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"Ecology and Evolution: New perspectives and societal challenges"

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Ecology & Evolution: New perspectives
and societal challenges

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Abstract book – Poster presentations
Regular sessions

Poster Session 1: Wednesday 23/11 ; 17:00-18:00 Hall 1

Poster Session 2: Thursday 24/11 ; 16:15-17:15 Hall 1

Agroecology/ecology of agroecosystems

00034
Contributions of agroecological infrastructures in developing pesticide-free solutions against the beet yellowing disease

Poster

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Abstract

In many crops, aphids cause direct damage through sap consumption, but also indirectly through the transmission of diseases to plants. In sugar beets, one devastating disease is the yellowing disease which causes severe yield losses. Since the banning of neonicotinoids and in order to support the agro-ecological transition, it is necessary to find perennial solutions against yellowing virus vectors. The deployment of agro-ecological infrastructures (AEI) such as hedges or flower strips is a strategy of plant diversification leading to a better regulation of crop pests. AEIs offer different types of food resources or habitats to natural enemies of aphids, which can increase the density and diversity of biological control agents locally. We monitored aphid (*Myzus persicae* and *Aphis fabae*) densities and their main airborne (parasitoids, hoverflies, lacewings, ladybugs) and ground-dwelling (carabid beetles, spiders, staphylids) natural enemies in about 20 fields. Each field had a border formed by a flower strip and another border formed by a grass strip. The monitoring was done until the end of the sensitive stage of the plant, and along transects starting from each type of border, and at three distances from the border. The project covers a large part of the sugar beet production area in France, which allowed to test whether the effectiveness of AEIs implemented in the fields on biological data (abundance of aphids and their natural enemies, symptoms of yellowing) depends on the climatic context (temperature gradient) or on the landscape context (gradient of landscape openness, presence of semi-natural habitats). The goal was to better consider these context-dependent effects in order to better inform decision-making in terms of aphid pest and disease vector management. Initial results indicate different dynamics of pests and their natural enemies near the flower strip, strong effects related to the distance to the border, as well as contrasts on a broad geographic scale.

00073
Protected semi-natural grasslands have higher plant species richness next to organic than to conventional arable fields

Oral

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Abstract

Semi-natural grasslands are highly species-rich and therefore usually protected areas. However, nature reserves are often small and at least their margins are affected by the land use of surrounding areas. It is likely, that only beyond a certain buffer, reserves display their full protective effect and that this depend on the kind of land use. However, how grasslands biodiversity is developing from their edges neighbouring arable fields into their deeper interior is not well-known.
Here, we compared the plant species richness of protected semi-natural grasslands next to organically versus conventionally managed arable fields in two German landscapes. We surveyed the vegetation in each ten 2x2 m plots distributed from the edges up to 50 m into the grasslands. In addition, we compare the local stand characteristics via Ellenberg indicator values and soil parameters.
In line with our expectations, the plant species richness in the edges of grasslands next to organic versus conventional arable fields differed notably. However, we did not expect that this difference holds true over the total sampled distance of 50 m into the grasslands interiors. Grasslands next to organic fields had lower Ellenberg moisture values, lower nitrogen und higher calcium content. The set of determining stand characteristics varied between the systems (organic, conventional, all).
The land use of neighbouring agricultural areas seems to have a strong impact on protected semi-natural grasslands, even deep into the interior. As it is often very challenging to enlarge protected areas, buffers with farming practices at least similar to organic management could be an alternative to improve the protective effect of nature reserves.

00082
No yield gap in organic grasslands? Soil nutrients and forage production in organic versus conventional permanent grasslands

Poster

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Abstract

Organic farming can benefit biodiversity and ecosystem services, but is criticised for lower yields that require a larger extent of farmland area to produce the same amount of food or forage as in a conventional setting. A main reason for lower yields is the ban of synthetic fertilizers by organic farming guidelines. While this issue is apparent for organic arable farming, where animal-derived fertilizers are often scarce, much less is known about the productivity and management of organic permanent grasslands. Previous studies reported inconclusive results such as lower fertilization and lower soil phosphorus availability in organic grasslands contrasting with the absence of a significant yield gap when compared to conventional grasslands.

We use a comprehensive study on 92 organic and conventional grasslands in the Canton of Solothurn, Switzerland, to assess grassland management, yield and soil nutrient availability. Study plots are arranged in a paired design with organic and conventional plots showing similar environmental characteristics. The study comprises both intensive and extensive grasslands. A farmer survey inquired details of grassland management.

In this study, we combine information on grassland management, soil nutrient availability, sward composition and yields to identify systematic differences between organic and conventional grasslands. Our results show no significant differences between organic and conventional grasslands, neither under extensive nor intensive management and neither for soil K and P availability nor for yields. In line with this, intensive organic grasslands received only little less fertilizer N than conventional ones, even though this difference was statistically significant. In our study, conventional farmers apply on average very little synthetic fertilizers, while both systems strongly rely on organic fertilization.

These results reveal that organic grasslands can be as productive as their conventional counterparts, provided that organic fertilizers are available in sufficient quantity. As organic farms of our study region show a significantly higher share of extensively managed land (ecological compensation areas), the final assessment of farming system productivity, competitiveness and sustainability must consider the question whether the higher share of organic extensive land could potentially be used for intensive production or not.

00091
Impact of farming practices at the landscape scale on aphids vectors of yellows in beet crops

Poster

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Abstract

One of the major agronomic issues in sugar beet production (Beta vulgaris subsp. vulgaris) is beet yellows virus. Their main vector is the green peach aphid, *Myzus persicae*. It was previously efficiently managed by neonicotinoid seed treatments. However, the use of these insecticides will be prohibited by 2023 in France, which requires considering and evaluating alternative agronomic solutions. In a context of integrated pest management, the planning of farming practices, including crop rotations, at the landscape scale could be a promising lever for controlling the colonization of beet crops by aphids (i.e., suppressive landscapes). In our study, we aimed to characterize farming practices, including crop rotations, spatial and temporal patterns and evaluate their role and thus determine their importance in the management of crop pests. They can directly and indirectly influence the presence of aphids, and thus beet yellows, for which data were extracted for the year 2020 from the database of the plant health bulletin of the French Ecophyto plan. We surveyed the 2019 and 2020 farming practices of 90 farmers, this concerns 509 plots in 33 doughnut-like landscape buffers of 500 m radius surrounding the margins of the monitored beet fields from northern France. National land-cover data were additionally used to characterize crop rotations from 2015 to 2020, from which we developed a spatiotemporal index of landscape-scale crop prevalence. The methodology and the impact of agricultural practices and rotations at the landscape scale on *M. persicae* and symptoms of yellows in beet crops will be presented. Our results demonstrate the importance of studying agronomic levers at the landscape scale. They underline the need for coordination of actors in the agricultural landscape, particularly for the management of crop pests.

00092
Potential for biological control by carabid beetles follows similar seasonal among five different crops

Poster

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Abstract

Agricultural intensification (through practices and landscape simplification) has altered the provision of ecosystem services, including bioregulation provided by carabids by reducing the diversity of species and selecting highly agricultural specialist communities. Increasing the crop diversity is a way to support ecosystem services. However, little is known about the effect of crops on temporal dynamics of carabid assemblages and their bioregulation potential associated. Here we assessed the effects of five different crops under non-inversion tillage on the temporal dynamics of both carabid assemblages and their diet-based functional structure.

Carabid assemblages were monitored over 4 years (from 2009 to 2012), in a total of 67 fields (each field followed one year) cropped with either oilseed rape, wheat, sugar beet, spring barley, or spring pea. We assigned a relative diet profile based on literature information was assigned to each species : granivorous, phytophagous, and zoophagous. We focused on seasonal changes in species composition, on taxonomic and diet-based functional structure of carabid assemblages.

We observed that the taxonomic changes (species richness, abundance-activity, and evenness) had the same seasonal trends in all crops, even though species identity differed between crops. In addition, the zoophagous and phytophagous diet profiles had similar temporal trends in all crop types, suggesting high functional equivalence among species.

These results suggest that there is a strong selection filter in agricultural landscapes that restricts the diversity of carabid species within cultivated plots regardless of the management implemented. Promoting biological regulation services in cultivated fields require valuing all auxiliary taxa and their complementarities. It is necessary to develop work that simultaneously looks at these different communities and their temporal complementarities. As the balance between the different taxa may change depending on the structure and nature of the uncultivated elements of the landscape, these are undoubtedly important avenues that should not be overlooked.

00139
Blackcurrant pollinators or the cost of absence

Oral

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Abstract

The decline of wild pollinators leads to a drastic drop in the associated ecosystem service, resulting in significant losses in agricultural yields. However exact cost for farmers is rarely accurately estimated. Our studies of blackcurrant pollination in Burgundy (France) show a decrease of 99% of pollinators population size since 1981. Yield decrease in the variety “Noir de Bourgogne” emblematic of “crème de cassis” production, is such, that economic sustainability was reached only 3 out of the last 12 years. In a field experiment with bumblebees addition under an insect proof net we showed that yield could potentially be more than tripled in the absence of pollination limitation. We also tested the potential of reintroduction of Osmia bees. Various agro-ecological measures beneficial to pollinators will be discussed, as well as ongoing scientific experiments and tests performed by farmers. The return to an agro-ecological equilibrium for which pollination becomes again a free ecosystem service for agriculture, requires the integration of multiple agro-ecological measures as well as a thorough revision of the whole cropping system.

00162
Functional and taxonomic diversity of carabid beetle assemblages in forest fragments and hedges in heterogeneous agricultural landscapes

Oral

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Abstract

The spatiotemporal connectivity of forest patches and hedgerows in lowland agricultural landscapes and their total amount matter to explain current biodiversity patterns across local to regional extents. However, whether such networks and habitats allow maintaining a high taxonomic and functional diversity of taxa remains largely unclear. In particular, can both forest specialists and open-habitat species benefit from the same landscapes, or do they require contrasted landscape structures? A better understanding of their relative responses can have important consequences for ecosystem functioning and the delivery of ecosystem services. Focusing on carabid beetle assemblages, we assessed the relative importance of local-to-landscape attributes in driving local α-diversity and species dissimilarity between patches (β-diversity), considering both taxonomic and functional facets of community diversity. We sampled 32 deciduous forest patches and 67 hedges in two 5-km × 5-km landscape contexts with contrasting management intensities in northeastern France. Functional diversity of carabid beetles was characterized based on morphological measurements and preferences in habitat requirements. We quantified the multi-level environmental influence using mixed-effects models and variation partitioning analysis. We found that α-diversity was primarily determined by habitat-patch characteristics, acting as a local-scale ecological filter on carabid assemblages. However, both α- and β-diversity were significantly influenced by the landscape context and the level of connectivity in the agricultural mosaic. Nevertheless, responses of carabid assemblages varied depending on species' preferences in habitat requirements (i.e., habitat openness and humidity). Consequences on biodiversity protection and ecosystem services maintenance is discussed.

00164

Impact of the “Farming with Alternative Pollinators” approach on crop pollinator pollen diet

Oral

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Abstract

Pollinators are facing declines at a global level. One of the main factors driving this decline is insufficient access to floral resources due to habitat loss and degradation that can affect both diet generalist species as well as those with more restricted floral preferences. Here we evaluated the effect of a novel mitigation strategy in agricultural ecosystems, Farming with Alternative Pollinators (FAP) on the pollen diet of crop pollinators. The approach dedicates 25 % of the cropped area to Marketable Habitat Enhancement Plants (MHEP) that attract pollinators, natural enemies of the crops and provide farmers with income. We assessed the effect of the approach on pollen diet of faba bean (Vicia faba) and pumpkin (Cucurbita maxima) flower visitors in four different regions in Morocco during 2018 and 2019 by comparing control fields (monoculture) and FAP fields in 13 trials and 101 sites. Results from 25 wild bee species show that almost two third of the species carrying or collecting pollen when visiting pumpkin flowers and half of the species carrying or collecting pollen when visiting faba bean flowers gathered this pollen from two or more host plants (i.e. MHEP, main crop and/or wild plants) and displayed a wide dietary breadth. Pollen grains from the main crops were poorly represented on the female scopae, indicating that crops were mainly visited for nectar. Hence, crop flower visitors may require alternative pollen sources to meet their nutritional needs. The number of pollen genera collected by flower visitors and the dietary breadth of crop flower visitors did not show a significant increase in response to FAP management. Among the selected MHEP, sunflower (Helianthus annuus) was the pollen resource for pumpkin flower visitors. In faba bean, flower visitors collected pollen from coriander (Coriandrum sativum) and canola (Brassica napus). Our study sheds light on the importance of characterizing the pollen diet and the foraging behavior of crop pollinators to identify appropriate plant species that complement their food, maintain and conserve their populations.

00166
REGRASS: Re-establishing grasslands in the agricultural landscape to promote insect diversity

Poster

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Abstract

Land use intensification is considered a major threat to biodiversity and has resulted in the loss of semi-natural grasslands and their associated flora and fauna during the twentieth century in Europe. Agri-environmental schemes seek to mitigate the ongoing trend of biodiversity loss and include measures to counteract the decline of grassland in agricultural landscapes by subsidizing the restoration and creation of grassland. However, little is known about the colonization of newly created ecological compensation areas by insects, especially over periods of several years. The project "REGRASS: Re-establishing grasslands to promote biodiversity and ecosystem services on farmland" was started in 2016 and aims to compare insect abundance, diversity and species assemblages of syrphids, wild bees, butterflies, heteropteran bugs and grasshoppers in i) permanent, old grassland and two types of compensation strips: ii) newly established grassland strips that were designed within the project using a diverse seed mixture and iii) subsidized grassland strips designated as “biodiversity areas” in the Austrian agri-environment program (ÖPUL). We want to find out how species numbers and assemblages develop in the different grassland types from 2017 until 2022 and how ecological traits affect colonization patterns. The survey is carried out in Sieghartskirchen, Lower Austria on five replicates with five subplots for each habitat type, and sampling takes place four times per year in a monthly interval between May and August. Preliminary results have shown that the grassland types differ in terms of abundance, species numbers and species assemblages: Newly established grasslands, that have high levels of plant species richness, supported especially pollinators (wild bees, syrphids) more than subsidized grasslands did. Heteropteran bugs preferred both types of compensation strips over permanent grasslands, while in contrast most butterfly individuals and species were recorded in permanent grassland. Grasshoppers showed similar species and individual numbers in all three grassland types, but different species assemblages. Additionally to species that were also found in the bordering permanent grassland, compensation areas were also attractive to new species – especially to wild bees and heteropteran bugs. Abundances differed from year to year, but species numbers did not significantly increase or decrease between 2017 and 2021.

00198
Agroforestery change carabid comunity in composition and space

Oral

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Abstract

Our project aims to survey the impact of agroforestry on ecosystemic services. The year 2021 was devoted to the study of the Carabid community 10 years after the afforestation on a exploitation close to a forest. As expected, this community has been strongly impacted by the growth of shrubs, both in its composition and in its spatial distribution. Before the afforestation, surveys carried out in 2012 presented us with an agrarian community of ground beetles, dominated by Pterostichus melanarius (Illiger, 1798) for the "large" ground beetles and Metallina lampros (Herbst, 1784) for the small ground beetles. The change in agricultural practices and the development of grass strips has enabled the detection of Pterostichus madidus (Fabricius, 1775), a forest species. In 2017, the colonization of this station by this species testifies to the impact of planting shrubs on the station. In 2021, the comparison with data from 2012 and then 2017 shows a profound change in the community. The species Pterostichus madidus (F., 1775) becomes dominant with 77% of the 1739 individuals collected. Metallina lampros (Herbst, 1784) has no longer been detected, but Brachinus crepitans (Linnaeus, 1758) a new small species, never inventoried over the whole area, including the forest, appears between 2017 and 2021 and represents 8% of individuals. We therefore compared the "β biodiversities" of this same station in 2012, 2017 and 2021. The modulation of the beetle community between 2012 and 2017 induced by afforestation is not homogeneous. The composition within the interval between two lines of shrubs is different from the population observed along the lines of shrubs. But the growth of trees obtained in 2021 seems to have induced a standardization of the whole community over the entire surface of the station.

00219
Fallow strips in agricultural grassland as temporary conservation measures

Poster

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Abstract

Agricultural intensification has been identified as a major cause of biodiversity loss. Accordingly, the biodiversity of agricultural grassland is highly dependent on management intensity. However, agri-environmental schemes aimed at maintaining grassland biodiversity must also consider grassland productivity. Fallow strips, i.e. agricultural grassland areas taken out of management, could meet this challenge by increasing the conservation potential while keeping most of the land in cultivation. This hypothesis was tested for temporary protection during mowing events by recording epigeic Arachnida and Coleoptera (especially Carabidae) abundances using pitfall traps. Sampling was conducted one week after mowing and eight weeks after mowing, each over a seven-day period, at 12 sites in Hesse (Germany). Arachnid abundance did not respond to the fallow strips, neither immediately after mowing, nor eight weeks later. However, the fact that web-building taxa were rarely found suggests that ground-hunting taxa do not directly benefit from the vegetation structures provided by fallow strips. Coleopteran abundance was significantly higher outside of fallow strips after eight weeks, but only slightly higher immediately after mowing. Thus, beetles seem to benefit from the temporal dynamics associated with mowing, as abundances were still elevated compared to fallow strips after eight weeks when the vegetation recovered comparable to the strips. Increased abundance immediately after mowing may be related to recolonisation from the fallow strips. However, this conclusion cannot be generalised because carabids did not respond in the same way. In fact, coleopteran responses were stronger when carabids were excluded from the calculation. In summary, under the conditions described here, fallow strips are of little benefit to ground-dwelling arthropods. However, they may hold potential for stabilising metacommunity dynamics.

00237
Influence of hedgerows and landscape composition on bats in vineyards

Poster

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Abstract

One of the main causes of the decline in the bat population is the intensification of agriculture and the resulting landscape simplification. Bats show responses to environmental stressors which makes them good bioindicators and, due to their insectivory, European species are important natural predators of agricultural pests. Therefore, bat activities correlate with a high insect abundance, but in addition, depend on the spatial heterogeneity of the habitat. High compositional heterogeneity of agricultural landscapes can benefit bat communities. Here we investigated how bat activity and community composition in vineyards respond to different landscape elements in three European regions; Rhineland-Palatinate (Germany), Burgenland (Austria), and Andalucía (Spain). We recorded bat activity using passive acoustic monitoring for four nights in 94 vineyards in total. Additionally, in Germany we recorded bat activity along transects from a hedgerow up to 120 m into the vineyards.
We found differences in bat activity and species occurrence depending on the surrounding landscape. The results showed a higher bat flight and feeding activity in vineyards with hedgerows in the three studied areas, as well as a higher activity closer to hedgerows compared to the centre of the vineyards. In addition, species adapted to foraging in edge spaces such as *Pipistrellus pipistrellus* showed higher benefits from hedgerows, while species adapted to open spaces such as *Nyctalus leisleri* and *Hypsugo savii* showed a preference for vineyards with a larger cover of woody habitat in the wider landscape. This study demonstrates the importance of landscape heterogeneity, in particular of permanent woody landscape elements, for bat conservation in viticultural landscapes.

