogeographic regions and individual taxonomic groups. Climatic and human impacts have determined the extinction of mammal species in the past, and are the main factors shaping their present distribution. Measuring climatic and human variables can allow to obtain approximate range size estimations for data deficient and newly discovered species.

PS02.14 - ECOPHYSIOLOGICAL RESPONSES OF COASTAL FORESTS TO GROUNDWATER CHANGES: COMPARING FUNCTIONAL GROUPS AND CLIMATIC REGIONS

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Groundwater alterations, particularly lowering, will affect ecosystems sensitive to water limitation as coastal dune forests. This can produce dramatic changes in plant communities, on physiological performance or survival of plant species. The additional impact of drought due to climatic change on groundwater-dependent ecosystems has become of increasing concern since it aggravates groundwater reduction impacts with consequent uncertainties about how vegetation will respond over the short and long term. Sand dune plant communities encompass a diverse number of species that differ widely in root depth, tolerance to drought and capacity to shift between seasonal varying water sources. Plant functional groups may be affected by water distribution and availability differently. We aim to evaluate in different climatic regions (Tropical, Meso-mediterranean and Mediterranean) the responses of different coastal plant functional groups to changing groundwater availability. The present isotopic approach (leaf δ13C, xylem+water sources δ18O, leaf δ15N) was used as a tool to assess physiological performance and water strategies integrated in spatio-temporal water dynamics. Groundwater modeling was developed to assess the availability of groundwater in our study areas. Furthermore, this isotopic spatial approach provided the possibility to find general patterns of responses and predict effects of water availability changes.

FUNCTIONAL TRAITS AND MECHANISTIC BIOENERGETICS MATTER IN DOWNSCALING GLOBAL VARIABILITY INTO ECOLOGICAL RELEVANT INFORMATION TO PROJECT CHANGES INTO A FUTURE

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The great concern toward the rapidly anthropogenic climate change (GC) has raised the interest toward new approaches on how to disentangle the GC pervasive effect on ecological processes. GC drives the loss of biodiversity challenging organisms to acclimate, adapt or move to track changes in their environment in space and time. Grasping GC variability and making it appropriately relevant for bio- and ecological processes is complicated by a conflict of scales. Thus, providing realistic scenarios of GC effects means adopting a downscaled approach as that proposed here through some marine-contextualised study cases. It relies on mechanistic metabolic theories such as the Dynamic Energy Budget, pioneering for solutions to quantitatively predict changes of species abundance in a rapidly changing world. Here, study cases will range from how to predict: interactive effects of acidification and warming on contraction of biogeographical distribution of invasive bivalves, effects of boat noise on damselfish fitness in MPAs and the role of eutrophication in buffering detrimental GC effects on bivalves. I will show how all these examples provide a common basis to project, on a broader scale, ecologically relevant information that has a potential for increasing effectiveness in mitigation, adaptation and proactive strategies.

AQUATIC ECOLOGY

PS03.1 - THE EUROPEAN S&T MED PROJECT: LINKING MARINE ECOLOGY TECHNOLOGY AND ECONOMICS IN THE CROSSFRONTIER PROMOTION OF SUSTAINABLE TOURISM

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In the framework of the harmonious cooperation between EU and non-EU states, the European S& T Med strategic project was recently launched, promoting good social and environmental practices and sustainable tourism. The strategy of this project is to establish Mediterranean networks of sustainable coastal destinations collaborating with the local scientific community in three pilot areas (Mahdia, Tunisia; Sinis and Isola Mal di Ventre, Italy; Aqaba, Jordan). Linking biology, ecology, technology, sociology and economics, joint public/private management schemes for the valorisation and promotion of natural and cultural assets will be defined. A trans-national environmental monitoring system, managed by the Stazione Zoologica Anton Dohrn in close collaboration with the other scientific partners, will feed a trans-national Observatory on Sustainable Tourism and a worldwide Long Term Monitoring Stations database. One high-tech monitoring system at each coastal site will include environmental sensors and underwater cameras to capture specific local environmental features. This project will start a process enhancing the better understanding of the global trends in environmental changes at a wider Mediterranean Basin level. The non-EU project partners will join a cross-boundary network of sites adopting common best practices for sustainable coastal management, focusing on the good environmental status of the Mediterranean marine ecosystems.

PS03.2 - BIOACCUMULATION OF HEAVY METALS IN THE MUSCLE TISSUE OF TWO ECONOMICALLY IMPORTANT FISH SPECIES FROM TWO IMPOUNDMENTS OF THE OLIFANTS RIVER SYSTEM

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The Olifants River is currently one of the most threatened and polluted river systems in South Africa. It is impacted by various anthropogenic activities, particularly mining, urbanisation, industrial and agricultural activities in the catchment, and have resulted in the gradual deterioration of the water quality. The main objective was to determine the levels of selected metals in the muscle tissue of two economically important freshwater fish species, *Oreochromis mossamhicus* and *Clarias gariepinus* from two impoundments of the Olifants River, Flag Boshielo Dam and Phalaborwa Barrage, and estimate the risk to human health resulting from the consumption of fish from the impoundments. Generally, there were significantly higher concentrations of metals in the muscle tissue of fish from Flag Boshielo Dam than those from the Phalaborwa Barrage. The Human Health Risk Assessment confirmed that metals have been assimilated into the muscle tissue of fish from the impoundments, and that for certain metals, viz. lead, antimony, chromium and cobalt, the levels in muscle tissue are high and pose a health risk. The risks associated with consuming fish from Flag Boshielo Dam were higher than those from the Phalaborwa Barrage.

PS03.3 - GREAT CORMORANT PREDATION ON AN ENDEMIC AND THREATENED FISH THE CISALPINE PIKE: A CONSERVATION CONFLICT

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In the last decades the abundance of Great Cormorants have extraordinarily increased throughout Europe. Many studies reported that cormorants may impact fish populations not only by consuming large number of individuals but also by wounding them, but information related to wild fish populations are scarce. We examined the incidence of wounds caused by cormorants on an endemic and threatened species, the Cisalpine Pike (*Esox cisalpinus*). The object of our research was to quantify this impact, and indirectly to estimate if cormorant predation may be one of the causes of the rapid decline of this Esocidae. In the years 2009-2013, 139 pikes were collected in some gravel pits in NW Italy. More than a half of the specimens reported wounds attributable to cormorant attacks, with significant difference in the wound occurrence between fish sizes. In a context of general freshwater habitat alteration, quarry lakes represent important refuges for pike conservation. Unfortunately, pike breeding season overlaps with the presence of large colonies of overwintering cormorants, increasing the probability of interactions. Our data evidenced that the increase of cormorants can represent an important menace for the conservation of this endemic species. We finally suggest some management options to minimize this problem.

PS03.4 - SEASONAL DISTRIBUTION OF MICROPHYTOBENTHOS IN THE OLIGOTROPHIC CONTINENTAL SHELF OF HERAKLION BAY (CRETE, EASTERN MEDITERRANEAN)

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It is evidenced that microphytobenthos can play an important role in the biogeochemistry of the continental shelf, though only a few regional estimates are available. Research conducted in the oligotrophic continental shelf of Crete offers strong evidence for the presence of benthic microalgal populations, especially diatoms, covering extended parts of the sediment-water interface in depths even deeper than 100m, since the sea floor receives enough sunlight to support them. Furthermore, high concentrations of epi-, hyper-benthic and zooplanktonic macrofaunal organisms found at the sediment-water interface of this oligotrophic environment indicate that this is a response to the high light levels close to the seabed and the availability of food sources associated with the sediment surface. Most probably these conditions are similar in other areas especially of the subtropical and tropical zones. These observations may overturn the view that shallow unvegetated benthic communities act only as heterotrophic systems. The presence of benthic microalgal populations over extended parts of the continental shelf may have important consequences for the functioning of the shelf ecosystem because they are expected to affect the exchange of nutrients and oxygen across the sediment-water interface, constitute a major food source for heterotrophic organisms and moderate benthic carbon flows.

PS03.5 - FIVE YEARS MONITORING OF BENTHIC HARMFUL DINOFLAGELLATES *COOLIA MONOTIS*, *OSTREOPSIS CF. OVATA* AND *PROROCENTRUM LIMA*

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Benthic Harmful Algal Blooms (BHABs) seem to exert larger impacts since the last decade enhancing the attention of both scientific community and public governance to this phenomenon. BHABs can be involved in Ciguatera (CFP), a food borne illness affecting humans and marine resource worldwide. Ciguatoxins are produced by dinoflagellates belonging to the genus Gambierdiscus, but it is also possible that other species such as *Ostreopsis*, *Coolia* and *Prorocentrum* spp are involved in CFP Another issue refers to the possible underestimation of BHABs species due to the lack of monitoring programs and standard methods focused on benthic habitats. This study quantified both planktonic and epiphytic dinoflagellate assemblages along the Genoa shoreline (at Quarto dei Mille, Italy) in sea water and in macrophyte samples collected during summer season from 2010 and 2014. *Ostreopsis cf. ovata*, *Prorocentrum lima* and *Coolia monotis* were the most common species, reaching the maximum density of round 2 x106 (O. cf. ovata,), 13 500 (*P. lima*), 28 000 (*C. monotis*) cells/gr of *S. scoparium*. Comparison among planktonic and epiphytic densities seem to highlight different ecological behavior of the three species, mostly between *P. lima* and *O. cf. ovata*, highlighting the importance to appropriately monitor the benthic habitat.

PS03.6 - VALIDATION OF A FISH-BASED INDEX FOR ITALIAN TRANSITIONAL WATER BODIES

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The water framework Directive (WFD) requires that the evaluation of the ecological status is carried out using methodologies compliant with the WFD normative definitions. In this work we present a multi-metric index, obtained following a protocol previously developed for the Venice lagoon and adapted to take into account the indication of the European Commission. The index is composed of four metrics, expressed as Ecological Quality Ratios related to habitat-specific reference conditions. The validation of the index is based on its relationship with anthropogenic pressures, quantified considering the impacts of human activities on the morphology of lagoons, on the quality of the environmental matrices and those related to the human use of resources. The evaluation was carried out using data previously gathered for the Venice lagoon together with information purposely collected between 2012 and 2013 in the lagoons of Lesina (southern Adriatic Sea), Marano (northern Adriatic Sea), Colostrai (Tyrrhenian Sea) and Cabras (Sea of Sardinia). Those water bodies represent about 65% of the total area of Italian transitional waters, and resulted to be characterised by different levels of pressures. The multi-metric index showed a significant relation with several pressure indicators , with the morphological ones being the most important.

PS03.7 - CHALLENGES AND SCIENTIFIC COOPERATION FOR THE STUDY OF MEDITERRANEAN CORALLIGENOUS HABITATS: CIGESMED EUROPEAN PROGRAM

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Coralligenous reefs are one of the most important biodiversity hotspots of the Mediterranean Sea. The development and the application of management and protection measures aimed at reaching a Good Environmental Status of coastal ecosystems (MSFD, 2008/56/EC) require a deep knowledge about the distribution, the composition, the functioning of the habitats, and the treats that may affect them. Unfortunately, except for a general knowledge about the specific composition and the distribution in the NW Mediterranean, coralligenous reefs are far from being well known and understood. In this context, the CIGESMED (Coralligenous based Indicators to evaluate and monitor the Good Environmental Status of the MEDiterranean coastal waters) project, thanks to the cooperation among research teams in France, Greece and Turkey, aims at: (1) improving the knowledge about coralligenous communities and define some reference conditions, by developing a network of experts at Mediterranean scale and by long-term observations; (2) developing standardized monitoring protocols, applicable across the Mediterranean sea; (3) creating a monitoring network at local and regional scale, by citizen science programs. The collaboration with the IndexMed consortium allows managing and sharing a big amount of heterogeneous data, by integrating ecological, biological, environmental, sociological and economic information: a global approach for coralligenous study.

PS03.8 - *LIMNORIA QUADRIPUNCATA* (ISOPODA: LIMNORIIDAE) IN THE ADRIATIC

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Limnoria quadripunctata Holthuis, 1949 is a woodborer isopod widely distributed in the European Atlantic coasts (Unite Kingdom, Ireland, Netherlands, France and Portugal), where is considered a native species, and introduced in many areas of the Pacific Ocean. In the Mediterranean the presence of this species was firstly reported from Triest (Italy) and, recently, from Banyuls-sur-Mer (France). Nevertheless specimens collected in 1957 at Triest could be attributed to *L. carinata*, although the status of the latter is still subject to debate. We found *L. carinata* on sunkenwood from coralligenous outcrops (the so-called Tegnue) in the Gulf of Venice (Upper Adriatic), at a depth about 20 meters. Specimens collected at these sites were clearly identifiable as *L. carinata* from morphological traits. Wood panels deployed on the outcrops at the same depth revealed an intense colonization , thus pointing out the presence of a stable population in this particular environment and its ability to colonize new substrata.

PS03.9 - THE SUSCEPTIBILITY OF CORALS TO THERMAL STRESS BY ANALYZING HSP60 EXPRESSION

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Due to the increasing frequency and severity of the coral bleaching events in the context of global warming, there is an urgent need to improve our understanding of the susceptibility of corals to thermal stresses, particularly at the sub-cellular level. In this context, we examined the modulation of the polyp mitochondrial Hsp60 in three scleractinian coral species (*Seriatopora hystrix*, *Montipora monasteriata* and *Acropora echinata*) under simulated heat shock bleaching at 34 °C during a time course of 36 h. All three species displayed a similar initial increase of Hsp60 level which accompanies the increasing paleness of coral tissue. Afterwards, each of them showed a specific pattern of Hsp60 down-regulation which can be indicative of a different threshold of resistance, although it proceeded in synchrony with the complete bleaching of tissues. The finely branched *S. hystrix* was the species most susceptible to heat stress while the plating *M. monasteriata* was the most tolerant one, as its Hsp60 down-regulation was less rapid than the branching corals. On the whole, the Hsp60 modulation appears useful for providing information about the susceptibility of the different coral taxa to environmental disturbances.

PS03.10 - EUTROPHICATION STATUS OF THE BLACK SEA TURKEY USING BEAST

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We investigated eutrophication status of the Black Sea for 2014-2015 using Black Sea Eutrophication Assessment Tool (BEAST 1.0) which is a customized version of HELCOM Eutrophication Assessment Tool (HEAT 3.0). Implication of Marine Strategy Framework Directive requires assessment of the current status of national marine waters and establishment of environmental targets and associated indicators to achieve Good Ecological Status. Black sea has been receiving excess anthropogenic inputs of nutrients since 1960's. However, our knowledge about the Black sea eutrophication status is still poor due to lack of adequate monitoring data and assessment tools. Therefore we used BEAST which is based on core indicators such as; 1) Nutrient levels: winter (December-February) total phosphorus (TP), dissolved inorganic phosphate (DIP), dissolved inorganic nitrogen (DIN), dissolved inorganic silicate (DSi) in the surface layer (0-10 m depth), 2) Direct effects: summer chlorophyll a concentrations in the surface layer, summer Secchi depth, and 3) Indirect effects: summer oxygen conditions in a certain sigma-t depth. Data aggregation was performed from data sets covering 2004-2014, however only three years of winter data were available. Reference and target values calculated by percentile method considering salinity effect on concentrations as salinity found significantly to be correlated with nutrients.

PS03.11 - USING FISH COMMUNITY TO IDENTIFY SUCCESS CRITERIA FOR SEAGRASS HABITAT RESTORATION

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A major goal in restoration of estuarine habitats is to establish effective success criteria, allowing to determine whether the objectives of restoration schemes have been met. In the northern basin of Venice lagoon (northern Adriatic Sea, Italy), the LIFE project N° LIFE12 NAT/IT/000331 started in 2014 with the objective of restoring seagrass meadows. The designed interventions are expected to enhance the overall ecological status (sensu Dir. 2000/60/CE) of the northern lagoon, and thus also to restore the conditions of fish community associated with seagrass meadows. Aim of this work was to identify the characteristics of the fish assemblage that would better indicate the success of seagrass restoration at the end of the project in terms of habitat functionality for fish. A fish-based multimetric index was developed and applied to assess the ecological status of newly-recreated and natural seagrass meadows, testing the latter as reference site. Fish assemblages were then compared and community attributes of recreated and natural habitats were evaluated. Ecological status resulted higher in natural meadows, and the multivariate analysis showed that an increase in the relative abundances of seagrass specialists in restored sites could represent an indicator of success of seagrass restoration.

PS03.12 - PLANT-HERBIVORE INTERACTIONS IN A TROPICAL MANGROVE ECOSYSTEM

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In the tropical and subtropical regions of the world, the highly productive mangrove forests grow at the interface between land and sea. These coastal ecosystems represent an important blue carbon sink as well as crucial habitat, nursery and spawning grounds for many terrestrial and aquatic species. Recent studies have highlighted the fact that benthic communities play a largely underestimated role in the cycling of matter, nutrients and carbon within the mangrove ecosystem. However, the functioning of mangrove food webs still remains poorly studied and little information is available on the importance of herbivory in this threatened system. The present study investigated plant-herbivore interactions at the individual and community level in a tropical estuarine mangrove ecosystem. The first part of the presentation discusses the results from an observational field study on the natural isotopic composition of benthic primary producers and consumers. In the second part we summarise the results from manipulative experiments performed in the laboratory on food preferences and feeding behaviour of the most abundant gastropod consumers. Field studies were conducted in the densely populated Red River delta Biosphere Reserve in northern Vietnam.

PS03.13 - SPATIO-TEMPORAL DYNAMICS OF THE ALIEN SPECIES *RHITHROPANOPEUS HARRISII* (CRUSTACEA: PANOPEIDAE) AND *XENOSTROBUS SECURIS* (MOLLUSCA: MYTILIDAE) IN TUSCAN BRACKISH ENVIRONMENTS

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The crab *Rhithropanopeus harrisii* and the mussel *Xenostrobus securis* are widespread invasive species in brackish environments worldwide. In the canalisation of the low course of the Arno River (northern Tyrrhenian coast), the distribution of these two alien species was monitored during one year, in order to understand how their population features vary with regard to the distance from the sea and the port of Livorno, which is considered the origin of the local introduction. Established reproductive populations of both species were found in the study area. Individual densities reduce with increasing distance from the port of Livorno. Results of our study are consistent with an annual and semelparous life cycle for *X. securis*, with a quick turnover. On the other hand, *R. harrisii* has a lower growth rate and a longer, iteroparous life cycle.

PS03.14 - WHY, HOW AND TO WHAT EXTENT RESTORATION OF LOWER DANUBE LAND-WATERSCAPE (LDLW) IS REQUIRED?

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One of the largest and most diverse European land-waterscape(LW), has been extended in the floodplain of Lower Danube river stretch, including river delta, over an area of > 10,000 km^2, from which 92% on Romanian territory. It was an effective buffer system between Danube river catchment and North-Western Black Sea. After 40 years of intensive management regime based on conversion of self-maintained ecosystems into intensive food production ecosystems and hydrotechnical works for hydropower generation and waterway transport, a wide range of structural and functional changes were recorded in the LDLW and N-W Black Sea, as well as severe reduction of the quality and quantity of the LW-services. Significant changes in the domestic policy and regulatory frameworks through transposition of regional, EU and international conventions require deep changes in the former and current management regime applied in LDLW. The poster presentation will focus on three main aspects: i)dynamics of structural configuration, functional regime and services under former neoclassical management regime; ii)threshold, functional regime shift and impact on LDLW-services,and iii)challenges and opportunities for alternative management regimes targeted to comply with the existing regulatory and policy frameworks. Four management regimes driven by land-waterscape restoration will be assessed in terms of potential outcomes.

PS03.15 - TRACKING THE PAST: FROM SHAPE AND SURFACE RECENT EVOLUTION TO ARCHAEOLOGICAL INFERENCE OF ECOSYSTEM SERVICES OF COASTAL LAGOONS TO EARLY HUMAN SETTLEMENTS

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Coastal lagoons are highly valuable ecosystems, supplying services to our societies as well as to many other species as birds (islands of habitat) or fish (nursery areas). Here, we have carried out a survey in the coastal zone of Apulia tracking the past history of coastal lagoons and early human population benefitting their ecosystem services. Data were from archival sources, i.e. historical maps (dating back from the seventeenth century), photo-interpretation of historical aerial photography (IGM, 1943, IGM 1954-55), and cultural heritage ICT Platform (SIT) jointly managed by CNR and University of Salento. The data and information retrieved from these sources have been used to: (a) trace on CTR cartographic base (1: 5000) the polygons corresponding to the most likely extension of the coastal lagoons before the structural and systematic land reclamation; (b) map changes detected before the pre-remediation level (early nineteenth century) and the post-remediation level (after nineteenth century); and, (c) map early diatribution of human settlments in three key coastal areas of the Apulia Region. Data analysis shows marked reduction coastal lagoon surface from pristine conditions and suggest a key role of lagoon ecosystem services for the development of human settlment in the proto-hystory of the Apulia Region.

PS03.16 - ASSESSMENT OF WATER QUALITY OF LAGOS LAGOON WITH RESPECT TO PROTECTION OF AQUATIC LIFE

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Water quality status of Lagos lagoon with respect to the protection of aquatic life was studied. Selected stations along the lagoon are, Bariga, University of Lagos (Unilag), Makoko and Iddo were monitored for six (6) weeks for Temperature (T), pH, Conductivity (Cond.), Dissolved Oxygen (DO), total Nitrogen (TN) and total Phosphorus (TP). Water quality index (WQI) of each station and the overall WQI of all stations were determined using the guidelines of Canadian Council of Ministers of the Environment (CCME) water quality index for the protection of aquatic life. The water quality in all stations was poor (CCME WQI=16) which is below the allowable standard. The mean of water quality variables were: T0C (29.0±0.8 °C), pH (7.33±0.32), Cond. (3325.7±7660 µS cm-1), DO (5.1±0.35 mgL-1), TN (2.80±0.39 mgL-1) and TP (6.63±1.93 mgL-1). The parameters that had poorest value were DO, TN and TP while pH was the only parameter that had allowable standard. P had greatest effect on WQI while conductivity had the least. This study suggests need to protect lagoon ecosystem from environmental pollution and degradation through sustainable environmental monitoring and regulatory control. Key words: Water quality index, aquatic life protection, Lagos lagoon, environmental pollution.

BIODIVERSITY & ECOSYSTEMS

PS05.1 - LIFE TO A(D)DMIRE; MIRE RESTORATIONS IN SWEDEN

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The Life to addmire project aimed at restoring 40.000 hectares of peatland and wetlands in Sweden during 2010-2015.Mires are for some people wastelands for others the land of oppertunity. Peatlands are the signle most important habitat for CO_2 emmission. Mires serve the human poplulation with essentioal ecosystem services and if you look closley a fantastic biodiversity. The project has been mostley pratical work. How to restore, what does it cost, where should the restorations take place and where are the restorations infavourable. But the project has also informed to WHY are these actions so neccessary localy and globaly. The LIFE+-fundings has made it possible to restore within the Natura 2000 network. I know it is time to give something back.

PS05.2 - DIVERGENT DIVERSITY PATTERNS OF SPECIES RICHNESS IN BRYOPHYTES AND VASCULAR PLANTS ACROSS EUROPE

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Understanding the mechanisms that drive the assembly of species has been a major topic in ecology for more than a century. The latitudinal diversity gradient has been a persistent feature in the history of life, with a remarkable consistency across space and habitat. Here, using extensive distribution data of bryophytes and vascular plants in Europe, we tested whether these two groups follow the same latitudinal trend in species richness. To this end, we analysed predictions of species distributions models and macroecological models coupled with species turnover and nestedness analyses, Lee's L statistics, multimodel inferences and canonical correspondence analysis. Our results show that vascular plants and bryophytes exhibit opposing latitudinal patterns in species richness. It is consistent with results obtained for other groups, it raises questions about the universality of latitudinal species richness gradients and points to dispersal limitations during post-glacial recolonization of high latitude areas from southern refugia in vascular plants, which does not seem to affect bryophytes. These results stress the importance of historical factors in shaping species richness patterns.

PS05.3 - FISH COMMUNITY COMPOSITION OF THE PO RIVER DELTA LAGOONS IN RELATION TO ENVIRONMENTAL FEATURES AND HUMAN EXPLOITATION

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The aim of the study is to provide an updated taxonomical and functional composition of fish species in the lagoons of the Po Delta. The study includes six lagoons where an extensive fish sampling was performed during 2009-2010. Taxonomical and functional composition were analyzed and comparative analysis was conducted based on water and sediment features. Thirty-four species where found, 6 of them listed in the Habitats Directive. The observed ecological categories were the marine migrants-MM (48.2%), estuarine species-ES (27.5%), marine stragglers-MS (14.2%), freshwater-F (8.1%), catadromous-C (1.2%) and anadromous-A (0.8%) species. Cluster Analysis based on the richness of the ecological categories highlighted two different groups: the first by the presence of MM, ES, MS and the second by F species. PCA analysis of environmental parameters on fish community showed that the pH and salinity mostly influence the variability of the systems, while secondary were the effects of lagoons dimensions and sediment features. Salinity mostly favors the categories MM and MS, while ER and MM were negatively correlated to the lagoon surface dedicated to clam breeding. The threats to the fish fauna were manifold by the simplification of habitats and by the current activity of fisheries conducted with no sustainable methods.