00258
Fungicide reduction enhances beneficial arthropods in grapevine

Poster

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Abstract

Grapevine is one of the most pesticide depending crops, typically receiving ten fungicide sprayings in three months of growing season in the Palatinate region, Germany. Sprayings contain several plant protection products of varying toxicity towards non-target organisms in both organic and conventional viticulture. The cultivation of fungus resistant varieties allows reductions of fungicide applications by around 70%.
We studied effects of organic vs. conventional viticulture under full (susceptible grapes) and reduced (resistant grapes) fungicide sprayings on non-target arthropods. Differences between organic and conventional management were minor. However, reduced fungicide sprayings through cultivation of fungus-resistant enhanced several groups of beneficial arthropods. For example, densities of both, cobweb spiders (Theridiidae) and running crab spiders (Philodromidae) in the grapewine canopy were 1.5 fold higher in fungus-resistant than in susceptible grape varieties.
We conclude that reduced plant protection in resistant varieties should be more widely pursued to enhance the sustainability of agriculture.

00264
Precision grazing for biodiversity? Spatio-temporal scales of grazing effects on vegetation structure and arthropod abundance

Oral

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Abstract

Grasslands are among the most biodiverse land-use types in Central Europe. Accordingly, observed biodiversity loss, especially in open, agriculturally used landscapes, has led to scientific concern about stability, sustainability and productivity of grassland systems. Remote sensing (RS) is increasingly employed to map the status of grasslands via vegetation parameters. Linking this information to spatially and temporally explicit grazing activity informs about the scales at which livestock moderates grassland structure and ecological functioning. To explore this potential with regard to grassland biodiversity, we related vegetation parameters and arthropod abundances to small-scale residence time of cattle at the field station Relliehausen (University of Göttingen, Germany). We used a 2.5m x 2.5m grid base over nine paddocks (1ha each) grazed by cattle (four, three and two per paddock, replicated three times) and sampled arthropods (suction sampling and colour traps) in 45 grid cells (five in each paddock) before and after two grazing periods (spring and autumn) in 2019. For the entire grid base, vegetation parameters were provided by ground-truthed unmanned aerial vehicle mapping (MK Oktokopter XL equipped with a Sony Alpha 6000 RGB-camera and a Micasense RedEdge multispectral camera). Residence time of individual cattle in the entire grid base was provided via GPS collars constantly during both grazing periods. Using simple linear regression models and neighbourhood analyses, we were able to specify the scale-dependent importance of specific vegetation structures, including heterogeneity and stability, for different arthropod taxa. Specifically, we were interested in spatio-temporal scales of direct effects of cattle residence time on vegetation structure and indirect effects on arthropod abundance. Cattle residence time was negatively related to vegetation biomass parameters with little variation across spatial and temporal scales, suggesting a certain degree of livestock habituality or constant vegetation quality heterogeneity. Contrastingly, indirect relations between cattle residence time and arthropod abundance were mostly positive and best explained by the cumulative residence time of cattle 10 to 14 days prior to sampling (regardless of season and arthropod abundance patterns before grazing periods). Overall, the results show a clear potential of aligning economic and ecological targets in grassland management by adjustments in grazing area and duration.

00271
ResBerry – Resilient organic berry cropping systems through enhanced biodiversity and innovative management strategies

Poster

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Abstract

A large part of the agricultural land is now laid out in monocultures although this cultivation type does not represent the ecological optimum because ecosystem services are lost. Consumer awareness of near-natural cultivation methods is increasing, resulting in a higher demand for organically produced food. This also applies to berry production, leading to increasing cultivation areas to meet the demand. Since organically produced berries are often negatively affected by various pests and diseases including new invasive pests, there is an urgent need for robust and resilient cultivation systems.
ResBerry is a newly launched EU-project funded under Core Organic Cofund. Its main objective is to provide the necessary knowledge and demonstrate the effectiveness of tools to enhance above- and belowground biodiversity in organic berry orchards to increase the resilience of berries against major pests and diseases. Accordingly, ResBerry will address the following fields: a) Identifiying suitable habitats and management strategies for natural enemies in organic berry orchards as a preventive pest control strategy. This includes **companion plants** as flower strips, trap plants and/or cover crops, supported by optimized crop canopy structure to enhance ecosystem services. The **movement of natural enemies and pests between crops and companion plants** will be assessed. b) Analyzing the **soil microbial community** in organic berry orchards and how they are shaped by companion plants. Measures to favour beneficial soil microorganisms as a preventive strategy against soil-borne pathogens and to increase general resilience will be tested. c) **Raising awareness for innovative but so far little implemented curative pest control strategies** among farmers, such as the application of entomopathogenic nematodes against *Drosophila suzukii* and entomovectoring of microbiological products against *Botrytis cinerea* by bumblebees. d) Evaluation of the proposed measures' impact on **yield and nutritional quality** of berries. e) **Dissemination of the results** to diverse stakeholders, growers, market organizations, scientists, and consumers.
With its wide geographical coverage, the project focusses on strawberries and raspberries but also considers other small fruits. This multidisciplinary approach develops systemic solutions supporting organic farmers and aims to reduce the dependency on fertilizers and plant protection products while stilll increasing economic sustainability and restoring biodiversity.

00295
Pest Population Status in Eastern German Apple Orchards

Poster

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Abstract

Apple orchards are considered important habitats for arthropods. As a perennial crop, apple production systems provide structural diversity and stability for arthropods. The range of habitats, including canopies and work rows contribute to a relatively high species richness compared to annually tilled crops. More than 400 insect species have been recorded in European apple orchards, of which around 200 are phytophagous. Herbivorous pests are considered a major problem in German apple production. With the increasing public awareness of negative environmental side-effects caused by conventional intensive agriculture on biodiversity and human health, apple farming in Germany is now based on two production systems, integrated production, and organic management. Integrated production mainly relies on integrated pest management (IPM) strategies for pest control, whereas organic management relies on bio-certified agrochemicals and mechanical weed control. Understanding the impact of both production systems on main pest populations is crucial for the implementation of more sustainable production strategies. We sampled 8 organically managed and 8 integrated production apple orchards in 2021 by beating samples from the canopy beating and suction sampling in the working rows in Eastern Germany. From these samples, we focused on the composition of herbivorous Hemiptera communities. In total, 6581 Hemipterans were determined to species/genus level for aphids (11 species/genera) and family level for true bugs (6 families). The orchard management (organic vs. IPM) did not significantly affect the taxonomic composition of herbivorous Hemiptera communities, but the dominance of taxonomic groups differed significantly between microhabitats. Individuals from the aphid genus *Dysaphis* dominated Hemiptera communities in the work rows, while individuals of *Eriosoma lanigerum* dominated communities in the canopy. In general, those two pest species were more abundant in IPM-based apple orchards than in organic ones. This research has implications for pest control and may help improve actual pest management options through a better understanding of pest arthropod ecology in perennial fruit tree systems.

00336
Blood bacterial diversity of small mammals from different agricultural contexts

Oral

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Abstract

Agricultural intensification is characterised notably by fields enlargement, reduction of perennial habitats, and increased use of chemical inputs, with potentially both direct and indirect effects on many taxa and ecosystem functioning. For instance, the exposition to pesticides may disturb the immune system of animals and affect their general health, thus directly or indirectly altering their resistance to infectious agents. While crucial and urgent in the current debate about the use of many chemical compounds in agriculture, identifying and quantifying the different impacts of pesticides on wildlife among other factors remains a complex task. In this study, we aimed at characterising the blood bacterial assemblages of small mammals trapped around maize fields cultivated with different agricultural practices and in different landscape contexts (i.e. proportions of surrounding woodland cover). We focused on Apodemus mice as these species are mostly granivorous and can forage in crops. We extracted the DNA of the blood of 88 Apodemus sp. mice from maize fields conducted with “organic” (two sites including one in forest fragmented landscape) and “conventional” (i.e. neonicotinoid coated seeds, three sites including one in forest fragmented landscape) agricultural practices before and after sowing (respectively 16 and 23 in “organic” fields and 21 and 28 in “conventional” fields). We expected and interaction between bacterial assemblage and agricultural practice because of a reduced immunity in mice from “conventional” crops after sowing.
High-throughput sequencing of the bacterial 16SrRNA gene allowed us to identify occurrence of bacteria. The composition of bacterial assemblages was analysed using a community ecology approach. Besides assessing the possible impact of agricultural practices on the bacterial diversity circulating in small mammals foraging in agricultural habitats, the results will be presented and discussed with regards to some pathogenic infectious agents of human health and veterinary concern (Bartonella sp., Borrelia sp., Neoherlichia mikurensis).

00338
Pesticide use on different crops and its impact on wild-bee communities at the landscape level

Oral

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Abstract

Wild bees play a crucial role as pollinators, thus providing a key ecosystem service for humans. However, the loss of (natural) habitats and land-use intensification are key drivers for wild-bee declines. In the context of land-use intensification, pesticides affect wild bees in multiple ways. Indirectly, by reducing the food supply as arable weeds are wiped out and directly, by affecting the behaviour of wild bees, their health and physiological traits. The toxicity, type and amount of pesticides to which wild bees are exposed depends on the crops grown in the surrounding of nesting and foraging sites. In our study, we investigate the effect of crop types in a 500m radius of twenty study sites across Germany, established in the BienABest project, and calculate a pesticide index for each site. Wild-bee communities are analysed with regard to the pesticide load in the surrounding. However, environmental stressors, such as pesticides, act already earlier during the development of insects. Using Bombus lapidarius, one of the most common bumblebees in Germany and an important pollinator, we analyse the forewing asymmetry and cuticular hydrocarbons (CHCs) of worker bumblebees. Forewing asymmetry is a commonly used biomarker in many insects to determine developmental stability. Another important physiological trait are the CHCs which act as a barrier on the insect cuticle against desiccation and pathogens and in addition function as communication agents. Even though studies on the impact of pesticides on CHCs are rare, evidence is growing that the CHCs are affected by pesticides, probably impair the communication of insects. In our contribution we present the effects of pesticides at the community level of wild bees and at the species level specific to traits. We furthermore show how, depending on the composition of the surrounding landscape, the provision of flower strips and nesting sites affect the occurrence of wild bees in agricultural landscapes.

00345
On the restoration of hedgerow ground vegetation: Local and landscape drivers of plant diversity and weed colonization

Poster

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Abstract

Hedgerows are among the most stable refugia for biodiversity in agricultural landscapes, providing food and shelter to many living organisms. However, the destruction and alteration of hedgerow ground vegetation compromise their potential for biodiversity conservation. The purpose of this study was to find local and landscape-scale drivers that promote plant diversity in hedgerows and prevent their colonization by troublesome weeds. Using a functional approach, we assessed the effects of hedgerow features, adjacent farming systems (conventional vs organic) and landscape context (bocage, semi-natural habitat cover, organic farming cover) on the diversity and composition of plant communities in 40 hedgerows, in Brittany (France). Hedgerow features had no effect on species diversity, but influenced functional diversity measured as a standardized effect size (SES), i.e. independent of species diversity. Organic farming at local scale was the main driver increasing both species and functional diversity (SES), doubling the cover of insect-pollinated forbs. High organic farming cover in the landscape increased species diversity, but not functional diversity (SES), of hedgerows adjoining conventional farming systems. Besides, high cover of semi-natural habitats and organic farming in the landscape prevented colonization of hedgerows by troublesome weeds. Promoting extensive management at both local and landscape scale is thus necessary for successful restoration of hedgerow ground vegetation, which should favour biodiversity conservation and ecosystem service provision.

00377
How do local habitat characteristics influence the population of cabbage stem flea beetle larvae in oilseed rape fields?

Oral

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Abstract

In areas of intensive agriculture, such as the Paris Basin in France, winter oilseed rape is central in arable crop rotations, leading to a high proportion of oilseed rape fields in the landscape. However, farmers have more and more problems to grow this crop, mostly because of the pressure of insect pests. These pests are commonly controlled by insecticides but this method contributes to the dramatic biodiversity decline and to some human health problems. In addition, the cabbage stem flea beetles, Psylliodes chrysocephala (Linnaeus, 1758, Coleoptera: Chrysomelidae) exhibit an increasing resistance to pyrethroid, one of the last substances authorized to control them. Thus, alternative ways to manage them need to be explored. Agroecological practices, such as a combination of reduction of tillage and an increase of agro-biodiversity within the field, could disturb females in autumn when searching for oviposition sites, and increase natural enemies, and so limit the population of larvae.
The objective of this study was to determine whether the cropping systems and the landscape influence the population of cabbage flea beetle. We explored how the local habitat characteristics, at plot level, affected them, across a range of contrasted cropping systems. To do so, we assessed quantitatively the number of larvae present in winter oilseed rape in January for two years, in 29 farmers' fields in 2021 and 25 in 2022. In each field, we described the local habitat characteristics and we took into account the landscape composition as covariable.
The populations of larvae seemed to be influenced by the local habitat characteristics found in the field: an increase in the percentage cover of oilseed rape or weeds led to a decrease in the number of larvae. As Breitenmoser et al. (Rech. Agron. Suisse 11: 16–25, 2020), we did not find any effect of the presence of companion plants. These populations could be also influenced indirectly by the landscape composition, especially the percentage of oilseed rape fields around, which could lead to a dilution or a concentration of flea beetles within the fields studied.

00394
French agricultural areas: more abundant bird populations where fewer pesticides are purchased

Poster

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Abstract

Despite increasing research efforts examining pesticide effects on biodiversity, studies at population or community levels in field conditions remain scarce. This lack is mainly due to the low availability of data on pesticide use and the difficulty of isolating the contribution of pesticides from other characteristics of agricultural intensification, particularly landscape effects. Further, current studies often focus on one or a few pesticide substances, despite the tremendous diversity of substances used in the field. However, accounting for the various toxicity and degradability of the molecules used remains challenging.
Here we used the French national database on pesticide purchases to define and quantify a pesticide hazard ratio integrating the quantity, toxicity and degradability of 269 active substances purchased locally. As data on pesticide purchases were used for the first time to our knowledge in France at the national scale, we tested the correlation between pesticide purchases and independent data on pesticide residues in French surface waters. We then related the pesticide hazard ratio to the local abundance of 90 common bird species in farmland, estimated from a participatory national monitoring program.
Our results first indicate that the pesticide purchase data are representative of environmental contamination, and second, that the relative abundance of 79% of the bird species studied is negatively correlated with the pesticide hazard ratio. This result suggests negative effects of environmental contamination by pesticides on bird abundance, which are probably channelled both directly and indirectly, via resource availability, on the survival and reproduction of birds. Our study thereby extends previous findings by accounting for the diversity of pesticide substances used in the field and by showing that such negative effects are not restricted to farmland bird specialists but to most bird species visiting agricultural landscapes.

00426
The role of small woody landscape features and agroforestry systems for national carbon budgeting in Germany

Poster

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Abstract

The intensification of food production systems has resulted in landscape simplification, with trees and hedges disappearing from agricultural land, principally in industrialized countries. However, more recently, the potential of agroforestry systems and small woody landscape features (SWFs), e.g., hedgerows, woodlots, and scattered groups of trees, to sequester carbon was highlighted as one of the strategies to combat global climate change. Our study was aimed to assess the extent of SWFs embedded within agricultural landscapes in Germany, estimate their carbon stocks, and investigate the potential for increasing agroforestry cover to offset agricultural greenhouse gas (GHG) emissions. We analyzed open-source geospatial datasets (CORINE Land Cover 5 ha 2015, Copernicus Small Woody Features 2015) and identified over 900,000 hectares of SWFs on agricultural land, equivalent to 4.6% of the total farmland. The carbon storage of SWFs was estimated at 111 ± 52 SD teragrams of carbon (Tg C), which was previously unaccounted for in GHG inventories and could play a role in mitigating the emissions. Furthermore, we found cropland to have the lowest SWF density and thus the highest potential to benefit from the implementation of agroforestry, which could sequester between 0.2 and 2 Tg of carbon per year. Our study highlights that country-specific data are urgently needed to refine C stock estimates, improve GHG inventories and inform the large-scale implementation of agroforestry in Germany. As we used publicly available data, our methodology has the benefit of being reproducible and can be used to inform SWF assessments across Europe.

00470
Participatory project on the ecological impact, economic efficiency and governance of cooperative agri-environmental measures

Poster

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Abstract

The intensification of agricultural landscapes is leading to progressive biodiversity loss and is endangering important ecosystem services. Therefore, measures are urgently needed to enhance biodiversity and ecosystem services in agricultural landsapes. Agri-environmental measures can be an important tool in this context but so far they have been implemented mainly on single and sometimes isolated plots while the promotion of many species requires measures at landscape level. An innovative approach is the coordinated implementation of measures at landscape level, in which several farms participate jointly. Cooperation and participation can promote joint thinking and action and generate situation-specific and solution-oriented expertise. However, from both a socio-economic and ecological point of view, many questions regarding the cooperative implementation of agri-environmental measures are still unresolved.
Taking into account the ecological effects and economic consequences, the project KOOPERATIV will develop and implement a participatory and cooperative approach to the implementation of agri-environmental measures at the landscape level. The aims are (1) to improve the state of biodiversity and related ecosystem services as cost-efficiently as possible and (2) to implement and institutionalize cooperative measures on a permanent basis. The optimal area shares and spatial configuration of agri-environmental measures will be determined. The project is based on an integrative and interdisciplinary approach that includes the development of cooperative governance structures as well as the ecological and economic evaluation of the joint implementation of agri-environmental measures. The interactions and synergies between governance, ecology and economy will be considered holistically.

00483
Winter survival of honeybees' colonies: is it also a matter of nutrition? How quality of pollen influences winter survival.

Poster

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Abstract

For honeybee colonies in temperate regions, winter survival is perhaps the most stringent test of colony health. Foraging stops, and the colony must subsist on accumulated food reserves. Overwintering workers must also be healthy enough to survive the winter months and resume foraging before the first round of spring brood emerges. Very important and well-documented conditions for successful overwintering are the amount of honey stored during the foraging period, and the preventive treatments for diseases, particularly against varroa. However, there might be other factors, to date less studied and understood, that contribute to the survival of a colony. For example, the lack of essential proteins and lipids (nutrient deficiency) from the diet of honeybees can result in both individual and colony fitness reduction (e.g., limited body fat, brood depletion, larvae cannibalism). Also, the effects of stochastic processes linked to climate (e.g., high temperature during winter, extreme weather events etc.) might contribute to winter mortality. When controlling for food reserves with artificial feeding and treating the colonies successfully against varroa, it is possible to focus on understanding the influence of pollen nutrition and climatic conditions on the overwintering of honeybees. For this purpose, we sampled pollen from 27 experimental sites during the foraging season, distributed along gradients of climate and landscape complexity (agricultural, semi-natural, and urban) in Germany, Greece, and France. Methods of analysis for our study will include metabarcoding to identify multiple plant species from mixed pollen samples, the quantification and qualification of fatty acid profiles with a modified FAME protocol developed in our laboratory, and protein content quantification (Bradford assay). Concurrently, we are monitoring in-hive and ambient temperature, colony weight, individual bee fitness parameters and survival. With the data collected, we will evaluate the relative importance of pollen nutrition and climate variables as drivers of honeybee overwintering. These results will not only inform apicultural management but also shed light on the basic biology of perennial eusocial insect colonies, for which winter survival has always been a key life history hurdle.

00511
Effects of biodiversity measures on cavity-nesting bees, wasps and their natural enemies

Poster

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Abstract

The implementation of agri-environment measures is a key approach to sustain biodiversity and ecosystem services in agricultural landscapes. We tested the effectivity of biodiversity measures in promoting solitary bees and wasps within the F.R.A.N.Z. project. In total 340 trap nests were set up in 9 km^2 landscapes in nine different German regions with intensive agricultural use in 2017 and 2018. The effect of the proximity of trap nests to the closest three biodiversity measures, the measures` area, the measures` quality (quality index based on floral resource availability of measures), of the proximity to the closest forest and the proximity to the closest oilseed rape field as well as of landscape connectivity (i.e. edge density) got analyzed on the abundance and species richness of cavity-nesting bees, wasps and their natural enemies.
We found cavity-nesting insect (wasps + bees) abundances to decline with increasing distance to oilseed rape and forest and to increase with measures` quality. Parasitism and mortality rates were reduced by edge density. While solitary bees were not affected by biodiversity measures, the abundance of all cavity-nesting wasps and of herbivore-predating wasps declined with increasing distance to biodiversity measures. The abundance and species richness of all wasps, of natural enemies and the abundance of spider-predating wasps declined with increasing distance to forest.
Our results show that biodiversity measures can positively affect cavity-nesting insects in agricultural landscapes. The proximity to forest is a major factor promoting solitary wasps and antagonists as forest edges provide valuable food and nesting resources and might have protected trap nests from unfavorable weather conditions. Solitary bees seem not to benefit from newly implemented biodiversity measures. As bee populations build up over time, an effect is likely to appear several years after implementation of biodiversity measures.

00536
Nature-Positive Agriculture (NaPA): participative, nation-wide, on-farm evaluation of a biodiversity-enhancement strategy

Poster

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Abstract

Flowering strips are promoted as a cheap, easy, and effective method for increasing biodiversity in agricultural landscapes, preserving productivity while making agroecosystems more sustainable. Initiated by a group of German farmers and supported by an industry partner, the NaPA project seeks to understand the effects of this strategy in practice and on a national scale. Each farm assists with weekly trapping of airborne arthropods along transects extending from flowering strips or control areas into the field, yielding data on abundance and diversity throughout the year. In addition, soil- and ground-dwelling arthropods are sampled at four timepoints during the growing season. This farmer-academia partnership facilitates more extensive and fine-grained sampling than previous farm-based studies on flowering strips. The project also provides rigorous testing or further development of methods which may be useful in the future to land managers and other stakeholders wishing to quickly and easily quantify biodiversity.

Initial results demonstrate the effectiveness of the partnership: sample coverage to date is >95%, which will result in a total of ~7000 samples in 2022. The greatest bottleneck in such projects is generally sorting and identifying the collected arthropods to a useful level; the NaPA project compares manual sorting and identification with biomass measurement, metabarcoding, and automated identification to evaluate the potential for rapid, near real-time, and potentially more cost-effective, biodiversity assessment. Other methods cannot yet approach the accuracy of expert taxonomic identification, however new and developing technologies may have the potential to shorten the window between observation or sample collection and actionable results. This may foster more robust, large-scale studies of how land use impacts biodiversity under real-world conditions and provide land managers with tools and data to choose the most effective biodiversity-enhancement strategies for their situations.

00557
Identifying bird and bat diversity in intensely used agricultural landscapes of Central Europe using novel passive acoustic monitoring tools

Oral

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Abstract

Agricultural production and the corresponding degradation or removal of semi-natural habitats is a major driver of the global biodiversity crisis, leading to dramatic declines in farmland flora and fauna over the last decades. Consequently, the protection and conservation of farmland biodiversity in intensely used agricultural landscapes has become an urgent priority. The presence of semi-natural habitats (e.g. small woody features) in agricultural landscapes is known to positively affect bird and bat species, but so far, very few landscape-scale comparative analyses investigate the contribution of natural habitat density and land-use to the presence and abundance of multiple bat and bird species in Europe.
Recent technological advancements such as automated audio or video recordings and artificial intelligence assisted detection of species using such recordings, have created new opportunities for landscape ecological research to monitor biodiversity at larger scales, over longer periods of time and at multiple locations at once.
In this study we were interested in the potential effects of land use and landscape structure on the presence and activity of bird and bat species in agricultural landscapes. We conducted two field surveys in the agricultural landscapes in Central Germany. For the first survey. we selected 62 sites along a gradient of available forest/shrub edge and proportion of grassland vs. cropland within a 500m radius around the small woody features within which passive acoustic monitoring devices (PAM) were placed. We recorded appr. 4500hrs of birdsong and used the BirdNET artificial neural network to identify bird species. For the second survey, we selected sites in agricultural landscapes of contrasting intensity in order to detect the presence and activity of bat species.
At the time of submission the analysis of the field surveys is still pending. In the presentation we will explain our methodological approach, highlight the benefits and drawbacks of using PAM devices and elaborate on the study outcomes with respect to species richness and activity in response to different land uses and the availability of semi-natural habitats.

00567
Thermal tolerance capacity might differ among longitudinal gradient: a study at individual level in cereal aphid guild

Poster

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Abstract

Temperature is a critical parameter that insects, as ectotherms, have to cope with constantly. To resist to climate change, insects may evolve rapidly through rapid local adaptation and/or plasticity. Thus, two types of thermal tolerance can be of interest, the basal thermal tolerance and the plastic thermal tolerance. Phenotypic plasticity is the capacity of a single genotype to generate two or more phenotypes depending on the environment. In the context of thermal biology, plasticity of thermal tolerance specifically refers to the variability of thermal tolerance through acclimation treatments. Aphids can be convenient models to study thermal biology since they are parthenogenetic organisms and the genotypes can be fixed in one clone.

Less studies relating to influence of climate on thermotolerance of insects have been carried out among longitudinal gradients, compared to those among latitudinal clines. However, it has been investigated that in France, the changes of genotypes follow longitudinal clines; and overwinter strategies of aphids might change among longitudes. My project is belonging to a large project “Gradients” aiming at investigating the underlying mechanisms of the geographic variation of aphid population dynamics along a longitudinal gradient, which integrate approaches involving field surveys, common garden experiments, and genetic profiling. We focus on cereal aphids including the Bird cherry-oat aphid *Rhopalosiphum padi*, the English grain aphid *Sitobion avenae*, and the Rose-grain aphid *Metopolophium dirhodum*. My work focuses on thermal tolerant capacity of aphids. I address the questions 1). Do basal cold and heat tolerances vary along gradients? 2). Do plastic cold and heat tolerances vary along gradients? To answer them, we sampled following the cline: Rennes-Amiens-Louvain-Würtzburg-Praha and build 75 clones for 3 species from 5 locations, and the parameters I use to quantify thermal tolerance are the upper and lower critical thermal limits (CT min and CT max), and cold survival. For plastic thermal tolerance, I am going to set hardening experiment to quantify plasticity. First results will be presented and my study will pave the way to integrate ecological and evolutionary theory with tools from thermal biology to better understand the shifts of species abundance.

00629
Intercrops as foraging habitats for bees: Bees do not prefer sole legume crops over legume-cereal mixtures

Oral

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Abstract

Enhancing crop diversity can make agriculture more sustainable and biodiversity friendly. Intercropping grain legumes with cereals leads to higher crop diversity and has a broad range of agronomic and ecological benefits. However, sole crop stands of grain legumes might be richer in floral resources than grain legume-cereal intercrops and thus are probably more useful to mitigate the lack of flower resources in agricultural landscapes, which is a main driver of pollinator decline. Yet, little is known about differences between both cropping systems and different legume genotypes in terms of attractiveness for pollinators and how these differences moderate the pollinators' foraging behavior and consequences for grain legume yields.

In a field trial, we analyzed the abundance of flower visiting insects, the foraging behavior of pollinators and related effects on grain yield per plant across six different faba bean genotypes (*Vicia faba* L.) grown as sole crops or as intercrops with wheat. As foraging behaviors, we considered legal flower visits (i.e., frontal visits) and illegal flower visits (i.e., nectar robbing through bite holes). We recorded characteristics of *V. faba* genotypes on crop stand level (*V. faba* plant height, number of *V. faba* inflorescences and leaf area index (LAI). *V. faba*-wheat intercrops and sole crop stands of *V. faba* were equally attractive foraging habitats for pollinators, implying that intercrops are as suitable as sole crops to mitigate the lack of floral resources. In addition, intercrops had higher yields per *V. faba* plant than sole crop stands of *V. faba*, indicating agronomic advantages of this farming practice. However, yields were moderated neither by the number of flower visits nor by the foraging behavior of pollinators. Although *V. faba* genotypes differed in their plant traits, these differences could not explain shifts in the number of flower visiting insects. However, illegal flower visits increased with a higher number of inflorescences whereas the number of legal flower visits declined.

Based on our small-scale experiment, we conclude that the use of *V. faba*-wheat intercrops brings agronomic benefits while serving as a foraging habitat for pollinators that proved to be as attractive as sole crop stands of *V. faba*.

00663
Monitoring the effects of climate change on insect-pollinated crops – a field experiment with oilseed rape and strawberry

Poster

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Abstract

Climate change and intensified land use are the main drivers of biodiversity losses in Europe. Adding to pollinator decline, heat waves and periods of drought negatively affect both insect pollinators and crop plants. To improve insect habitats within arable landscapes and thus to support pollinator services, flower strips have been established that may mitigate negative effects of climate change. However, the combined effects of weakened plant flower signals and less active pollinators on the resulting fruit set of cultural crops, and the role of wildflower resources in this context, are largely unknown. To fill this knowledge gap, we launched a field study in Bavaria, focusing on two insect-pollinated crops, i.e. oilseed rape and strawberry. Flowering plants, half of which were subjected to drought stress before, were positioned along the margins of managed and unmanaged fields with varying wildflower resource availability located in two climatically contrasting regions. Climate conditions were monitored throughout the experiment and pollinator community was recorded with pan traps and flower visitation surveys. Fruit set of the potted plants was measured to capture differences in pollination services between field types and regions. Our results provide valuable insights in climate-induced challenges for crop pollination and the mitigating potential of wildflower resources.

00664
Biotope connectivity in intensively used agricultural areas: What do we know about functional landscape connectivity?

If you have chosen the theme "free topic" please indicate 1 or 2 keywords here.
Landscape connectivity, Agriculture

Poster

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Abstract

Reconnecting fragmented biotopes is one of the major levers for conservation of threatened species in intensively used agricultural areas. Over the last decades, increasing intensity of agricultural use was accompanied by a decrease in species abundances and richness in many central European landscapes. In such landscapes, land sparing is not really an option because of the high yields from highly productive soils. Thus, increasing landscape through targeted management interventions and small landscape elements are a more feasible option, e.g., planting of tree rows, hedges (which could have additional benefits for erosion prevention), sowing of perennial flower strips, extensifying at least parts of the agricultural production. In this presentation, we will show results from multiple species connectivity models applied to agricultural areas in Northern Germany. Management scenarios were modelled in order to compare different interventions. The intensively used region would benefit strongly from implementing, flower strips, hedges, etc..

00680
Assessment of ecosystem services and environmental impacts of agricultural systems: going further than an indicator list

Poster

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Abstract

Integration of ecosystem services (ES) in the redesign of agricultural systems is a major avenue for progress towards sustainability. Such agroecological transition requires the integration of ES in sustainability assessment methods. A review of literature showed that few methods assessing environmental impacts (EI) have addressed ES until now. Furthermore, on the conceptual level, the border between the classical concept of EI and the concept of ES remains blurred. Yet, a clear separation is absolutely needed to avoid any attempt of greenwashing.
Here a new conceptual indicator framework is developed to integrate both EI and ES, starting from the definition of ES linked to ecosystem processes while EI are due to human activities. The indicator framework consists in sustainability themes which address negative impacts (hereafter impacts) and positive ones (hereafter benefits) caused by agricultural systems. Overall 22 themes including 7 benefits and 15 impacts were defined. The themes may be aggregated in a hierarchical way at several levels. Each of those impacts and benefits are determined by the interactions of effect linked to human activity (e.g. greenhouse gas emission), ES (e.g. carbon storage) and environmental characteristics (e.g. soil texture). For each theme, a joint assessment method of impact and ES was developed to identify favourable (low impact, high service), unfavourable (high impact, low service) and mitigated (low impact and low ES or conversely) situations regarding sustainability.
The framework was implemented for a sample of 33 arable intensive and organic farms around Arcis-Sur-Aube in chalky Champagne, members of the SCARA cooperative. Some economic (e.g. gross margin) and social (e.g. working time) indicators, were selected to complete the assessment with the other dimensions of sustainability. Synergies and trade-offs between indicators were studied. The joint assessment of EI and ES, followed by a PCA and a hierarchical ascendant classification analysis highlighted the interest of the method. It was possible to distinguish more groups of farms than only the expected and binary opposition of intensive vs. organic. The group of farms with high level of ES and EI should be noticed. Those farmers do not use the potential ES linked to diversified crop rotation.

00686
ReCROP : Bioinocula and CROPping systems: an integrated biotechnological approach for improving crop yield, biodiversity and REsilience of Mediterranean agro-ecosystems

Poster

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Abstract

The Mediterranean economy is highly dependent on agriculture. However, agricultural sustainability and productivity in this region is under serious threat due to climate change and the depletion of water resources. This is worsened by poor management practices, such as the overuse of chemical fertilizers, pesticides, overgrazing and monoculture farming. Recent climate change models indicate that European and Northern African regions will undergo extreme climatic events throughout the year, this will negatively impact crop yield and productivity. Summer droughts and heat waves periods will increase for most parts of Europe, as well as short intense rain events. Preserving and improving productive agricultural land in this region is vital, especially through the application of sustainable soil and crop management practices that promote soil fertility and water conservation; this will improve resilience to degradation and to extreme climatic events.

ReCROP is a European project that aims to identify sustainable and resilient agricultural production systems in the Mediterranean region through the combined use of biotechnological tools, such as bioinoculants, and environmentally friendly agronomic practices. ReCROP will assess different agroecosystems with key local crops (i.e vineyards, maize and aromatic/medicinal plants) of the Mediterranean region under field conditions to help improve crop resilience, yield, water conservation and soil health under the current scenario of climate change.

Soil organisms play a key role in ecosystem processes, leading to essential soil functions and are used as bioindicators of soil quality. Their monitoring is crucial to assess the impact of beneficial agricultural practices on soil functioning. One of the goals of ReCROP will be to evaluate the beneficial impact of different agricultural practices on the structural and functional soil diversity at different levels of the soil food web. The macrofauna and mesofauna (i.e springtails and mites) as well as microbial biomass, activity and biodiversity of soil microbial communities (bacteria, archaea, fungi) will be monitored with a special effort to produce a multitaxa index of soil biological quality. This work will contribute to identify which practices are beneficial for the biodiversity of Mediterranean agricultural soils, thus providing resistance and resilience, in terms of soil functioning and against soil disturbances.

00047
Toward integration of nutritional and metabolic ecology: the energetic cost of food quality

Poster

T. Ruiz [1], A.M. Koussoroplis [1], M. Danger [2], J.P. Aguer [1], N. Morel-Desrosiers [1], A. Bec [1]

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Abstract

Two biological currency have been the focus of much work in ecology: energy required to fuel metabolism and material necessary to build biomass. To date, the link between energy metabolism and the effects of food composition (i.e. material) on biomass production remains elusive. Here we measured the resting metabolic rate (RMR) of Daphnia magna submitted to a gradient of (non-energetic) nutritional constraints. We showed that all types of dietary (co)limitations (Fatty acids, Sterols, Phosphorus) induced an increase in mass-specific RMR up to 128% between highest and lowest quality diets.A strong negative correlation appeared between RMR and growth rate suggesting that RMR may constitute a promising predictor of consumer growth rate. We argue that quantifying the energetic cost imposed by food quality on individual RMR may constitute a common currency enabling the integration of nutritional and metabolic ecology.

00051
Temperature dependency of nutritional requirements : A U-shaped response Unifying divergent stoichiometric viewpoints

Poster

T. Ruiz [1], A.M. Koussoroplis [1], M. Danger [2], J.P. Aguer [1], N. Morel-Desrosiers [1], A. Bec [1]

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Abstract

Temperature and nutrient availability are major drivers of consumer performance severely affected by global change. To date, no consensus emerges on whether warming increases or decreases consumer needs for dietary carbon (C) relatively to phosphorus (P), thus hindering predictions of secondary production in a context of global change. Here, we investigate how the dietary C:P ratio maximizing consumer growth ($TER_{C:P}$: Threshold Elemental Ratio) changes along temperature gradients by combining a temperature-dependent $TER_{C:P}$ model and growth standardized experiments on *Daphnia magna*. Both lines of evidence show that consumer $TER_{C:P}$ exhibited a U-shaped thermal reaction. This non-monotonic response indicates that consumer nutrient requirements can either increase or decrease with increasing temperature, thus reconciling previous contradictive observations into a common framework. This unified framework improves our capacity to forecast the combined effects of nutrient cycle and climatic alterations on invertebrate production.

00173
Digital microscopy improves diatom research

If you have chosen the theme "free topic" please indicate 1 or 2 keywords here.
Digitization

Oral

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Abstract

Identifying and counting diatom cells under the light microscope is a key element of diatom research as well as ecological and water quality investigations. In an effort to advance this kind of work into the digital age, in this study we present a new variant based on the manual analysis of digital virtual slides, and compare it to the traditional non-digitized light microscopy workflow. We compared three replicates of six diatom samples by
a) preparing digital virtual slides by high resolution slide scanning and subsequently identifying and counting individual valves or frustules using the web browser-based BIIGLE image annotation platform, or
b) working the traditional way directly on the light microscope.
Both methods led to comparable results in diatom community structure, species richness and diatom indices.
The slight increase in expenditure of time in the digital method can be weighed against higher taxonomic resolution due to easier and hence more frequent use of morphometry. Furthermore, improved reproducibility and quality assessment in the digital approach can increase transparency and taxonomic precision. This digital workflow can also be applied for inter-calibration of individual experts through the web, and for producing training image sets for deep learning-based diatom identification, making it a promising and versatile alternative or extension to traditional light microscopic diatom analyses in the future.

00594
Flow Cytometry assays for detection and cell-sorting of polyphosphate accumulating bacteria (PABs)

Poster

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Abstract

Since the "green revolution" in the 1960s, phosphorus (P) in geological deposits has been massively extracted for fertilizer production, increasing the P cycle by 400%. During the same period, P storage in terrestrial and freshwater ecosystems increased dramatically (>75%). Paradoxically, and by analogy with "peak oil", a "phosphorus peak" is predicted by 2035 and this P shortage is likely to be one of the greatest challenges of the 21st century. To tackle the two faces of phosphorus and to ensure P ecological sustainability, holistic approaches coupling microbiology, ecology and geochemistry are needed. In this vein, there is emerging evidence of the unexpected and ubiquitous presence of polyphosphate-accumulating bacteria (PABs) in natural environments inviting endeavours to reveal their unknown functions and roles in the P cycle. Unveiling the environmental significance of PABs communities require high throughput methods of characterizing their structure, dynamics and functioning in complex environmental samples. To this purpose, a promising strategy is to combine staining of polyP and their detection by flow cytometry, enabling a rapid data acquisition and multi-parameter analysis. In combination with various dyes, FCM provides opportunities for investigation at the community level with capabilities of analyzing thousands of microbial cells per second. The possibility of fluorescence-activated cell sorting (FACS) also makes FCM a powerful technique for the identification and isolation of cells with particular characteristics. In order to optimize FCM detection and enumeration of PABS, a detailed evaluation of a broad range of factors (buffers, storage conditions and staining specifications) were performed. We also compare different dyes, DAPI, JC-D7 and JC-D8. DAPI is frequently used to visualize cellular polyP granules as it emits a green-yellow fluorescence, which is distinct from the blue fluorescence emitted from DAPI-stained DNA. JC-D7 and JC-D8 are benzimidazolinium dyes and whilst these novel specific polyP sensors were found to be suitable for polyP staining of living eukaryotic cells and tissue, these probes were not yet used to target prokaryotic cells. Our work provides a generic protocol for detection, quantification, and cell sorting of PABs by FCM and highlights JC-D7 dye as a promising fluorescent probe to achieve these purposes.