PS05.4 - RESPONSES OF SOFT-BOTTOM BACTERIAL DIVERSITY AND PROCESSES TO OXYGEN DEPLETION AND RECOVERY: INSIGHTS FROM MANIPULATION EXPERIMENTS IN THE VENICE LAGOON

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Hypoxia and often anoxia are threatening biodiversity and associated processes in transitional water ecosystems under anthropogenic pressures. Oxygen availability especially affects microbial functional diversity and activities which in turn regulate biogeochemical processes. Microbial communities can take advantage from benthic vegetation, e.g. through oxygen transport and release from root hairs. These issues were experimentally tested in the Venice lagoon (Italy). Hypoxia and anoxia were experimentally induced in sediment patches with different primary producer communities (microphytobenthos, macroalgae and rizophytes). Normoxic conditions were then re-established. Features of the bacterial community and benthic processes were investigated before and during the anoxia onset and after re-oxygenation. Bacterial diversity (16S rDNA mass-sequencing) and functional proxies (prokaryotic C production and extracellular enzymatic activities), net fluxes of O_2, CO_2, N_2, NO_3^-, NH_4^+ were measured at the water-sediment interface. The experiment outcomes highlighted differential responses of microbial diversity and functions, evidencing a faster recovery of vegetated versus bare sediments.

PS05.5 - AROMATIC HYDROCARBON UTILIZATION ABILITY OF *CHROMOHALOBACTER* SP.

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This study aimed to reveal the ability of utilizing different aromatic hydrocarbons (p-hydroxybenzoic acid, naphthalene, phenanthrene, pyrene) by a halotolerant bacterial strain *Chromohalobacter* sp. under saline conditions. The aromatic hydrocarbon degradation pathways were identified. PCR amplification was carried to define the gene zones which codify dioxygenases of the isolates. Possible gene zones of catechol 1,2 dioxygenase and protocatechuate 3,4 dioxygenase were determined. According to PCR amplification and enzyme test results *Chromohalobacter* sp. utilizes aromatic hydrocarbons by the ortho cleavage of the β-ketoadipate pathway. In this study, it was concluded that this isolate could be used in bioremediation studies of the saline environments contaminated with aromatic hydrocarbons.

PS05.6 - BIOSORPTION OF MERCURY BY MUCOR SP ISOLATED FROM CERAMIC WASTE

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The microorganism which will be used for removal of metals should be able to easily and economically produced in high quantities. Almost all organisms have negatively charged surfaces and they capable to adsorb positively charged metal ions, such as Cu^{+2}, Pb^{+2}, Zn^{+2}, Mn^{+2}, Cd^{+2}, Ni^{+2}, Hg^{+2}, Cr^{+3}, Cr^{+6}, Fe^{+2}, Fe^{+3} etc. Some living organisms take and accumulate the metal ions into the cell. Removal of heavy metals by biosorption is the result of an interaction between the cell wall and metal ions. In this study, ceramic waste obtained from ceramic industry was used for the source of fungi. Isolations were carried out on PDA and identifications were carried out morphologically. Minimal inihibitory concentrations of mercury solution was obtained. FT-IR Spectra of mercury-loaded live and death Mucor sp. showed that different functional groups, aliphatic compounds (2990-2850 cm^{-1}), carboxylic acides (3100-2400 cm^{-1}), primary amides (1420-1400 cm^{-1}), organophosphoric compounds (1055-915 cm^{-1}), esthers (1750-1740 cm^{-1}) and vnyl componds (900-950 cm^{-1}), were responsible from the biosorbtion of mercury.

PS05.7 - STRUCTURAL COMPLEXITY AND ENVIRONMENTAL GRADIENTS AFFECT MEIOFAUNAL DISTRIBUTION AND DIVERSITY ASSOCIATED TO VERMETID REEFS

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Vermetid reefs are biogenic constructions housing large amount of biodiversity within the Mediterranean rocky intertidal zones and provide complex 3-D structures that are only comparable with tropical coralline reefs. These habitats are particularly vulnerable since they are threatened by both local and global factors. Reefs are composed by three morphological sectors (the inner-, the cuvette and the outer-edge) that along the gradient up-littoral - open sea differ on the basis of the tidal height and exposure to waves. Varying hydrodynamics possibly drive remarkable differences in structure and composition of these communities. In particular, the cuvette sector seems an ideal system to accommodate new avenues for predicting responses at scales that are relevant to biodiversity and for its management and conservation. Nevertheless, there are biotic components, as the meiofauna associated to Vermetids, not fully studied although they represent key elements of the intertidal Mediterranean biodiversity. Here, we present the first dataset on meiofauna collected from the soft fraction accumulated into the three sectors in western Sicily (Italy). As predicted, meiofaunal distribution depended on hydrodynamics although macroalgae cover was the proximate factor in driving differences in diversity. Cover, increasing the substrate complexity, significantly affected the structure of meiofaunal assemblages.

PS05.8 - SOIL-VEGETATION RELATIONSHIP IN THE WATERSHEDS OF THE TONGA AND OUBEIRA LAKES (NATIONAL PARK OF EL KALA, ALGERIA)

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The National Park of El-Kala is a set of landscapes whose bioclimatic stages of vegetation extend from sub-humid to humid. In order to know the soil occupation in this complex, we initiated an ecological soil cartography using a stratified sampling plan of vegetation. The inventory of vegetation carried out on different sites has allowed identifying several plant groups with the following distribution: The group of cork oak, occupies the biggest part of the area, it develops mainly on Incepttisols, Alfisols and Mollisols; Group of kermes oak, occupies a large area, it grows on Mollisols and Alfisols; Group of maritime pine, it occupies the same soils as the Kermes Oak; Group of Mirbeck oak, installed on Regosols, it is located in the Eastern part; Group of eucalyptus, it grows mainly on Inceptisols, Mollisols of, and Vertisols; Group of wetland, it grows along the banks of lakes and rivers, develops on Histosols soil Mollisols and Vertisols; The cultures, distributed mainly around the lakes occupy several soil types on Histosols, the Inceptisols, Mollisols of, and Vertisols. This great diversity of vegetation is linked not only to the soil variability but also to climate, hydrological and geological variability.

PS05.9 - PLANT AND ARTHROPOD COMMUNITIES IN *MYRIOPHYLLUM AQUATICUM* (VELL.) VERDC. INVADED AND UNINVADED WATERS IN A MEDITERRANEAN WETLAND (TUSCANY, CENTRAL ITALY)

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Biological invasions have been recognised as one of the most dramatic threats to biodiversity. Invasive Alien Species (IAS) can exert detrimental effects on the invaded ecosystem, generating both ecological and socioeconomic impacts. *Myriophyllum aquaticum* (Vell.) Verdc. is a well-known invasive species, native of South America, which is nowadays widespread in many countries. It was introduced in the alien range mostly as an ornamental plant in ponds and aquaria. In Tuscany, it has been recorded in the area of Lake Porta where it shows an invasive behaviour, spreading across the network of canals around the lake. The study focused on the comparison of macrophytes and arthropod communities between the canals with vegetation dominated by native plants and those with a strong invasion of *M. aquaticum*. The sampling units were transects of 5x2 metres placed along the stream banks of several canals around the lake Porta. The first results show differences mainly in plant species richness and in floristic composition between invaded and uninvaded transects. Further analyses are still in progress to evaluate possible changes in the arthropod communities on *M. aquaticum*-dominated stands.

PS05.10 - DO SEEDLING TRAITS REFLECT ADULT TRAITS IN VASCULAR PLANTS FROM THE HIMALAYAS

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The aim of this study is to identify whether seedling traits reflect traits of adult plant species from Ladakh (India). The main question of our study is how much of the variation in seedling plant traits can be atributed by evolutionary relatedness between species and how is the relationship between seedling and adult plant characteristics affected by evolutionary history. Seeds from 120 species were recollected in Ladakh Himalayas during August 2013. To obtain information about seedling parameters as root lenght, leaf area and biomass, species were grown under controlled conditions. Parameters from adults plants as plant height and ecological attributes were recollected during field expeditions from 2009 to 2014. Relationships between seedling traits and adult plant characteristics were evaluated with phylogenetic corrections and without. We expect to find a relationship between seedling and adult traits in the studied species meaning there could be a trade-off between competitive performance of seedlings and the ability of adult plants to grow in suitable conditions in vascular plant species of Ladakh.

FOREST ECOLOGY & DYNAMICS

PS06.1 - CHANGES IN SOIL CHEMISTRY AND SOIL MICROBIAL BIOMASS AFTER SHRUB ENCROACHMENT IN THE SPANISH PYRENEES

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In mountain areas across Europe, the abandonment of traditional pasture management has led to the encroachment of abandoned pastures by shrub communities, in what can be considered the first steps towards the recovery of forests. In this study we analyzed the changes in soil chemistry and soil microbial biomass along chronosequences of shrub encroachment in the Spanish Pyrenees. Soil collected under open pastures, young (less than 20 year-old) and old (more than 40 year-old) individuals of the main shrub encroaching species of the area (*Juniperus communis*, *Echinospartum horridum* and *Buxus sempervirens*), was analyzed for N, C, ammonium, nitrate, P, K, pH, electric conductivity (EC) and organic matter (OM) concentrations and for the %C and %N in the soil microbial biomass. Although most effects were species-specific, the encroachment by all three study species led to an increase in nitrate concentrations in the soil. Encroachment by the legume E. horridum further increased total soil N, C and OM, while decreased soil microbial biomass and the amount of N cycled through soil microbia. Our results indicate that the colonization of abandoned pastures by shrubs has profound effects on soil properties, leading to soil conditions more typical of forests than open pastures.

PS06.2 - INTERRELATIONS OF *PINUS SYLVESTRIS* L. AND *LOPHODERMIUM PINASTRI* SCHARD. POTENTIAL RANGES IN CENTRAL SIBERIA IN A WARMING CLIMATE

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The pine (*Pinus sylvestris* L.) forest that was monitored for the needle-cast damage caused by *Lophodermium pinastri* Chev. across Russia was found to be most damaged up to 1/3 in Siberia. To predict the pine and needle-cast potential ranges in Siberia in a warming climate, we developed bioclimatic envelope models from three climatic indices: growing degree-days above 5°C and an annual moisture index. Additionally, permafrost was explicitly included in the model as limiting the pine forest distribution. All simulations were run by coupling our bioclimatic models with climatic indices and the permafrost for the 1960-1990 and 2090 climates as simulated by the HadCM3 general circulation model for A2 and B1 emission scenarios. With these projected warmer and drier future climate, both the host-tree and pathogene would expand north-eastwards by 2090. The water stress tolerant *Pinus sylvestris* would 2-fold increase in a warmer climate. In the moderate B2 climate, the forests damaged by the needle-cast would be more extent relatively to the contemporary climate. In the extreme A2 climate, the pathogene could shift as far north as the Arctic circle. However, the pine distribution would be limited by permafrost, so that the pathegene shift northwards would be also limited.

PS06.3 - INFLUENCE OF PLANT LITTERS ON SOIL BACTERIAL AND FUNGAL GROWTH IN MEDITERRANEAN FORESTS

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The influence of soil characteristics, such as pH, water and organic carbon contents, on microbial activity is widely investigated, but the influence of different litters on the balance of bacterial and fungal growth in soil is scantly known. Nowadays, bacterial and fungal growth is easily estimated by the leucine and the acetate-in-ergosterol incorporation methods, respectively. These techniques were used to evaluate microbial growth on litters from turkey oak, beech and holm oak in two Mediterranean forest soils, with mainly beech and holm oak forest. Wheat straw and alfalfa litter, predicted to favour fungal and bacterial growth, respectively, were included as positive controls. Respiration was measured as an overall activity. Soils were incubated with litters under laboratory conditions and analyzed at time intervals. In both soils, highest bacterial and fungal growth were, as expected, found with alfalfa and straw additions, respectively. These treatments also had highest respiration. Comparing the other litter types, respiration and fungal growth were lowest in soils with beech litter, while bacterial growth did not differ between the three litter types. Soil type did not favour microbial growth or decomposition of the same litter as the dominant tree species.

PS06.4 - CONTRASTING ECOPHYSIOLOGICAL STRATEGIES RELATED TO DROUGHT: THE CASE OF A MIXED STAND OF PINUS SYLVESTRIS - QUERCUS SUBPYRENAICA

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Submediterranean forests are considered an ecotone between Mediterranean and Eurosiberian ecosystems. These transition zones are very sensitive to global change, so models on future climatic scenarios predict dramatic changes in their species composition. A decline of *Pinus sylvestris* and a related expansion of *Quercus* species have been reported in the Spanish Pre-Pyrenees. To elucidate the mechanisms underlying this decline, for one year we sampled seasonally twig xylem and soil for water isotopes composition (δ18O and δ2H), leaves for carbon isotope composition (δ13C) and stems to quantify non-structural carbohydrates (NCS) concentration in a mixed stand of *Pinus sylvestris – Quercus subpyrenaica*. In addition, we measured twig water potential, leaf gas exchange and sap flow. Isotopic and physiological data reflected a tighter stomatal control and an isohydric strategy for *P. sylvestris* compared to *Q. subpyrenaica*. However, despite the expected carbon limitation for isohydric species under severe drought, we did not find clear evidence of *P. sylvestris* carbon starvation based on NCS patterns. However, water potential values and the isotopic uncoupling between soil and xylem water point towards hydraulic failure as a more plausible cause for this species decline. Funding: Spanish project AGL2012-40039-C02-02, FPU fellowship for PMG (FPU12/00648).

PS06.5 - THERMAL IMAGING OF FOREST CANOPY TEMPERATURES: RELATIONSHIPS WITH BIOLOGICAL AND BIOPHYSICAL DRIVERS AND ECOSYSTEM FLUXES

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Temperature is a primary environmental control on plant processes at a range of spatial and temporal scales, affecting enzymatic reactions, ecosystem biogeochemistry, and species distributions. Although most focus is on air temperature, the radiative or skin temperature of plants is more relevant. Canopy skin temperature dynamics reflect biophysical, physiological, and anatomical characteristics and interactions with environmental drivers, and can be used to examine forest responses to stresses like droughts and heat waves. Until recently, direct measurements of plant canopy temperatures have been challenging due to sensor limitations. Thermal infrared (TIR) imaging allows for extensive temporal and spatial sampling of canopy temperatures compared to direct spot measurements using thermocouple sensors. We present results of TIR imaging of forest canopies at eddy covariance flux tower sites in the United States and Panama. These forests range from an old-growth temperate rainforest to a second growth semi-arid pine forest to a semi-deciduous tropical forest. Canopy temperature regimes at these sites are highly variable and display frequent departures from air temperature, particularly during clear sky conditions. Comparison of canopy temperatures to fluxes of carbon dioxide, water vapor, and energy reveals relationships not apparent using air temperature.

EVOLUTIONARY ECOLOGY

PS07.1 - FLOWER COLOUR POLYMORPHISM IN SILENE LITTOREA: THE WHITE-PETAL MORPH SHOWS ANTHOCYANIN AND OTHER FLAVONOIDS IN THE REST OF THE PLANT

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Flower colour is one of the main floral traits for pollinator's attraction, and is caused by accumulation of anthocyanins in most angiosperms. In the anthocyanin biosynthetic pathway, other flavonoids that protect against different biotic and abiotic stresses are synthesized. *Silene littorea* is an entomophilous annual plant with pink flowers, however white flowered individuals are found in some populations in a relatively high proportion. We measured the concentration of anthocyanin and non-anthocyanin flavonoids in petals, calyxes and leaves of white and pink-flowered plants in two polymorphic populations. The white and pink-flowered morphs showed similar concentrations of anthocyanins and non-anthocyanin flavonoids in all parts of the plants with the exception of the anthocyanin in the petals, which was very low. These results suggest that the white morph show the whole battery of flavonoids for stress protection. In fact, there were no differences in petal and leaf herbivory between the two flower colour morphs. Furthermore, the colour spectra of the petals were analysed to determine if pollinators perceive the different floral morphs. We found that pink and white petals plotted in different regions of the honeybee color hexagon with a high Euclidean distance suggesting that pollinators are able to distinguish between them.

PS07.2 - REPRODUCTIVE BARRIERS IN SYMPATRY: SELFING AS A WAY TO AVOID COMPETITION FOR POLLINATORS BETWEEN TWO MOTH-POLLINATED SPECIES

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Silene niceensis and *S. ramosissima* are taxonomically related species sharing habitat, with the same nocturnal pollinator syndrome and overlapping flowering phenology. Our aim is to demonstrate that a prior selfing strategy in *S. ramosissima* allows it to avoid pollinator competition with *S. niceensis*. The breeding system, petal colour, flower lifespan and degree of overlapping between male and female phases, floral visitor abundance and visitation rates, were analysed in two sympatric populations. Autonomous selfing treatment in *S. ramosissima* produced high fruit and seed sets, similar to the control and supplementary pollinated plants. *S. niceensis* showed significantly lower levels of autonomous selfing, and supplementary pollination increased seed set. . Contrary to S. niceensis, flower lifespan was much shorter in *S. ramosissima*, and male and female organs completely overlap in space and time. Upper surface petals of both species showed differing brightness, chroma and hue. Flowers of *S. niceensis* received many pollinator visits whereas those of *S. ramosissima* were almost never visited. Our findings show different breeding strategies between sympatric co-flowering *S. niceensis* and *S. ramosissima*, the former specialized in crepuscular-nocturnal pollination and the latter mainly based on autonomous selfing. These two strategies allow them to share the restricted dune habitat.

AGRICULTURAL ECOLOGY

PS08.1 - DUNG BEETLES COLEOPTERA: SCARABAEOIDEA DRIVE ECOSYSTEM FUNCTIONING IN ALPINE GRASSLANDS

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It is broadly recognized that dung beetles play a key role in ecosystem functioning, even though the physical, chemical and biological processes they affect and their degree of relatedness are still poorly known. We used a field mesocosm experiment to assess the cascade effects of dung beetles on dung removal, soil nitrogen (N) cycling (total and available forms of N), and plant community dynamics of an Alpine grassland. Dung beetles contributed to remove dung both over a short (one month) and long (one year) time period. Their presence influenced N availability mainly in the surface soil layer (0-5 cm), where nesting and feeding activities favoured organic matter mineralization and nitrification processes leading to an increase in nitrate concentrations compared to controls after one month. In turn, nitrate availability fostered herbage growth and increased the proportion of meso-eutrophic grass species after one year. The addition of a 15N enriched dung allowed to trace the fate of dung-derived N in the soil and aboveground plant tissues. The effects of dung beetles changed according to the functional group (tunnelers and dwellers) and the number of species (one or four) added to the mesocosm.

PS08.2 - GROUND-DWELLING BEETLES IN MAIZE AGROECOSYSTEMS OF NORTHERN ITALY: THEIR POTENTIAL AS BIODIVERSITY INDICATORS

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The potential of ground beetles (Coleoptera: Carabide) as bioindicators is widely recognized. These insects are commonly sampled using pitfall traps, which usually collect a wide array of other less studied beetles, including the diverse family Staphylinidae. The present research was aimed at assessing the potential of Carabidae, Staphylinidae and other ground dwelling beetle families as biodiversity indicators for the order Coleoptera in maize agroecosystems of Northern Italy. This information might have considerable practical importance for the monitoring of beetles in the studied area, where maize is an economically important and widespread crop. A total of 10 sites in the Bologna province were sampled with pitfall traps in 2013 and 2014, and the captured beetles were identified at the level of species or morphospecies. Activity density, taxonomic richness and some diversity indices were considered as indication parameters. In total, 7753 individuals belonging to 142 species and morphospecies were recorded. The most abundant families were Anthicidae, Carabidae and Staphylinidae, and the latter two families showed by far the highest species richness. The quantitative and qualitative relationships among beetle families and their implications for bioindication in maize agroecosystems are discussed.

PS08.3 - BIOLOGICAL SOIL QUALITY INDICATORS AND SUSTAINABLE VITICULTURE: A CASE STUDY IN THE VERDICCHIO TERROIR OF MATELICA ITALY

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The aim of our study was to assess the long-term effects of organically managed vineyards on soil quality by means of two bioindicators: ciliated protozoa and microarthropods. The study was realized in the terroir of Verdicchio di Matelica (Marche, Italy), on three vineyards that were organically managed since 1992, 1998 and 2009 respectively. In each vineyard, soil samples (0-10 cm depth) were taken every month from March to October 2011. Soil chemical-physical parameters were measured. For microarthropods, the measured biological parameters were: the Soil Biological Quality (QBS-ar) index, abundances of biological and euedaphic forms and diversity indices. Soil samples were collected in both disturbed (tillage) and not-disturbed (no-tillage) inter-rows. For ciliates: abundances and diversity indices were measured and soil samples were randomly collected in the whole sampling area. The results of the multivariate data analysis and diversity indices (H',J,d) indicate that the most stable habitat for ciliates and microarthropods is represented by the "older" (V92) followed by the V98 and the "younger" V09 vineyards. Collectively, the data seem to indicate that the long-term organic management of the soil contributes to global soil quality in vineyards at least in this particular pedoclimatic area and for the investigated bioindicators.

PS08.4 - LOCATING NITRATE VULNERABILITY IN MOUNTAIN CATCHMENTS

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Diffuse water pollution can arise from many sources. However, agriculture is a major contributor to water quality reduction. Especially aquifers with shallow water tables combined with permeable soils are very vulnerable to agricultural contamination. As mountain regions are very fragile ecoregions and sensitive to human activities, we developed a method for risk evaluation of nitrate contamination for South Tyrol, the northernmost province of Italy, located in the heart of the Alps. Due to the scarce availability of hydro-geological and pedological information, alternative parameters were considered: (1) risk factors (number and size of agricultural and zootechnical farms and their distance to water courses); and (2) control factors (local climate, mean slope of cultivated land). Spatial data was combined with non-spatial information in a GIS environment to create a potential risk map at catchment scale. In South Tyrol, higher risk to nitrate contamination can be found in areas characterized by agricultural activities on steep slopes. Water vulnerability assessments, capable of delineating vulnerability zones at the catchment scale, are important to stimulate prevention activities that can contribute to mitigate diffuse agricultural water pollution and provide multiple environmental and social benefits.

PS08.5 - STRUCTURE OF THE SOIL MICROBIAL COMMUNITY AND SOIL ENZYMATIC ACTIVITY AS INFLUENCED BY DECOMPOSING SPEARMINT LEAVES

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Aromatic plants can be used as soil amendments. To explore this potential, we incorporated dried leaves of Mentha spicata into the soil of a field, at 2% and 4% rates. Immediately after incorporation and 20, 40, and 60 days later, we examined structural features of the soil microbial community, the activity of soil enzymes that participate into the carbon, nitrogen and phosphorus nutrient cycles, and the concentration of these nutrients and compared them with those from samples of non-treated soil. Spearmint leaves increased soil respiration and soil organic carbon. It also increased the total microbial biomass, and that of fungi, Gram+ and Gram- bacteria; the Gram+/ Gram- ratio decreased with time. Actinomycetes biomass did not present a clear pattern. The structural changes were always most pronounced at the 4% rate. Acid phosphatase was not affected. The activities of urease, N-acetyl-glucosaminidase and b-glucosidase presented similar patterns of change: they were higher in the treated soil samples, but there was no difference between the two rates. Discriminant analysis separated samples into three groups. The treatment effect was more important than the time effect for this grouping, with the biomass increases of the Gram– bacteria and fungi being the major discriminant factors.

PS08.6 - DO VINEYARDS CONTRIBUTE TO CONSERVE PLANT SPECIES OF ARID GRASSLANDS?

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The increasing development of vineyards in Mediterranean areas is a major driver of conversion of arid grasslands that are targeted for biodiversity conservation by the EU according to Natura 2000 policies. It is therefore crucial to evaluate the potential of vineyards to providing surrogate habitat for the conservation of plant communities of arid grasslands. This study was carried out in the region of Conegliano-Valdobbiadene DOCG where 40 vineyards on steep slopes and 20 remnants of arid grasslands were selected for plant survey. We evaluated whether the frequency of herbicide treatement, the extension of semi-natural habitats in the landscape, and their interaction would affect plant species richness. We also tested floristic and functional differences among vineyards and arid grasslands. In spite of the beneficial effect of semi-natural habitats in the landscape to plant richness of steep slope vineyards, our results indicate that cultivated areas weakly contribute to the conservation of the arid grasslands species. Local management impacts plant diversity, also interacting with landscape composition. In particular, the use of herbicides is detrimental for plant diversity in our vineyards and seems to offset the positive effect of semi-natural habitats in the surrounding landscapeAgricultural Ecology.