00612
Seasonal movements of porbeagle sharks (Lamna nasus) in the Northeastern Atlantic Ocean

Oral

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Abstract

The porbeagle shark (*Lamna nasus*) is a ubiquitous species whose populations have been strongly affected by fisheries over the last decades, both as a targeted or as a by-catch species. Since the 2010 fishing ban in Europe, sighting reports have been increasing in summer along the French coast of the English Channel. Observed individuals were all females, raising questions about the functional roles (i.e. post-partum rest or sex-segregation) of this coastal ecosystem for this epipelagic species. Eighteen individuals were equipped with PSATs tags, to unravel their horizontal movements between the summer coastal phase and the wintering period. Our results revealed that the exploitation of coastal areas of the English Channel is higher in summer. Unexpectedly, although all individuals move away from the coastal area in winter, most of them remained in the English Channel or the Celtic Sea, and therefore only performed limited seasonal movements. Only two individuals were characterized by extensive horizontal movements in the Northeastern Atlantic. Our results raise questions about the existence of different populations of porbeagle sharks exploiting different grounds.

00688
Toward the discrimination of relic and active microbial communities in lake sedimentary archives: a paleolimnological approach applied to the three domains of life

Poster

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Abstract

The understanding of long-term changes in past environmental conditions and biological communities is a key challenge to predict how future environmental pressures will affect ecosystem properties and biological diversity. Lake sedimentary archives are relevant to address this challenge, due to their ability to record both local and global environmental conditions. While the use of genomic approaches has been successfully applied for the reconstruction of the long-term dynamics of micro-eukaryotes, no similar effective application has yet been obtained for prokaryotic communities, although these taxa represent valuable indicators of the environmental changes affecting lake ecosystems functioning. One of the major limitation for the interpretation of the prokaryotic sedimentary DNA signal is the difficulty in distinguishing molecular signals from presently active and past archived micro-organisms. Our objective is to validate an analytical approach to discriminate relic and active microbial communities by comparing the diversity patterns obtained from sedimentary DNA and RNA pools.
Lake Bourget (France) has been chosen as a model site to test this approach. A sediment core was sampled (January, 2022) in the deepest zone of the lake. Subsamples, taken every cm from 0 to 50 cm depth, were immediately preserved in liquid nitrogen. Microbial diversity was investigated by high-throughput sequencing of both 16S rRNA (Archaea and Bacteria) and 18S rRNA (micro-eukaryotes) genes and transcripts.
Our preliminary results allow to detect 1183 and 875 ASV for Archaea, 3345 and 3105 ASV for Bacteria, and 3063 and 1301 ASV for micro-eukaryotes, respectively for genes and transcripts. For all three domains, diversity indices exhibited significant differences between the DNA- and RNA-based datasets. Community compositions were also different according to the two nucleic acid pools, with, for instance for Archaea, members of the Methanomicrobia class being dominant in the DNA library while the Methanosarcinia class dominated the RNA library. The differences between DNA and RNA-based datasets varied with sediment depth, with distinct trends for Archaea, Bacteria, and micro-eukaryotes. Further analyses will focus on the confrontation of the DNA- and RNA-based datasets to identify more particularly the past microbial communities, and explore the correlations between their changes and environmental conditions modifications (water [P], anoxia/hypoxia, etc.).

00691
Effects of litter preconditioning on its subsequent decomposition in an intermittent river network

Poster

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Abstract

River ecosystem functions (e.g. decomposition) are increasingly studied but a meta-ecosystem focus, linking terrestrial and aquatic processes, is still lacking. Here we present field evidence demonstrating that terrestrial preconditioning can have an effect on subsequent instream decomposition. We investigated variability in decomposition rates across eight terrestrial preconditioning treatments (i.e. related to land uses and hydrological conditions) as well as across perennial and intermittent reaches. Terrestrial exposition had an impact on leaf-litter decomposition rates depending on the preconditioning treatment. Three main factors played a key role in preconditioning: temperature, soil humidity and efficiency of pre-colonization by decomposer communities (i.e. bacterial and fungal). Instream decomposition rates driven by macroinvertebrates did not differ across preconditioning treatments even though decomposition in the intermittent reach was two times faster than in the perennial stream. This was mainly attributed to macroinvertebrate communities differences in richness and ecological/functional traits composition. Some trends appeared regarding decomposition driven by bacteria and fungi as a result of intra and inter specific competition between terrestrial and instream decomposer communities leading to a delayed colonization and reducing the decomposition efficiency.

00203
Hydrochory as a means for mediterranean vineyards revegetation

Oral

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Abstract

Maintaining biodiversity of spontaneous species in agricultural landscapes is a major challenge regarding the bundle of ecosystem services provided by them, such as preservation of water and soil resources. It is possible to increase landscape's resilience to climate change through their renaturalization with agroecological measures, especially maintenance practices of vegetation cover in agroecological infrastructures.
In the Mediterranean environment, those infrastructures such as ditches, plot borders or even inter-rows of perennial crops concentrate both biodiversity and flow of matter (water, pollutants, particles), making these landscape elements particularly susceptible to intense rainfall events that contribute to exchange of biodiversity across landscapes. Managing vegetation of these elements is a significant lever for biodiversity maintenance considering impacts of plants on flows of matters, such as water and seeds. Promoting exchanges requires knowledge of the relative importance of the main types of plant dispersal i.e. hydrochory, anemochory and zoochory that affects seed exchange between landscape elements, by making the hypothesis that the hydrochoric dispersion, i.e. by water, is particularly important in the Mediterranean environment.
To establish the potential of hydrochory to rehabilitate Mediterranean vineyard environments, we proposed a conceptual model of seed exchanges at landscape scale incorporating the levers available to stakeholders (vegetation maintenance in inter-rows, drainage ditches and plot borders), as well as climatic variables and the specific characteristics of each seed present. We will present the first results of seed dispersal experiments after a rainy event on a vineyard plot, as well as manipulations to determine the seed bank, allow us to make a first estimate of seed transport and the rehabilitation potential of Mediterranean vineyard environments. At the end of the experiments, the knowledge obtained will be integrated into a spatially explicit model based on the source-sink principle to simulate the dispersion of seeds by water, this model being considered as a virtual laboratory to co-construct landscape arrangements with stakeholders for maintaining biodiversity.

00232
Space use of terrestrial invertebrates : phylogenetic, functional and environmental drivers of interspecific variations

Poster

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Abstract

Several studies have synthesized available knowledge on the space use of vertebrates, revealing energetic, phylogenetic and environmental drivers of movement rates, as well as co-variations between different movement types. Similar data on invertebrates are still scattered in the literature. In this contribution, we aim at filling this gap by compiling published data on foraging and dispersal behaviours of terrestrial invertebrates. We performed a literature search on Web of Science and Google Scholar and collated a variety of movement metrics, including foraging distance, foraging rate, dispersal distance and dispersal rate, using standard definitions for these movement types. Our synthesis currently gathers 263 active movement data of 137 species, stemming from 128 published studies. We will use this database to analyse the contribution of several putative drivers of the observed interspecific variations in movement behaviour. These drivers include functional traits of invertebrates: body mass, movement mode (flying, walking, crawling) and trophic guild (carnivore, herbivore, detritivore); phylogenetic position of these organisms; and environmental descriptors of the study sites. These analyses will reveal the relative importance of intrinsic functional properties of invertebrates and of the environmental conditions they experience, in driving interspecific variations in space use. These results are of paramount importance if we are to build a general understanding of meta-ecosystem dynamics.

00519
Study of the spatial ecology and terrestrial habitat selection of the green toad (Bufotes viridis) by radio telemetry during the post-breeding period.

Poster

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Abstract

The green toad is considered “Endangered” in the French national red list, as well as in the Grand-Est region (Alsace and Moselle). For these reasons, it benefits from a National Action Plan. It inhabits open disturbed habitats in past industrialized areas often subject to strong land pressures. However, there are still gaps in the knowledge of its ecological demands, particularly concerning terrestrial habitats. As a result, the "Avoid, Reduce and Compensate" sequence as well as corrective measures linked to land planning projects are difficult to implement for this species.
To characterize the terrestrial habitats, evaluate the home ranges and the distances of dispersal to the aquatic breeding sites, a radio telemetric monitoring (twice a week; 7 months, 19 individuals) has been carried out in a former mining site in Moselle (La Houve). Adult green toads were equipped with an external transmitter after being weighed, measured, and photographed.
Data collected from April to the end of July 2021 showed:
- A non-random selection of shelters in comparison to the availability of microhabitats. These shelters are of different natures: artificial, small mammal burrows, loose substrates, sandy soils and schlamms; they are located in an open environment or a low herbaceous plant layer as in areas of low slope.
- Estimated home range of individuals in summer (n=10, sex ratio 1:1) ranges from 0.07 to 3.6 ha (mean: 0.63 ± 0.17 ha)
- Movements within a radius of a few hundred metres of potential breeding pools ranges from 50 to 450m (mean: 119 ± 71m from nearest pools)
- Location of the most suitable terrestrial habitats for the species based on a predictive model,
From this new state of knowledge, it is planned to use a European land use reference system (EUNIS) to define the surrounding environment of the terrestrial habitat areas to be protected near the breeding sites. In the short term, we plan to integrate these results together with additional data collected in another mining site in Alsace within a multi-scale approach for taking into account functional connectivity and corridors at the landscape scale to reduce and avoid fragmentation of populations.

00646
Diversity at Giving-up-Density: top-down effects of foraging decisions and of functional trait composition of resource species on the biodiversity of resources after foraging

Poster

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Abstract

Foraging by consumers has direct effects on the community of their resource species, and may serve as a biotic filtering mechanism of biodiversity. Determinants of foraging behaviour may thus have cascading effects on abundance, diversity, and functional trait composition of the resource community. Here we propose diversity at giving-up-density (DivGUD) as a novel concept and simple measure to quantify community effects of foraging at multiple spatial diversity scales. DivGUD provides a framework linking theories of adaptive foraging behaviour with community ecology. In experimental resource landscapes we showcase effects of patch residency of foraging wild rodents on α-DivGUD, ß-DivGUD and γ-DivGUD, and on functional trait composition of resources. Using DivGUD allows for prediction-based investigation of cascading indirect predation effects (ecology of fear) across multiple trophic levels, of feedbacks between functional trait composition of resource and consumer communities, and of effects of inter-individual differences among foragers on the diversity of resource communities.
Here we introduce a modeling study focussing on the feedback loop of distinct combinations of functional traits of virtual seed species, which moderate foraging behaviour and thus DivGUD.

00030
Biodiversity in agriculture: Sustainable cultivation methods as an opportunity for environment and farmers

Poster

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Abstract

The *AgroBioDiv* project is part of the project network for ecological agricultural research funded by the Baden-Württemberg Ministry of Science, Research and Arts. It brings together biological, agricultural and political science expertise to further develop concepts for promoting biodiversity in the agricultural landscape. Our central questions are:
- How is biodiversity perceived in politics and by the public?
- What are effective incentive structures for a transformation towards sustainable agro-ecosystems without serious disadvantages for all stakeholders?
- Can variety selection influence biodiversity?
- Is ecological farming the key to solving the biodiversity crisis in our agricultural landscape?

In cooperation with 31 organic farmers we want to find an answer to these questions. Additionally, a growing number of farmer cooperatives cultivate crops without chemical pesticides, but also without organic certification. AgroBioDiv analyses, what the outcomes of this production form on cropland biodiversity are and which policy instruments can facilitate the success of such production forms. We therefore cooperate with farmers' cooperatives KraichgauKorn, Linzgaukorn and Albkorn, all based in the German State of Baden-Württemberg.
The aim of the project is to record biodiversity on selected farmland (mainly cereal fields) with a focus on arable flora. The data collected will be used to find ways to conserve and promote the enormous potential that these areas offer for our native biodiversity. Using data from over 1000 fields, supplemented by qualitative and quantitative surveys with farmers and political actors, the project will also investigate to what extent the transformation towards organic agriculture can protect our environment. The interdisciplinary approach and the close cooperation between political science and biology make it possible to tackle the problem of species extinction in agriculture from all sides at the same time, if possible without actors feeling left out. At the same time, the current situation in Europe opens up the question of whether it is at all possible to meet food demand through these less intensive farming methods, as the war in Ukraine is significantly increasing demand in Germany.

00078

Climate warming compounds plant responses to habitat conversion

Oral

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Abstract

Serious concerns exist about potentially reinforcing negative effects of climate change and habitat destruction on biodiversity. Here, we investigate the compounding effects of climate warming and land-use change on the distributions of 1701 plant species in Sweden over 60 years. We show that species associated with warmer climates have increased, while grassland specialists have declined. Importantly, we find that vegetation densification through grazing abandonment and climate warming have synergistic effects on species distribution change. High levels of warming were related to increased local extinctions, with grassland specialists especially affected. In contrast, colonisations occurred more often in cold areas experiencing high levels of both climate and land-use change. Strong increases in the temperatures experienced by species across their ranges indicate substantial time lags in their responses to climate change. Our results highlight that the conservation of threatened plant species relies on both reduced greenhouse gas emissions and retention and restoration of grassland habitat.

00144
Is crop emergence influenced by intercropping? Early growth dynamics of spring wheat and faba bean in crop mixtures

If you have chosen the theme "free topic" please indicate 1 or 2 keywords here.
diversification, interspecific competition,

Oral

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Abstract

Crop emergence is an important variable determining early crop performance. To be able to improve the management of intercrops, a more detailed knowledge is required on the aspects of early growth dynamics between intercrops in intercropping. The present work evaluates interspecific interactions of spring wheat and faba bean during crop emergence stage.
As part of a larger research project, Robotics and Phenotyping for Sustainable Crop Production (Phenorob), we set up field trials at a low input conventional site in 2020 and an organic site in 2020 and 2021 at Experimental Sites of the University of Bonn, Germany. Each of the three field experiments was performed as a randomized complete block design with four replicates. Treatments included all possible sole crops and 1:1 intercropping mixtures of twelve spring wheat (Triticum aestivum L.) entries (ten cultivars and two 5-component mixtures of these wheat cultivars), and two faba bean (Vicia faba L.) cultivars. All combinations were each sown in two sowing densities. The design resulted in a total number of 320 plots per site. To measure the effect of intercrops on early crop establishment, we counted crop emergence (plant m-2) after four weeks of sowing.
Our results showed weak positive but significant mixture effects on wheat emergence at the low input conventional site as well as on wheat and faba bean emergence at the organic site in 2021. We also observed that wheat was the dominating partner in the case of all three environments but the domination could already be observed at emergence in case of the conventional site.

00154
Fagus sylvatica L. & *Quercus pyrenaica* Willd.: an odd couple of the sub-Mediterranean ecotone

Oral

S. De Tomás Marín [1], J. Rodríguez-Calcerrada [2], S. Arenas-Castro [3], I. Prieto [4], G. González [2], L. Gil [2], E. García De La Riva [1]

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Abstract

The Iberian Peninsula comprises one of the largest boundaries between Mediterranean and Eurosiberian vegetation. Moreover, this transitional region hosts many plant species and communities at their low-latitude (warm) margin of European distribution together with Mediterranean species and communities. The climate in this sub-Mediterranean region will probably become warmer and drier, which can lead to substantial changes in plant species composition. Therefore, sub-Mediterranean regions are highly vulnerable to climate change and a priority area for applied and basic biodiversity research. Two of the main species found in the sub-Mediterranean zone of the Iberian Peninsula are the central European species European beech (Fagus sylvatica L.) and the Mediterranean Pyrenean oak (Quercus pyrenaica Willd.). It remains unclear how the adaptive strategies of these two species determine the structure of sub-Mediterranean ecotones. To clarify this question, we quantified niche partitioning between Pyrenean oak and European beech by using the n-dimensional hypervolume approach, based on the Hutchinsonian's multidimensional niche concept. The main aim of the present study is to understand how environmental factors and biotic interactions drive the functional assembly of these two key species in the sub-Mediterranean forest of "El Hayedo de Montejo", included in the world heritage list of the UNESCO. The overarching goal is to assess the potential impact of climate change on the functional structure of ecotones.

00157
Direct and indirect effects of insect diversity on wood decomposition

Oral

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Abstract

Biodiversity is important for multiple ecosystem processes, such as productivity or decomposition. Considering the ongoing changes in biodiversity, a detailed understanding of biodiversity-ecosystem functioning relationships is required to predict how these biodiversity change affects ecosystem fuctioning. Intensive studies have confirmed the vital role of biodiversity in determining plant productivity, however, the role of different facets of biodiversity for decomposition and the underlying mechanisms remain poorly understood.

Here, we examine the direct and indirect effects of insect diversity on wood decomposition by using a mesocosm experiment manipulating beetle species richness and functional diversity. Our results show that decomposition rates were higher when beetles were present. Species richness and functional diversity had independent positive effects on wood decomposition, but effects of functional diversity could be attributed to higher beetle biomass and the presence of one large-bodied species. Moreover, we also show that beetles had indirect effects on wood decomposition via bacterial diversity, fungal communities and biomass.

Our experiment provide novel information about how beetle diversity directly affects wood decomposition and indirectly by interaction effects with bacteria and fungi. These findings highlight the importance of conservation of insect diversity as well as insect-microbe interactions for maintaining decomposition processes.

00231
Aquatic communities in urban micro-ecosystems – The black Bucket Challenge

Oral

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Abstract

As a consequence of human population growth, people are increasingly living in cities, resulting in increased soil sealing, a higher density of buildings and rising temperatures. An important aspect in urban ecology is to protect biodiversity, to maintain resilient ecosystems and to fulfil human needs. Small aquatic systems such as water-filled tree holes and man-made containers harbor a variety of invertebrate species (e.g. decomposers, pollinators and nuisances) but may be affected by human activities. Generally, small waterbodies in urban environments are underrepresented in research but relevant, for example, as breeding grounds for disease-carrying species like mosquitoes.
To investigate small standing waters in the city of Salzburg, we ran a Citizen-Science project – the "Black Bucket Challenge". Participants were asked to keep water-filled buckets in their gardens or backyards allowing the colonization of invertebrates. We quantified abundance, species richness and decomposition in each bucket at the end of the study period and handed out small prizes to the winners. In this study, we addressed following research questions: (1) Are invertebrate communities (abundance, species richness and community composition) in urban aquatic microhabitats affected by urbanization (degree of imperviousness, water temperatures)? (2) Does urbanization affect leaf litter decomposition by invertebrates and mosquito production in aquatic microhabitats? We found that communities in artificial, small standing waters were composed mainly of insect larvae, similar to communities in natural tree holes. Our results give first insights into how soil sealing affects larval insect abundance. While species richness did not change with urbanization, species composition in highly urbanized areas differs from that in more natural areas. Litter decomposition by larvae could be confirmed as important ecosystem function even in urban, artificial waterbodies irrespective of the degree of urbanization. However, in city centers with high imperviousness, we could detect high numbers of mosquitoes. Concluding, our project and consequent results not only raised awareness of biodiversity within Citizen-Scientists but can also help to understand complex species dynamics in urban space and how to avoid the possible spread of nuisances or pests such as novel mosquito species.