PS08.7 - THE ROLE OF FARMING PRACTICES IN SHAPING COMMUNITIES OF EARTHWORMS IN ORGANIC RAINFED ARABLE FIELDS

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Earthworms represent most of the animal biomass in arable soils, and are commonly termed 'ecosystem engineers' because of their important role in improving soil structure and fertility. It is well known that soil tillage with soil inversion affects dramatically earthworm populations in agricultural soils and, in turn, their structure and fertility. Thus, conservation agriculture techniques such as reduced tillage precluding soil inversion have been strongly encouraged. The objective of this study was to analyse the effect of tillage (mouldboard ploughing vs. non-inversion tillage by chiselling), fertilization with composted farmyard manure and green manure on earthworm abundance in a long term experiment consisting of a four-year rotation of cereals and legumes under Mediterranean climate. After three years of continued application of the three experimental treatments, earthworm abundance and biomass and soil bulk density were assessed. Results showed that earthworm population is enhanced by fertilization with composted farmyard manure. Adult earthworms were more abundant and accumulated more biomass in plots with farmyard manure fertilization and chiselling than plots with soil inversion tillage. However, the effects of fertilization are more important than the effects of tillage.

PS08.8 - INNATE AND LEARNT PREFERENCES OF AN ANTHOCORID PREDATOR TOWARDS MAIZE DAMAGED PLANTS BY HERBIVORES WITH DIFFERENT FEEDING STRATEGIES

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In Mediterranean conditions, the leafhopper *Zyginidia scutellaris* colonizes maize stands early in the season being the first herbivore to establish in significant numbers to the aerial part of the plant. This early colonization is a key feature for attracting and establishing generalist predators as Orius spp. on maize crops. To establish the specificity of this recruitment we study (1) the innate preferences of Orius majusculus females towards maize damaged by three maize herbivores with different feeding strategies, *Z. scutellaris* (mesophyll feeder, Zs), *Spodoptera littoralis* (chewer, Sl) and *Dalbulus maidis* (phloem feeder, Dm); (2) the potential preference change in the case of previous prey experience; and (3) the volatile profiles emitted by the damaged plants (HIPVs). Our results show that predators show an innate preference towards Zs and Sl damaged plants, and that previous prey experience influences odor choice. Learning changes the frequency of Dm treatment choice by predators, but not of the other treatments. Choice of Dm is increased by two-thirds in Dm experienced individuals showing a preference, and the same is observed for Sl experienced predators showing a rejection towards Sl odors. We discuss these results based on volatile profile comparison and a predation assay.

PS08.9 - POSSIBLE EFFECTS OF PHENOLOGICAL MISMATCH BETWEEN FLOWERS AND POLLINATORS IN APPLE ORCHARDS

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Organisms may shift their phenology in response to climate change. Asynchronous phenological shifts among closely interacting species can lead to a phenological mismatch that inhibits the interaction and consequently may result in a dramatic decline in ecosystem functions. We aimed to reveal how a shift in flowering time can affect the diversity of pollinators on apple trees and the efficiency of pollination. Flowering time of young apple trees in tubs was experimentally manipulated by keeping them in either a greenhouse (earlier flowering) or a cooling house (delayed flowering) during early spring. We had five treatments altogether (2 greenhouse, 2 cooling treatments and one control). Trees were placed into apple orchards one week before flowering. Number of flowers and pollinators were sampled on each tree twice during flowering. Number of flowers was significantly higher on untreated control trees than on all other treatments. Flower number had a significant positive effect on honey bee abundance and presence of solitary wild bees. Honey bee abundance increased during the season, while presence of wild bees was highest on early flowering trees and decreased during the season. Results on pollination success were inconclusive.

PS08.10 - AN INTEGRATED APPROACH TO ACHIEVE ENVIRONMENTALLY SUSTAINABLE CONTROL OF THE NEW EMERGING PEST *DROSOPHILA SUZUKII* IN CHERRY ORCHARDS OF EMILIAROMAGNA

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An integrated approach is presented in this study for achieving environmentally sustainable control of Spotted Wing Drosophila (SWD), *Drosophila suzukii*, in cherry orchards of the Emilia-Romagna region. Analysis was conducted on the response of SWD based on a variety of control strategies and techniques in laboratory and field conditions. The mechanical control considered the use of net covers to avoid pest infestation. Field monitoring was performed to investigate SWD flight patterns and infestations. The biological control of the pest considered the use of native natural enemies (predators and parasitoids). Entomo-pathogenic microorganisms were also investigated in the context of microbiological control. The aim is to enhance SWD self-infection using a 'catch and release' traps, which attract the adults by means of appropriate chemical and physical stimuli, exposing them to entomo-pathogenic microorganisms. Finally, toxicological (LC50 and LC90) and enzymatic bioassays were performed using different insecticides on different populations to assess SWD resistance. The results of the study will be useful for a better control of this invasive insect following integrated pest management and protecting native beneficial insects.

PS08.11 - LONG AND SHORT-TERM EFFECTS OF OLIVE POMACE AMENDMENT ON SOIL QUALITY

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Italy contributes about for 20% to the European olive oil production, generating more than 2000 t of wastes yearly. The problems related to the disposal of these by-products are increasing and to analyze the environmental effects of their agricultural use can be fundamental to face the waste removal problem and to preserve soil quality. In this study we carried out a laboratory trial to compare, in controlled condition of temperature and moisture, the long- (8 years) and short-term (3 months) effects of amendment (50 t/ha) with composted and non-composted olive pomace on soil, testing also the combined effect of the mineral fertilization (i.e. urea, 100 kg/ha). To better highlight changes in soil quality, we analyzed a minimum data set of chemical (pH, electrical conductivity, total and mineral N, organic C), biochemical (β-glucosidase, acid-phosphatase and urease activities) and biological (microbial C, fungal mycelium biomass, potential respiration) soil properties and, on the basis of the tested enzyme activities, we calculated the AI3 quality index, able to discriminate altered and non-altered soils under a wide range of conditions (Puglisi et al., 2006). Preliminary results showed a general increase in soil quality due to olive pomace amendment, with more remarkable effects in the long-term.

PS08.12 - CONTRIBUTION TO THE STUDY OF THE INFLUENCE OF CULTURAL PRACTICES ON STRUCTURAL STABILITY AND ORGANIC SOIL POTENTIAL OF THE PLAIN OF ANNABA ALGERIA

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Aggregate stability has been proposed as an indicator of soil quality due to its importance in the physical degradation and its sensitivity to organic matter content. The aim of our contribution is showing the influence of cultural practices on physico-chemical properties of soils in the region of Annaba "The northeast Of Algeria» The comparative study is made between station which has been undergone to traditional work floor which comprises in plowing and usual cultural practices and soil protection against cultural practices for at least five years. The results show that in soils subject to plowing, or burying the organic material is more important, the reaction is slightly acid but the structure is less stable. On the other side in soil which has not been plowed the content of organic matter is higher in the surface than in depth and that the structural stability remains higher in surface than in depth. The results of our study showed that farming practices cause changes in the structure and concentration of organic matter in the soil.

KEY WORDS: cultural practices, structural stability, organic potential physical degradation.

PS08.13 - CHEMICAL AND ORGANOLEPTIC CHARACTERISTICS OF TOMATO PUREE ENRICHED WITH LYOPHILIZED TOMATO POMACE

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The Tomato is the second most important vegetable crop next to the potato. Total world production in 2011 was about 160 million tonnes. The production includes both tomatoes consumed as fresh and industrially processed tomato products. The global consumption of tomato products increased from 28 to 40 million tonnes from 1999 to 2009. Epidemiological studies have proved that tomato consumption is associated with the lower risk of developing several diseases (certain types of cancers, cardiovascular diseases, macular degeneration, age-related eye disease…). Many of micronutrients and bioactive compounds are mainly present in peel and seeds and are lost during the processing into sauce, puree, paste and juice.In this paper we reported the chemical and physico-chemical characterization of a puree enriched with 2% of dry pomace. The comparison of the analytical data of starting puree with the enriched puree showed a significant increase of all micronutrients, without the taste and appearance are compromised or altered negatively. The product obtained is an example of a functional food rich in health promoting phytochemicals, with the significant aspect of recovering a waste fraction of the tomato processing that must be disposed of in a landfill with an increase in costs and environmental impact.

PS08.14 - DIFFERENTIATED METAL ACCUMULATION IN *HELIANTHUS ANNUUS* L AND *SORGHUM BICOLOR* L GROWN IN THE FIELD UNDER MEDITERRANEAN CLIMATE CONDITION

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The intensive agricultural practices cause substantial losses of nutrients required by plants. Therefore, it needs to add chemical fertilizers, which, often, increasing soil heavy metal (HM) content, cause deterioration of crop quality and later negative effects on human health. Each plant species typically accumulates metals in different biomass portions. The aim of this study was to evaluate HM translocation and accumulation capabilities in two different crop species used in animal and human dietary: sunflower (*Helianthus annuus* L.) and sorghum (*Sorghum bicolor* L.). The study was carried out in summer 2014 in an agricultural site near Naples. The concentrations of Cd, Cr, Cu, Ni, Pb were measured by atomic absorption spectrometry in the soil and in roots, stems, leaves and seeds of the two investigated species. The bioaccumulation and translocation factors were also calculated. On the basis of these factors, sunflower accumulated Cr and Pb in the root, Cd in the above-ground biomass, and no differentiated accumulation of Cu and Ni was observed; sorghum accumulated in the root all the detected metals with the exception of Cu that showed similar concentrations in root and above-ground biomass. Sorghum better compartmentalized metals in the root, likely, reducing their transfer to humans.

PS08.15 - RELATIONSHIPS AMONG SOIL PROPERTIES FUNCTIONAL LEAF TRAITS FRUITS AND OIL QUALITY IN DIFFERENT CULTIVARS OF OLEA EUROPAEA L

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Extra virgin olive oil (EVOO) is a typical product of the Mediterranean region. The composition of EVOO may be influenced by different factors: cultivar, climatic and edaphic conditions, time of harvesting, stage of maturity, integrity of the fruit, and the oil production technology. Each cultivar is generally associated to specific physical, chemical and biological soil properties as well as to functional leaf characteristics. The aim of this work was to investigate the relationship among soil properties, plant characteristics and oil quality of different Italian Olea europaea *L. cultivars* (*Pisciottana, Ravece, Ortice, Frantoio* and *Moraiolo*) and to assess if any differences may be related to the specific cultivars or to environment. *Pisciottana, Ortice, Frantoio e Moraiolo* cultivar showed the highest values of microbial respiration, total fungal biomass and C/N ratio of the soils. RDA analysis exhibited a close and positive relationship among soil characteristics, leaf photochemistry, fruit moisture content and carotenoids and chlorophyll content in relative extra-virgin olive oil. In this study soils qualitative characteristics were very important because of they affect the good productivity of the plant, in particular the antioxidant activity, which follows the same trend of the total polyphenols content of the fruits and oils which can extend the relative shelf-life.

IMPACTS OF AGRICULTURAL INTENSIFICATION ON BIRDS COMMUNITIES: NEW INSIGHTS FROM A MULTI-LEVEL AND MULTI-FACET APPROACH

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The investigation of agriculture-biodiversity interface relationships commonly suffers from scale-dependence, information redundancy and non-linearity, often leading to disparate results. Here, we propose a multi-scale and multi-facet approach to clarify the impacts of four independent gradients of agricultural intensification on bird biodiversity: landscape opening, and homogenisation, chemical intensification, and tillage vs. herbicide. We tested whether and how these gradients interacted with each other at field, farm and regional levels in shaping taxonomic diversity, and ecological responses of communities and proposed explicit links between these two facets of biodiversity. Landscape homogenisation and opening were negatively linked to both alpha and turnover diversities, within and between farms. Communities' size and composition were modified with ecological consequences: heterogeneous landscapes promoted a more generalist but also trophic-complex biodiversity, while homogenised landscapes enabled the existence of farmland specialist communities. However, communities negatively responded to chemical and mechanical practices. This is especially true at the farm level, and importantly obscured by interaction effects between landscape and practices. Our results highlight the farm level as a relevant unit for agricultural policies. We emphasize the necessity to conserve heterogeneous landscapes to promote taxonomic diversity. However, simplified landscapes also favour specialised farmland biodiversity, providing that practices remain extensive.

ECOLOGICAL MODELLING & BODY SIZES ALLOMETRIES AND PATTERNS

PS09.1 - SCALING WHOLE TREE WATER USE IN YOUNG INDIVIDUALS OF JAPANESE CEDAR IN RELATION TO ABOVE- AND BELOWGROUND RESPIRATION SIZE AND GROWTH RATE

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Here we present first results of a study focused on the scaling patterns and bidirectional interactions between whole plant respiration and transpiration. The experiment was performed on 25 seedlings (7-10 years old) of Japanese cedar (Cryptomeria japonica D. Don). with whole-tree fresh weight ranging from 0.2 to 8.0 kg. Whole-tree water use and sapflow velocity was determined by Deuterium dilution method (Meinzer et al. 2006 Plant, Cell Environ. 29:105). After labelling, trees were uprooted and respiration rates of stem, roots PS16.5 PS16.5 and photosynthetic tissues were measured using custom-made incubation chambers and Vaisala CO2 sensors (Mori et al. 2010 PNAS 107:1447). For each individual mass, water content, tree dimensions and growth rate were also determined. Tree mass was proportional to growth rate, but not to age. Total water use was better correlated with recent growth rate and stem respiration than with tree mass, whereas sapflow velocity was linked to tree size and leaves and root respiration. Our results confirm that the scaling of water use does not only reflect aboveground size traits (e.g. leaf area, basal area, tree height), but is also linked to belowground processes and growth patterns. Funding: JPF was supported by JSPS invitation fellowship (L14560).

PS09.2 - CROSS- COMMUNITY SCALING OF MACROINVERTEBRATE GUILDS: DECODING DEVIATION FROM METABOLIC EXPECTATION INTO POTENTIAL MECHANISM

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Body size is a fundamental property of organisms related to many individual traits with cascading influences on population and community abundance and energy use. These latter have been described as size-distribution relationships at population and species levels (local or global size density relationships, LSDR and GSDR respectively) or at guild and community levels (cross community scaling relationships, CCSR), with -3/4 expected scaling exponents. Real guilds/communities commonly show much higher scaling exponents in aquatic ecosystems, particularly when dealing with benthic macroinvertebrates, suggesting a hierarchical dominance of large species. Here, we present an experimental test of the mechanisms underlying the observed deviation of CCSR exponent from the expected -3/4 scaling exponent in macroinvertebrate guilds. Particularly we test two main hypothesis: (i) if observed deviation is related to body size positive dependency on energy flow within aquatic ecosystems; and, (ii) if observed deviation is determined by body size dependency of resource exploitation efficiency. These hypotheses were tested on benthic macroinvertebrate guilds of fifteen lagoon ecosystems in the Mediterranean and Black Sea. We used secondary production data as proxy of energy flow and hierarchical energy partitioning to address resource exploitation efficiency of macroinvertebrate guilds. The results are going to be presented.

PS09.3 - COUNTRY-BASED MODELS FOR PREDICTING TROPICAL DEFORESTATION IN THE 21ST CENTURY

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Forests host high levels of biodiversity and provide a great variety of ecosystem services. Despite their importance, forests face high rates of loss, especially in the tropics. In order to understand the causes of deforestation in tropical environments, we developed country-scale models of forest change. We measured forest change rates using maps derived from satellite-borne imagery between 2000-2012. For each country we employed multiple linear regressions and identified the best model able to predict forest change. We predicted changes in forest cover using a set of intrinsic and extrinsic predictors, representing both forest structure and external drivers (i.e. anthropic pressure, topography, etc). In order to evaluate the reliability of models' results and to establish their suitability for future predictions, we trained models on one period of simulated "present" (2005-2008) and used them to predict a simulated "future" (2009-2012).We found that human pressure and climatic variables were always present in the most supported models. When comparing "future" predictions vs observations, we found reasonably good prediction accuracy in Indonesia and Brazil, but not in Democratic Republic of Congo. All models tended to underestimate deforestation rates, but their performance improved when adding variables interaction terms and when accounting for spatial autocorrelation.

PS09.4 - SOIL FACTORS IMPROVE PREDICTIONS OF PLANT SPECIES DISTRIBUTION IN MOUNTAIN ENVIRONMENT

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It has been confirmed that climate and its associated variables are primary factors for plant species distributions models (SDMs). However, the importance of soil for plants is well known as it constitutes the belowground environment from which plants capture water and nutrients. In this study, we tested the effects of adding very high resolution (VHR) soil factors and topo-climatic predictors in model plant SDMs in the Swiss Alps. We used logger measurements to build temperature map and field soil samples to model the spatial variation of soil δ13C and pH. We found that the addition of VHR soil factors increase by 3.5% the AUC and also it improve the poorest models by 22%. The higher model performance increase due to the addition of soil factors was shown for high elevation species. When soil pH and δ13C where included in the models, they became respectively the second and the fourth most important predictor for plant species distribution. This study highlighted that important abiotic information is still missing in SDMs to capture all drivers of plant species distributions. We therefore suggest that, in future studies, soil information at high resolution should be considered when building plant SDMs.

PS09.5 - ASSESSMENT OF SANDY BEACH MACROFAUNAL PATTERNS ALONG A LARGE-SCALE ENVIRONMENTAL GRADIENT: A FUZZY NAÏVE BAYES APPROACH

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The assessment and forecast of faunal distribution patterns are often affected by high uncertainty, which results from two principal components: the uncertainty of state due to error, variability and vagueness of measures and the relational uncertainty linked to complexity of the ecological dynamics. In this study, we applied a fuzzy naïve Bayes classifier (FNB), to assess large-scale macrofaunal distribution patterns in Uruguayan sandy beaches affected by the simultaneous effects of morphodynamic and estuarine gradients generated by Rio de la Plata. The dataset included observations of biotic and abiotic descriptors in fifteen beaches, six of which were used to estimate FNB parameters, while abiotic data of remaining nine were used to forecast macrofaunal distribution patterns (target variables: abundance, species richness and diversity). FNB simulation results mainly followed the observed trends along estuarine and morphodynamic gradients, thus reproducing well large-scale patterns in the target variables. We highlight how different effects at a local scale could easily lead to increased stochasticity in the assessment of ecological processes at large scales. This approach seems relevant given the current challenge to develop predictive methodologies to assess the simultaneous and nonlinear effects of anthropogenic and natural impacts in coastal ecosystems.

PS09.6 - CLIMATE DATA AND ECOLOGICAL RESEARCH: A METHOD TO DOWNSCALE ENVIRONMENTAL BIG DATA INTO ECOLOGICALLY RELEVANT INFORMATION

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Global climate change will modify the distribution of organisms with large implications for biodiversity management. Recently, thanks to the large technological improvement of remote sensing devices, large climate datasets flourished and became available for macro-ecological and bio-geographical research. Translating such a big datasets of climate data to relevant information for ecological purposes is complicated by long procedures and complex computational framework. Most common procedures involve a number of different steps and software tools which are not easily manageable by most ecologists. Here, we propose a new framework to process environmental big data through Climate Data Operator (CDO) software (Max-Planck Institut für Meterologie) to handle and manage Network Common Data Form (NetCDF) files and for making such information in a suitable format for a Geographical Information System (GIS). To show the complex series of steps, we present a case study to translate large datasets of satellite temperature to group locations of European Atlantic Ocean and Mediterranean Sea on the base of the occurrence of extreme thermal seawater events in the last years. Such example will provide a common basis to identify critical areas in future planning of marine spatial activities and for tailoring appropriated conservation strategies.

POPULATION & COMMUNITY ECOLOGY, FOOD WEBS NETWORKS AND COMPLEXITY

PS10.1 - THE SEASONAL CHANGE IN ANTARCTIC SEA-ICE COVER INFLUENCES THE STRUCTURE OF INVERTEBRATE FOOD WEB AT TERRA NOVA BAY (ROSS SEA)

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Seasonal dynamics of Antarctic sea ice affects primary production patterns, impacting benthic communities fuelled by sympagic algae. We addressed the trophic organisation of benthic communities at Terra Nova Bay (Ross Sea), by means of stable isotope analysis on macroinvertebrates sampled in five locations differing in sea-ice cover dynamics during the Antarctic spring. We hypothesised an increased contribution of sea-ice algae to benthic food webs after sea-ice break-up and a predominance of detritus consumption and intraguild predation in ice-covered locations due to conditions of resource shortage. According to optimal foraging theories, trophic niche broadened at the community level and narrowed at the population one in ice-free conditions, as a consequence of increased quality range of resources. Sympagic algae fuelled benthic communities in those locations where sea-ice break-up occurred earlier in spring. Inversely, both intraguild predation and niche overlap between populations increased in locations exposed to prolonged ice-cover, resulting in longer food chains fuelled by detritus and benthic production. These results suggest that studying the effect of changes in resource availability in benthic habitats could be a key for understanding trophic-functional responses and food web reorganisation and stability in the face of future climate change-related variations in sea-ice cover in Antarctica.

PS10.2 - *LIZA RAMADA* (RISSO 1826): HOW MANY KINDS OF DIET? TROPHIC NICHES OF MULLET FISH IN DIFFERENT ENVIRONMENTAL CONTEXTS USING STABLE ISOTOPE APPROACH

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Mullet fish is the most common fish species in transitional ecosystems of tropical and temperate zones around the world. It is an important low-cost protein source for a large number of human populations. The trophic ecology of this species is one of the factor determining its success in these systems because of its trophic plasticity that allows its foraging on either green and brown chains. Aim of this study was test the hypothesis of dependence between trophic position in the web and availability of resources. The approach was to investigate the plasticity of mullet by stable isotope analysis of fish and of potential resources. At least 130 samples of *L. ramada* were collected from 5 different ecosystems, characterized principally by different salinity and other physical-chemical factors. Sample of white-soft dorsal muscle were collected from each specimen. Also all potential resources were collected from the five different environments. All sample were analyzed to obtain d15N and d13C isotopic signatures. Standardized data were elaborated using R-software and SIAR-package. Bayesian mixing-models were performed for each environment. *L. ramada* showed a great trophic plasticity, shifting on various resources available in different environments and occupying trophic levels higher than expected from classical stomach content data.

PS10.3 - INTRASPECIFIC TRAIT CHANGES PROMOTE SPECIES COEXISTENCE

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Species can exhibit a considerable amount of intraspecific variation in traits arising from genetic variation and/or phenotypic plasticity enabling them to adjust their phenotypes to ambient conditions. Recent model studies accounting for intraspecific trait variation revealed effects on the stability and the phase relationship of predator-prey dynamics but ignored potential effects on species coexistence. We developed a mathematical framework to examine the potential effects of intraspecific trait changes on species coexistence in a multi-species model with functionally different prey and predator species. Prey species differed in their maximum growth rate and vulnerablilty to predation, and predator species in their half saturation constant and selectivity for prey items. We examined the influence of the range and speed of intraspecific trait changes for coexistence. We show that moderate intraspecific trait changes occurring in ecological time strongly promote species coexistence by increasing stabilizing and/or equalizing forces. In contrast, very small and very large intraspecific trait changes do not enhance species coexistence due to large fitness inequality or a lack of adequate niche-differentiation. Hence, we find an optimum in the amount of intraspecific trait changes promoting stable coexistence.

PS10.4 - CAN WE USE NICHE MODELS OF INDICATOR SPECIES TO PREDICT THE DISTRIBUTION OF ENDANGERED COMMUNITIES?

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European-wide conservation policies are based on the identification of priority habitats. However, research on conservation biogeography often relies on the results and projections of species distribution models to assess species' vulnerability to global change. We assess whether the distribution and structure of threatened communities can be predicted by the suitability of the environmental conditions for their indicator species. We present some preliminary results elucidating if using species distribution models of indicator species at a regional scale is a valid approach to predict these endangered communities. Dune plant assemblages, affected by severe conditions, are excellent models for studying possible interactions among their integrating species and the environment. We use data from an extensive survey of xerophytic inland sand dune scrub communities from Portugal, one of the most threatened habitat types of Europe. We identify indicator shrub species of different types of communities, model their geographical response to the environment, and evaluate whether the output of these niche models are able to predict the distribution of each type of community in a different region.

PS10.5 - THE REPRODUCTIVE CYCLE OF THE THERMOPHILOUS ECHINOID *ARBACIA LIXULA* (LINNEO, 1815)

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In the Mediterranean sea, the thermophilous black sea urchin *Arbacia lixula* is the only exponent of *Arbacia* genus, a pan-tropical group of species marked by high phenotypic plasticity. According to the few studies available it seems this species has a multi-spawning period. We studied the reproductive cycle of *A. lixula* in a subtidal population from Ustica Island MPA (southern Tyrrhenian Sea) over two years (2007-2008) using both gonadosomatic index (GSI) and gonad histology. Samples of *A. lixula* were collected monthly by scuba-diving from two sites apart in the no-take zone A. For each site, 5 mature sea urchins >35mm) were utilized for GSI analysis, and 5 females and males were employed for histological analysis. A 3-way ANOVA analysis was performed, with Month as fixed factor and Site and Year as random factors. Month showed a significant difference in the GSI with highest values from May 2008 to September 2008. None difference was marked in Year and in any interaction between factors. From the examination of histological sections of *A. lixula* gonads, we have shown that gametogenesis of *A. lixula* starts in late fall, after the last spawning peak, to be complete in late winter/early spring.

PS10.6 - SETTLEMENT AND POST-SETTLEMENT DETERMINANTS OF *PARACENTROTUS LIVIDUS* SEA URCHIN RECRUITMENT

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Sea urchins may deeply shape the structure of macrophyte-dominated communities, requiring the implementation of sustainable management strategies. In the Mediterranean, the identification of the major recruitment determinants of the keystone sea urchin species *Paracentrotus lividus* is necessary, so that source areas of the populations can be identified and exploitation or programmed harvesting spatially managed. In this study a collection of nine possible determinants, these encompassing both the biotic (larvae, adult sea urchins, fish, encrusting coralline algae, habitat type and spatial arrangement of habitats) and abiotic (substrate complexity, nutritional status and depth) realms, was considered at different spatial scales. Data from a survey including sites subject to different levels of human influence (i.e. from urbanized to protected areas) were fitted by means of a generalized linear mixed model. Despite the extensive sampling efforts of benthic quadrats, an overall paucity of recruits was found, recruits being aggregated in a very small number of quadrats and in few areas. The analysis of data detected high adult sea urchin abundance, predatory fish ratio, habitat spatial arrangement heterogeneity, encrusting coralline algae cover and nutritional status as the significant determinants of *P. lividus* recruitment. Possible mechanisms of influence are discussed beyond the implications of conservation management.

PS10.7 - ECOLOGICAL DOMINANCE BY TALL PERENNIAL HERB (*SAMBUCUS EBULUS* L.) IN PRODUCTIVE HABITATS

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Vegetation patches dominated by a rhizomatous perennial herb *Sambucus ebulus* L. were studied in three sites in SW Slovakia, Central Europe, located in an agricultural landscape. The dominance of the species was analysed and evaluated quantitatively, using several indices based on species abundance data (cover, biomass, density) and vertical stratification of the stands. Tall (>1.5 m), close (100% cover) and dense discrete patchy stands of the plant community exhibit low species richness, alfa diversity and equitability but high dominance of the dwarf elder by cover and biomass. The dominant species forms dense leaf canopy at top layers of the stands excluding other species by shading lower layers. Thin layer of litter and standing dead protect the habitat during the late Autumn, Winter and early Spring. Synchronized rapid growth of *S. ebulus* above-ground shoots (ramets), starting in end of March or in beginning of April, and formed close canopy in May, support the dominant role of the species in the community. Dominant index calculated for the species was high. The upper/main canopy species exhibits community ediphicator features: high leaf canopy > 1.5 m), litter accumulation. It can be classified by type of dominance as „a competitive dominant“.

MACROECOLOGY & SCALING

PS11.1 - SEASONAL TRENDS AND SPATIAL PATTERN OF BRYOPHYTES IN MEDITERRANEAN TEMPORARY PONDS

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Despite the important ecological functions of bryophytes in the Mediterranean temporary ponds, they often are neglected or undervalued. Mediterranean temporary ponds present a small-scale zonation arranged in inner, central, and outer belt. Bryophytes are distributed in the belts according to their tolerance floods: we observed a gradient from the outer belt (O), mainly composed by colonist and perennial such as Pottiaceae and Brachytheciaceae, to the inner one (I) with annual shuttle such as Ricciaceae. We found significant species associated with belts, such as *Tortella squarrosa* in the outer belt, *Fossombronia caespitiformis* in the central belt and *Riccia canaliculata* in the inner belt. The distribution analysis of bryophytes in the belts within the ponds allows us to suggest the bryophytes as useful bioindicators of the state of conservation of Mediterranean temporary ponds, since the presence of indicator species in the different belts enables us to monitor over time the changes in the flood level. Those information are useful to build up a scientifically sound knowledge useful for future effective conservation actions. Results contribute to the use of bryophytes as bioindicators in Mediterranean temporary wetland ecosystem and provide a helpful benchmark to plan effective conservation actions in those fragile environments.

BIOGEOGRAPHY AND LANDSCAPE ECOLOGY

PS12.1 - ANALYSIS OF SPATIAL DISTRIBUTION DRIVERS AFFECTING ENDEMIC PLANTS FROM MEDITERRANEAN ISLANDS

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Endemic plants are of particular interest for a variety of reasons among which inherent geographic restriction, usually threatened or endangered conservation status, and important ecological role such as specialist pollinators or dispersers. To date, most authors have focused on the drivers of speciation rather than the drivers of distribution of Mediterranean insular endemics. This study, in turn, aimed to shed further light on the factors that play a significant role in the spatial distribution of Mediterranean endemic plants. In particular, a multiple linear regression was used to identify which ecological drivers influence the range size of endemic plants from Sicily and its satellite islands, including the Maltese archipelago. The statistical model included 27 environmental predictors, and found 57.6% of variation in the outcome variable (range size). Overall, a complex picture emerged from the analysis of endemic distribution patterns. This study showed not only how important species ecological spectrum and local geomorphology are to predict range size, but also species distribution may be the result of a long and complex climatic and geological history.

PS12.2 - ANALYZING THE EFFECTS OF LOCAL PEOPLE ON LANDSCAPE CHANGE AND TRANSFORMATION IN AHIR MOUNTAIN, TURKEY

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Mountainous areas are complex ecosystems depending on their geomorphology, soil, climate, and forest features. Mountainous areas also exhibit different socio-economic structure in terms of human life and environmental activities. These areas have been defined by Agenda 21 as areas with risk of high degradation that are subject to significant environmental pressures, most of which are of anthropogenic origin. The aim of this research was to analyze the effects of local people on landscape change and transformation in Ahir Mountain, Turkey. Face-to-face questionnaire survey was realized in villages and summer houses. The use of land, forest and other natural resources from past to present were analyzed. The main results displayed that local people plays important role in landscape and landscape function changes, and consequently, landscape planning studies should be realized considering the needs and habits of local people, especially from the viewpoint of nature conservation applications. The authors gratefully acknowledge the scientific research grant (TOVAG-COST 113O212) of The Scientific and Technological Research Council of Turkey (TÜBİTAK).

PS12.3 - LANDSCAPE CHARACTERIZATION AND URBAN CONTEXT OF URBAN PARKS IN MONTPELLIER CITY, FRANCE

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The urban sprawl is a threat for biodiversity because of the conversion of green areas into mineral ones. This urbanisation leads the fragmentationof green areas, like urban parks (UP), byreducing theirconnectivity and eventually their size. Understanding how the UP may be benefit to biodiversity conservation is achallenge because the UP design is mainly produced to provide well-being services. The aims of this study is to define a typologyofUP in Montpellier city through a species centred definition of landscape. To do sothe landscape pattern (composition and composition) and the urban context (park boundaries, urban rate and NDVI) of UP were analyzed by multivariate analysis and trend surface analysis to deal with the spatial distribution of the UP and analyse the influence of the spatial autocorrelation on the UP classification. Indeed, this spatial approach allows us to get out the intrinsic spatial variation of landscape UP data forward a partial redundancy analysis in order to see if the classification still holds. We will discuss how this UP classification could be useful for landscaping in an optic of species conservation in urban environments.

PS12.4 - TRACING THE EVOLUTIONARY HISTORY OF THE EUROPEAN MOLE BY COUPLING MTDNA PHYLOGEOGRAPHY AND SPECIES DISTRIBUTION MODELLING

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Our understanding of the effect of Pleistocene climatic changes on the biodiversity of European mammals mostly comes from phylogeographical studies of non-subterranean mammals, whereas the influence of glaciation cycles on the distribution and evolution of subterranean mammals has received little attention. The lack of data raises the question of how and to what extent the current amount and distribution of genetic variation in subterranean mammals is the result of Pleistocene range contractions/expansions. The common mole (*Talpa europaea*) is a strictly subterranean mammal, widespread across Europe, and represents one of the best candidates for studying the influence of Quaternary climatic oscillation on subterranean mammals. By using cytochrome b sequences we found evidences three differentiated mitochondrial DNA lineages: two restricted to Spain and Italy and a third that was widespread across Europe. Genetic data combined with species distribution models support the presence of at least three putative glacial refugia in southern Europe (France, Balkan Peninsula and Black Sea) during the last glacial maximum that likely contributed to post-glacial recolonization of Europe. By contrast, the Italian lineage remained trapped in the Italian peninsula and, according to the pattern observed in other subterranean mammals, did not contribute to the recolonization of northern latitudes.

PS12.5 - FOLLOW THE BEETLE: A LONG HISTORY OF MEDITERRANEAN ISLAND COLONIZATION

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Species extinctions occurring on islands after anthropic colonization are considered paradigmatic of the threats man poses to biodiversity. As a result of the negative impacts of human population growth, more densely inhabited islands are expected to have higher extinction rates, and hence fewer species than less populated islands. However, ecological theory also predicts that human-induced environmental heterogeneity may increase species richness. Moreover, human settlements tend to be located in sites whose environmental conditions are particularly favourable also for many other animal species. This may lead to find unexpectedly high biodiversity levels in densely populated areas. To test this latter hypothesis, we investigated the relationships between human population density and species richness of native (non-synanthropic) tenebrionid beetles in Italian small islands, many of which have been inhabited by man for millennia. We found that species number increased not only with island area (according to the power function) and maximum elevation (used as a measure of environmental heterogeneity), but also with human population density. This may suggest that islands that were (and are) more accessible and hospitable to humans are also those which can be more easily colonized by tenebrionids thanks to their larger areas and higher environmental heterogeneity.

EVALUATING CONNECTIVITY OF SIMILAR FUNCTIONAL HABITAT TYPES IN PROTECTED AREAS OF THE IBERIAN PENINSULA

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Systematic methods for characterizing functional and structural properties of protected areas, and of the lands separating these areas, are required for regional and global studies related to conservation planning. eHabitat+, one of the web services supporting the Digital Observatory for Protected Areas (DOPA), uses a procedure of automatic image segmentation of remote sensing data and other environmental variables to perform ecological stratification of protected areas in combination with a multivariate analysis procedure to compute the likelihood to find elsewhere similar ecological conditions. This approach allows for a systematic mapping and characterization of distinct functional habitat types in protected areas, as well as to identify similar areas that might serve as potential corridors between them. In this study we apply this methodology to characterize the habitat types in some protected areas of the Iberian Peninsula and to analyze functional connectivity among them. Our connectivity analyses are based on resistance surfaces derived from the ecological similarity of the landscape matrix to the focal habitats, ecological network analysis and habitat reachability metrics. The advantages and limitations of the method for studying the connectivity among protected areas will be discussed, particularly considering its potential of application at the continental or global level.

BIOGEOCHEMISTRY IN TERRESTRIAL & AQUATIC ECOSYSTEM

PS13.1 - TRACE GASES EXCHANGE AT ECOSYSTEM LEVEL IN AN URBAN FOREST IN NAPLES

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Urban forests are living systems integrated in highly anthropic areas, where they establish close interactions with all the other systems around. Thanks to those interactions, urban forests provide to people and to all the urban environment many ecosystem services, the most important of which is probably the absorption of chemically and radiatively-active trace gases and thus the effect on the local air quality. Among the trace gases, beyond the main GHG gases (CO_2, H_2O and CH_4) in urban areas a relevant role is played by the photochemical pollution mainly constituted by O_3 and particulate matters. Despite their importance, experimental sites monitoring trace gases fluxes in urban forest ecosystems are still scarce. Here we show the preliminary results of an innovative experimental site located in the Royal Park of Capodimonte within the urban area of Naples (coordinates 40°51'N-14°15'E, 130 m above sea level). The site is mainly composed by *Quercus ilex* with some patches of *Pinus pinea* and equipped with an eddy-covariance tower measuring the exchange of CO_2, H_2O, CH_4, O_3, PM, VOCs and NOx; it is running since the end of 2014 and it is part of the I-AMICA project.

PS13.2 - SOIL EFFECTS OF AFFORESTED TREE SPECIES: TRACE ELEMENTS STABILIZATION AND CARBON SEQUESTRATION

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Tree-soil interactions are complex and depend on the site conditions. Here we present results from the Guadiamar Green Corridor (Sevilla, Spain). A former cropland was affected by a mine-spill (in 1998), then the soil was cleaned-up, remediated and afforested with several native shrub and tree species. In 2014 we studied biogeochemical processes in seven of the afforested tree species, three deciduous (*Populus alba*, *Celtis australis*, *Fraxinus angustifolia*) and four evergreen (*Quercus ilex*, *Olea europaea*, *Ceratonia siliqua* and *Pinus pinea*). We sampled five replicates of each tree species and the soil underneath in a random block design, including adjacent open soils as reference. We studied the differential effects of the contrasted tree species on two ecosystem services: 1) the regulation of soil quality by immobilization of trace elements (the remediation technique called “phytostabilization”), and 2) the mitigation of climate change by carbon sequestration in biomass and soils.

PS13.3 - CONTRIBUTION OF REPRESENTATIVE GROUND COVERS OF SEMIARID ECOSYSTEMS TO SOIL CO2 EFFLUX

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Soil respiration is the main process through which carbon fixed through photosynthesis returns to the atmosphere and thus strongly influences net carbon uptake. Respiratory activity is influenced by abiotic factors, but also by biotic factors such as the type of soil cover. While the factors that drive CO_2 efflux in temperate climates are more clearly understood, information for drylands is quite scarce. In these regions, interplant soils are usually covered by biocrusts and annual plants, which exert an important influence on CO_2 exchange into and from soil. Our goal was to analyse the influence of abiotic factors and the type of soil cover on soil CO_2 efflux, in two semiarid ecosystems. Our results show that moisture availability was the main factor controlling CO_2 efflux. Soil CO_2efflux strongly varied among cover types, and was the highest in soil under plant and covered by annuals and the lowest in bare soils, showing soils with biocrusts intermediate values. Our findings highlight the high spatial variability in CO_2 efflux in semiarid areas and the need to consider the contributions of the different representative ground covers to make more accurate predictions of the effects of climate change in semiarid regions.

PS13.4 - THE EFFECT OF NON RAINFALL WATER INPUTS ON BIOCRUSTS ACTIVITY

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In water limited systems, non rainfall water inputs (NRWI) which include dew, water vapour adsorption and fog are key water sources that contribute to the maintenance of vital ecological processes. The role of these occult precipitations may be especially important for biocrusts which need very small amount of water to stimulate their activity. Biocrusts are considered the major source of organic carbon in many arid ecosystems. To know if NRWI are capable of activating biocrust photosynthesis and the respiratory activity on soils covered by biocrusts, we measured both processes after different nights with dewfall events, on biocrusts with NRWIs exclusion and on others not excluded. We used lysimeters containing intact samples of the lichen (*Diploschistes diacapsis* sp.) and its intact underlying soil. Results: in the early morning, biocrusts with NRWI showed similar respiration rates to biocrusts with NRWI exclusion, but the former showed net CO_2 assimilation compared to biocrusts without NRWI, which exhibited net emission. Biocrust photosynthetic activity triggered by NRWI was able to offset CO_2 emissions by respiration. As soil dried out, both treatments showed net emission, but fluxes were lower in the biocrusts with NRWI, despite they showed higher respiration rates, because of their higher photosynthesis

CLIMATE CHANGE WILL REDUCE LITTER DECOMPOSITION WHILE ENHANCING THE CONTRIBUTION OF PHOTODEGRADATION IN DRY PERENNIAL MEDITERRANEAN GRASSLANDS

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Understanding how solar UV radiation will affect leaf litter decomposition and how it will interact with climate drivers is fundamental to predict how soil and ecosystem biogeochemical cycles will respond to climate change. We carried out a manipulative experiment to investigate how UV radiation and its interaction with increased temperature (3ºC) and a ~35% reduction in precipitation affected the decomposition of "standing" and “on the ground” litter of Stipa tenacissima, a dominant species in semiarid Mediterranean grasslands. Climate change manipulation treatments decreased litter decomposition. Decay rates were reduced (compared to the control) by a 34%, 43% and 62 % in the rainfall reduction (RE), warming (W), and the combination of both (WRE), respectively. In the control and RE treatments, litter on the ground decomposed 25% faster than standing litter, suggesting that microbial decomposers contributed substantially to litter decomposition. In the W and WRE treatments, litter decomposition rates increased by 29% when exposed to UV radiation. Lignin losses were paralleled by increases in cell solubles, particularly when litter was exposed to UV radiation. Our results indicate that predicted climate change scenarios will reduce litter decomposition rates while enhancing the contribution of photodegradation to overall litter decomposition in semiarid Mediterranean grasslands.

ECOLOGY & SOCIETY

PS14.1 - PHOENIX FLAGSHIPS: CONSERVATION VALUES AND GUANACO REINTRODUCTION IN AN ANTHROPOGENIC LANDSCAPE

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Multiple forms of valuation contribute to public acceptance of conservation projects. Here, we consider how esthetic, intrinsic, and utilitarian values contribute to public attitudes toward a proposed reintroduction of guanaco (*Lama guanicoe*) in a silvopastoral system of central Chile. The nexus among landscape perceptions and valuations, support for reintroductions, and management of anthropogenic habitats is of increasing interest due to the proliferation of conservation approaches such as rewilding and reconciliation ecology. We assessed attitudes and values through an online questionnaire for residents of Santiago, Chile, including photo-montages and assessments of value-based statements. We combined the questionnaire approach with key informant interviews. We find strong support for the reintroduction of guanacos into the Chilean silvopastoral system ('espinal') in terms of esthetic and intrinsic values but less in terms of utilitarian values. Respondents preferred a scenario of espinal with guanacos and expressed interest in visiting it, as well as support for the reintroduction project on the basis that guanacos are native to central Chile. We suggest that reintroduced guanacos could serve as a 'phoenix flagship species' for espinal conservation: a flagship species that has gone regionally extinct and is known but not associated with the region in the cultural memory.

PS14.2 - BUTTERFLIES AS AMBASSADORS FOR BIODIVERSITY KNOWLEDGE TRANSFER

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Loss of biodiversity under changes in climate and land use is essential subject for research. However, there is still a huge gap which has to be bridged in order to make results available for school education. Furthermore, studies indicate that alienation from nature increases with class levels. On the other hand, surveys show that students care for the findings of environmental science and think that scientists have the responsibility to share their insights. Biodiversity knowledge, including the knowledge of butterfly species, was found to be extremely poor. Nevertheless, for most students butterflies are symbols for a healthy nature. We developed educational software which combines computer work with field experiences. Butterflies can be “discovered” on virtual excursions and in a “species gallery”. The interactions between butterflies and their food plants are demonstrated in a way that is understandable for students. A specific “butterfly tool” allows simulating climatic niches of 15 popular European species for different climatic futures within the next decades. The feedback of teachers shows that our educational tools are attractive for students. They inspire students to leave their computers behind and enter into nature and they help to raise the students’ awareness for biodiversity conservation.

PS14.3 - RAISING PUBLIC AWARENESS ABOUT SACRED FORESTS USING THE BIOCULTURAL VALUES OF ANCIENT TREES

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Ancient trees constitute distinctive features of cultural landscapes and they are essential for symbolic, aesthetic and historical reasons for the local societies that live close to them. At the same time, they are important for biodiversity conservation, especially for organisms that depend on them. In the villages of the Pindos mountains, ancient trees exist in public places, such as village squares, and sacred sites, such as churchyards and sacred forests. As part of the project "Conservation through Religion: The sacred forests of Epirus", we created an environmental education package about ancient trees and their cultural and ecological values. We involved different stakeholders (local authorities, National Park, teachers) in the development of the educational material, particularly in defining its aims and structure. The material is aimed at students, local residents and visitors. As a range of socioeconomic factors jeopardize the existence of ancient trees, our goal is to raise public awareness about the oldest living beings of the area. We believe that the wider recognition of their ecological and cultural values will support conservation efforts and encourage municipalities and forestry services to apply appropriate management practices.

PS14.4 - EMERGING INTEGRATED SPSI FOR SUSTAINABLE GOVERNANCE AND MANAGEMENT ACROSS ROMANIAN WATERSHEDS

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The consolidated SPSI conceptual framework, one of major outcomes of the three years Collaborative Research Project (2010/2013)/SPIRAL: "Science - Policy Interfaces for Biodiversity: Research, Action, and Learning" has been applied in the case of "WFD implementation in Romania". Intensive and extended collaborative work has been carried out aiming to achieve particular targeted outcomes: i)clarification and sharing common understanding of the complex and dynamic institutional context, driven by transposition WFD and other sister directives; ii identification and assessing existing water and water related SPIs, highlighting contribution to policy implementation across watersheds, and major gaps and needs for improvement, and; iii)an integrated architecture of the Ro-SPSI/WFD which enables sustainable governance and management across watersheds. The poster presentation will be centered on:i)established architecture of the Ro-SPSI/WFD and conceptual principles which guided the designing process; ii)facilitation capacity related to balancing membership and power relations; multidisciplinary and transdisciplinary integration of relevant - scientific, traditional, policy, institutional knowledge; flexible combinations among science and policy driven functions and;synergy and/or integration of many sectoral policies, and; iii)preliminary evidence on the effectiveness of some key features- continuity and adaptability, conflict management, capacity and trust building, balancing supply and demand science, horizon scanning, objectivity, transparency and holistic vision.

PHYSIOLOGICAL ECOLOGY

PS15.1 - ALGAL BIOREMEDIATION OF AQUACULTURE WASTEWATER: A STUDY ON THE CAPABILITY OF *CHAETOMORPHA LINUM* AND *CLADOPHORA PROLIFERA* IN REMOVING NUTRIENT SURPLUS

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Marine pollution deriving from aquaculture wastewater is a widespread and increasing ecological problem. The use of algae in bioremediating nutrient surplus in wastewater could be useful to achieve a more sustainable aquaculture. In this study the capability of two algal species, *Chaetomorpha linum* and *Cladophora prolifera*, in removing nitrogen and phosphorous surplus from seawater was investigated. In order to define the best conditions for wastewater bioremediation, nitrogen and phosphorous variations were monitored in the presence of different algal biomass (from 5 to 50g fw /liter) at different time intervals (from 30 min to 48 h). The results indicate that both species were able to significantly decrease nitrogen and phosphorus concentration in seawater. Nutrient removal increased with the algal biomass, although an acceptable depletion of N and P was reached using an average algal biomass of 10g/l. Between the two tested species, *C. linum* was found to be more efficient in N removal, while *C. prolifera* in P removal. The nitrogen removing ability of *C. linum* was further investigated by studying some changes in algal metabolism. In particular, photosynthetic pigment content, intracellular nitrogen pool and activities of the enzymes involved in N metabolism were determined.

CONSERVATION ECOLOGY

PS16.1 - ECOLOGY AND CONSERVATION OF THREATENED LICHENS IN THE IBERIAN PENINSULA: FROM INDIVIDUALS TO POPULATIONS

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Effective conservation strategies rely on a thorough understanding of the life processes and ecology of threatened species. Unfortunately, we still lack such required knowledge on lichens, primary producers that play important roles in ecosystems. We developed a multi-scale approach to understand the ecology and functioning of the threatened lichens *Lobaria pulmonaria* and *Lobarina scrobiculata* in Mediterranean environments. At the large scale, we analysed the environmental factors driving their distribution, abundance, and reproductive strategy. At the local scale, we assessed the population dynamics, the factors affecting demographic rates and the physiological performance in contrasting habitats. Results indicated that both species required high levels of precipitation to occur and increase their abundance, but their habitat requirements differed. Reproductive allocation increased in drier locations, probably to enhance the species establishment in adverse conditions. *Lobaria pulmonaria* grew and recruited faster than its relative, due to contrasting functional traits. Within populations, microhabitat heterogeneity, reproductive stage, and physiological performance significantly affected growth rates. These results highlight the impact of environmental and species-specific factors on lichens functioning and, consequently, on their population dynamics and their ability to respond to environmental changes. This integrative approach is essential to develop conservation strategies for these frequently overlooked organisms.

PS16.2 - ISOTOPIC VARIABILITY OF POTENTIAL TROPHIC RESOURCES OF APENNINE BROWN BEAR (*URSUS ARCTOSMARSICANUS*) IN ABRUZZO, LAZIO AND MOLISE NATIONAL PARK

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Stable isotope analysis is a relatively recent technique, which can complement classical ecological data byanalysing directly assimilateddiet (tissues) instead of feces. Noisotopic data have been collected on Apennine brown bear (*U.arctosmarsicanus*). This is an endemic subspecies, highly threatened with extinction, whose habitat conservation may be strongly enhanced by insights of food use offered by isotopic analysis. However, when dealing with generalist consumers with wide homeranges, such as bears, the isotopic variability of trophic resources may introduce a bias in diet reconstruction. The aim of this work is therefore to evaluate the extent of the spatial component of this variability, by comparing isotopic signatures within and between food items collected throughout the Abruzzo Lazio and Molise National Park (PNALM). We divided PNALMaccording to a 1x1 km cells, 30 of which were selected to account for environmental heterogeneity (latitude, longitude, elevation). We sampled and performed carbon and nitrogenisotopic analysis on all potential trophic resources corresponding to key foods used by bears on a seasonal basis. Our preliminary results detected a spatial isotopic variability of food items, permitting to define the correct baseline, prerequisite to investigate the 39 individually known Apennine bears diet using mixing models.