00239
Temporal dynamics of plant available nutrients are affected by mycorrhizal type and tree species richness

Oral

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Abstract

The positive effect of plant diversity on ecosystem functioning is hypothesized to depend on plant nutrient availability, uptake, and their temporal dynamics. However, empirical evidence is scarce. Nutrient supply of plants is greatly influenced by mutualistic fungi. Tree species predominantly associate with either arbuscular mycorrhizal fungi (AMF) or ectomycorrhizal fungi (EMF). While AMF are known to support phosphorus provision to plants, EMF are thought to enhance the availability of mineral nitrogen to plants. Thus, higher-diversity tree stands might enhance soil nutrient uptake by forming associations with different mycorrhizal types. We investigated the effects of tree species richness and mycorrhizal type on the temporal dynamics of the plant-available nutrients nitrate, ammonium, and phosphate in soil. In the tree diversity experiment MyDiv, three levels of tree species richness (monocultures, two- and four-species mixtures) were crossed with either AMF, EMF, or a mixture of both mycorrhizal types. Ion exchange membranes were inserted over the course of two years to assess monthly concentrations of plant-available nutrients. Mycorrhizal type and tree species richness showed differing effects on concentrations of plant-available nutrients throughout the year. We found significant effects of tree species richness on soil nitrate, showing that nitrate decreased significantly with tree species richness, despite strong temporal fluctuations and variable treatment effects dependent on the year of sampling. Effects of mycorrhizal type on nitrate concentration were strongly dependent on season and year, showing significantly higher levels of nitrate in EMF in spring compared to summer and autumn, while nitrate concentrations in AMF communities did not change significantly with time. Phosphate and ammonium concentrations in soil showed temporal dynamics, but were less affected by the experimental treatments. Our results indicate that tree diversity enhances soil nitrate uptake, while the effects of mycorrhizal fungi were more variable in time. With this study, we were able to shed light on the nutrient-related mechanisms underlying mycorrhiza-mediated tree diversity effects on ecosystem functioning.

00272
Suggestions and requirements for a national biodiversity monitoring in German forests (NaBioWald)

Poster

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Abstract

With increased interest in biodiversity from the public and policy makers, the need for reliable data at all landscape levels arises. Therefore, a working group, consisting of representatives of federal and state departmental institutions in the field of forestry and nature conservation have formulated propositions on the development of a national forest biodiversity monitoring to close existing knowledge gaps.
The aim of the monitoring is to collect comprehensive, representative information on biodiversity in Germany's forests, the influencing factors ("drivers"), and their cause-effects. The focus will lie on the interactions of forest management and environmental factors on forest biodiversity. The data and information obtained are suitable a) to provide an important basis for biodiversity-oriented, adaptive forest management, b) to support the forest and nature conservation policy of the federal government and the states, and c) to fulfil necessary national and international reporting obligations. Links with other monitoring programmes covering various landscapes shall lead to a cross-land-use assessment across larger entities (landscapes, regions). The complexity and effort of monitoring requires a division of labour and tasks between the different scientific and administrative actors in forest and nature conservation at federal and state level. A draft concept is to be discussed in an extended circle of experts and other actors and subsequently presented as a final draft to politicians for a decision on implementation.
Here we present our working hypothesis and the envisaged output.

00324
Significant changes in the ground vegetation along an environmental gradient across German forests: results from the intensive forest monitoring sites

Poster

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Abstract

Intensive forest monitoring (Level II) offers a huge data basis to study cause-effect-relationships in forest ecosystems. As part of the European ICP Forests programme, assessments of environmental parameters and the state of forests have been conducted on over 100 intensive monitoring sites according to harmonized methods. In 2012, 68 Level II sites were selected as an official German set of intensive monitoring sites, based on different environmental variable (the pH value of the upper mineral soil, yearly precipitation sums, long-term N-NH4 deposition as well as altitude). The 68 sites represent different environmental gradients common for the main forest ecosystems in Germany. Here we analysed which environmental variables most significantly affect the composition of the ground vegetation and whether changes in environmental gradients can be linked to those in the composition of ground vegetation.
The pH value in the upper soil ranges between 3.3 and 7.6. Compared to a 2001-2005 reference period, we have observed a slight but significant increase. Yearly precipitation sums are between 460 to 2040 mm a-1. In the observation period 2016-2020, N-NH4 deposition ranged between 3 and 15 kg ha-1 a-1. It has decreased by about 20% since 2001.
Preliminary results show a shift in the ground vegetation towards species with a lower Ellenberg N index, lower Ellenberg K index, as well as a significant increase in C-score and a significant decrease in R-score. Shannon index significantly decreased over the last twenty years. At the spatial scale, Ellenberg N can be linked to foliar nutrition: mean Ellenberg N index is highest at sites where foliar N is above critical limits. Mean Ellenberg K index shows a significant negative relationship with yearly precipitation sums. CSR signature shows significant links with soil pH as well as precipitation sums, mean temperature, and length of the vegetation period, e.g. variables that are influenced by ongoing global change.

00503
Retrospective assessment of the global decline of European bats (1940s-2010s)

Oral

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Abstract

Consecutively to the great acceleration of human global population growth in the 1950s, human pressures on ecosystems have reached such an unprecedented rate that many ecosystems have been irreversibly damaged and many animal and vegetal populations have declined. The lack of long-term data and the multiplicity of causes that may act on populations make it difficult to understand mechanisms underlying the decline of biodiversity, and to measure success or failure of conservation actions. As a result, only a few studies focused on the long-term impact of global changes on species, and the vast majority of published data are diachronic or derived from modelling. Assessing temporal changes in species extinction risk might help to reconstitute population demographic trends from past to present and relate them to their drivers of change.
There is currently more than 1,300 bat extant species recorded in the world, which makes the Order Chiroptera a major contributor of mammalian biodiversity. To date, almost a quarter of them are globally threatened by land use change, urbanization, environmental pollution, infectious diseases, hunting and persecution, quarrying and human intrusions on bat habitats. In European countries, bats experienced a dramatic decline during the 1950s-1970s period, leading to the local extinction of several species. Yet, there is no long-term picture of demographic trends of European bat populations and this decline is only supposedly related to several causes.
We conducted a review of 80 years of bat-related literature sources (i.e, grey and academic literature, action plans, red-data books, etc.) on population surveys and species conservation status, to assign retrospective red-list categories to 38 European bat species. We assessed the Red-List Index (a relative overall distance of a group of species from extinction, based on IUCN categories) to examine how their extinction risk has changed since the 1940s. Our results suggest that European bat populations reached a particularly high extinction risk during the 1950s-1970s, and surprisingly recovered from their past decline after the 1990s. The examination of species conservation status over long-term may allow better understanding the evolution of causes of decline, and might become a valuable tool in further conservation strategies.

00606
Effects of nutrient enrichment and fishing pressure on top predators on the structure and functioning of aquatic ecosystems: a large-scale experimental approach

Oral

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Abstract

Ecosystems are facing numerous natural and human-induced perturbations. To assess and mitigate ecosystem responses to these perturbations, we need to understand how they affect the diversity of species or functional groups, as well as their complex interactions, and how these effects determine ecosystem functioning and stability. In freshwater ecosystems, replicated experimental studies have shown that nutrient enrichment and predator manipulation alter biodiversity, trophic structure, and ecosystem functioning. However, most experiments were conducted in small systems that allowed to manipulate only a few trophic levels, with no population dynamics of top predators. Moreover, these experiments mainly concerned small fractions of ecosystems, such as pelagic or benthic compartments. Complex direct or indirect interactions might occur in more realistic and heterogeneous ecosystems. Last, the duration of these experiments generally ranged between a few weeks and a few months. The responses at longer time scales of more complex and larger systems remain to be explored experimentally.

In order to explore such questions, we built sixteen experimental ponds (15x30m, 2.7-m deep, vol. 700 m^3), with littoral zones covered by dense communities of macrophytes (PLANAQUA platform, CEREEP-Ecotron IDF [France]). In December 2016, Roach (*Rutilus rutilus*, omnivorous fish at the bottom of the food webs) and Perch (*Perca fluviatilis*, omnivorous fish at the top of the food webs) were added in all the ponds. From 2018 to 2021, perch individuals were regularly captured (using a trawl net and fish traps) and removed in half of the ponds. Nutrients (Phosphorus and Nitrogen) were added in half of the ponds, leading to a full factorial design crossing fishing pressure on top consumers (Yes/No) and nutrient loading (Yes/No) with 4 replicates. Ponds were emptied in January 2022.

Preliminary results suggest consistent effects of nutrient loading, with increased lake metabolism, decreased stability of oxygen concentration and increased fish growth with high nutrient inputs. However, the effects of fishing of top predators seem limited to high trophic levels. In addition, overall effects of top-predator manipulation and nutrient loading seem dampened when compared to smaller-size experiments with comparable treatments, suggesting that ecosystem complexity is key to understanding the effects of perturbations.

00626
Impacts of alien invasive plant species on biodiversity in Central Europe. Impact of *Prunus serotina* in pine stands on the local entomofauna in the Berlin urban forests (Grunewald area).

Oral

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Abstract

Prunus serotina is known to have significant impacts on native plant species. Numerous authors point out that *P. serotina* has a negative impact on European native flora. Dyderski M, Jagodzinski A. (2021) studied the impact of several non-native tree species on biodiversity, species composition and shrub biomass in forests. The scientists found that *P. serotina*, among other invasive species, had the greatest impact, displacing native species and dominating the understorey. Also, Baranowska and Korzeniewicz (2020) have shown that *P. serotina* can even outcompete beech (*Fagus sylvatica*) in the competition for light.
However, so far, there are no studies on whether *Prunus serotina* affects the local entomofauna under Central European conditions.
Starting in 2021, an experiment is being conducted in the Berlin urban forests.
The aim of this study is to understand the impact of *Prunus serotina* on local insect populations. In addition, we want to determine the abundance and species composition of ground beetles (Coleoptera; Carabidae) occurring in pine stands with or without *Prunus serotina* and investigate the structure of the beetle communities.
We aim to check whether *P. serotina* has an influence on the species diversity and total biomass of the entomofauna in pine stands.
The study is conducted on a total of ten experimental plots in selected pine stands (approx. 60-80 years old) in the Grunewald- Berliner Forsten forest district. In each plot, 10 traps are randomly distributed over about 200 m2.
The first partial results of the research will be discussed at the SFE² GfÖ EEF conference in November 2022.

00627
Consistent increase of ecosystem functioning with diversity for two tropical mountain ecosystems

Poster

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Abstract

Numerous observational and experimental studies have shown that ecosystem functioning increases with biodiversity. However, we have little knowledge of whether the effect of diversity on ecosystem functioning is consistent across ecosystems and functions. In this study, we compared the diversity effect within and across elevational levels covering six different habitat types (i.e. anthropogenic and forest systems) of two tropical mountain ecosystems located in the Andes, south-eastern Ecuador, and on Mt Kilimanjaro, Tanzania. Both mountains are distinct in geological history, climate, and biodiversity. We included eight ecosystem functions belonging to biomass stocks or process rates provided by microorganisms, plants, insects, and birds. Based on these functions, we study the roles of environmental heterogeneity in shaping the contributions of species richness and species turnover to the diversity effect along the two elevational gradients. On both studied mountains, the diversity effect was stronger across than within elevational levels. While, species richness and species turnover had a positive effect on ecosystem functions along the elevational gradients, the effect of species richness was consistently stronger than the effect of species turnover across functions. In both studied mountain ecosystems, the effect of species richness and species turnover on the diversity effect was mediated by environmental heterogeneity. The contributions of species richness and turnover to the diversity effect did not differ between biomass stocks, process rates, or taxonomic groups. Our results indicate that regardless of mountain ecosystems, type of function, or taxonomic group, environmental heterogeneity fosters the contribution of species diversity to ecosystem functioning. In addition, our results imply that (1) assessing richness is a robust surrogate for ecosystem functioning and (2) conserving biodiversity and environmental heterogeneity is key for maintaining ecosystem functioning. ACKNOWLEDGE MENT: This project was done with additional contributors from the research units FOR1246, FOR402, FOR816, and FOR2730, as well as the knowledge transfer program PAK823-825.

00639
Can rolling composite wildflower blocks increase biodiversity in agricultural landscapes better than wildflowers strips? I. The effect of shape

Poster

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Abstract

Biodiversity and abundance of wildlife has dramatically declined in agricultural landscapes. Sown, short-lived wildflower strips (WFS) along the margins of crop fields are a widespread and often subsidised agri-environmental scheme, intended to enhance biodiversity, provide refuges for wild plant and arthropod populations, and to provide ecosystem services to crops. Meanwhile, WFS schemes are also criticized, since their functionality decreases with plant succession, the removal of aged WFS poses an ecological trap for the attracted arthropod populations, and only common and mobile species benefit. Further, insects in WFS are impacted by pesticides from agricultural fields due to shared boundaries with crop fields, and by edge effects.
The performance of the measure could potentially be improved by combining several WFS of different successional stages, each harbouring a unique community of plants and arthropods, into persistent, composite wildflower blocks (WFB) where successional stages exist in parallel. Species richness in WFB could increase by 28-39% compared to WFS, as projected from successional data available in the literature for several plant and animal taxa. Persistence of composite WFB would offer reliable refuge for animal and plant populations, also supporting their predators and herbivores. Further, WFB have less boundaries to crops compared to WFS of the same size, and are less impacted by edge effects and pesticides. Policy implications: We suggest a change of conservation practice changing from successional WFS to parallel, composite WFB. By regular removal and replacement of aged WFS either within the block (rotating) or at its margins (rolling), the habitat heterogeneity in WFB could be perpetuated. Rolling composite WFB change locations over years, and the original location can be re-converted to arable land while the nearby WFB is still available to wildlife. A change in agricultural schemes would be necessary, since in some European countries clustered WFS are explicitly not subsidised.
In the first year of our project testing these predictions (Linde-Wildflower-Experiment) we investigate edge effects on biodiversity in first year wildflower strips and wildflower blocks.

00668
CaMTrAB - Camera Trapping for Mammal Trophic Interactions, Abundance and Biodiversity

Poster

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Abstract

Small and large terrestrial mammals have a major impact on multitaxa community structure and ecosystem functions, e.g. through browsing, seed dispersal and predation. Mammal species interact as predators, prey or competitors for resources that are dependent on forest management and structure. In order to assess the entirety of bottom-up and top-down effects, it is necessary to investigate not only single carnivore – single prey interactions or only two competing species but to use a comprehensive multi-species community approach. For this purpose, camera trapping is an objective and efficient method

In a pilot project for a comprehensive camera trap-based monitoring of all large and small ground-dwelling mammals in the Biodiversity Exploratory Schwäbische Alb, we illuminate mammal diversity and abundance dependent on forest management and structure. The interdisciplinary nature of the Biodiversity Exploratories provides a unique opportunity to understand how the abundance of large mammals is determined by the local abundance and diversity of other organisms and, conversely, how differences in large mammal abundance and activity affect the diversity of other groups of organisms.

Large mammals are monitored using a classical wildlife camera trapping approach, while small mammal diversity and abundance is assessed using customized baited camera trap boxes. This novel small mammal camera traps are calibrated and validated by direct comparison with classical snap and life trapping.

00010
Palaeo-environmental study of two charcoal-hearth soil sequences in the northern Vosges mountains (Bitche, France)

If you have chosen the theme "free topic" please indicate 1 or 2 keywords here.
historical ecology

Poster

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Abstract

This multidisciplinary study aims to decipher XVIIIth century charcoal production impact on northern Vosgian soils. Field and analytic soil observations are complemented by charcoal and phytoliths observations on mammoth thin sections, molecular analyses of organic pollutant content and phytoliths analysis on bulk preparation. The complex platform Technosol, results in an ancient natural soil sequence buried by a man-made platform on which charcoal are accumulated. The uphill current soil is an Entic Podzol. The local low bioturbation and acid context, allowed to collect trustable past ecological data from the buried soil. Podzolization started before the platform construction. Inducing a low alkalinization of the soil developed in the charcoal hearth remains, ashes production favoured the migration of iron/clayey/organic bands through the platform sediment and the buried soil. The charcoals studied on mammoth thin section gave relevant assemblages of mainly Quercus and Fagus. Phytoliths studies suggested less dense or degraded forest canopy preceding the platform construction more likely due to ancient wood coppicing or previous disorganized wood gathering. Abundant in the current soils, PAH did not migrate under the charcoal hearth layers. Their absence in the platform sediment suggests less residual no residual pollution in local soil before the charcoal activities than later.

00134
TEMPERATURE AND BODY SIZE REDUCTION ALTERS FOOD WEB STRUCTURE AND AQUATIC ECOSYSTEM FUNCTIONNING

Oral

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Abstract

Global warming affect individual phenotypes, which can translate into altered biotic interactions. One of the most common phenotypic change induced by global warming is a reduction of individual body size. Body size structures trophic interactions in aquatic food webs. Here we investigated how temperature and body size reduction can influence the food webs structure and how these modifications affect ecosystem processes. We conducted a mesocosm experiment with temperature treatments (ambient; ambient +4 °C) crossed with fish treatments: no fish, fish reared over several generations at 20 °C (large fish) or fish reared over several generations at 30°C (small fish). Mesocosms were inoculated with zooplankton and phytoplankton from a local Pond and left open to the natural colonization. From April to June we weekly sampled biological data related to the food web structure (body size and abundance of major taxonomic groups). We also collected ecosystem processes data. We hypothesized that (1) Temperature alter the community stability through an unstable dynamics (density variations over time), decrease the trophic links and as a driver of physiological rate processes increases oxygen demand. (2) Body size reduction induced by temperature alter interaction strengths and modify the size dominance of lower trophic levels organisms. (3) The presence of Fish modify the trophic cascade. Our preliminary results indicate lower density of micro-zooplankton in warm mesocosms suggesting that temperature may alter the community stability. We observe a decrease of the body size of copepods & rotifers throughout the experiment supporting the idea that temperature induced a body size reduction. The O2, CH4 and CO2 concentrations decrease in warm mesocosms at the end of the experiment but CH4 and CO2 concentrations increase in presence of fish in ambient mesocosms. We also observe an increase of cyanobacteria and diatoms in warm mesocosms. We are now investigating if the experimental treatments have induced changes in the food web structure and if these changes can be linked to effects on ecosystems functions. These preliminary results reinforce the idea that better understanding the cross and complex impacts of temperature and body size reduction are determining for a better aquatic ecosystems preservation.

00253
Prospective researches on the long-term trajectories of forest ponds in lowland forests in North-Eastern France

Oral

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Abstract

Wetlands are among the most impacted ecological systems by past human activities and on-going climate change, mainly through the modification of hydric regimes. But it is also well established that wetlands provide crucial ecosystem services. Therefore, that are in the centre of several programs of monitoring, conservation and/or restoration. This is the case of the forest ponds in the lowland temperate biogeographic domain. These forest ponds are wetland about some hundred m² and few meters depth, which might be present locally in high density. Therefore, they constitute significant ecological entities, from local to reginal scale, although they might be in very much different ecological states, from waterlogged to terrestrialized states. However, the forest ponds remain undescribed and uncharacterized as specific ecological system. Thus, a key question that remains open is their long-term trajectories.

Indeed, their origin, the past dynamics, and the heritages, possibly explaining their current, heterogeneous states, remains heavily discussed, whereas insights about their long-term trajectories might provide strategic knowledges for their stakeholders.

To undertake these questionings, we developed researches on forest pond on two areas on the Lorraine lowland in north-east of France. On these areas forest ponds have been inventoried, using LIDAR images, and described regarding their present-day ecological state. Some of them, have been characterized in terms of long-term ecological trajectories, according palynological records and 14C dates. Their distribution has been characterized according topographical position and geomorphological features.

Our analyses permitted to stress the significant synchronicity of origin of the investigated forest ponds, and to confirm the large variation of localization and geomorphological features. This is support by the observation about their divergences of long-term dynamic, providing much divers state of sedimentary patterns, from nearly no sediment to several meters of organic sediment. Finally, we highlight the role of the last century forest management as main factor influencing the state of the forest ponds today.

00422
Two thousand years of boreal disturbances history : a multi-proxy approach

Poster

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Abstract

Boreal forests occupie 30% of the global forest area and provides many ecosystem services essential to the development of societies (water ressources, timber production, maintenance of the global climate balance). Their functioning, structure and dynamic are intrinsically linked to natural disturbance regimes, particularly insect outbreaks and fire. While the dynamic of fire regimes in the face of climate change are fairly well understood, insect pest outbreaks are poorly know, especially spruce budworm (Choristoneura fumiferana, SBW), as well as the interaction of these two disturbance regimes. This project therefore aims to answer the following question : how have the cross-dynamic of these two disturbance regimes responded to past and present climate changes? Paleoecology, through its long-term approach, allows a better understanding of these dynamics. The project will be conducted at large spatial scale in different bioclimatic domains of Quebec, selected as key ecosystems for the understanding of fire/epidemic dynamics. The objectives of our project are : (i) to develop a methodology for reconstructing TBE epidemics, over a 1500 year period thanks to qPCR quantification of sedimentary DNA, in order to obtain a complete warming - cooling - warming cycle. (ii) Investigate the interactions between these two natural disturbances, over the last 1500 years, using sedimentary DNA and macro-charcoals. (iii) To evaluate the changes in macroinvertebrates communities (diversity and assembly rules) during SBW outbreaks, and the role of these communities in regulating SBW epidemic cycles, using Next Generation Sequencing. This project opens the perspectives of a better understanding of the cross dynamics of epidemics/fires in the face of various past climatic changes and would thus allow a better understanding and prediction of the impacts of climate warming on the forest dynamics of Quebec.

00439
Post-drought rhizodeposition from mature temperate trees defines formation traits of soil organic matter stabilization

Poster

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Abstract

Forest soils are crucial for many ecosystem services that rely on soil organic matter (SOM) stability. Soil OM originates mainly from either aboveground litter or from belowground rhizodeposition with the latter being associated with formation traits assigned to greater SOM stabilization. With more frequent and extreme droughts followed by intense rainfall, the role of rhizodeposition in post-drought SOM stabilization processes remains to be elucidated. Under prolonged periods of drought, traits promoting greater SOM stabilization are reported, e.g. elevated belowground carbon allocation with increasing amounts of rhizodeposition. However, if and how belowground carbon allocation controls SOM stability is difficult to predict as analysis techniques characterizing rhizosphere SOM stability are limited. Hence, approaches are required with a conservative need for sample material that provide broad information. In this study, we used a novel thermogravimetric approach (TGA-DSC) to describe the SOM stability in depth profiles below mature *P. abies* L. (Karst) and *F. sylvatica* L. trees growing in the long-term K.roof experiment located in a temperate forest in Germany, where a one-year post-drought phase followed five years of drought. The separate investigation of the rhizosphere and the detritusphere allowed us to determine whether SOM stability is controlled by either belowground (rhizodeposition) or aboveground (litter) processes. We hypothesized that post-drought effects result in losses of SOM that are controlled by reduced SOM stability in the rhizosphere. In contrast to our expectations, SOM stability increased in the rhizosphere of *P. abies* post-drought which was most pronounced in the subsoil, emphasizing the importance of rhizodeposition in stabilizing SOM under *P. abies*. Under *F. sylvatica*, SOM stability increased in the detritusphere with rewetting, suggesting a stronger impact of aboveground processes on SOM stabilization. Our measurements provide valuable information on SOM stability post-drought, with thermogravimetry providing a useful tool to gain detailed insights into mechanisms of SOM stabilization in forest ecosystems under climate change.

00448
Former crops have stronger legacy effects than former meadows and pastures on soil conditions, taxonomic and functional composition of plant communities in French montane forests

If you have chosen the theme "free topic" please indicate 1 or 2 keywords here.
Historical ecology

Poster

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Abstract

Differences in understory vegetation in ancient and recent forests have been largely explored; however, few studies have investigated the legacies of different former land uses in recent forests. Indeed, due to more intense agricultural practices (tillage and fertilisation), legacy effects are expected to be stronger in former crops compared to former pastures or meadows. Our objectives were to compare soil conditions, taxonomic composition and functional composition of understory plant communities in recent forests located on former pastures, meadows or crops, with ancient forests as a reference.Based on land-use maps surveyed between 1862 and 1864, we selected 82 forest sites with different former land uses in mountain forests in the French Alps and carried out soil sampling and botanical surveys in summer 2021. To account for potential confounding factors (altitude, canopy cover, tree species composition), we applied multiple linear regressions to analyse soil properties, Canonical Correlation Analysis to analyse plant taxonomic composition and multi-species generalized linear mixed-effects models to analyse plant functional composition according to the former land uses.Former crops displayed richer, more alkaline soils compared to other past land uses, while soils on former pastures and meadows differed only slightly from ancient forests. We also found differences in plant taxonomic and functional composition among the four past land uses. Ancient forests were characterised by small, acidophilic, shade-tolerant, forest-dependent species, whereas former crops were characterised by basophilic, non-forest species. Former pastures and meadows communities displayed a distinct taxonomic composition compared to other past land uses, but a functional composition closer to ancient forest than to former cropsFormer crops have a stronger legacy effect than former pastures or meadows; this could explain small differences between ancient and recent forests observed in previous studies conducted in mountainous landscapes where crops were rare.

00489
From chironomids to climate: environmental control of chironomid assemblages in lakes of northeastern North America and palaeoecological applications

Poster

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Abstract

The concept of reference conditions is increasingly used in ecosystem management. In the context of global change, paleoenvironmental records complete the monitoring data and can help define these conditions by describing natural variabilities in relation to climatic fluctuations. However, this approach requires appropriate paleoclimatic reconstructions at local and regional scales. The aim of this study was to develop the use of subfossil chironomid remains from lake sediment for paleoecological purposes in eastern Canada. We assessed the environmental control of chironomid taxa distribution by analyzing the subfossil assemblages in surface sediment samples from more than 150 lakes across northeastern America, spanning a climatic gradient from the arctic to the temperate zone. The canonical analysis of chironomid and environmental data established that summer air temperature was the main factor influencing the taxonomic composition of assemblages. Thus, the potential of chironomids as paleoclimatic indicators was confirmed, resulting in the development of temperature inference models with good statistical performances. This new transfer function was then applied to stratigraphic data from a boreal lake in the Quebec Province. The summer temperature reconstruction appeared in good agreement with other proxies, as it identified several well-known paleoclimatic trends since the last deglaciation. The warm period of middle Holocene and the following Neoglacial cooling were clearly reconstructed, as well as shorter climatic anomalies such as the medieval warm period, the little ice age or even the 8200 years BP cold event. These results suggested a good ability of chironomid assemblages to reconstruct Holocene climate variability and encourage the production of new reconstructions on other sites. Ultimately, chironomid-inferred temperature reconstructions could be used as constraint variables in paleoecological records, for instance, in linking with fossil pollen abundances for studying climatic control on vegetation dynamics.

00506
Controls of nitrate leaching in forests of Douglas fir, European beech and Norway spruce and their mixtures: species and site

Poster

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Abstract

Forest management aims for productive and stable forests, that continuously provide ecosystem goods and services, including balancing nutrient fluxes (nitrogen). In a changing climate, drastically altered biotic (species interactions) and abiotic (climate) factors hamper the provisioning of such services. Increasing heat and frequent droughts in temperate European forests make the introduction of non-native Douglas fir (Pseudotsuga menziesii) an increasingly relevant climate change adaptation strategy, particularly as an admixture to native tree species.
We studied the effect on the cycling and accumulation of the macronutrient nitrogen (N), when admixing Douglas fir and native Norway spruce (Picea abies) to European beech (Fagus sylvatica) stands. We used tension lysimeters at root-like negative pressure at 5 and 60 cm to collect soil solution and throughfall collectors on two sites with contrasting soil texture in North-West Germany over 2 continuous years. Measuring nitrate forms in soil solution at 60 cm depth was not yet done under these mixtures and allows for estimating leaching potential.
We found the patterns of nitrate and ammonium accumulation to vary with species, particularly between conifers and beech. Total nitrogen concentration in soil solution was generally higher under conifers. We further found nitrate concentrations in conifers were proportionally higher at 60 cm depth than in beech. Admixing Douglas fir to beech, however, seemed to mitigate this effect, but only on sites with finer soil texture.
We conclude that coniferous stands show high leaching potential compared to beech stands, which are characterized by tighter nitrogen loops. However, low susceptibility to leaching in beech stands becomes an effect trait in mixtures with conifers, such as non-native Douglas fir, buffering the high leaching potential of the coniferous admixture on certain sites. Low leaching potential is key to sustain adequate nutrition in temperate forests, and reduces pollution of groundwater. This conclusion should guide forestry practitioners to foster mixtures with European beech, when planting (non-native) conifers.

00513
Existing and future ways to learn and teach Research Data Management with NFDI4Biodiversity

If you have chosen the theme "free topic" please indicate 1 or 2 keywords here.
Research Data Management, Training and Education

Poster

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Abstract

NFDI4Biodiversity already offers a wide range of training opportunities for students, researchers, NFDI4Biodiversity use cases and partners. We are planning to add more workshop topics and formats, and we are looking forward to suggestions from the conference participants.
We are conducting two workshops during this conference: in the first one, we offer hands-on training in Research Data Management (RDM) ("How to better manage your data - and thereby enrich research"), and in the second one, we discuss challenges and opportunites of open data, i.e. the highly topical issue of benefit-sharing for Digital Sequence Information (DSI), and data copyright, licenses and the German Umweltinformationsgesetz ("Who owns my data? On our way to open data - Nagoya and beyond!"). In December 2022, we will be organizing a RDM Winter School together with GfÖ. We have been organizing a series of workshops on legal issues for the NFDI4Biodiversity community, hands-on workshops on how to submit your biodiversity data, and how to write a Data Management Plan (DMP), and we will offer those workshops in different context again. You can book a free "Roadshow" with us, which is a hands-on workshop on RDM tailored to your working groups' interest and level of expertise. We are also offering video series on data science for ecologists, data visualization, analysis and transformation (VAT tool), and data management for researchers. In Bremen, Kassel and Marburg, we are supporting the implementation of RDM in curricula of future biologists and data scientists. Finally, we are offering individual support around RDM-related questions, submission of biodiversity data and writing DMPs via our helpdesk.
Now, we would like to collect your suggestions for future events, training resources, training formats and/or types of support. Which topics do you want us to cover? Do you know a great way to teach research data management to students, to citizen scientists, to lecturers and/or to conservation practitioners? Please share your ideas, suggestions and requests with us via www.nfdi4biodiversity.org/de/kontakt/, during our workshops on Monday 21.11.2022, or visiting our poster!

00520
Forest history and industrial development interlinks at territorial scale inferred from an innovative combination of wood and charcoal past use evidences

Poster

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Abstract

Many studies have shown the importance of wood resource for long-term socio-economic development, as well as the environmental consequences of the forest biomass harvesting. However, only few studies have examined in details the historical exploitation of forest resource related to local industrial needs. Therefore, here it is presented one of the first study focusing on the history of wood consumption related to industrial development at the territory scale. This study is based on an innovative combination of data from charcoal kilns and written historical archives from a territory unit, the “Pays de Bitche” (Northern Vosges, France). Analysis of 234 charcoal kilns and 415 written records provided information on woodland exploitation, industrial consumption, and forest dynamics. The datasets were chronologically coherent since kilns date back to the 17th and 18th centuries, and the archival written records are from the same period. Quercus and Fagus were the most abundant taxa, with Fagus dominating some areas and Quercus some others. This spatial pattern fit the identified preferential consumption of Fagus by glassworks in the west and the preferential consumption of Quercus, with also Pinus and Betula, for on-site charcoal production for local forges. Moreover, we have identified that the past forest distribution, inferred from written sources and charcoal data, presented significant similarities with the current distribution of trees in the area. Finally, we showed that the combination of the methods we used was highly complementary for assessing the historical use of forests and providing relevant and valuable insights for the reconstruction of forest history.

00525
The Hohenheimer Tree-Ring Collection at the Curt-Engelhorn-Center Archaeometry gGmbH – A collection of specimens for dendroecological and dendroclimatological research

Poster

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Abstract

Dendrochronological collections and wood archives are valuable sources of environmental and cultural information, which are stored in the specimen. They can provide important insight in past forest dynamics and the climate system as well. Long-term curation of wood collections as well as a good organization of the specimens and data are essential for future research terms in the field of dendrochronology. The presence of the Vikings in America was recently dated to a precise year (1021 CE) based on the re-investigation of well-preserved and stored material (Kuitems et al., 2022). This research exemplifies and highlights the significance of conservation and curation (e.g. well catalogued) of large specimen collections (Büntgen et al., 2022).
Here we present the `Hohenheimer tree-ring collection`, its state of the art as well as the different types of specimen and their value for dendroecological and –climatological research. In the future the Hohenheimer tree-ring collection (Hohenheimer Jahrringsammlung) will offers a permanent archive of precisely dated, high-quality tree ring data (mainly from Germany) that can be used by follow-up climate and environmental research. The newly established dendrochronological laboratory at the Curt-Engelhorn-Centre of Archaeometry gGmbH (CEZA) curates more than 35,000 well-stored wood samples from different chronologies based on the Hohenheimer wood collection (50,000 samples in total).
In cooperation with the radiocarbon and the stable isotope laboratory at CEZA we will work intensively with the collection to provide data for community. In addition, the sample collection and data will be available for future collaborations and we will improve access for the public and researchers.

Büntgen, U., Esper, J. & Oppenheimer, C. In praise of archives (and an open mind). Commun Earth Environ 3, 84 (2022).
Kuitems, M., Wallace, B.L., Lindsay, C. et al. Evidence for European presence in the Americas in AD 1021. Nature 601, 388–391 (2022).

00534
The paleoecological reconstruction of the Machais peat bog (High Vosges France): an outstanding site

Poster

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Abstract

Many paleoecological reconstructions, have been carried out in the Vosges mountains in North-eastern France. However, among the several sites that have been investigated, a site was remaining poorly documented: the Machais peatbog. This site appears especially interesting because it is known today to be among the most preserved peatbog on the Vosges massif, where many sites have been degraded because of past and on-going human activities (mining, drainage, skiing, etc.). Nevertheless, as most of the wetlands at global scale, the Machais peatbog is facing the stakes of climate change which might modify its hydrologic system and thus its ecosystems composition, structure and functioning. Therefore, the local manager induced a set of environmental studies aiming to better characterized the site in order to apply the most relevant conservation strategy for the future. In such framework, we investigate the origin and long-term trajectories of the peat bog.
We used radiocarbon, palynological, charcoal, and loss-in-ignition methods to assess this paleoecological reconstruction.
A five-meter core was sampled. This core is constituted of organic (peat) material on about 2m and of mineral gyttja on about 3m. It has been obtained 13 radiocarbon dates, which permitted to build a solid age-depth model covering the whole Holocene. The pollen record, of high quality, reflected a full Holocene ecosystem trajectory, fitting well with low mountain ranges patterns identified in the area so far. The anthracological and sedimentary signals fit well together to point out a long and, more or less, continuous fire and erosion history, probably with local human impacts, at least until the site moved from lake to peat bog.
Our results confirm that the Machais peatbog is a partly interesting site, not only because of its present state but also for its long-term changes that lead to its present and future states.

00584
Above-ground structural complexity of *Cymodocea nodosa* meadows enhances their role as carbon sinks

Poster

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Abstract

Blue carbon ecosystems, such as saltmarshes, mangroves and seagrasses, are amongst the most relevant carbon sinks on Earth, constituting a primary target to tackle climatic crisis. Strategies to promote their potential in this regard are being displayed across the globe, from conservation measures to restoration actions. The understanding of the biophysical factors that drive blue carbon storage and its spatial variability is key to guide those strategies, yet they are not yet fully investigated. In particular, it is important to identify those traits that may enhance organic carbon storage in the soil, the compartment with the higher carbon stock. Amongst them, above-ground complexity may have a paramount role, with more complex canopies expected to result in higher deposits of carbon due a greater capacity of trapping particulate organic matter from the water column. In the Canary Islands, the meadows formed by the seagrass species *Cymodocea nodosa* are the main blue carbon ecosystems in the archipelago. To date, only one study has attempted to evaluate the carbon sinks of *C. nodosa* in the Islands, providing valuable local estimates. However, less attention has been paid at identifying the traits that may enhance this accumulation.

Here we assessed the potential role of above-ground structural complexity of *C. nodosa* in enhancing soil organic carbon accumulation. Two replicated levels of seagrass above-ground structural complexity (high vs. low), using canopy height as a proxy, were assessed in natural meadows of the Canaries. At each meadow, replicated sediment cores (40 cm deep) were collected. Organic carbon and carbon stocks were estimated following loss-on-ignition procedure and standard calculations.

Organic carbon and carbon stock in the soils of *Cymodocea nodosa* were significantly higher in high complex meadows than in low complex ones. Our results show that above-ground structural complexity of *C. nodosa* meadows in the Canary Islands may mediate their carbon sink capacity, with highly complex meadows functioning as enhanced sinks when compared to low complex ones. Although further assessments are needed, this empirical evidence should be considered in the implementation of management actions aimed at promoting the blue carbon potential of *Cymodocea nodosa* meadows in the Canary Islands.

00589
Holocene REVEALS-based diversity changes across Europe

Poster

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Abstract

Land-use and land-cover changes are ranked as the greatest driver of declines in nature and biodiversity. Combined with the exploitation of nature through deforestation, conversion for agriculture, and livestock production, these threats are identified to be responsible for anthropogenic biodiversity decline (IPBES, 2019 and 2021). Reliable reconstructions of past land-cover are crucial for improving our understanding of past land cover interactions with biodiversity. Here we use the latest pollen-based land-cover reconstruction, the third generation (Serge et al. in prep). The **R**egional **E**stimates of **VE**getation **A**bundance from **L**arge **S**ites_REVEALS" model (Sugita 20007) was applied on pollen data from ca 1600 sites across Europe to produce grid-based estimates of past plant abundance for 539 1°x1° grid cells in 25 time windows during the Holocene for 31 taxa. This new dataset provides unique possibilities to explore spatial-temporal changes in past land-cover and biodiversity over long time periods. This projects aim is (i) to recognize biogeographic regions during the Holocene and its movements and shifts from the last glacial maximum to the present time (ii) to derive past diversity indices (α - and β - diversity) within each of the biogeographic regions and (iii) to identify the species contributing to the groups and the β - diversity. Seven major biogeographic regions in Europe were identified: the Mediterranean vegetation, the *Abies-Fagus* forest, the broadleaved mixed forest, the *Betula-Pinus* forest, the *Pinus-Picea* forest, the open vegetation and the *Cerealia*-group. The Mediterranean vegetation and the *Cerealia*-group are very stable in their location. On the contrary, massive changes in extension and location can be observed in the other groups. Central Europe is occupied in the early Holocene by *Betula-Pinus*-forest, where it's replaced by the broadleaved-mixed forest and later by the open vegetation. α - diversity in terms of richness increases constantly through time in all groups. *Abies-Fagus*-forests have the highest richness and open landscape the lowest. α – diversity in terms of richness of abundant species on the other hand is the highest in broadleaved forests and lowest in *Abies-Fagus*-forests. The highest β - diversity can be found in the Middle East and the Mediterranean group.