PS16.3 - EXPLORING FORECASTING TOOLS: CORRELATIVE VS MECHANICISTIC APPROACHES

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The increased need to accurately predict the species responses to global change generated large body of research producing models to investigate contractions/fragmentation of species biogeographical distributions. Questions on accuracy of species predictions are crucial. The most adopted approaches are essentially opposite: correlative models (CM) incorporate statistical estimates of environment-range associations of occurrences; mechanistic models (MM) capture biological processes and derive their parameters from the phenotypes of organisms. Although MM are invoked as “Holy Grail in Ecology”, they are often criticized across the current literature as more time consuming. Thus, exploiting powerful methods of synthesis as the Quick Scoping Review (QSR) may help to test the reliability and pro and contra of every approach. Here, we review the current literature through a QSR to obtain informed conclusions on the volume and characteristics of the two approaches. Across the current literature (n= 750), we found significant differences in the use of two approaches, in where they were applied (marine vs. terrestrial) and taxonomic differences. CC and MM have been used mostly to: predict species invasions, delimitate suitable habitat for threatened species, define mode of speciation, identify conservation hotspots. Overall, there is a growing consensus on advantages of combined approaches.

PS16.4 - LIFE BARBIE - CONSERVATION AND MANAGEMENT OF *BARBUS MERIDIONALIS* AND *BARBUS PLEBEJUS* IN THE EMILIAN TRIBUTARIES OF PO RIVER

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Recent studies have confirmed a significant decline in native barbel populations (a species of fish) in northern Italy. The recent IUCN classification of Italian vertebrates raised the risk status of the *Barbus plebejus* to “vulnerable” and of the *Barbus meridionalis* (syn. *B. caninus*) to “endangered”. Particularly the Emilian tributaries of the Po River have faced local population extinctions due to habitat alteration and fragmentation, river discontinuity and competition with alien species. To counter the progressive decline of populations of *B. plebejus* and *B. meridionalis*, a LIFE^{+} “named BARBIE” started in July 2014 with the aim to preserve and restore the native populations of the two focus species in 14 Natura 2000 sites in the Emilia-Romagna Region. Main project objectives are: (1) the creation of new native barbel populations and/or re-stocking existing populations after evaluating the environmental suitability and composition of existing communities; (2) the identification of threats to the survival of the targeted species at local level and networking activities at interprovincial scale to safeguard their long-term management; (3) the eradication/control of exotic barbus species; and (4) the implementation of guidelines for the conservation and sustainable management of the targeted species for application at local and European level.

PS16.5 - PROTECTED AREA NETWORK AND CONSERVATION EFFORTS TO THE THREATENED AMPHIBIANS IN THE BRAZILIAN ATLANTIC FOREST

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One of the most common conservation strategies used to preserve threatened species is the establishment of Protected Area Network (PAN). The Brazilian Atlantic Forest (BAF) is one of the 34 global biodiversity hotspots, with high rate habitat loss, being one of the main factors driving threatened amphibians to extinction. Gap analysis was employed to evaluate whether or not the PAN of the BAF safeguards populations of threatened amphibians present in this region. Species status and occurrence maps were obtained from the IUCN Red List database, overlapping this data over the PAN. Thirty-eight species were found, accounting for 17 critically endangered, 10 endangered, and 11 vulnerable. There are 110,648 km^2 of Protected Areas (PAs) distributed in the BAF, comprising about 10% of the region's total area. This PAN is made up of 28,216 km^2 strict protection areas (IUCN categories I–II) and 82,433 km^2 sustainable use areas (IUCN categories III–VI), covering about 30% of the total geographical range of the assessed species. However, a shift in Brazil's PAs policy has led to an increase in PAs downgrading. Therefore, the maintenance of the PAs integrity is essential and investment is needed to ensure the creation of new reserves, avoiding extinction processes.

PS16.6 - BUILDING UP A NETWORK FOR MONITORING CONSERVATION STATUS OF THREATENED SPECIES

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Monitoring of conservation status of species of Community interest is an obligation arising from the Habitats Directive. However, resources (including human ones) allocated to this task are often restricted, and as a result, conservation status of many species is still poorly known. In the present contribution we demonstrate how different agents, including volunteers, rangers, scientists and other professionals can be involved into a long-term monitoring network aimed at filling this gap. Main challenge is precisely how to integrate participants with different skills into monitoring routines. We therefore developed an hierarchical methodology to gather information about geographic distributional of plants (Level 1), their population characteristics (Level 2), their population trends, vulnerability (Level 3 and 4), and individual vital rates (Level 4). Levels 1 and 2 only require a good taxonomic knowledge of the target species, while for levels 3 and 4, one day training to learn an easy handle methodology is necessary. To date, more than 100 people have joined the network, and more than 160 populations have been successfully monitored. These results endorse the great potentiality of the proposed working framework and methodology, which can be applied to other taxonomic groups.

PS16.7 - CONSERVATION OF BIODIVERSITY IN FERRUGINOUS CAMPO RUPESTRE LOCATED AT SERRA DO ROLA MOÇA STATE PARK, MINAS GERAIS – BRAZIL

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Identifying priority areas for Brazilian biodiversity conservation and applying prompt actions is essential for environmental management. The Canga vegetation is rich in endemic species, rare and endangered, and there are yet few records of studies with its species. The transposition of the Canga from Capão Xavier mine to the surroundings of the PESRM headquarters, MG, Brazil, was executed, as well as its floristic survey. The study aimed the preservation of the mine species for environmental education works with schools and tourists. This region is considered of mega-diversity and is dominated by species of the Orchidaceae, Asteraceae, Velloziaceae and Poacea families. An area of 0.61 hectare and 4500 tonnes of iron ore were used. Plants were relocated and some species were fixed using one ore (PFF) and a percentage of cement, forming a non-toxic substrate. The management of all the transplanted area was done, eliminating the invasive alien species, giving greater support to the already established native vegetation. The area now shelters about 25000 species. The acquired knowledge about the conservation and propagation feasibility of the researched species will indicate the possibility of in vitro reproduction of native species and their use in plant restoration in regions with mine areas.

PS16.8 - FISHING IMPACT AT THE INTERFACE BETWEEN COLDWATER CORAL AREA AND EXPLOITED AREA IN THE NORTHERN IONIAN SEA (MEDITERRANEAN SEA)

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The Santa Maria di Leuca (SML) cold-water coral (CWC) province is a Fisheries Restricted Area (FRA) and a proposed priority conservation area according to several conservation initiatives in the Mediterranean Sea. Fishing impact on this CWC area was investigated using a towed camera system during 2005 and through an observers' program of longline and trawl fishing activities during 2009 and 2010. Vessel Monitoring System (VMS) data 2009-2013 were also used. Using the video system, it was possible to observe evidence of impact due to longlines, proved by remains of lines on the bottoms and/or entangled in corals, while those due to trawl nets were proved by trawl door scars on the bottom. Differences among sites and habitat types for the remains of the two fishing activities were analysed by zero-inflated Poisson models. The geographic distribution of fishing hauls for each type of fishing technique was mapped distinguishing hauls belonging to CWC. A comparison of the fishing effort inside and outside the CWC area was carried out by means of Generalized Linear Models eventually accounting for temporal, spatial and depth effects. For the period 2009-2013, VMS tracks were mostly distributed on fishing grounds north to SML CWC province.

PS16.9 - MULTISCALE GIS AND STATISTICAL ANALYSIS OF NATURA 2000 NETWORK: HIGHLIGHTING CURRENT VULNERABILITIES AND PECULIARITIES TO IMPROVE BIODIVERSITY CONSERVATION IN MEDITERRANEAN REGIONS

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The Habitat and Birds Directives have set up the governance structure of bio- and landscape diversity at continental level in Europe, defining criteria and rules to build an impressively large European network of protected areas. Most studies addressing conservation in Nature 2000 sites from ecological perspectives have given priority attention on specific conservation issues, with respect to general pattern analysis of structural ecosystem properties, which determine the ecological context for ecosystem response to external pressures. Here, we focus on a pattern analysis of structural heterogeneity of Nature 2000 areas and on an evaluation of implications for the conservation of the most endangered species and habitat types in the cross-boundary Adriatic-Ionian region, including Puglia, Ionian Islands, Epirus and Western Greece. Original data on physiographic characteristics, habitat and species of Community Importance have been collected from the European Environment Agency and organised into a geo-database. Results show significant heterogeneity in the physiographic characteristics of protected sites among Regions. Overall Puglia Region has more but smaller sites than Greek trans-boundary Regions. The latter have more endemic species, some of which restricted to an extremely limited number of protected sites. Implications of physiographic heterogeneity on endemism conservation will be discussed.

ECOSYSTEM SERVICES & SOCIETAL BENEFITS

PS17.1 - EVALUATING THE IMPACT OF RECENT LAND USE CHANGES ON NATURAL CAPITAL AND NATURAL ECOSYSTEM SERVICES IN ITALY

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The land use (LU) maps of Italy of the years 2005 and 2009 (five years interval) were used to analyze the annual gain/loss rates of natural ecosystem services (N-ES) at province (p.l) and national (n.l.) level. The analysis showed a decrease of the natural lands in the 106 out of 110 provinces. The mean annual contribution of N-ES at n.l. was estimated at 45.77 billion US$2007 (~2.45% of the national GDP). The mean annual rate of N-ES gain(+)/loss(-) per province ranged between -46.5 and 13.06 million US$2007 with a total loss of -952.3 million US$2007 per year at n.l. (~0.05% annual loss of GDP). The specific LU changes, which occurred during 2005-2009, correspond to annual losses of 23.54 US$2007 per hectare for 1% unit loss of natural land per year. The methods used and the results of the study highlighted the contribution of the Italian natural habitats and LU changes in the national GDP of Italy and can be used as a tool to develop land use management plans.

PS17.2 - BIOFOULING AS A PROVIDER OF ORGANIC MATTER CLEANING SERVICES: AN AQUACULTURE CASE STUDY IN SICILY

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With the main purpose to evaluate the functional role exerted by biofouling community in highly impacted areas, this study was designed to characterize the functioning and recruitment dynamics of communities naturally colonize aquaculture facilities (e.g. cage nets). On a seasonal basis, a total of 18 panels (fiber cement 10 cm x 10 cm) have been brought back to the laboratory and after 1 day of recovering they were divided in three subgroups and acclimated at three different oxygen concentrations for 6-h and 24-h to mimic the occurring natural oxygenic conditions. In order to examine the filtration efficiency of biofouling, clearance rates (CR) have been estimated on individual panels. As expected, results showed that biofouling communities are mainly dominated by filter feeders (both suspension and deposit feeders) typical of urbanized areas, with CR values ranging from 33.07 ± 23.38 l d^{-1} g^{-1} m2 in normoxic conditions and 20.29 ± 19.47 l d^{-1} $g^{-1}m^{-2}$ for the treatments in low oxygen conditions (i.e. 2 mg l^{-1}). Our study highlights that in heavily polluted areas, some biofouling can work as a sort of ecological buffer being able to reduce coastal eutrophication, provide environmental detoxification and control primary production of adjacent exploited habitats.

PS17.3 - ESTIMATION OF HYDROLOGICAL ECOSYSTEM SERVICE IN AGROECOSYSTEM FOR CIRCEO NATIONAL PARK

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Among different multiple hydrological ecosystem services (HES), this research focuses on irrigation water that is the main sector in term of water use. Irrigation water (i.e. blu water) is a strategic hydrological ecosystem service. The quantity, quality and timing of this HES are important factors in supporting human well-being and in maintaining habitats for species, agriculture, livestock and energy. This study estimates irrigation water as the ratio of water volume used for crop growing (measured especially by evapotranspiration) and the volume of water really used. Evapotranspiration is an indicator for understanding water needs for crop production by either meeting the crop water requirement or avoiding crop water stress during dry season. In literature, there is no data available on the volume of water used in agro-ecosystems, especially at micro-scale (farm) level. Therefore, this research is a first attempt to estimate these information. The estimation of irrigation water is provided by a spatial and statistical model. The model allows the estimation of the irrigation water used for agro-ecosystems in Circeo National Park (CNP). The results of the model contribute to reduce the lack of irrigation water measurements by providing an innovative approach for CNP.

PS17.4 - THE EFFECT OF BIOCRUST ON ECOSYSTEM SERVICES AND THEIR IMPORTANCE FOR DRILANDS MANAGEMENT

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Drylands ecosystems usually show low productivity, considerable water losses and land degradation problems associated with soil erosion. Most of bare-looking areas in these ecosystems are often covered by biocrusts, which represent an important nitrogen and carbon sink and preserve essential ecosystem services. However, until now no studies compared and analyzed trade-offs between biophysical capacity of biocrusts to preserve the ecosystem services and the social perception. This study aims to quantify the effect of biocrusts on three regulating services: infiltration, erosion and climate change mitigation. To do so, we i) characterized the effect of biocrusts on selected ecosystem services; and ii) we explored social importance and perceived vulnerability regarding ecosystem services.Our results disclose an important role of biocrusts in providing the three regulating services. As consequence of increasing human population, and global change, drylands' capacity to preserve these services has been drastically reduced during the last years. This perception of a negative trend in all regulating services is also shared by the local population. However, respondents not clearly recognized the importance of these services and more effort is needed to raise awareness for the role of biocrusts in drylands in preserving ecosystem function.

POLLINATION DEFICITS AND ALTERNATE WAYS FOR ITS ASSESSMENT – A CASE STUDY OF TWO CROP SYSTEMS IN NORWAY

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Crop pollination is a global concern as a result of deteriorating wild pollinator communities, emerging disease in beekeeping and increased worldwide cultivation of pollination dependent crops. Evidence is emerging globally of potentially significant yield gains by better utilizing wild pollinators. However, mapping of pollination deficits – the decrease in yield due to insufficient pollination – is still fragmentary. There are various methods to assess pollination deficits, differing in spatial extent, detail, generalizability and practical feasibility. We employed three different approaches to mapping the state of domesticated and wild pollinators and their effect on yield for two crops in Norway, apple and red clover seed production. We: i) employed the "Pollination Deficit Protocol", developed by the FAO and currently implemented within IPBES, ii) performed landscape modelling of pollinator habitats and pollination-dependent crops, and ii) performed detailed transect surveys surrounding target crops, in relation to present and past yields. We present the different methods with respect to their different requirements in fieldwork, background data, and methods for analysis, and ultimately the virtues of their results and how they contrast to each other. Our work addresses both the conceptual grounds of pollination deficits as well as practical solutions for its assessment.

THE ROLE OF DIVERSITY IN SUSTAINING INDIGENOUS FOOD SECURITY UNDER CLIMATE CHANGE

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Little attention has been given to indigenous subsistence hunting societies amidst mounting concerns for food security triggered by climate change. The IPCC identifies the urgent need to engage adaptation planning at local community levels to anticipate climate change impacts on food security. We address this gap within two High Arctic communities, at the forefront of dramatic climatic variation, the Iñupiaq of Wainwright, USA and the Inuvialuit of Ulukhaktok, Canada. We integrate emergent tools and insights from the disparate disciplines of biodiversity science and human ecology to ask how the species assemblages that comprise the bulk of the diet (terrestrial and marine mammals, fish) will respond to climate change, and thereby develop an understanding of both vulnerabilities and new opportunities for adapting food practices. Our analyses reveal overall vulnerability scores of -0.5 in both populations, intermediate between not vulnerable (-1) and vulnerable (0). There were no systematic differences in vulnerability among the three food groups, indicating that the overall system's stability drives the vulnerability of human populations. Our finding that Ulukhaktok and Wainwright vulnerabilities are similar implies equivalent food security risk, but because Ulukhaktok uses a far smaller assemblage, loss of a few species would have disproportionate effects on them.

ECOLOGICAL NICHE & INTERACTIONS

PS18.1 - GENETIC DIVERSITY AND ECOLOGICAL NICHE MODELLING OF TWO EPIPHYTIC LICHENS WITH CONTRASTING DISPERSAL MODES

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Dispersal among populations is a key process which drives genetic structure and diversity, and can explain population persistence under different ecological and environmental scenarios. Dispersal traits (i.e., reproductive strategy and propagule size) are thought to reflect a trade-off between dispersal ability and establishment success, and they have important consequences on population and community structure. We tested evidence for this trade-off using two closely related epiphytic lichens, which differ in their reproductive mode – *N. laevigatum* (sexual spore-dispersed) and *N. parile* (asexually species dispersing both symbionts together). We compared the patterns of occurrence and genetic diversity along a steep bioclimatic gradient in Scotland. As expected from their contrasting dispersal modes, we found differences in both occurrence and genetic diversity despite similar biogeographic distribution within our study region. The sexually reproducing *N. laevigatum* may be limited by the presence of other asexual species which act as key symbiont facilitators, while *N. parile* is sensitive to a precipitation gradient modified by microhabitat factors. Using newly developed microsatellite markers for each species, we found that both species showed a decreasing genetic diversity as sites become drier. Furthermore, *N. laevigatum* showed substantially higher gene and genotypic diversity than the predominantly asexual *N. parile*.

PS18.2 - FEEDING ECOLOGY OF ITALIAN CRESTED NEWT *TRITURUS CARNIFEX* (LAURENTI, 1768) IN THE CENTRAL APENNINES ITALY: COMBINING STABLE ISOTOPES AND STOMACH CONTENTS ANALYSIS

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Understanding feeding habits of protected/threatened species is crucial in order to evaluate the effects of ecological disturbances such as global climate change, human induced habitat modifications or species introductions. The Italian Crested Newt, *Triturus carnifex* (Laurenti, 1768) is listed in annexes II and IV of the EU Habitats Directive (92/43EEC). The major threats for this species are the changes in water quality and the loss of aquatic breeding habitats. The principal aim of this study was to determine the microhabitat use and the diet of Italian Crested Newts sampled in different water reservoirs (in particular troughs) under different ecological conditions in order to obtain information about their trophic relationship with the other aquatic organisms. We analysed stomach contents and tissue δ13C and δ15N signatures from 85 adult newts from three different artificial troughs in the central Apennines. Prey communities were also sampled and processed for stable isotope analysis. Stomach contents and SIA providing different but complementary information about the diet of *T. carnifex*. Results of our study evidence a high degree of species generalism and differences in the preys use and selections by newts in the three reservoirs.

ECOLOGICAL RESILIENCE & SUSTAINABILITY

PS19.1 - SUBSTRATES QUALITY AFTER SHORT AND LONG-TIME BY COMPOST APPLICATION

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Human activities cause a soil quality worsening, affecting soil fertility. Recently, compost derived from municipal solid waste is applied to improve soil quality. Unfortunately, the addition of compost can generate adverse effects, over the time, due to the release of potentially toxic substances, such as metals. It is known that rhizosphere is rich in organisms that improve the soil properties. The aim of this study was to evaluate the quality of compost, with (CP) or without plants (C), added to limestone debris after one (2005) and ten years (2014) from mesocosm setting up. The substrates quality was defined by chemical, physical, biological tools. Over ten years, the organic matter content decreased whereas nitrogen content increased in both C and Cp. At the beginning of the period, the plant presence stimulated fungal biomass and biological activities. Anyway, the differences of these parameters were not observed at the end of the period. Over the time, the metal bioavailability decreased. Besides, despite of the highest microbial biomass a low activity was observed, likely due to the compost scarce quality and unfavorable climatic conditions. In conclusion, positive effects of compost were mainly observed at short time, therefore periodic applications are desirable.

PS19.2 - AGRICULTURE AND CLIMATE CHANGES IN EU COUNTRIES: RESILIENCE'S MEASURES

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Agriculture sector is highly exposed to climate change. In 2007, the EU conducted a study of the impact of climate change on different European agro-climatic zones, and options for adaptation (resilience). In 2009, the European Commission presented a White Paper to improve Europe's resilience to climate change, emphasising the need to integrate adaptation into all key European policies and enhance co-operation at all levels of governance. This study aims to adopt a DPSIR approach to agriculture sector to measure its adaptation to climate changes across European Countries. It is useful for structuring the analysis of the linkages between climate change on environmental components in agriculture and consequences for biodiversity and possible policy response. Main objective is to build up a set of simple indicators of Response for each factor of Impact using the only sources of EU FSS & SAPM 2010 to cluster the European agro-climatic zones. The use of a single statistical source is a strengthens point for building up of homogeneous indicators in terms of collecting/estimating methods, parameters' definitions, adopted frames and reference times among the Countries. This approache could be a starting point for further developments since the data used came from a cyclical survey.

PS19.3 - INDICATORS FOR ASSESSING RESILIENCE OF FOREST ECOSYSTEM SERVICES: A REVIEW BASED ON THE DPSIR FRAMEWORK

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Forests face several pressures (namely climate and land use changes, and biological invasions) which induce shifts in ecosystem functioning, threatening the provision of goods and services needed for human well-being. Understanding the relations between drivers and pressures that impact on forest ecosystem services (ES), and how these relations are modulated by societal responses, are major sustainability challenges. Resilience-based research has been proposed as a new paradigm for these challenges, considering the ability of ecosystems to resist and recover from impacts, to absorb disturbances and to maintain core ecosystem functions. Yet, robust frameworks that allow the operationalization of resilience-based approaches to address forest ES are underexplored. Based on a literature review, this study identifies a set of indicators which have been used to assess the general and specified resilience of worldwide forest ES. Indicators are organized following the categories of the DPSIR (Drivers-Pressures-State-Impacts-Responses) framework, adapted whenever necessary. Through an explicit linkage with resilience thinking, this study identifies the drivers and pressures of ES in several forest types, along spatial and temporal scales, identifying resilience approaches behind such assessments. We argue that integrating resilience-based indicators in a DPSIR framework provides a useful management tool for supporting solutions regarding common socio-ecological problems.

EDUCATION TO SUSTAINABILITY

PS20.1 - SATOYAMA CONSERVATION INITIATIVES IN THE PHILIPPINES:THE CASE OF THE OPEN ONLINE COURSE OF THE UNIVERSITY OF THE PHILIPPINES OPEN UNIVERSITY

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Satoyama landscapes are traditional landscapes characterized by subsistence farming and secondary forests known as ili or lasang. Three distinct satoyama landscapes are identified in the Philippines: 1) satoyama with rice farms, 2) satoyama with rice and other crops and, 3) satoyama with corn farms. At present, these landscapes suffer from overutilization and an alarming biodiversity loss. Open Online Course (OOC) on satoyama has been offered at the University of the Philippine Open University (UPOU) to enhance conservation of this endangered landscape. The modules are as follows: 1) Introducing satoyama, 2) Practical ecology and biodiversity conservation, 3) Sustainable agriculture, 4) Nature, culture and heritage, and 5) Satoyama field study. OOC is a non-degree course offered online for free to the entire public. Hopefully, this course will help inculcate the concept of the satoyama landscape bringing about social transformation and subsequent environmental rehabilitation.

PS20.2 - WHY AND HOW HIGHER EDUCATION SYSTEM SHOULD REACT TO MAJOR CHALLENGES ARISING FROM TRANSDISCIPLINARY SCIENCE OF SUSTAINABILITY?

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The answers to questions “why?” and “how?” will be formulated based on: i) the advanced theoretical and conceptual constructs in the global science of Systems Ecology and/or Sustainability; ii) understanding non-linear dynamic relationships within components of socio-ecological systems and among them across time and space scales; iii) recognition that sectoral and inappropriate space and time scales approaches in the environmental and socio-economic policies development and implementation are the main cause of the current stage in “ecological crisis”; iv) needs of particular university curricula and training programs for human resources development and v) the approaches, achievements, as well as many gaps and institutional barriers, experienced during the development and 15 years of implementation under the umbrella of UNESCO-MAB program and EU financial support of the first postgraduate curricula in “Ecotechnie/Sustainability”, by a network of European universities and Equipe Cousteau.

PS20.3 - DIGITAL DIORAMA PROJECT: INITIAL RESULTS FROM SCHOOL TESTING

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In the Digital Diorama project we digitalized some dioramas from Museums of Natural History to obtain interactive multimedia interfaces working with IWB, pc and tablet. We have completed a Digital Diorama prototype and started testing it in some primary school classes. To assess its use by the students we have utilized different research methodologies. One of the techniques used was that of the eye-tracking (quantitative assessment), the other ones, used to assess quality, were: teachers' focus groups, monitoring of classroom work, collecting and evaluating students' products. The results of our research will be presented. Future Digital Dioramas planned in the project will deal with sustainability, highlighting its relationship with present environmental issues. We will test the Digital Dioramas in over twenty classes throughout the country.