Biogeography

00066
Biological validation of European Broad River Types

Oral

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Abstract

We need regulatory frameworks to slow down, halt and reverse the ongoing loss of freshwater biodiversity. These frameworks often use typology systems to group ecosystems into environmentally homogenous types and assume similar physicochemical and biotic conditions within each type. The Broad River Types (BRT) have recently been proposed as a pan-European river typology and are gaining traction within the research community. Meanwhile, the crucial assumption that biological communities are relatively homogenous within each Broad River Type and hence whether the BRT are a suitable model for freshwater biogeography and potential tool for bioassessment remains untested. We examined within- and between-type similarity of macroinvertebrate, diatom, fish, and macrophyte communities for the BRT and four other typologies by Analyses of Similarity and classification strength. We further tested within-type homogeneity by analyzing patterns in zeta-diversity decline and type-specific indicator communities. Regardless of the test, the BRT always performed worse than at least one of the alternatives. The generally low test statistics indicated substantial overlap of macroinvertebrate communities between types. Preliminary results for diatoms, fishes, and macrophytes confirm that the BRT do not improve upon existing typologies.

00158
Countrywide wild bee taxonomic and functional diversity patterns reveal a spatial mismatch between alpha and beta diversity components across multiple ecological gradients

Poster

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Abstract

Uncovering the spatial pattern in the distribution of wild bee diversity and understanding its determinants is critical for their conservation. Here, we model wild bee taxonomic and trait-based diversity in Switzerland to (1) uncover nation-wide taxonomic and functional diversity patterns and determine if they provide complementary information, (2) assess the importance of the different drivers structuring wild bee diversity, (3) identify hotspots of taxonomic and functional diversity, and (4) evaluate the existing conservation strategies in the network of protected areas. We used site-level occurrence and trait data of 533 species across 4591 community-plots in Switzerland for the period 2015-2020, and calculated community attributes including taxonomic diversity metrics, community mean trait values and functional diversity metrics. We then modeled the spatial distribution of the different community attributes over Switzerland using predictors describing energy, resource and anthropogenic influence gradients.

00374
Exploring mechanisms of spatial segregation between body size groups within fish populations: a case study in the North Sea

Oral

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Abstract

While there is ample evidence for the shift in the distribution of fish populations in response to environmental stress, most studies focused at the whole population scale. This neglects the spatial dynamics between groups of different body size (body size groups), that fundamentally shapes the spatial structure of a population. We developed novel spatial indices that characterize spatial dynamics at body size level, and we applied them to three economically important North Sea fish populations: Atlantic cod (*Gadus morhua*), haddock (*Melanogrammus aeglefinus*), and whiting (*Merlangius merlangius*). All populations exhibited strong declines in the overlapped area between body size groups over 43 years. The declines were due to (1) different magnitudes of contraction of the distribution area of body size groups; and/or (2) different speeds and directions of shift in the abundance-weighted center of distribution area (center of abundance), which then increased the distance between centers of abundance between body size groups. We further explored how these patterns were associated with ocean warming and declining population biomass. This analytical approach can be used to explore within-population spatial dynamics in various ecosystems and to identiy vulnerable populations under environmental stress.

00466
The global distribution of burrowing mammals

Poster

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Abstract

The ability to burrow is thought to have facilitated the survival and diversification of mammals under high predation risk, extreme climatic conditions, and seasonal shortage of food. Whether or not animals burrow might thus be determined by complex interactions between phylogeny, climatic conditions, primary productivity, and the animals' ecological niche. Here, we combined distributional data of the global diversity of mammals with an assessment of their borrowing behaviour based on a literature survey. We tested whether burrowing is common in regions with a low productivity, in colder regions, and/or in regions with a low annual or seasonal availability of food. We found that at least 59% of all mammals use burrows, and that this proportion increased with latitude. Specifically, the proportion of burrowing mammals increased with decreasing temperature, and temperature seasonality. Species-level analyses showed that burrowing is generally associated with smaller body sizes across families, and the proportion of burrowing mammal species decreased with increasing body size. Together, our results suggest that burrowing behaviour is an important trait in determining the global distribution and the ecological strategy of mammal species.

00499
sOilFauna - a global synthesis effort on the drivers of soil macrofauna communities and functioning

Oral

J. Mathieu [1], P. Ganault [2, 3], A.E. Bonato Asato [2, 4], M.L.C. Bartz [5, 6], G. Brown [7], I. Calderon-Sanou [8], S.J. Fonte [9], B. Gauzens [2, 3], K.B. Gongalsky [10], A. Potapov [11, 12], E. Thébaut [1], W. Thuillier [8], T. Soilfauna Consortium [1, 3], N. Eisenhauer [2, 3]

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Abstract

Understanding global biodiversity change, its drivers, and its consequences on ecosystems requires to include soil macrofauna, a highly diverse group involved in numerous ecosystem processes. So far, our knowledge of both the factors that shape soil macrofauna communities and the ecosystem effects of these organisms is limited at the global scale, while numerous local studies exist. The project “sOilFauna” fosters the gathering of literature data on macrofauna communities and produced the most comprehensive soil macrofauna database - the MACROFAUNA database - which collates abundance and biomass data of 17 soil invertebrate groups assessed with a standardized method at ~8700 sites around the world. This dataset will allow testing many important theories in macroecology such as latitudinal gradients and productivity/perturbation-diversity relationships), as well as quantifying the responses of functional and trophic groups of soil macrofauna to different climatic, edaphic, and human-induced drivers (e.g. land use type and change). We will display preliminary results on macrofauna abundance, diversity, and biomass, with the identification of their main drivers at a global scale. The sOilFauna project and consortium also aim at encouraging the global community of soil ecologists to use and share standardized data for future research that will allow even further increase of our knowledge on this understudied group.

00542
Application of null models to evaluate the incorporation of intraspecific variation in habitat suitability models for European beech (*Fagus sylvatica* L.)

Poster

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Abstract

Habitat suitability models (HSMs, also known as species distribution models or ecological niche models) are vastly applied to predict species range shifts under climate change scenarios. Classical HSMs however assume species homogeneity, which disregards the effects of limitations to gene flow and resulting intraspecific variation through local adaption. Compared to classical HSMs the incorporation of intraspecific variation (e.g., by using genetic data) can improve model performance and provide more realistic predictions of climate change impacts. However, genetically informed HSMs are still rarely used and may suffer from biased estimates of model performance or overfitting. We propose the application of a null model approach to assess the model performance of genetically informed HSMs and provide further information about the meaning of intraspecific variation in HSMs.
We use publicly available range-wide genetic structure and observations from forest inventory plots of European beech (*Fagus sylvatica* L.) to create individual genetically informed models for the distinct genetic groups representing different ecotypes. The obtained individual models are combined into one overall genetically informed model. Model performance is assessed with measures of discriminatory ability and overfitting based on area under the receiver operating characteristic curve (AUC) and the omission error rate. Null models based on random sets of spatial points are computed for each of the models. This allows us to estimate null distributions of the performance measures and compare them to the measures of the real model and subsequently determine the strength of the effect by calculating the standardized effect size. By doing so, the null models will help us to check if indeed genetic adaptation or rather just statistical artifacts explain the improved habitat suitability found in such approaches. Finally, we compare model performance of the individual models and the overall model against a classical HSM approach. Thus, our approach will allow to quantify the importance of local adaptation for future habitat suitability.

00554
iPhenology – using open-access citizen science data to track plant phenology at continental scale

If you have chosen the theme "free topic" please indicate 1 or 2 keywords here.
Biological invasions, Citizen Science

Oral

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Abstract

Citizen science, the participation of nonprofessional volunteers in scientific research, has enabled the collection of research data at unprecedented scales. In particular, photo observations are a highly valuable but rarely used source of citizen science data. Recently, the number of photo observations has increased strongly due to the use of smartphone applications. Many of these observations are made publicly available through online databases. This is why gaining ecological insights in poorly studied subjects may now have become possible. One of the fields with the highest potential to benefit from the use of photo observations is plant phenology.
Phenology explores the timing of recurring biological events and their causes. For plants, the capability to reach pivotal reproductive stages such as bud burst, flowering and seed production under differing climates is a prerequisite to persist across geographical ranges. Despite their relevance, empirical phenological studies across large geographical scales are limited. This is mainly because such studies require frequent simultaneous observations across e.g. different latitudes. This is very time-intensive and usually requires the co-operation of scientists from many different institutions, which makes such observations costly and hard to organize.
A promising avenue to gain large amounts of information on phenological events is iPhenology, the use of publicly available photo observations to track phenological processes. However, it is not known yet whether the use of photo observations is suitable for large-scale detailed phenological observations. In our study, we explore the suitability of iPhenology to observe key phenological stages in the plant reproductive cycle, link them to underlying climatic drivers, and identify potential limitations of the approach. We use the herbaceous invasive alien species *Lupinus polyphyllus* Lindl., which is among Europe's most widespread invasive species, as a model species for iPhenology. The species is particularly suitable, as it is widespread, prominent, and relatively easy to identify due to the lack of native relatives. Through the utilization of photo observations, we track multiple phenological stages of *Lupinus polyphyllus* across Europe, link them to climatic drivers, and discuss potential limitations and caveats. Additionally, we assess the potential of iPhenology for other invasive species.

00559
Disparate patterns of genetic divergence and environmental adaptation among three Pacific corals across their geographical range

Oral

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Abstract

The setup of conservation strategies for coral reefs impacted by climate change necessitates a better understanding of how coral genetic diversity is shaped by the environment. Here we quantified the standing genetic diversity of three corals - *Porites lobata*, *Pocillopora meandrina*, and *Millepora platyphylla* - in relation to past sea temperature variations across their Pacific spread, as part of the Tara Pacific Expedition. Coral specimens with colony morphologies corresponding to the three target species were sampled across 11 islands on an 18,000 km longitudinal transect of the Pacific Ocean, and either genome-wide (*Porites*, *Pocillopora*) or targeted (*Millepora*) SNPs were obtained for 109, 103, and 57 colonies, respectively.

For each genus, a low variation in colony morphology was revealed, which was not linked to the 3 and 5 independent genetic lineages identified in *Porites* and *Pocillopora* respectively, highlighting the difficulty of targeted sampling based on morphology in corals. Only one lineage was identified in *Millepora*

The biogeographical distribution of these lineages was distinct for each genus. These different biogeographical patterns in the same oceanographical context do question the relation of these genera to the environment. In *Porites* and *Pocillopora,* we counted how many of the 100 strongest historical temperature outlier SNPs were included in genomic islands of differentiation among lineages and under positive selection. We found that *Porites* had considerably less such SNPs than *Pocillopora*.

This lesser genomic signature to prevailing environments in *Porites* argues for a built-in stress tolerance, whereas the stronger genomic imprint by the environment on *Pocillopora* may be due to a stronger adaptation to different reef niches, making it more sensitive to selective pressures exerted by climate perturbations. Within the context of conservation, *Millepora*, that demonstrates a higher degree of biogeographic structuring, will require a greater number of reefs to be preserved to protect extant diversity.

00601
How anthropogenic and natural parameters shape plant species richness on European barrier islands

Oral

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Abstract

Biodiversity on islands is determined by a set of natural biogeographic parameters, such as area, isolation, or island age. However, during the last centuries and millennia, species compositions and abundances on islands have been heavily impacted by humans. To understand biodiversity patterns on islands in the Anthropocene, human-related variables need to be considered as complementary parameters. We aim to disentangle how native and non-native plant species richness is impacted by both, natural and anthropogenic parameters on islands. As study systems, we selected a chain of barrier islands located along the coasts of the Netherlands, Germany, and Denmark. We use a system approach to understand the effect of anthropogenic parameters affecting the diversity of plants on islands. Generalized linear models (GLMs) and structural equation models (SEMs) are used to understand the driving forces underlying plant diversity patterns on European barrier islands in these modern times. Native plant species diversity is mostly driven by habitat heterogeneity, which can be considered to essentially be a natural driver that, however, is additionally shaped by humans. In contrast, non-native plants seemed to respond mostly to the number of inhabitants. Island area can be seen as a proxy for both, habitat heterogeneity and the number of inhabitants. To understand modern biodiversity compositions, it is essential to include explanatory anthropogenic parameters. Islands, being simple, clearly confined microcosms, are highly suitable to explore the impact of human-related parameters on biodiversity.

00642
Spatio-temporal dynamic and global change effects on ant communities of small Mediterranean islands and islets

Poster

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Abstract

Identifying the factors that govern local species assemblages is one of the major challenges of fundamental ecology and island biology. Islands harbor remarkable biodiversity and are particularly vulnerable to global changes. We chose to study ants because they are almost systematically present on islands and they play key roles in the structure and functioning of ecosystems, e.g. as ecological engineers or invasive species. The objective of the project is to study the dynamics of ant communities on small Mediterranean islands and islets, at different spatial and temporal scales. The first step is to evaluate the influence of geographical, historical and ecological characteristics of the islands on the composition and structure of the ant communities at the scale of the Mediterranean Basin. The aim is to create a database of ant species lists from Mediterranean islands with the associated island features using published and unpublished data. In a second step, the objective is to study the temporal dynamics of the communities in order to test the dynamic equilibrium predicted by Mc Arthur and Wilson in 1967, i.e., the stability of the species richness and the turn-over in the composition of the community. This is an opportunity to sample the myrmecofauna on islands that have already been surveyed 40 years ago, 10 years ago and 1 year ago in order to compare the structure and composition of the community taking into account anthropic pressures and constraints related to climate change. A third objective is to study the connectivity between islands and whether there is still colonization from the mainland. It is planned to focus more specifically on two species, Messor bouvieri and Pheidole pallidula, and to evaluate the genetic distance between populations. Finally, we study the response of ant communities to the eradication of an invasive plant, Carpobrotus / iceplant, within the framework of the ecological restoration program of Bagaud, which is an integral reserve of the Port-Cros National Park.

00658
Biotic and abiotic drivers of geographic distributions and co-occurrence of Proteaceae species in the South African Fynbos

Oral

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Abstract

Spatial patterns of biodiversity depend on the ability of species to coexist at different scales and across environmental gradients. Explaining the geographic distributions of species does thus not only require the quantification of species' ecological niches, but also an understanding of the context-dependent effects of biotic interactions on demography and population dynamics. Commonly applied static joint species distribution models (jSDMs) aim at disentangling ecological niches and biotic interactions by estimating environment-occurrence relationships simultaneously for multiple species and including a covariance structure that describes residual patterns of co-occurrence. However, covariance in species' occurrence can result from a range of different factors and estimated model parameters cannot be interpreted as interaction coefficients of joint population dynamics. Here, we instead analyse species co-occurrence data with an integrated statistical model of community dynamics. The model combines species-specific demographic responses to environmental variation (pre-interactive Hutchinsonian niches) with Lotka-Volterra population dynamics to predict stochastic equilibria of species abundances and population growth rates in different abiotic and biotic environments. We apply our approach to multi-scale biodiversity data for Proteacea shrubs in the South African Fynbos that comprise (i) ordinal abundance data for 55,000 Proteaceae communities, (ii) proxies of population growth for 2000 species-community combinations and (iii) individual-level measurements of demographic rates in comprehensively mapped plant communities. Our model not only generates predictions of shifts in possible community compositions under environmental change, but enables us to test whether effects of biotic interactions on local population growth can explain range-wide co-occurrence patterns, thereby enhancing our predictive understanding of large-scale biodiversity dynamics.

00104
Why raccoon presence is no reason to panic – results of a long-term field study in Germany

Poster

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Abstract

The North American raccoon is an introduced carnivore species in Germany and one of the most omnivorous mammals worldwide. This and other alien species can play a significant role in the ecological balance of their newly encountered biotope, particularly if their habits overlap and compete with those of the native animals. Due to a vast increase of raccoon numbers over the last years, a controversial discussion arose regarding the influence of the new inhabitants on indigenous and especially protected species, as well as the potential transmission of diseases and parasites. As a component of the Union list of invasive alien species, the procyonid is heavily demonized and instrumentalized by the media. However, extensive evidence-based knowledge about the actual consequences of raccoon settlement, primarily in natural landscapes, and the possible occupation of an ecological niche is still lacking. Aiming to elucidate the wildlife biology of this introduced species, a long-term and integrated research project was conducted from 2006 to 2017 in the northeastern area of distribution (Müritz National Park, Mecklenburg-Western Pomerania; www. projekt-waschbaer.de). In 16 different sub studies and by telemetric control of 69 raccoons, profound data on the population biology in the allochthonous distribution area was collected for the first time. In depth investigations regarding the nutrition ecology and parasitology were conducted with scat analysis as the most informative approach. Based on the hypothesis that raccoons may affect local stock of ecological relevant species through predation, raccoon faecal samples (n=1280) were collected and analysed with regard to nutrition ecology (frequency of occurrence and consumed biomass) and endoparasite infestation. This is so far the only study where raccoon prey categories were linked to available resources in the study area, which is a prerequisite for assessing local impact. The poster highlights the ecological background of raccoons in Germany and shows the correlation between predation and potential influence.

00249
Title: Social perception of a freshwater introduced top predator, the European catfish, by angler community in Europe.

Poster

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Abstract

Biological invasions strongly alter biodiversity patterns worldwide. The management of non-native species requires knowledge about the species, its dispersal, its population dynamic and its impacts on the introduced area. It is crucial to understand how human behave and react regarding the propagation or the regulation of introduced species. In this study, we used an interdisciplinary approach to better understand the social representations of an iconic non-native species.
The European catfish (Silurus glanis L.) is the largest European predatory fish (up to 2m long). It has been introduced in the seventies from Eastern Europe to Western Europe, where it has colonized many rivers. Due to its position at the top of trophic networks, it has emerged as a potential concerning invasive species. Due to its huge dimensions, the European catfish is currently targeted as a sport-fish by recreational anglers, which create economic inputs. On the other hand, this species provoke controversies, even within anglers as some of them point it as the main responsible for the decline of some native species. It therefore represents a relevant model to analyze the perception of non-native species by an informed and implied public, the anglers.
To access to the social representations of the European catfish, we used a questionnaire that we send to anglers in different countries in Europe (France, Belgium and Portugal). The questionnaire was built: (i) to determine typical profiles of anglers according to personal traits (age, sex, location, socio-professional category etc…) and fishing practices and (ii) collect the perception of the European catfish using close or open questions. Quantitative and qualitative analyses were preformed to test the links between anglers profiles and their perception of the European catfish. Our prediction was that young fisherman, well equipped and looking for angling trophies are in favor of the propagation of the European catfish. First preliminary results suggest that such profile exists and that age could be the main factor explaining the social and perceptive opposition among anglers.