HIDDEN & DARK BIODIVERSITY - FORM MOLECULES TO MACROECOLOGY

PS21.1 - THE EVOLUTIONARY AND ECOLOGICAL HISTORY OF *TALITRID AMPHIPODS* (CRUSTACEA, AMPHIPODA) OF THE MEDITERRANEANEAST ATLANTIC AREA

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The species of the Talitridae family are particularly intriguing because of their adaptation for a semi-terrestrial or terrestrial life. Moreover, these organisms are important to the ecology of marine (supralittoral), freshwater (riparian), and terrestrial (forest) ecosystems. A growing interest to talitrid amphipods is also expressed by recent taxonomic insights. In this study, to gain further insight into the evolutionary relationships of species belonging to this singular crustacean group, we investigate mitochondrial and nuclear genes. We analysed talitrid amphipods belonging to the genera *Africorchestia*, *Britorchestia*, *Cryptorchestia*, *Deshayesorchestia*, *Macarorchestia*, *Orchestia*, *Palmorchestia*, *Platorchestia*, *Sardorchestia*, and *Talitrus* of the Mediterranean-East Atlantic area. A phylogenetic modelling revealed an interesting clustering with a clear separation between morphologically recognised species. For instance, *O. montagui* and *O. stephenseni*, two species endemic to the Mediterranean basin, appeared to be more closely related to each other than to other Orchestia species. Moreover, from the phylogenetic trees we inferred that terrestrial Orchestia species from the Canary Islands do not belong to the new genus *Cryptorchestia*. As a further development, our observations contribute to drive future DNA based–study aimed to investigate the roles of gut microbiome in speciation and ecological differentiation from marine (beach dwellers) to freshwater (riparian dwellers) talitrid amphipods.

MOLECULAR ECOLOGY

PS22.1 - ANTIOXIDANT AND STRESS-RELATED GENES IN THE SEAGRASS POSIDONIA OCEANICA IN THE VICINITY OF NATURAL CO2 VENTS AT DIFFERENT NUTRIENT CONDITIONS

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Human activities have intensified in coastal areas, increasing the number of stressors that act simultaneously over natural systems (e.g. ocean acidification and eutrophication). In this study, RT-qPCR was used to characterize expression levels of key stress-related genes in response to natural CO_2-enrichment and artificial nutrient-enrichment in proximity of a volcanic vent located in the Ischia island (Gulf of Naples). The seagrass Posidonia oceanica was collected in a control site and in the vicinity of the CO_2 vents. In each location, plants experienced three different nutrient concentrations: natural (without adding any nutrient), low- and high- enrichments. Results show that nutrient addition mainly induced an over-expression of antioxidant genes in the control site (e.g. up-regulation of glutathione synthase, glutathione peroxidase, catalase, ascorbate reductase and cythocromeP450). In the acidified site, trends in expression changes were similar, but expression levels were notably lower. The difference in response between acidified and control site and in different nutrient conditions seems to derive from the combined affect of multiple stressors, in a way that still remains obscure. Effects of different stressors should be disentangled in order to identify stress-specific genes as early indicators of stressful conditions at sea and during laboratory experiments.

PS22.2 - ECOLOGICAL AND EVOLUTIONARY CONSEQUENCES OF A COLONIZATION EVENT: THE CASE STUDY OF THE MOSQUITOES AEDES MARIAE AND AE. ZAMMITII

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Human activities and climate-induced environmental changes are even more favoring the spread of species worldwide and biological invasions. When a species reaches a new area already occupied by another interbreeding species, hybridization and gene exchange (i.e. introgression) can occur between them. In this context, the ecological and evolutionary effects that these processes have on introduced and local species as well as the ecological factors affecting the introgression pattern remain still debated. Here, we presented the results about a translocation experiment in which two interbreeding mosquitoes species, Aedes mariae and Ae. zammitii, were put in sympatry. Hybridization and introgression pattern were monitored since their first contact across 25-years, using nuclear and mitochondrial DNA markers. Our results support the view that hybridization can persist even between “good species” and that it can be a prominent factor promoting intraspecific diversity. Furthermore, they highlight the role of demographic processes occurring during colonization, that had been up until now overlooked, in determining the introgression pattern.

PS22.3 - ESTABLISHMENT OF NETWORKS OF MPAS: INCORPORATING INFORMATION ON GENETIC CONNECTIVITY OF BENTHIC ECOSYSTEM ENGINEERS IN PILOT PROJECTS

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Despite the increasing awareness of the importance of connectivity for MPA design, only very few MPA design processes have included connectivity into planning. Seagrasses are important ecosystem engineers in the coastal environment and designing MPAs to ensure connectivity of such ecologically important habitat providing species is crucial, given the major declines of seagrasses worldwide and their increasing fragmentation, which has important cascading effects on the associated ecosystem.Here, we focus on two seagrass species, which are affected by smaller sized habitats and increased isolation in two pilot project areas in the Black Sea and in the Adriatic.We aim to determine the extent to which the assessed populations (collected in established and suggested MPAs) are connected, given the environmental conditions present in each pilot project area and the demographic processes the different populations and species are affected by. Conserving populations in MPAs that are at a reciprocal distance that still allows gene-flow, given the environmental conditions of the area, is possibly the only way to maintain levels of connectivity that can avoid inbreeding and allow the spread of advantageous alleles in the future and will allow the network of MPAs to work well in protecting biodiversity in and over its' boundaries.

PARASITES, PATHOGENS & WILDLIFE DISEASE

PS23.1 - ECOLOGICAL PROCESSES DRIVE THE EPIDEMIOLOIGY OF ENVIRONMENTAL PATHOGENS

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Pathogens arising from environmental microbiota form an important threat to wildlife, food production, and human health. Classical examples of environmental, opportunistic pathogens include *Cholera*, anthrax, and *Flavobacterium*. The epidemiology of such pathogens cannot be understood with traditional models that ignore the ecological and evolutionary processes—such as biotic interactions and fluctuations in environmental conditions—affecting the free-living stage of these organisms. By combining a host model (transition between susceptible, infected, and recovered individuals) to an ecological model, including a pathogen as a member of a species community, we have shown that loss of diversity in the outside-host community can lead to a catastrophic emergence of pathogen outbreaks. When the system is subjected to environmental variation, the severity and temporal predictability of fluctuations has an important effect on epidemiology; depending on the conditions, either persistent infections or outbreaks can arise in situations where infections do not occur under a stable environment. Environmental pathogens cannot be eradicated by treating hosts, as the environment provides an endless pathogen reservoir. Our results provide important insight for understanding the epidemiology of these pathogens, which can be utilized for devising experiments and developing policies for mitigating and preventing pathogen outbreaks.

PERTURBATION ECOLOGY & ECOLOGICAL INDICATORS

PS24.1 - USING WATER QUALITY STANDARDS AND MACROBENTHIC POPULATIONS TO DEVELOP A PRIORITIZATION SYSTEM FOR RESTORATION PLANS OF THE LOTIC SYSTEMS OF NORTERN ITALY

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Water quality and macrozoobenthos data were used in this study in order to have a better understanding about the biological quality of streams and rivers in northern Italy (585 sampling sites in Po valley and Italian Alps). The revised water quality standards of EAP Task Force/OECD together with Redundancy Analysis (RDA) of taxa response to pollution stressors were used to set priorities on sites selection for restoration based on the most important pollution indicators and their degree of severity. RDA showed the following ranking scheme of pollution stressors (*E.coli*>COD>NO_3>P>BOD5>NH_4^+>DO) setting *E.coli* (surrogate of fecal/organic pollution) as the most important stressor. The WQ standards grouped the values of WQ parameters (WQPs) in five quality classes (I: very high, II: high, III: moderate, IV: low, V: very low quality), where the majority of sampling sites (28.2%) presented very low quality (V class) due to *E.coli* verifying the results of RDA. Focusing only to *E.coli* affected sites (first degree of prioritization), further analysis was made to identify which sites have more WQPs grouped in the most severe quality classes (second degree of prioritization) and which of these WPQs have more severe impact based on the ranking scheme (third degree of prioritization).

PS24.2 - EFFECT OF SOLOFRANA RIVER FLOODING ON SOIL MICROBIAL COMMUNITY

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Soils of Solofrana Valley (Southern Italy) are interested by flooding of Solofrana River, which is contaminated by chromium derived from sewage of tanning plants. In 2010, two strong floodings affected an area of 100 ha causing a soil pollution by chromium, but not by other trace elements. This study aims to evaluate the effects of this perturbation on soil microbial community. Soil samples were collected from 10 plots interested by flooding and from 4 control plots. Soil chromium concentration ranged from 21 to 229 mg Cr/kg. Soil was analyzed for microbial biomass (MB), respiration, metabolic quotient (MQ), carbon mineralization rate (CMR) and DNA amount, which is a parameter not commonly used as soil microbial indicator. DNA amount was positively correlated with MB, suggesting that it is a good indicator of microbial growth. Chromium pollution did not affect DNA amount and MB. By contrast, soil respiration, MQ and CMR were significantly reduced in flooded than in control soils and negatively correlated with chromium concentration, suggesting that they are microbial indicators more sensitive to chromium pollution than MB and DNA amount.

TROPICAL ECOLOGY

PS25.1 - SPATIAL PATTERNS OF SOIL ECOSYSTEM ENGINEERS' FUNCTIONAL DOMAINS DETERMINE ECOSYSTEM FUNCTION

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Ecological processes are spatially influenced on various scales, ranging from global to local scales. In natural communities, the observed spatial pattern is the result of environmental, biological and/or historical drivers, which are not exclusive but rather complementary. Unveiling the spatial scales at which species assemblages are structured, and the extent to which they match those observed in soil is of paramount importance in ecology. Specific spatially explicit sampling protocols for targeted soil organisms and adequate conceptual approaches are needed in soil ecology. The functional group of soil ecosystem engineers (SEE) creates in the soil volume areas of influence or functional domains, e.g. the rhizosphere, drilosphere, termitosphere and myrmecosphere that modifies habitat suitability for other organisms. Multi-scale variability of the soil environment created by processes of abiotic and biotic (in the "functional domain" of SEE), explain the spatial patterns observed on several scales. The use of spatially explicit multivariate analysis and variation partitioning analysis allows to discriminate the respective effects of these drivers. We discuss in this presentation how much spatial planning is operated in soils by SEE and to what extent this process determines ecosystem function and processes.

PS25.2 - GLOBAL CHANGE AND PRIMARY PRODUCTIVITY IN TROPICAL FOREST

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The quantification of the allocation of the net primary productivity (NPP) of an ecosystem in slow and fast compartment is an important descriptor of the forest functioning and helps to understand how tropical forests may respond to global climate changes. We measured above and below ground carbon stocks and fluxes, in 14ha permanent plots in the Atlantic forest across an elevation gradient to understand the patterns of allocation of the carbon cycle components and their response to the biotic and environmental heterogeneity. Across the elevation gradient, above ground live carbon stocks ranged from 77 -160 MgC ha^{-1}. The average of coarse wood debris carbon stocks was 4.4±0.6 MgC ha^{-1} and fine wood debris was 1.6 ±0.2 MgC ha^{-1}. The fine root carbon stocks ranged from 1.3 - 5.5 MgC ha^{-1} and coarse roots range from 15.4 up to 32.0 MgC ha^{-1}. Above ground coarse wood production ranged from 1.5 up to 3.0 MgC ha^{-1} yr^{-1}. The average of coarse wood debris production was 2.1±0.3 MgC $ha^{-1}yr^{-1}$. The above ground live and dead carbon stocks increase with increasing elevation whereas the components of carbon fluxes decrease with elevation. The environmental heterogeneity did not influence the production of fine root biomass.

URBAN RESILIENCE & SUSTAINABILITY

PS26.1 - THE ECOLOGICAL STATUS AND HEAVY METAL POLLUTION IN SMALL TRIBUTARIES OF TIBER RIVER IN THE URBAN AREA OF ROME (ITALY)

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The increasing inputs of silt, nutrients and pollutants deriving from forest harvest, agriculture, urban areas and industrial activities, represent important pressures that reduce water quality and biodiversity of aquatic ecosystems. The present study aimed to assess the ecological status and the heavy metal pollution of watercourses in the urban area of Rome. A total of 13 sampling stations were selected along 6 small tributaries of Tiber river. The ecological status was evaluated using aquatic macrophytes as biological indicators, according to the Water Framework Directive. The heavy metal pollution was assessed by the collection and analysis of water and sediment samples. Due to the lack of macrophytes coverage characterizing this typology of water bodies, it was not possible to assess the ecological status in all the study sites. Significant pollution by several heavy metals was detected in all sampling stations, thus showing an altered ecosystem. The results of this work indicated the importance of restoration activities of small rivers in the urban area of Rome.

ANY OTHER TOPIC

PS27.1 - INNOVATIVE FEEDS AND SYSTEMS FOR SEA URCHIN FARMING

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Two experiments were performed to optimize farming of *Paracentrotus lividus* in land-based systems, and to reduce time to commercial size (50 mm of diameter). In the first experiment, the suitability of three feeds (A, B, C) with different characteristics to produce large gonads and a fast somatic growth was assessed. Their stability in seawater was also measured. Feed A and C produced larger gonads, while no increase in gonad weight was recorded in urchins fed B. Feed A and C were also more stable at the chosen farming temperatures, making them suitable for commercial purpose in the Mediterranean. In the second experiment growth performances of urchins farmed in two types of land-based holding systems for grow out, a conical tank and a cage made with plastic panels, were tested. The latter produced the best performances in homogeneity of growth of a cohort of urchins. Time to commercial size using the best system and the two best feeds werw then modelled, and results were best for feed C, 609 days, two months less than A. These results represent an improvvement, especially compared to the actual duration of a production cycle of sea urchins, which varies from 2 to 3 years.

PS27.2 - TRACKING THE WAY OF PHENANTHRENE UPTAKE IN MOSSES

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Polycyclic aromatic hydrocarbons (PAHs) are organic lipophilic pollutants generated from incomplete combustion of organic materials. Many PAHs have detrimental effects on the organisms of affected habitats, including humans.Mosses, lacking cuticle and roots, and depending on atmospheric depositions for water and nutrient supply, have been largely employed as bioaccumulators of pollutants. Pollutant capture occurs with different efficiency depending on the moss species. This study aims to investigate the way of PAH uptake in four moss species: *Amblystegium humile, Hypnum cupressiforme, Plagiomnium affine* and *Sphagnum palustre*. Phenanthrene was selected as target compound because its wide presence in the atmosphere; due to its fluorescence it can be directly observed under fluorescence microscopy. Mosses were exposed in separate glass pots, inside a glass incubation chamber. Phenanatrene 5mg/ml dissolved in acetone was let evaporate in each pot during 12 days, and its uptake and movement tracked by a confocal LEICA TCS SP5 microscope after 4, 8 and 12 days. Phenantrene was observed as fluorescent particles of various size and shape generally deposited on moss surfaces, or among protonema turfs (P. affine), or stored in the hyalocysts (*S. palustre*). Specific surface properties of the investigated species (i.e. wettability, hydophobicity, etc.) might influence the phenantrene uptake.

PS27.3 - SPATIAL DISTRIBUTION AND CONTAMINATION LEVELS IN THE MARINE SEDIMENTS OF THE GULF OF MANFREDONIA (ITALY)

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A data matrix, obtained during an oceanographic sampling carried out on March 2012 in 12 sampling locations in the Gulf of Manfredonia (Italy), was subjected to pollution indicator, graphical and statistical technique analysis to assess the inorganic and organic contamination levels, sediments composition and to investigate possible connections with land (river input) and surface marine circulation. The sites were chosen taking into account the Western Adriatic Current, flowing southward along the Italian coast, and possible spatial gradients North-South and East-West in sediment composition, based on bibliographic references on the investigated area. Bottom sediment samples were collected by taking the top 10-cm layer of marine sediments using a box-core (09x19x20 cm). A total of 1 Kg surface sediment was sub-sampled from triplicate grab samples from each site and mixed thoroughly after removing any pebbles and twigs. The sub-samples were refrigerated (4°C) on site, stored avoiding exposure to light, and then rapidly transported to the laboratory where they were frozen at -20°C prior to analysis. Sub-samples of sediments were used to analyze organic matter (LOI, %), granulometry (sand%, silt%, clay%), total PAH's (ng g^{-1}), total PCB's (ng g^{-1}), trace elements (Hg, Cr, Cu, As, Zn, Mn, Fe, Al, P, mg kg^{-1}).

PS27.4 - BEST PRACTICES, GOOD PRACTICES AND GUIDELINES: A CRITICAL REVIEW BASED ON DIFFERENT MANAGEMENT OPTIONS IN PROTECTED AREAS OF CROSS-BOUNDARY ADRIATIC-IONIAN REGION

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Best practices are, by definition, the best ways to reach a specific goal. In the environmental field, best practices are experiences and quality projects carried out in the territory, by institutions, companies or citizens, that produce benefits in different environmental sectors applied to solve a concrete problem. Relevant features of best practices are their validation and replicability in time and space. In the context of the EU Co-funded BIG (Improve governance, management and sustainable valorization of coastal and rural protected areas and contributing to the implementation of the Natura 2000 provisions in Greece and Italy) best practices have been collected through a web search and questionnaires submitted to the managers of the protected areas to build a reference database/atlas. The database critical analysis has highlighted some gaps about the effective presence and applicability of these best practices. Moreover, their effectiveness has been analyzed on the base of the specific characteristics of the Italian and Greek areas involved in the BIG project. Some contrasting problems to the best practice definition have been highlighted.

PS27.5 - BIOREMEDIATION OF CHRONICALLY OIL-POLLUTED MARINE SEDIMENT USING BEATS OF HYDROCARBONS-DEGRADING BACTERIA

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Bioremediation is a good kind of "green biotechnology" based on the microorganisms ability to degrade hydrocarbons fractions.

In this work sediment samples were collected from the industrial harbor of Priolo Gargallo (Augusta, Syracuse, Sicily - Italy), a chronically polluted area.

Enrichment cultures and microbial isolation were performed. Amoung 258 bacteria and 5 consortia isolated, strain S1 (*Alcanivorax borkumensis*, 98%) and two consortia (PSO and PSM) showed degradation rates of ~98% for linear and polycyclic aromatic hydrocarbons (PHAs) after 10 days of incubation (25±1°C, shaking 100 g). Taxonomic analysis (16S clone libraries) of consortia showed as dominant genera hydrocarbonoclastic bacteria (HCB): *Cycloclasticus sp.* (~ 80%) in PSM and *Alcanivorax sp*. (~70%) in PSO.

Bacteria and Consortia selected were tested to develop a bioremediation strategy using chitosan/ agar beats for polluted marine sediments recovery.

9 different bioremediation treatment were performed: Control (C), Immobilized Hydrocarbonoclastic bacteria(HCB) (IH), Immobilized (HCB) + Air Insufflaction (HIA), Air Insufflaction (A), Oxygen (O), Oxygen + Immobilized HCB (OHI), Immobilized HCB + Oxygen20 (IHO20), Bioturbing (B), Bioturbing + Immobilized HCB (HIB).

Analysis of hydrocarbons (GC-FID), TOC, structure of bacteria population (16S clone libraries) and enumeration of total bacteria (DAPI count) were performed at the end of experimentation.

PS27.6 - APPLYING SOUNDSCAPE ECOLOGY METHODS TO MONITORING A PRODUCTION LANDSCAPE

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Unsustainable forestry and agriculture are major threats to global biodiversity. Certification schemes offer an opportunity to minimise impacts on biodiversity loss. These schemes require land-owners to encourage and maintain biodiversity within their estates, which calls for an efficient monitoring system to be in place. Recent studies demonstrate the potential for using soundscape data as a surrogate for measuring biodiversity. This study tested the potential for using these methods as part of a monitoring programme, which could fit into current frameworks for certification initiatives such as the Forest Stewardship Council (FSC) and agri-environment schemes. In July/August 2014 and 2015, soundscape recordings were made on a systematic grid covering 73 forest stands in Thetford Forest, a largely coniferous plantation managed by the Forestry Commission, UK. The majority of forest stands comprised Corsican Pine (55%), Scots Pine (25%) and other coniferous woodland (8%). Strong relationships between vegetation structure, stand age and acoustic diversity were found. Although more research is required, these data indicate the potential for integrating soundscape methods into landscape scale adaptive management strategies. Further use of the audio recordings to identify key bird species that affect management decisions would reinforce the value of this approach to long-term monitoring.

PHYTOPLANKTON TRAITS, FUNCTIONAL GROUPS AND COMMUNITY ORGANIZATION IN THE PERSPECTIVE OF GLOBAL ENVIRONMENTAL CHANGE

PS28.1 - TO FLOAT OR TO SINK? A PRELIMINARY EXPLAINATION TO PHYTOPLANKTON DILEMMA ACCORDING TO ALLOMETRIC SCALING MODEL AND A NOVEL METHOD TO STUDY SINKING RATE

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It is widely recognized that the sinking-floating dilemma strongly affects phytoplankton life, however we lack a comprehensive view of how phytoplankton sinking rateis linked tophyletic divergence and morphofunctional traits.Although the size dependence of growth and metabolic rates has been fully studied, and nutrient and light utilization traits have been shown to scale with cell volume, no allometric model was used to describe the size scaling of sinking rate. We compiled and analyzed a comprehensive body of literature data on phytoplankton sinking rate and cell size to in order todefine a general pattern in the size dependence of sinking rate according to phytoplankton taxonomic and geometric diversity and to review the previous methodological approaches to study phytoplankton sinking rate.Here, we present the first determination of the allometric relationship in phytoplankton sinking rate, showing that even if trends in size scaling are the same, important differences exist according to taxonomic and geometric diversity. Moreover, we show a novel and innovative methodological approach to quantify in a more realistic and accurate way the sinking rate measures of phytoplankton species according to their morphofunctional traits.

PS28.2 - NEW DATA-DRIVEN METHOD FROM 3D CONFOCAL MICROSCOPY FOR CALCULATING PHYTOPLANKTON CELL BIOVOLUME

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Biovolume is commonly used as a size descriptor in the study of phytoplankton ecology. Usually, biovolume is not measured directly but is obtained from a standardized set of geometric models based on linear dimensions measured by light microscopy. This commonly used method allows visualization and measurement in two dimensions (2D) yielding no information at all on the third dimension of phytoplankton cells. Inaccurate biovolume assessment resulting from geometric approximation leads to erroneous interpretation of eco-physiological processes and morpho-functional traits. Here, we use confocal microscopy coupled with an image analysis system (NIS Elements AR software, Nikon) to determine directly shape and biovolume by means a 3D reconstruction of phytoplankton species. We evaluate the accuracy of current methods by comparing the results obtained using geometric models with direct biovolume and shape. We find that calculation of biovolume by approximation to geometric models leads to a significant over- or underestimation with respect to direct volume. We also propose a data-driven formula for calculating the biovolume of *Coscinodiscus granii* and *Ceratium furca* specimens based on easily-measured linear dimensions.

PS28.3 - CYANOBACTERIAL SUCCESSION, SIZE STRUCTURE AND TOXINS IN THE VOLCANIC LAKE VICO (LATIUM, ITALY) OVER A FIVE YEAR PERIOD

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Human activities can substantially increase occurrence and severity of harmful cyanobacterial blooms and consequently the presence of cyanotoxins in water intended for human consumption. In this paper we addressed the relationship between filamentous toxic cyanobacterial and toxin succession in water samples of Lake Vico over a five year period (2010-2014). Bottle samples were collected at 5m depth at the inlet of a water treatment plant, serving the local community, and microscopically estimated for cell abundance and filament morphometry. Corresponding sample aliquots were used for HPLC-MS/MS toxin determinations. Microscopy image analysis allowed to tentatively discriminate between *Chrysosporum ovalisporum* (ex *Aphanizomenon ovalisporum*), *Dolichospermum* sp., *Limnothrix redekeii* and *Planktothrix rubescens* in the monthly samples, and to collect a large set of morphometric parameters of the populations, that occurr all year long in the reservoir. The existence of a succession of different morphotypes within a single cyanobacterial taxon was statistically tested and dimensional classes recognised in the natural populations. The linear dimensional patterns obtained were evaluated in relation with the toxin succession measured in the samples, being a number of different microcystin variants and cylindrospermopsin, the latter found for the first time in the lake, the main cyanobacterial toxins measured in this study.

PS28.4 - THE DETERMINANTS OF SEASONAL AND VERTICAL TRAIT DYNAMICS IN PHYTOPLANKTON COMMUNITIES, USING LONG-TERM DATA FROM GERMANY´S LARGEST DRINKING-WATER RESERVOIR

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Dynamics in phytoplankton communities are highly influenced by chemical and physical factors. Especially light energy and mineral nutrients are often key limiting factors in pelagic ecosystems. Both resources exhibit strong opposing vertical gradients in the water column, which underlie seasonal changes due to varying mixing intensity. The light versus nutrient availability gradient along the vertical axis offers the possibility for the development of vertical trait separation. In this study we statistically analyzed how abiotic factors determine the vertical distribution of algal communities and their functional traits.The influence of environmental drivers on seasonal and spatial phytoplankton trait dynamics was examined by using a vertically-resolved long-term dataset (>20 years)from the Rappbode Reservoir, Germany´s largest drinking water reservoir.We hypothesize that the development of vertical niches is high during periods with high thermal stratification and low vertical mixing.Therefore the highest vertical separation of different phytoplankton taxa and traits is expected during stratification in summer. Moreover we anticipate that taxa with different trait-values show different distributions along the vertical gradient in the water column. We presume that trait values associated with high nutrient competition abilities are more pronounced in algae closer to the surface, while in algae in deep waters trait values associated with high light competition abilities dominate.

PS28.5 - EFFECTS OF WEATHER EXTREMES ON PHYTOPLANKTON STRUCTURE AND COMPOSITION IN A FRESHWATER RESERVOIR

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River inflow is one of the major forcing of ecosystem function in canyon-shaped reservoirs. Phytoplankton seasonal dynamics in a reservoir have a close relationship with hydrodynamic changes in particular the inflow regimes and subsequent mixing processes that distribute inflow nutrients. In addition to a warming trend observed in numerous lakes and reservoirs worldwide, changes in rainfall patterns are predicted to result in higher frequency and intensity of rainfall events with longer intermittent drought periods. Using a thirty-year data set of chemical and biological parameters measured in the Římov Reservoir (Czech Republic), we examined effects of weather extremes on reservoir functioning. In dry and warm seasons cyanobacteria prevailed, benefiting from the enhanced water column stratification. Extreme rainfalls acted in contrast as disturbances, shifting seasonal planktonic events and favoring diatoms that rely mainly on turbulence to remain entrained in the water column. Detail analysis of particular flood events with high spatial and temporal resolution revealed another mechanism underlying changes in phytoplankton dynamics. Cyanobacteria, originally accumulated near the inflow, dominated across the whole reservoir soon after the flood as a result of excessive water withdrawal over the spillway and consequent preferential displacement of the epilimnion, which facilitated cyanobacterial transport to the dam.

CYANOBACTERIA SPECIES DIVERSITY, TRAITS AND DOMINANCE IN PHYTOPLANKTON OF MEDITERRANEAN FRESHWATERS

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Cyanobacterial species diversity and traits, dominance and biovolume of 47 Mediterranean freshwaters (21 lakes and 26 reservoirs) of different watersheds land use types and surface area, depth, altitude, mixing regime and trophic state were examined during the warm period of the years 2007-2013. In total, cyanobacteria were characterized by high taxonomic and functional diversity. Cyanobacterial biovolume ranged widely from 0.007 to 480 mm^3 L^{-1}. In most of the lakes, cyanobacteria dominated the phytoplankton community. Dominants were represented by species of the genera *Microcystis*, *Aphanizomenon*, *Anabaena*, *Planktolyngbya*, *Cyanodictyon*, *Limnothrix*, *Cylindrospermopsis*, *Aphanocapsa*, *Planktothrix*, *Pseudanabaena*, *Myxobaktron* and *Aphanothece*. We analyze and discuss the cyanobacteria species diversity, traits and dominance in relation to water body and watershed land use types.

LAND USE HETEROGENEITY AMONG CATCHMENT AREAS PROMOTES HYPER ß-DIVERSITY OF PHYTOPLANKTON COMMUNITIES ACROSS URBAN REGIONS

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β-diversity patterns among phytoplankton communities in 50 different lakes (Paris area, France) were analysed as a function of stochastic, spatial and environmental factors to better understand the sensitivity of these ecosystems to environmental changes and human pressures. β-diversity was estimated using the Sørensen dissimilarity index β and partitioned into its turnover (β_{sim}) and nestedness (β_{nes}) components. We then used a null model approach to test whether the observed species dissimilarity patterns across phytoplankton communities could emerge from stochastic processes alone, with species assembled independently of niche or spatial considerations. Finally, we tested whether the most distinct (spatially or environmentally) sites host the most distinct species communities and thus contribute most to the regional diversity using Isaac's evolutionary distinctiveness index. We found that the regional species pool was highly diverse (γ-diversity = 676), with β-diversity representing more than 95% of the γ-diversity. This unexpected hyper β-diversity pattern did not emerge from null models of random species distribution or by spatial processes. It was strongly related to the level of local environmental distinctiveness, with the most extreme environments, including human-dominated areas, promoting highly distinct phytoplankton communities. Our study suggests that in dense urban areas, the heterogeneity of land use across catchment areas contributes to the maintenance of high phytoplankton β- and γ-diversity, which may buffer ecosystem functioning against species loss.

LTER

PS29.1 - FIELD ENVIRONMENTAL PHILOSOPHY: INTEGRATING ENVIRONMENTAL ETHICS AND ECOLOGICAL SCIENCES AT LTSER-CHILE

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To effectively address global environmental change, Long-Term Socio-Ecological Research (LTSER) networks offer anideal platform to integrate research at multiple ecological, cultural, and political scales. However, this socio-ecological work still requires better integration of social components beyond economic factors, and consider the inclusion ethical dimensions. A central reason for the omission of ethical dimensions in LTSER is the lack of methodologies. To resolvethis limitation, at the Chilean LTSER network we have developed a methodological approach that we call “field environmental philosophy.” It integratesecological research and environmental ethics into biocultural education and conservation through an interrelated four-stepcycle: i) interdisciplinary ecological and philosophical research, ii) composition of metaphors, and communicationthrough simple narratives, iii) design of guided field experiences with an ecological and ethical orientation, and iv)implementation of in situ conservation areas. This cycle has been defined a posteriori, by analyzing successfulexperiences of biocultural research, education and conservation program at the Omora Ethnobotanical Park (OEP) in theCape Horn Biosphere Reserve (CHBR). The Masters of Science in Subantarctic Conservation at the University ofMagallanes (UMAG) adopted this cycle as a structured methodology to design theses and academic curricula for studentswho are creating innovative educational and ecotourism activities, such as “Ecotourism with a Hand Lens” and “EthicalBirding.” To articulate the programs at multiples scales, the OEP functions at the local scale as a research center in theCHBR, at the national level as a cofounder and southernmost site of the Chilean LTSER network coordinated by theInstitute of Ecology and Biodiversity (IEB), Chile, and at the international level as a reserve and field station of theSubantarctic Biocultural Conservation Program that is coordinated by UMAG, IEB and the University of North Texas(UNT). This organization of nested units has permitted to synergistically articulate the work at local, national andinternational scales. Collaborative research has led to the discovery of biological

and cultural diversity singularities in theremote Magellanicsubantarctic ecoregion, enabled education and conservation work with multiple social actors andinstitutions, and has strengthened the incorporation of environmental philosophy into socio-ecological research. In thisway, OEP's program is contributing to broaden the definition of the social (“S”) component in LTSER, and to generatemethodologies to integrate, at multiple scales, ecological and ethical dimensions into socio-ecological research, as well asbiocultural education and conservation programs, which could be implemented and assessed at other LTER sites.

PS29.2 - ECOLOGY AND ETHICS IN ILTER

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The European Long-Term Ecological and Socio-Ecological Research (LTSER) platform was designed “as a research infrastructure to support integrated socioeconomic and ecological research and monitoring of the long-term development of society–nature interaction within the context of global environmental change” (Haberl et al. 2009 , p. 1798). These quotes show that socio-ecological is subsumed by “socioeconomic” in foundational documents of Earth Stewardship and LTSER . It is also striking that in socio-ecological research, the fields of philosophy, including ethics, are most often absent. For example, in a recent comprehensive review of the state of the art in long-term socio-ecological research in the US and Europe by Singh et al. (2013), philosophy is not included, and the word ethics is not used. The integration of socioeconomic research into the LTSER framework during the last decades represents a significant step forward for the inclusion of the human component in LTER. Our work complements these approaches by incorporating philosophy and ethics as disciplines into the theory and practice of LTSER and Earth Stewardship. Earth Stewardship implies a paradigm shift in linking facts and values, multiple forms of ecological knowledge and practices, and broadening the mission of the ecological sciences. However, two core limitations need to be addressed: (i) geographical gaps in the coverage of long-term ecological and socio-ecological research (LTER, LTSER, and other long-term environmental research networks) across the planet; (ii) philosophical gaps in the epistemological, political, and ethical dimensions of LTSER. If the rates of anthropogenic damage to the biosphere are to be reduced, both research and its application on a planetary scale requires transdisciplinary as well as inter-hemispheric, and intercultural inputs. Also both scientific and traditional ecological knowledge are dynamic. The integration of biocultural diversity is not an integration of a collection of biological, physical, or cultural objects; it is the incorporation of dynamic, often conflictive, processes of intercultural dialogue, negotiation,

and poetic creativity. These intercultural, interdisciplinary, inter-institutional, and international processes generate forms of ecosystem co-management, which constitute Earth stewardship. Three areas of discussion contribute to fi nding the way forward: (1) embracing the multiple forms of understanding and co-inhabiting the biosphere; (2) undertaking the transdisciplinary work of long-term socio-ecological research networks; and (3) integrating ethics and ecological sciences through environmental citizenship. Bringing these broad areas together will contribute to overcoming the geographical and philosophical gaps that limit effective Earth Stewardship.

PS29.3 - AN INTEGRATIVE ANALYSIS OF THE VISIBLE AND INVISIBLE EFFECTS OF HURRICANE JOVA ON THE CHAMELA LTER SITE IN WESTERN MEXICO

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There is a growing interest on the potential socio-ecological impacts of hurricanes worldwide. Previous research about hurricane effects on ecosystems has centered on evaluating changes in patterns (visible structural effects: e.g. defoliation, understory light availability, uprooting of trees, avian nesting resources, branch and tree mortality) not in processes (invisible functional effects: primary productivity, water and biogeochemical cycles). Changes in ecosystem processes are poorly understood due to the lack of pre-disturbance data. In recent decades, hurricane impacts on ecosystems have increased particularly along the Mexican Pacific coast where Hurricane Jova landed in October 2011, causing an unprecedented forest disturbance.At the Chamela-Cuixmala LTER site we have a unique dataset that includes up to 30 years of pre-hurricaneJovadata for some ecosystem processes. Our objective was to synthesize pre- and post-hurricane data to document the immediate visible and invisible effects of Hurricane Jova on this seasonally dry tropical forest ecosystem in western Mexico. The visible effects of hurricane Jova (category 2)were remarkable. In the primary forest,there was decreased flowering and fruit production over the first year, and a third of known parrot tree-cavity nest-sites were lost, with a 2-mo delay in the timing of nesting by parrots in the first breeding season after the hurricane. In the secondary forest, abundance of amphibians and reptiles tended to increase probably due to greaterlight availability in the understory, whereas abundance of insects (lepidopterans) did not change. Hurricane Jova triggered massive forest defoliation and altered ecosystem processes. Litterfall rates ofmostly non-senescent leaves and branches increased by three-fold immediately after Jova. This was by far the highest litterfallpeak in 30 years of continuous monthly measurements, but dropped quickly to pre-hurricane levels in the following months. At the watershed level, there was a positive balance in dissolved organic carbon and nitrogen fluxes. The quick return to pre-hurricane levels for many processes may indicate that primary tropical dry forest is resilient to low-level hurricane impacts. However, other climatic events such as severe droughts, atypical dry season rains, or a prolonged rainy season, associated with the El Niño-La Niña cycle in the Pacific Ocean, need to be investigatedto understand the vulnerability of this ecosystem to infrequent climatic events that may increase with climate change.

PS29.4 - INTEGRATING SCALES AND LTER METHODS TO BETTER UNDERSTAND THE OVERALL DYNAMICS OF A MOUNTAIN PROTECTED SPACE: THE ORDESA AND MONTE PERDIDO NATIONAL PARK

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The Ordesa and Monte Perdido National Park and the Pyrenean Institute of Ecology (CSIC) recently joined the Spanish LTER network. As part of our strategy to understand recent changes in this protected area, we are carrying out a number of projects to evaluate changes at different spatio-temporal scales, using a variety of methods and approaches. We highlight here some of the most consolidated ones: long-term reconstructions from sedimentary lake records and cave speleothemes, the dynamics of one of the few active Iberian glaciers, thephysico-chemical components of alpine streams, springs and lakes, the fingerprint of climatic change from ancient trees, changes in the composition and structure of biodiversity of alpine communities, natural and man-made grasslands at different altitudes, and thetreeline, and population dynamics of endangered species or habitat indicators. The ecological monitoring shows that changes in both climate and land use, are having a strong influence in the physiognomy and structure of some of the most iconic and abundant habitats in the National Park. However, we found an important spatial variability in some processes, and also that othersdo not fit the established paradigms. The integration of partial results obtained from different methodologies and approaches diminishes the importance of each perception separately, helps to evaluate current changes in a long-term framework (geological scale), and will serve to validate the forecasts when modeling future environmental scenarios.

PS29.5 - MONITORING THE IMPACTS OF GLOBAL CHANGE IN SIERRA NEVADA LTER PLATFORM: PRELIMINARY RESULTS

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Sierra Nevada Global Change Observatory is a long term monitoring program to assess the effects of global change in Sierra Nevada LTER platform, a high mountain region (3,482 m.a.s.l., 177,000 Has) located in Southern Spain. The basic objective is to collect information to identify the impacts of global change and design management actions that minimize them. To achieve this objective, a solid monitoring programme has been designed to evaluate the effects of global change on Sierra Nevada. This monitoring programme, initiated in 2007, is based on thematic areas proposed by GLOCHAMORE Research Initiative (GLObal CHAnge in MOuntain REgions). Five years after its implementation, this work summarizes some preliminary results of different thematic areas: - Half of the area occupied by Sierra Nevada has suffered a significant reduction in rainfall as well as a significant increase in maximum temperatures in the last 50 years. These results are consistent with those obtained by future climate scenarios during the XXIth Century in Sierra Nevada.- These changes in rainfall and aerial temperature are also consistent with other observed trends: significant reduction in snow cover duration in Sierra Nevada, increase of water temperature in rivers/lakes and reduction of flow in rivers. - While climate change is expected to be a strong driver of change during the XXIth Century, land use changes has been very relevant in the last decades: 42% of the area occupied by Sierra Nevada has suffered changes in land use since 1956. - Changes in these two drivers (climate and land use) are shaping the structure and functioning of ecosystems in Sierra Nevada: o Terrestrial ecosystems: We have observed a densification of forest since the 1950s due to abandonment of rural activities. *Quercus* forests are colonizing pine plantations as well as abandoned mountain crops. Tree line is shifting uphill probably due to a combination of land use changes and climate change. These structural changes are accompanied by functional modifications: changes in phenology (forest raptors, flora), altitudinal shifts of alpine species and changes in the composition of bird communities. o Aquatic ecosystems: The increase in aerosol deposition detected since 2000 is provoking changes in the functioning of lakes in Sierra Nevada. The balance between oligotrophic and heterotrophic plankton has changed in several mountain lakes. We have also observed altitudinal shifts in river macroinvertebrates. These changes are consistent with the observed changes in brown trout demography and phenology. o Socioecosystems: We have detected a significant increase in human well-being of Sierra Nevada municipalities since 1989 to 2009. In total we have identified 84 relevant evidences of change in Sierra Nevada. These evidences can be classified according to different criteria. Under a spatial point of view most of the evidences are located in high mountain ecosystems as well as in aquatic ecosystems. Pine plantations contains also many evidences, due to the managerial actions conducted in this ecosystem type. The distribution of evidences among taxonomical groups shows that vegetation flora and aquatic microorganisms contain most of the collected evidences.

Finally, most of all the evidences (53%) describe cause-effect relationships between variables. Some others show significant trends in biophysical variables.

PS29.6 - ECOHYDROLOGY ACROSS THE GLOBAL DOMAIN OF ILTER

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Due to the number of factors: growth of human population, climate variability, increasing demand for resources and related environmental degradation, and economic instabilities due to broadly understood conflicts, water security in many parts of the world cannot be guaranteed in long term. The problem has been recognized internationally and addressed by global initiatives such as UNESCO International Hydrological Programme or UNDP Water Governance Security Programme. Simultaneously, both researchers and practitioners started to seek the solutions to water problems, which are economically feasible, ecologically efficient, and societally acceptable. The key issues became understanding of dependencies of society on water systems exposed to increasing stress and ways of achieving water security at all scales – local, regional and global, through development of respective systemic solutions. Current approach to the issues is threefold. First, water governance aspects attract more and more attention, especially: equity and efficiency in water resource and services allocation and distribution; IWM; water administration; relevance of policies, legislation and institutions; and clarification of the roles and responsibilities of government, civil society and the private sector. Secondly, it became critical to quantify ecosystem processes as relying on water – biota mutual regulation, to understand how the regulatory feedbacks will change under variety of pressures – both locally and globally, and how the regulation can be reinforced through nature-based solutions and harmonizing engineering, technology and green infrastructure. That approach is e.g. promoted by Ecohydrology Programme of UNESCO IHP. Thirdly, it become inevitable to develop societal tools and mechanisms to maximize the co-benefits that sustained water provides our regional social – ecohydrological - technological systems (socio-ecohydrological context). The ILTER is an unique network acting across space, scales, and research domains, and able to deliver synthesis of the long term data. ILTER includes recording co-evolution and mutual dependencies of social, economic and ecological components of socio-ecological systems, and has a potential to become an important partner in research and actions focused on water security and sustainability. With this initiative, we will explore the capacity of ILTER network and set up an action plan with respect to: 1) data on social, economic and biophysical attributes and on processes (across gradients) which drive availability, access to, and share of water resources between stakeholders (including ecosystems); 2) quantification / assessment of socio-ecological processes, cause-effect analyses at LTER sites that answer the questions on water quality, accessibility in long-term; and 3) system solutions – integrative / interdisciplinary science or/and approaches for problem solving.

PS29.7 - BIODIVERSITY MONITORING AS AN OPPORTUNITY TO ENGAGE ILTER IN CLIMATE CHANGE MITIGATION

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A core objective of ROBIN Project is the assessment of the role of biodiversity in tropical forest in mitigating climate change. Ongoing forest transformation suggests that a key requirement in the path toward sustainability is to understand tolerable levels of disturbance in the different environmental systems, amenable to maintain enough integrity in the ecosystems as to safeguard their ability to provide ecosystem services. In the framework of the international agreements to mitigate climate change, the countries are making efforts to develop better instruments to monitor the state of the environment and better estimate the impacts of the human actions on them. We have found that ecosystem integrity is a viable alternative. It is useful to effectively measure and monitor the impact of public policies on biodiversity and to assess simultaneously the capacity of a forest to provide various ecosystem services. As a proof of concept, we have elaborated maps that show the changes of ecosystem integrity in Mexico (2004-2007). Ecosystem integrity may meet the requirement of policy for biodiversity assessment and the implementation of international policies on biodiversity and mitigation of climate change. Ecosystem integrity is an integrated window that promotes a more holistic way of approaching ecosystem condition while dealing with environmental problems. The concept of Ecosystem Integrity has now been officially proposed in the framework of the Experimental Ecosystem Accounts of the UN Statistical Division.

PS29.8 - MONITORING OF ESSENTIAL BIODIVERSITY VARIABLES IN PROTECTED AREAS AND ENVIRONMENTAL CHANGE: IMPACT OF RURAL ABANDONMENT IN LTER MONTSENY (NORTH-EAST SPAIN) MEASURED BY MEANS OF INDICATORS BASED ON BIRD MONITORING DATA

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Delivering scientific information to the policy makers and the general public on how global change is affecting biodiversity represents a crucial step for the implementation of widely accepted environmental policies. It is therefore important to monitor a number of Essential Biodiversity Variables (EBV) capable to track the impact on biodiversity of main environmental changes. Strategies to reinforce large-scale long-term monitoring projects in the LTER nodes may facilitate comparisons of ecological responses within LTER networks, regions or countries and improve integration into large scale policies. The abandonment of traditional land use practices in mountainous areas is reported as one of the main environmental pressures in the Mediterranean Basin since it produces a general vegetation encroachment and thus a decrease in open habitats. The protected mountain areas of the LTER network are privileged zones to study in detail this process by means of long-term monitoring projects. In this work we used well-established indicators based on bird monitoring projects to evaluate the impact of afforestation on birds in the LTER Montseny (north-east Spain). This strategy allowed developing indicators that determine the shifts in bird communities associated to the open and forest habitats of this LTER nodule and robustly compares them with those determined at regional level. In this work we used multispecies indicators based on the geometric means of yearly population indices to determine the change that forest and open habitat birds are undergoing in these environments. Results show that the impact of vegetation encroachment is noticeable in the populations of open habitat species (44% population decrease between 2002 and 2014). Following these results, park managers, together with local socioeconomic stakeholders, are currently promoting practices to recover and improve open pastures and disseminate all this monitoring strategy among the users of the park.

PS29.9 - A QUARTER-CENTURY MONITORING OF LITTERFALLS AND REPRODUCTIVE INVESTMENT OF TREES IN THREE FOREST SITES OF JAPAN LTER (JALTER)

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Monitoring seed- and litter-falls in forests is fundamental in understanding patterns, processes and functions of ecosystems. Since 1980's we have performed the seed/litter trap investigations in three forest sites, Aya Research Site (ARS), Kanumazawa Riparian Research Forest (KRRF), and Ogawa Forest Reserve (OFR). These three sites are placed across temperate climate regions in Japan, and share basic plot designs. In this poster, we show case-study highlights from our 24-28 years in each site. ARS is under strong influence of typhoon disturbance. Sato et al. (2010) documented annual litterfalls for 14 years and demonstrate resilience after a strong typhoon-hit event in 1993. In KRRF, disturbance includes canopy breakage through strong winds as well as heavy rain-induced transportation of fluvial sediments. The combined disturbance regime provides various site conditions, leading to the occurrence of a diverse array of temperate tree species. Here, relationships between annual seedfall variability and rodent population fluctuation have also been studied intensively (e.g. Hoshizaki and Hulme 2002). In OFR, a prominently successful site in Japan, basic life history parameters and their variability have been illustrated (e.g. Nakashizuka 2001). Shibata et al. (2002) documented annual variability of community-wide reproductive outputs in a 9-yr (1987-1995) study. Since the findings therein is testable using longer-term data and also in the other two sites, we have ample opportunity to explore decade-scale trends in litterfall and tree reproduction. Based on an updated version of the dataset, we also show some prospects for tree reproduction along the environmental change since late 20th Century.

PS29.10 - ILTER NITROGEN INITIATIVE: CHALLENGE FOR GLOBAL COMPARATIVE STUDIES ON NITROGEN CYCLES

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Nitrogen is an essential nutrient for ecosystem, but become source of pollutant at the excess N use by human activity. Nitrogen pollution is a key global and regional environmental issue that already exceed planetary boundary. Once nitrogen is produced in the environment as a form of reactive nitrogen, the impacts to the ecosystem and environments cascades among atmosphere, land, water and ocean through the complex interaction. The ILTER-N Initiative is one of the leading research initiatives working on the ILTER platform with international collaboration of the long-term and site-based studies. The ILTER Nitrogen Initiative has been organized to foster the various nitrogen-related researches since 2011 through several workshops with publication of review paper (Shibata et al. 2015: AMBIO 44(3):178-193). The contributing member (>20 researchers) have various backgrounds and belongs to various member network of ILTER worldwide. The ILTER-N initiative is now conducting global comparative or meta-analysis on key research topics on nitrogen issues in ecosystems with long-term aspects based on the field observation data in each LTER site in various climate and biomes. The current specific focus of the global comparison include: (i) Lichen and mosses as bio-monitoring, (ii) N_2O emission from different ecosystem and environments, (iii) Long-term legacy impact on current N cycles. The recent outcomes, key research questions and future plan is described.

PS29.11 - DOMINANCE CONTROLS DIVERSITY: PLANT COMMUNITY RESPONSES TO GRAZING FROM A WORLDWIDE META-LEVEL ANALYSIS

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Human alterations of historic disturbance regimes are pervasive in their impacts on patterns of plant diversity, community organization and ecosystem function. This is especially true in disturbance–dependent ecosystems such as grasslands sensu lato where depauperate herbivore suites are common. Responses of herbaceous plant communities to grazing vary widely in these systems, with grazing having positive, negative, or no effect on diversity. The prevailing theory is that contrasting responses to grazing (or the loss of grazing) occur primarily because of differences in productivity driven by moisture availability; however, not all grasslands conform to this theory. Many studies have examined direct effects of grazing on plant species richness, often evoking grazing effects on dominance as an explanation of their results but without explicit tests of this mechanism. Our main objective was to determine how grazing impacts plant richness via its effects on plant dominance and how these patterns vary across productivity gradients. To do so, we conducted a meta-level analysis (based on raw species composition data) comparing results from grazing exclosure experiments in which large herbivores were excluded from 215 sites around the world; 15% from each of Africa, Asia and South America, a further pooled 15% from Australia and Europe, and with the majority (40%) sited in North America. Included data sets reflect the effects of at least 3 years of herbivore exclusion; 60% of sites provide data reflecting 10 or more years of grazing manipulation and 18% of sites provide herbaceous data following 50 years of exclusion. These 215 sites span a wide range of locations as well as large gradients in mean annual precipitation (45-1511 mm). In contrast to general theory, we found that the effects of grazing on both dominance and richness do not vary consistently across the rainfall gradient. Instead and importantly, we found that the effect of grazing on richness is strongly related to the effect of grazing on dominance. Essentially, richness increases as dominance decreases. This pattern held across all continents and across the rainfall

gradient. These results demonstrate for the first time across large precipitation gradients and on multiple continents that the mechanism driving grazing effects on richness is dominance.

PS29.12 - 21-YEAR PATTERNS OF LITTERFALL IN RELATION TO TYPHOON DISTURBANCE AND PREVAILING CLIMATE

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Litterfall production ad decomposition are important ecosystem processes closely linked to ecosystem structure and function. The effects of precipitation and temperature on litterfall patterns has been widely examined. In contrast, the effects of climate extremes such as tropical cyclone is much less well documented. Addressing the long-term ecological effects of changes in climate extremes requires data both prior and post extreme events for multiple events over a period that is long enough to detect patterns of both climate extremes and ecological patterns/processes. Yet, the long return intervals between cyclones in most regions make acquisition of both prior and post cyclone data very challenging. Fushan Experimental Forest, the first Long-term ecological site in Taiwan experiences on average 1.7 typhoons per year is an ideal site to examine long-term patterns of litterfall in relation typhoon disturbance. We used 21 yr monthly litterfall data to explore the relationship between litterfall and 1) prevailing climate factor and 2) typhoons. Our results indicate that there was an increasing rate of approximately 1.5 category 3 typhoons per decade between 1959 and 2013 and typhoon disturbance dominated 21-yr pattern of litterfall at a subtropical rainforest in Taiwan. The number of typhoons positively correlated with annual litterfall with a slope of 1100 kg ha^{-1} per (Simpson and Saffir scale) category 3 typhoon. While typhoon season litterfall (~800 kg ha^{-1} mo^{-1}) varied more than 10 folds, a comparable litterfall peak (700 kg ha^{-1} mo^{-1}) associated with annual leaf senescence varied < 20%. Monthly maximum wind speed has high predictive power of monthly litterfall and the role of precipitation and temperature become more evident when typhoon affected periods were excluded from the analysis. Both annual leaflitter and LAI increased gradually following the record high 4 typhoons in 1994 to levels higher than before the 1994 typhoon season and the two are highly correlated suggesting that the long-term trend of litterfall can be explained by forest growth. We propose that while long-term increases in litterfall is likely related to forest growth, the rate of litterfall increase and biomass accumulation likely limited by the frequent typhoon disturbance. Predictions on long-term ecosystem patterns and processes requires a thorough understanding of the role of climate extremes such as cyclone disturbance.

PS29.13 - STUDYING SPECIES DIVERSITY AND ITS LINKAGE TO ECOSYSTEM FUNCTIONS IN THE FUSHAN EXPERIMENTAL FOREST, TAIWAN – A LONG-TERM ECOLOGICAL STUDY VIA A FOREST DYNAMICS PLOT

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The high diversity of tree species in tropical forests has intrigued ecologists for a long time. Understanding mechanisms of species coexistence and the impact of species diversity on ecosystem functions have been important themes in modern ecology. To appropriately address this question, a large-scale, long-term and spatially-explicit approach is necessary. A series of forest dynamics plots, therefore, have been established worldwide since 1980s, including Taiwan. A 25-ha forest dynamics plot was established in the Fushan LTER site, Taiwan in 2003. In the forest dynamics plot, all woody stems greater than 1 cm in diameter at breast height (DBH) were identified, tagged and mapped and recensus every five years. Three tree censuses were completed since 2003 (2003, 2008 and 2013). Using available census data, we investigated spatial and temporal variability in tree abundance and functional traits to identify potential mechanisms of species coexistence. We also explored relationships between species richness and aboveground biomass. Our analyses suggested that habitat preference and habitat filtering could be critical mechanisms for species coexistence in the Fushan Experimental Forest. Especially, habitat-specific mortality rates were detected in Fushan and suggested strong filtering effects imposed by habitats. In the Fushan Forest, aboveground biomass increased with convexity and stem density. However, there is no significant relationship between species richness and aboveground biomass. The long-term data at the Fushan LTER site revealed that topography is critical in maintaining species diversity in the forest. It may influence ecosystem functions. In this study, we demonstrated a case study in which census data of forest dynamics plots provided a unique opportunity for long-term ecological research.

PS29.14 - LONG-TERM MONITORING OF CORAL REEFS IN THE MEXICAN PACIFIC: ACHIEVEMENTS AND SOCIOECOLOGICAL IMPLICATIONS IN A CLIMATE-CHANGING WORLD

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“Arrecifes del Pacífico” is a group of the MEXLTER founded in 2004. We have been monitoring the main coral reefs in the Mexican Pacific (MP) since 1998, recording coral cover and relative abundance of fish and macro-invertebrates as well as characterizing the socio-economic environment. Unlike what happened in southern locations in the Eastern Pacific, coral reefs in the MP have not been drastically affected by El Niño, showing rapid recovery to bleaching events and resilience to environmental and anthropogenic impacts. In recent years, the group has started monitoring ocean acidification and its impact on coral reef ecosystems, but results in this respect still pending.

PS29.15 - CHANGES IN BIODIVERSITY AND TRADE-OFFS AMONG ECOSYSTEM SERVICES, STAKEHOLDERS AND COMPONENTS OF WELL-BEING: THE CONTRIBUTION OF THE ILTER TO PECS

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The ILTER network covers a wide range of socio-ecological conditions and is aligned with the Program of Ecosystem Change and Society (PECS) goals and approach. The aim of this poster is present the conceptual basis for a proposed collaboration between ILTER and PECS. We describe how a coordinated effort of several contrasting LTER site-based research groups, contributes to the understanding of how policies and technologies drive either towards or away from the sustainable delivery of ecosystem services. This effort is based on three tenets: trans-disciplinary research; cross scale interactions and subsequent dynamics; and an ecological stewardship orientation. The overarching goal is to design

management practices taking into account trade-offs between using and conserving ecosystems towards more sustainable solutions. To that end, we propose a conceptual approach linking ecosystem integrity, ecosystem services and stakeholder well-being, and as a way to analyze trade-offs among ecosystem services inherent in diverse management options. We also outline our strategy and methodological approach which includes: i) monitoring and synthesis activities following spatial and temporal trends and changes on each site and by documenting cross-scale interactions; ii) developing analytical tools for integration; iii) promoting trans-site comparison; and iv) developing conceptual tools to design adequate policies and management interventions to deal with trade-offs. Finally, we highlight the heterogeneity in socio-ecological setting encountered in small subset of 15 socio-ecological research groups. These study cases are diverse enough to provide a broad cross-section of relevant ecosystems with: different policy and management drivers of ecosystem conversion; distinct trends of biodiversity change; different stakeholders' preferences for ecosystem services; and diverse components of well-being issues.

PS29.16 - SOCIO-ECOLOGICAL RESEARCH AT THE ENGURE LTSER PLATFORM, LATVIA

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LTSER platforms have been developed by the countries of ILTER network for integrated studies of socio-ecological systems under different climates and different economies. Latvia LTSER platform represents the drainage basin of costal Lake Engure (644 km^2) including the coastal marine zone of the Gulf of Riga. The core zone of the territory is the Lake Engure Nature Park (LENP), the Ramsar site. The first version of the conceptual model was elaborated for the Engure LTSER platformbased on a modified version of DPSIR (Drivers–Pressures–States–Impacts–Responses) concept. The main external drivers comes from political system, energy and food consumption, leasure time spending, and improvement of living conditions.The local drivers are agriculture, demand for timber and firewood, building construction, demand for lands on the sea coast. The Engure LTSER was subdivided into seven sub-regions demarcated by natural geological and geographical barriers. Each sub-region has specific set of drivers and pressures as well as specific ecosystem structure and elements of biodiversity. Analysis of the governing drivers and pressures was performed separately for each sub-region during three time periods: the period from 19th century to beginning of 20th century, the period of Soviet occupation (1940–1991), and the period after restoration of independence of Latvia (1991 – up to now). These periods differed significantly by antropogenic pressure to the landscape, in particular intensity of agriculture and environmental pollution, and human attidude to nature conservation and environmental protection. Periods of high agricultural activity are reflected by the chemical composition of the lake sediments. At present there are no strong sources of local air pollution in the region, transboundary pollutants dominates, except ground level ozone and chemical elements fromroad dust. Biodiversity of grasslands is endangered because of land abandonment, dune vegetation is subjected to changes due to trampling and eutrophication. Climate warming interacts with various local environmental factors, including human induced ones, such as regulation of lake water level, water pollution and soil eutrophication by nitrogen deposition. More than fifty-year monitoring of thebird faunaof the LENP showed that nine bird species of southern origin have started nesting there while five northern species have ceased nesting in the region. Long-term (1995-2012) studies of insect within 12 different habitats of the LENP revealed statistically significant increase in species richness of flies (Diptera) in dry and moderately moist habitats which was interpreted as a result of complex interactions of climate warming and nitrogen pollution of soils.

PS29.17 - LARGE MOORINGS ARRAYS AROUND SOUTH AFRICA – DEVELOPMENT IN DEEP OCEAN MOORING SYSTEMS

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South Africa is at a geographical advantage, ideally positioned between three large oceans, the Indian, Atlantic and Southern Oceans and bordered on the east by the Agulhas Current, the largest western boundary current in the Southern Hemisphere; a highly productive eastern boundary current to the west, the Benguela Current, and the perpetually eastward flowing Antarctic Circumpolar Current to the south. Large arrays of moored instruments collecting in situ ocean current, temperature, salinity and dissolved oxygen data are the most effective way of providing long term, continuous observations and monitoring changes on daily to interannual time scales, resolving mesoscale dynamics, transport variability and the impact key oceanographic features such as the Agulhas Current and the Benguela Jet have on the Meridional Overturning Circulation a fundamental driving force of the earth's climate systems. Two arrays have been developed and partially deployed thus far. The first in to the South Atlantic as part of the South Atlantic Meridional Overturning Circulation initiative, encompassing four tall moorings (full water column measurements) of 75 kHz ADCPs and SBE Microcats, two shelf moorings, and eight CPIES installations. These will have been deployed for one year when the maintenance crews takes place in October 2015. The second array in to the Agulhas Current off the east coast of South Africa, the Agulhas System Climate Array, has four of its seven tall moorings deployed thus far encompassing 75 kHz ADCPs, single point current meters and SBE Microcats and two shelf moorings. In April 2016, a maintenance crews will service the existing array and deploy a further three tall moorings and five CPIES installations. Given the magnitude and global importance of the arrays, the technical and scientific teams are made up of local and international researchers, across the physical, chemical and biological oceanography disciplines, thus fostering collaboration. These arrays enable monitoring and understanding of global circulation. Collaboration between South Africa, and international partners promotes local skills development necessary to establish and maintain these large arrays. The extensive datasets stemming from these long-term deployments will be used for scientific research but also for policy and decision-making with respect to impacts ranging from regional weather and severe events, to fisheries and global environmental health.

PS29.18 - LONG-TERM SOIL WARMING EXPERIMENTS IN COOL-TEMPERATE FORESTS BELOWGROUND CARBON DYNAMICS

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How climate warming will affect soil respiration (R_S) and its source components is poorly understood despite its importance for accurate prediction of future global carbon (C) cycles. To simultaneously assess the effects of warming on R_S, heterotrophic respiration (R_H), autotrophic respiration (R_A), and their temporal variation, we examined their responses to increased temperature in open-field soil warming experiments using heating wires in both undisturbed and trenched plots. The experiments were conducted at JaLTER sites, the short-term warming site (Takayama field station, TKY) and the long-term warming site (Tomakomai experimental forest, TOEF) in a temperate deciduous forest ecosystem dominated by Quercuscrispula in Japan. Soil warming stimulated RSduring the snow-free season by 24% at TKY and by 34% at TOEF. The warming effect size on R_H was higher than that of R_A at both sites. The magnitude of the warming effect showed seasonal variation; the effect on R_S was greatest during the early and late parts of the growing season, suggesting that warmer spring and fall temperatures might increase the warming effect more than warmer summer temperatures. Temperature sensitivities (Q_{10}) of R_S based on full-year data to warming were 3.47 in control plots and 2.86 in warmed plots at TKY, versus 2.79 and 2.41 at TOEF, showing the possibility of thermal acclimatization of R_S by declines in Q_{10} of R_H and R_A by warming. It will be necessary to account for the different responses of soil respiration components to warming as well as their acclimatization processes to accurately predict the long-term impacts of global temperature on future soil C cycles.

PS29.19 - A NATIONWIDE LONG-TERM MONITORING SURVEY OF FOREST ECOSYSTEMS IN JAPAN

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A forest ecosystem monitoring network linking 48 sites (mainly old-growth forest), including 23 sites of JaLTER, all over Japan was developed in the Forest and Grassland survey of the Monitoring Sites 1000 Project funded by Ministry of the Environment of Japan. Censuses of indicator organisms (trees, ground-dwelling beetles, birds) and carbon stocks have been conducting every year or every 5 years at each site (Ishihara et al. 2011; Suzuki et al. 2012). The results in the initial 10 years (2004-2014) showed geographical patterns of forest biodiversity and temporal trends suggesting community shifts. For trees, directional changes in the relative abundance of functional types were detected along the temperature gradient. Relative abundance of evergreen broad-leaved trees increased near their colder range boundaries, especially in secondary forests, coinciding with the decrease in deciduous broad-leaved trees. Similarly, relative abundance of deciduous broad-leaved trees increased near their colder range boundaries, coinciding with the decrease in boreal conifers (Suzuki et al. 2015). Continuous monitoring is needed to determine whether they are transient trends or relating to long-term shiftsfor other indicator organisms. This long-term and wide geographic scale monitoring is expected to enable to detect signs of ecosystem changes due to large-scale gradual environmental shifts caused by global warming.

Ishihara, M. et al. (2011) Forest stand structure, composition, and dynamics in 34 sites over Japan. Ecological Research Data Paper 26: 1007-1008. Suzuki, N. S. et al. (2012) Nation-wide litter fall data from 21 forests of the Monitoring Sites 1000 Project in Japan. Ecological Research Data Paper 27: 989-990. Suzuki, N. S. et al. (2015) Regional-scale directional changes in abundance of tree species along a temperature gradient in Japan. Global Change Biology online.

PS29.20 - MAPPING PRODUCTION OF BIOMASS BY ANNUAL PLANTS IN MEDITERRANEAN EVERGREEN WOODLANDS IN THE MONTADO LTSER PLATFORM

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Mediterranean evergreen woodlands are sparsely forested areas, where trees occur mingled with patches of shrublands and grasslands dominated by annual plants. While the standing biomass (trees and perennial shrubs) is often calculated in ecosystem services studies, the production of biomass by annual plants remains overlooked. This annual biomass is an important part of the overall ecosystem produced biomass, and it's consumed locally by cattle (by extensive grazing), harvested and stored to be consumed elsewhere as forage (in livestock production units) or stays in the system contributing to soil organic matter and to soil quality avoiding erosion. Although it could be assumed that the production of biomass by annual plants is the same for the entire ecosystem range, previous work has shown that annual biomass strongly depends on the local climate and land-use. For this reason the production of biomass by annual plants in woodlands must be measured in a spatial explicit way. This work was done within an LTSER Platform established to study these woodlands, located in southern Portugal, the LTSERmontado (LTER_EU_PT_001, see ltsermontado.pt). The platform includes 6 Research and Monitoring stations distributed over a climate and land-use intensity gradients. In this work we have focused in Holm-oak (*Quercus ilex*) woodlands, because they are located between the semi-arid and dry sub-humid climates, limited by water availability and located in the areas most prone to be affected by desertification and land degradation. To characterize the production of biomass by annual plants in Holm-oak woodlands we used long-term (12 years) satellite measures provided by Modis and calculated several metrics related to the annual vegetation, over the entire span of Holm-oak woodlands distribution in Portugal (the south-east area of mainland Portugal). These variables were collected annually for each growing season from 2000 to 2012 and then averaged. In siteslocatedover the same gradientwe also measured in the field the annual biomass production. A model was then built relating satellite and field data, and then used to extrapolate the biomass values production over the entire study area. A map, showing the production of the biomass produced by annual plants within Mediterranean woodlands was then built and evaluated using geostatistics. Using this approach, we could calculate the production of biomass by annual plants within Holm-oak woodlands distribution. The values differ greatly between sites, from less than 50 g m^{-2} to 350 g m^{-2} or more. These values were spatially aggregated, with a spatially continuity of

6500m, suggesting that these patterns can be caused by climate, soil or land-use intensity. The most productive regions were located in the center of the distribution area of Q. ilex, while less productive regions were located in the mountains areas to the north and south. This work highlighted that the production of biomass by annual plants within woodlands can be accessed by associating satellite and field data. Due to the large differences between sites, these values must be mapped with high spatial resolution, rather than assuming a value for the entire region.

PS29.21 - BROADENING THE SOCIETAL RELEVANCE OF INTERNATIONAL LTER NETWORK CARBON SCIENCE AND DATA

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The ultimate objective of the United Nations Framework Convention on Climate Change (UNFCCC) is to achieve "... stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system…". Estimating the levels of greenhouse gas (GHG) emissions and removals by means of GHG inventories is an important element of the efforts to achieve this objective. The goal of this workshop is to present the context for a framework and mechanism to support this objective in the areas of agricultural and land use and land-use change, and increase capacity around the globe to produce inventories that are “neither over nor underestimates and reduce uncertainties as far as practicable” (IPCC 2000). Through integration, we can hope to broaden the societal relevance of international carbon networks and ILTER to achieve stabilization of GHG and address environmental issues at national and global scales. The IPCC Task Force for National Greenhouse Gas Inventories (TFI) develops national-scale greenhouse gas (GHG) methodological guidance in documents requested by governments through the United Nations Framework Convention on Climate Change (UNFCCC). The TFI hosts a database or “evolving library” of data (Emission Factor Database), including country-specific data that is used to improve the quality of greenhouse gas (GHG) inventories. The TFI provides a workable framework for enhancing data for policy use, but there are significant gaps between available data and policy-relevant data. This initiative will aim to highlight and consolidate the potential synergies that can be created by linkages between efforts like that being conducted by the IPCC, the ILTER Network and other international carbon-related networks. Our working group brings together experts from across the science-policy discipline. We will address: 1) the networks, what is covered and the gaps, 2) how to incentivize integration and data delivery, and 3) how this can be achieved. The goal is to leverage this expertise to foster a successful model for interlinking science and policy to narrow the gap between high quality, available data produced by the ILTER and useable data required for global climate policy support.

PS29.22 - EFFECTS OF ALTITUDE SOIL WARMING AND LITTER ACCUMULATION ON THE DECOMPOSITION BY USING TEA BAG EXPERIMENTS

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Decomposition of litters in the fields should be largely affected by litter traits as well as environmental factors. We have to evaluate the decomposition rate by using a common material when we compare the decomposition activity in multiple sites. In this study, we investigated the decomposition activity and its response to the environments which include 2500 m variation in altitudes, soil warming, and litter manipulations by using the tea bag index (Keuskamp et al. 2013). We set up the tea bags at 55 sites ranging 300 to 2800 m in altitudes which include the Japanese Central Alps, Mts. Northern Yatsugatake, Mt. Norikura, Mts. Okuchichibu. In addition, we set up 6-10 tea bags at the soil warming and its control sites in Tomakomai Exprimental Forest of Hokkaido Univ. (TOEF) and Takayama site of Gifu Univ., and at litter manipulation sites and its control sites in TOEF and Nishikoma Experimental Forest of Shinshu Univ. We set up the tea bags at early June to late July, and collected it after 90 days. We calculated the index of short term decomposition rate (k) and that of stabilization factor (S) from the two kinds of tea bags. The index of short term decomposition rate (k) was higher where the pH was high, and the index of stabilization factor (S) was smaller where the soil temperature was high. Furthermore, soil warming manipulation tended to accelerate k. The litter removal manipulation tended to decrease k, and the litter addition tended to decrease S. In conclusion, the indexes of decomposition activity k and S are valuable to examine the response of decomposition to environment.

PS29.23 - INTERNATIONAL PERSPECTIVES FROM LONG-TERM RESEARCH IN ECOSYSTEM CARBON CYCLING SCIENCE: IMPLICATIONS FOR GLOBAL CHANGE RESEARCH

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Unique insights are gained from international perspectives rooted in the context of long-term research. An enhanced understanding of the approaches to and challenges of understanding processes that affect ecosystem carbon (C) budgets across continents and biomes contributes significantly to the advancement of the science of global change. We focus on the unique contributions made from collaborative and site-based international long-term research efforts to gain new insights on ecosystem C budgets and to draw out applicability and implications for global change research. We provide an overview of several long-term projects and networks, reflect on the key questions related to C cycle science (CCS) and uncertainties they address in the context of the current state of knowledge. Drawing on examples from various approaches, scales and hierarchal levels of inquiry applied at long-term research sites, we posed questions to better understand soil C development by disentangling local conditions from species effects in forest biomes, evaluating the influence of chronic nutrient additions in grasslands, and manipulating component inputs and effects on soil respiration. We also review the significant contributions made to CCS through large-scale, long-term research networks at the national and global scales. This synthesis highlights the valuable insights gained from international, long-term research and identifies priorities to further broaden the ecological scope and societal relevance of international long-term CCS for global change research.

PS29.24 - FOSTERING ECOLOGICAL DATA SHARING: COLLABORATIONS IN THE INTERNATIONAL LONG TERM ECOLOGICAL RESEARCH NETWORK

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A founding aim of the International Long Term Ecological Research (ILTER) Network, a network of national LTER networks, is to collect data with which to address broad spatial and temporal scale ecological research questions. These data are valuable, however, only if the data can be easily discovered, accessed, and understood by scientists throughout the network. Challenges to publishing ILTER data have included unequal distribution among networks of information management expertise, user-friendly tools, and resources. Language and translation have also been issues. Despite these significant obstacles, ILTER information managers have formed grassroots partnerships during the last 20 years to advance ILTER information management. Their collaborations have included 1) ILTER information management training workshops; 2) development of a multilingual thesaurus that supports data discovery across the many languages of the ILTER Network; 3) development of the Drupal Ecological Information Management System (DEIMS), a web-based framework for managing information products for ecological research sites; and 4) workshops to capitalize on synergies between information managers and scientists to produce research products. Here, we describe these accomplishments and products. We also note lessons learned about what has made these international grassroots collaborations successful within the ILTER information management community. In an environment where resources are limited and research is global in scale, international grassroots collaborations such as these may become an emerging norm in ecology.

PS29.25 - LINKING LONG-TERM ECOSYSTEM MONITORING TO FOREST MANAGEMENT FOR MULTIPLE ECOSYSTEM SERVICES

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The demand for comparable, long-term, high quality data on the status of ecosystems, their ecosystem services and the changes is increasing at the national and global levels. Over the past thirty years, forest monitoring in Slovenia and Europe has provided an effective methodology for ecological evaluation and modelling of forest processes as well as for investigating the effectiveness of forestry and environmental policy measures. Previous investment in forest monitoring and research is a strong basis for future needs, provided that effective communication with the end-users is established. Forest covers about 60% of Slovenia and is a symbol of the country's recognition as well as reflection of its attitude towards sustainable and close-to-nature forest management system for multiple ecosystem services. The Forest monitoring programme in Slovenia has been taking place informally since 1986 and from 2004 onwards within the framework of the ICP Forests Programme, widely implemented in most European countries as well as in Canada, USA and some Asian countries. The transnational network of monitoring plots, including their installation and equipment, is an outstanding asset for European scientists in forestry, meteorology, modelling, medicine and decision makers. This study presents an approach how long-term observations of different forest ecosystem compartments using internationally harmonized techniques and approaches can be linked to sustainable forest management principles and provision of multiple ecosystem services by forests, e.g. biodiversity, carbon sequestration, clean air and water production, etc. Forest monitoring should be continuously evolving and adapting in order to reflect the evolving emphasis on multipurpose ecosystem services. Therefore, we present two demonstration projects where forest monitoring approaches were used to address specific forest management for multiple ecosystem services: Monitoring ecosystem services provided by urban forests within the LIFE+ project EMoNFUr In the recent years there has been an increasing focus on ecosystem services provided by urban forests, such as flood regulation, moderation of the urban climate, air, water and soil pollution reduction. Relative to natural ecosystems, urban ecosystems seem to possess similar climate, soils, vegetation, soil dynamics, and flows of energy as a result of natural ecological patterns and processes. However, urban ecosystems differ from natural ecosystems in importance and prevalence of certain disturbances. Consequently, monitoring of ecosystem services in urban forests differs from the one in managed forests. Harmonized methodology for monitoring multiple ecosystem services in urban forests and plantations is presented and could serve as an example of adaptive forest monitoring. The project Life+ ManFor C.BD where the impact of different forest management options on carbon cycling, biodiversity and social well-being were monitored. Sustainable forest management principles are continuously challenged by innovative forest management practices. We present how the provision of multiple ecosystem services by managed forests, e.g. biodiversity and carbon sequestration was assessed by linking longterm forest

monitoring plots and research activities with different forest management practices, relating the results to the Pan-European indicators for Sustainable Forest Management.

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