00379
Modelling the establishment potential of the brown marmorated stink bug (*Halyomorpha halys*) in Germany

Oral

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Abstract

The polyphagous brown marmorated stink bug (BMSB) is a fast spreading plant pest that can cause serious ecological and economic damage. Rising temperatures in the course of the current climate change may lead to more-favourable conditions for this climate-sensitive pest species in Germany. This can lead to an increased area of potential establishment, increased growth rates and higher risk of damage. Information about the maximum habitable area in Germany and the advantageousness of the environmental conditions for the species are helpful for estimating the amount of damage that may be caused by BMSB. Additionally, anticipating current risks and long-term changes of the future risk potential is beneficial in the preparation of phytosanitary pest risk analyses. Using the dynamic ***Mo**del for spatio-temporal Plant **P**est Spread **Si**mulations (MoPSi)* we modelled the ecoclimatic suitability (EI) i.e. an estimation of the establishment potential for the BMSB in Germany (and Europe). We additionally considered the distribution of host plants in Germany to estimate the potential risk posed by the species. The simulations (averaged from 1991 to 2018) indicate high-risk areas for pest establishment, which can be used as primary locations for surveys to determine the status of spatial distribution. Most of the area (98 %) of Germany seems to be habitable (EI>5) for the BMSB while some parts (5 %) are even likely to have highly favourable conditions (EI>15) for the species. These favourable and highly favourable areas and conditions will, according to our simulations, increase over time. In climate simulations with a higher increase of CO_2 towards the end of the century (RCP 8.5) these effects are more drastic (mean highly suitable area for 2006-2100: 28%) than in climate simulations with a lower increase of CO_2 (RCP 2.6) (mean highly suitable area for 2006-2100: 15%). These results are an important information for plant growers, and breeders as well as policy makers as they allow the preparation and adaption to future pest situations and can be the basis of cost-benefit analyses for phytosanitary treatments.

00530
Australian acacias: a showcase for remote sensing-based mapping and impact assessments of invasive trees

Poster

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Abstract

Assessing the impact of invasive plant species is one of the key goals in invasion ecology. Certain invasive species, so-called invasive ecosystem engineers, can alter ecosystem to a degree that a return to the original state is unlikely with negative consequences for ecosystem functioning and services. As impact of invasive species is context-dependent, spatial data is required not only on location and impact of the invader, but also on the biophysical characteristic of the recipient ecosystem. Methods of remote sensing provide powerful tools to retrieve such data on various spatio-temporal scales, but transferability and generalisability of approaches can be challenging. Comparative, multisite-studies could shed a light on the context-dependency from both a (technical) remote sensing and an ecological perspective. The invasion of *Acacia* spp. is a global phenomenon, and most likely follows similar patterns, so worldwide, multi-site studies are possible.

Here, we will give an overview of remote sensing-based studies of invasive acacias worldwide with a focus on mapping and impact assessment. We will present a conceptual framework on how to capture plant invasive impact using remote sensing considering context-dependency, and we will demonstrate in a case study on how acacia impact on ecosystem functioning can be mapped at the landscape scale. Due to the increasing availability of remote sensing data and processing options, *Acacia* spp. invasions are an ideal showcase for remote sensing applications in the context of biological invasions from low-barrier to high-fidelity solutions.

00579
Back introduction of invasive genotypes as an underestimated risk within a species' native habitat – insights from a transplant experiment

Poster

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Abstract

Non-native species are acknowledged worldwide as a possible threat to ecosystems and biodiversity. Their potential to become invasive in novel ranges outside the species' native range, makes them a challenge both from ecological and economical perspectives. While evidence is provided that invasive genotypes may exhibit increased competitive ability due to post-introduction evolution, little attention has been paid to the possibility that these genotypes might be back-introduced into a species' native range. Here, they could trigger a problematic increase in population growth and thus pose a new challenge to nature conservation.

The biennial model species Jacobaea vulgaris GAERTN. is a successful invader on multiple continents and is additionally considered problematic in its native range due to its toxic. It can form dense populations and is difficult to manage or even eradicate. We conducted a transplant experiment in the species' native range within naturally occurring populations in Schleswig-Holstein. Transplants of both native and invasive origin were planted in five replicate plots within six field sites. We assessed performance at the end of the vegetative growing phase to determine whether invasive origins show the potential to promote possibly problematic population dynamics in the species' native range or whether they showed reduced performance, e.g. because of reunion with specialized herbivores or general maladaptation to the species' native range.
With our experimental set-up we found invasive origins to accumulate more aboveground biomass by the end of the growing season. Furthermore, we found a stronger reaction of invasive origins to biotic environmental factors such as α-diversity and height of surrounding vegetation in both specific leaf area and leaf dry matter content.
Although we cannot conclude with certainty that these results would directly translate to the generative life-stage of this species, adding highly competitive genotypes from the invasive range might further exacerbate the challenges associated with J. vulgaris in its native range. Our findings furthermore highlight the importance to study the effects of bringing back genotypes from a species' invasive range to the species' original native range in general as this might be an underestimated concern in nature conservation.

00602
Population and biological characterization of the Invasive Plant species Baccharis halimifolia in South Brittany (France)

Oral

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Abstract

Invasive alien species are a serious threat to biodiversity. Baccharis halimifolia is classified by the European Commission as a "Shrub, IAS of concern for the European Union, FLORA, Flora of concern for the EU". This plant is susceptible to generate ecological and landscape impacts.
This species belongs to the Asteraceae family and is native to North America where it is present on intertidal marshes. Nowaday, the species has been introduced on 4 continents: Europe, Oceania, Australia and New Zealand, mainly for its ornamental value and its function as a windbreak and soil stabilizer. IIt is gradually invading the French coastline. In the Ria d'Etel (South Brittany, France), the species is already well established, and old individuals are present
The aim of the presented research is to characterize the different populations of Baccharis halimifolia present in the Ria, as well as to improve our knowledge on the species and its management.
Thus, measurements of biological traits were carried out on 16 identified populations of Baccharis halimifolia, Including individual height, diameter, fresh and dry leaf biomass, and leaf area. In order to complete these data, the abiotic characteristics of the soil were also reported, such as salinity, water content, pH, and inorganic carbon and nitrogen concentration.
The germination capacity of the species according to different environmental parameters was also studied in the laboratory. The germination capacity under different salinity, pH and temperature conditions was notably considered. In parallel, observations on sites that have been subject to management operations in recent years were carried out in order to evaluate the effectiveness of these operations. Permanent quadrats were installed on the sites to follow the evolution of the area after the removal of the species. In addition, various experiments were carried out with the primary goal of testing the tolerance of the species to different stresses, with the objective of finding a more reliable means of containing its progression on the territory.

00636
Application of a BACI protocol to assess the efficiency of management (or control) of the exotic invasive *Myriophyllum heterophyllum* in a freshwater yacht harbour

Oral

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Abstract

The aquatic invasive species *Myriophyllum heterophyllum* has settled in the main freshwater yacht harbour in France for at least 5 years yet. It usually forms monospecific dense stands, that emerge during late spring. Those stands impair navigation, slowing down boats if not leading to broken engines. This has negatively impacted the tourism in the area as well as the financial health of local boat hire companies. French Waterways (VNF) as manager of the site has thus mandated a company to apply in 2022 a combination of different management techniques to attempt to control the plant. Among them, a dye treatment is used to reduce light availability and hinder plant photosynthesis. The experiment also includes bioprocessing and aeration of the water column. To assess the efficiency of the chosen approach, we used the Before-After Control-Impact (BACI) protocol to study the growth dynamics of *M. heterophyllum*. The BACI protocol is useful to assess anthropogenic modifications on ecological variables. Using this design, we focused on water and sediment chemistry, plant biomass and plant nutrient content to evaluate the efficiency of the applied treatments. In 2021, environmental conditions explain the strong plant growth. We especially follow the evolution of biomass before and after treatment. The biomass produced by the plant reached about 1 $kg.m^{-2}$ dry mass in summer 2021, with some heterogeneity across sites. A high nitrogen content in the plant – up to 5% – was observed, which relates to high nutrient availability in the harbour. We will compare these data to the ones collected in 2022 during and after the application of the treatments. Practically, the results of this experiment would contribute to reassess which management strategies should be applied in open freshwater and especially waterways to control this aquatic species.

00086
On the skin of the dragon – The role of cuticular hydrocarbons for thermoregulation in damselflies (Zygoptera)

Poster

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Abstract

Climate change is a powerful stressor for many insect species. For predicting how species will react to its effects like higher temperatures an in-depth understanding of the animal's physiology is necessary. Nevertheless, there are still big gaps in the knowledge of even well-known species of insects. One example for this are the morphological and biochemical characteristics that influence species' ability to respond to increasing temperatures. In this context, the composition of cuticular hydrocarbons plays a key role for desiccation regulation and thus for how insects cope with high temperatures. Here, we study the composition of cuticular hydrocarbons in damselflies (Odonata: Zygoptera), which to our knowledge has never been studied before. In particular, we aim to close this gap of knowledge and to answer the question, of whether the cuticular hydrocarbon composition can be used to predict the thermal tolerance of damselflies. *Chalcolestes viridis*, *Erythromma viridulum* and *Lestes virens* were chosen for conducting this experiment as a previous study showed considerable differences in the critical thermal maxima of these species. We used a state-of-the-art hexane washing procedure, followed by gas chromatography with attached mass spectroscopy, for individuals caught at different locations in the federal state of Bavaria (Germany). For uncovering correlations between the different species, a non-metric multidimensional scaling (NMDS) was used, controlling for phylogenetic influences. So far, results are preliminary, but if a correlation between the cuticular hydrocarbons of damselflies and their thermotolerance can be shown, predictions for the future of these species as well as management plans for safeguarding them could benefit from such new findings.

00286
Functional traits modifying nutrient loading effects on the productivity of *Trapa natans* L.

Poster

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Abstract

Only a few plants elicit as many opposing impressions as the water caltrop *Trapa natans* L. (Lythraceae). It is nowadays recognized as a rare species of conservation priority in part of its native range (i.e. Europe, Asia and Africa) in which it had formerly been widely distributed. The aquatic plant species has been introduced to North America and Australia, where it spread, naturalized and is today recognized to be an invasive species. It has a history of utilization reaching far back into Neolithic times, being commonly cultivated for both the nut-like fruit it produces as well as its leaves and being exploited for means of food production, phytoremediation as well as medication. Interestingly, though the ambiguous nature of the water caltrop *Trapa natans* L. is apparent, it has not been decrypted yet. Especially, the environmental drivers underlying its extinction, invasion and its utility as a crop have not been unraveled yet and functional traits modifying environmental plant responses have rarely been investigated. So far, nutrient availability has been identified as a key resource determining productivity of *Trapa natans* L. in aquatic systems. It is clear that the water caltrop occurs more frequently in (excessively) nutrient-rich, i.e. (hyper-)eutrophic habitats, than in those of moderate (mesotrophic) fertility and it is only exceptionally found under (hyper-)oligotrophic nutrient-poor circumstances. Nevertheless, there is unclarity with respect to the optimal range of nutrient supply and the extent to which it may withstand temporal-spatial alterations in nutrient status. Here, under hydroponic greenhouse conditions, we add on previously conducted field studies and complement rarely executed controlled experimental studies, by investigating the effect of varying mineral nutrient levels (based on nitrogen and phosphorus concentrations representing categories of the trophic classification system, i.e. ultraoligotrophic to hypereutrophic conditions) on the plant performance of *Trapa natans* L. and how it is modified by reproductive and vegetative traits. On this basis, we will be able to learn more about the ecology, more specifically the fundamental nutrient niche, of this highly interesting but so far under-investigated macrophyte, which may for instance serve as a basis for predicting its historic, present and future distribution.

00396
Semi-natural habitats promote winter survival of wild-living honey bees in an agricultural landscape.

Poster

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Abstract

The diversity of endemic honey bee subspecies and ecotypes is at risk in Europe because modern apiculture promotes only a small number of honey bee strains. A crucial step for the conservation of honey bee diversity is the assessment of the status of remaining wild populations and their limiting factors. Here we present a two-year census of native, wild-living honey bees inhabiting power poles in an intensive agricultural landscape in Galicia, NW Spain. The autumn colony densities were at least 0.22 and 0.17 colonies/km² and winter survival rates were 59 % and 26 % for the years 2019 (N = 29) and 2020 (N = 23), respectively. Both the initial occurrence and the subsequent winter survival of the colonies were positively correlated with increasing proportions of wood- and shrubland in the surroundings in both study years. These observations highlight the importance of semi-natural habitats for the conservation of wild-living honey bees.

00403
A review of belief-based use of vultures in West Africa

If you have chosen the theme "free topic" please indicate 1 or 2 keywords here.
Belief-based, Vulture, Critically-Endangered,

Poster

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Abstract

Belief-based use of vultures causes serious threats to vulture populations across the West African sub-region, where records of intentional poisoning to harvest body parts for traditional medicine or charms exist. Today almost all vulture species in the study region face conservation risks and this review examines a severe driver of raptor trade in West Africa: belief-based use of vultures or body parts. Belief-based use of vultures remains poorly studied and is not well documented in many regions of the world. We performed a systematic search in Web of Science and Google Scholar, using relevant search strings, to identify publications in peer-reviewed scientific journals and other sources. We found 38 independent sources of information concerning raptor trade and belief-based use of vultures in West Africa. These sources include unpublished reports, technical reports, natural history journals, books, academic theses, bird atlases, popular media publications, and records at the International Union for Conservation of Nature (IUCN). There are pronounced differences in the prevalence of belief-based vulture use amongst the West African countries because of cultural, political, and policy differences with severe consequences already evident in Nigeria, Ghana, Guinea Bissau, Senegal and The Gambia. The ongoing increase in the prices for vulture parts in the sub-region has stimulated raptor trade and hunting in West Africa. International trade has posed a serious threat to West African vultures from intentional killing to satisfy belief-based use as well as sentinel poisoning. Vulture conservation is presently in dire need for support and involvement of the public to help spread the awareness to protect and conserve vulture species. Future investigations should be focused on proactive vulture conservation strategies involving stakeholders and local communities, and these approaches must be taken seriously in every member state of West Africa.

00452

Effects of habitat size, landscape context and management on the diversity of true bugs in bush ecotones

Poster

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Abstract

Despite their importance for biodiversity and ecosystem functioning, bush ecotones are neglected habitats in nature protection. In today's agricultural landscape, due to land consolidation, transitions between open grassland and woody vegetation are usually sharp, which strongly restricts the ecological value of the ecotones. Bush ecotones include a wide range of habitat types, from wood-dominated vegetation along forest paths to scrubby grasslands, with huge differences in physical properties such as sun exposure. Vast bush ecotones with smooth boundaries, as they can still be found on former military training areas, harbour many rare species, such as the mirid true bug Excentricus planicornis.
We recorded the diversity of true bugs (Heteroptera), an often neglected but ecologically and economically relevant group in 118 bush ecotones throughout Bavaria, Germany. Heteropterans are often specific to certain habitats and host plants, which makes them suitable ecological indicators. The true bugs were collected with a beating tray within five sampling campaigns between May and August 2021. Sampling effort was standardized to three minutes per habitat, independent of its size. We evaluated habitat type (forest paths, fringes, woody strips, bushy grassland), ecotone size, management type, landscape context (proportion of seminatural habitat within 500 and 1000 meters), plant species richness and a hedge quality index.
In total, 5000 individuals from more than 160 species were sampled. In accordance with our expectations, preliminary results imply that the open habitats, i.e. ecotones where the transition from open land to forest was less sharp (e.g. scrubby grasslands) had the highest heteropteran species richness. Moreover, species richness was positively related to habitat size. Local habitat quality (plant richness, age structure of woody plants) also had a positive impact, whereas landscape context was less important. The impact of the management is still to be analysed.
The results underline the value of ecotones for the conservation of true bug diversity. The biggest ecotones with high plant richness had the highest heteropteran diversity, whereas small ecotones with sharp boundaries had low species richness.

00472
Biodiversity in protected areas: priorities for regional biodiversity conservation

Poster

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Abstract

Land-use change is the most important driver of biodiversity decline globally. Especially in areas with a high human population density and a high land-use turnover, species are struggling finding suitable habitats. Protected areas are a key tool in nature conservation to protect habitats, aiming to keep natural areas in pristine conditions, and to safeguard threatened species. Especially in central Europe, an area under high anthropogenic pressure, protected areas are often small and get influenced by the intensive use of the surrounding landscapes. However, few studies have assessed whether protected area networks have been effectively protecting biodiversity at the regional scale over long time scales, mainly due to the lack of biodiversity data over larger spatial and temporal scales. In this study, we aim to overcome this gap of knowledge by comparing protected to unprotected areas for the German federal state of Bavaria, an ideal study region in central Europe containing a mosaic of different land-use types, climatic zones, and a network of protected areas of different sizes and protection status. Specifically, we aim to (1) evaluate the effectiveness of protected areas by comparing different biodiversity indices for raster cells of different protection status (protected vs. unprotected as well as different legal protection categories). Furthermore, we aim to (2) disentangle these effects among specific land-use types and climatic zones. As a main data source for the biodiversity data, we will use species occurrence data for different insect groups (dragonflies, butterflies, grasshoppers) from the species mapping database (ASK) of the Bavarian State Agency for the Environment. Our results bear potential to evaluate the effectiveness of the current protected areas network and to guide decision makers in finding new areas for safeguarding regional biodiversity.

00491
Small stream floodplains hold high conservation value for carabid beetles but not for spiders

If you have chosen the theme "free topic" please indicate 1 or 2 keywords here.
Floodplain ecology

Poster

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Abstract

Floodplains along rivers and streams are naturally subject to flooding events and are characterized by a large habitat heterogeneity and biodiversity. However, floodplains are highly threatened by anthropogenic activities such as channelization and bank enforcement. River floodplains are known for their importance for riparian biodiversity, but the conservation value of floodplains along small streams is far less understood. Therefore, we analysed the species diversity, individual numbers and species composition of carabid beetles and spiders along forested small streams in Rhineland-Palatinate (Germany). We investigated 16 pairs of floodplains (stream section with flooding events) and controls (deeply cut and regulated stream sections), where we sampled carabid beetles and spiders at different distances to the shoreline (0 m, 5 m, 10 m). We found that floodplains along small streams had contrasting value for carabid beetles and spiders. For carabid beetles, we observed distinct species assemblages between floodplains and control stream sections and found positive effects of the floodplains on endangered and hygrophilic species. Moreover, species richness and individual richness of carabid beetles was highest at the shoreline of floodplains and decreased with larger distance to the stream, while the opposite pattern was found for the control stream sections. For spiders, in contrast, species richness and individual numbers were lower at the floodplains than in the control stream sections. Also, the species assemblages of spiders did not differ between floodplain and control sites. We conclude that floodplains of small streams are less relevant for spiders but provide important habitats for riparian carabid beetles and should thus be considered in future conservation considerations.

00673
Hedges and flower strips promote plant-pollinator interactions without compromising apple flower visitation

Oral

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Abstract

Conservation measures next to agricultural fields, such as flower strips and hedges, are beneficial for insects, most especially insect pollinators. If crops are dependent on insect pollination, such as apples, there is an additional interest in the effects of conservation measures on crop pollination.
We have analysed plant-pollinator networks in apple orchards with and without conservation measures, i.e. adjacent hedges and flower strips. We found that conservation measures next to fields are neither to an advantage nor a disadvantage for apples in terms of flower visits they receive. However, they provide a benefit for apple-pollinating bees and hoverflies with a more abundant flower offer across the whole season.

00003
Physiological and behavioural consequences of environmental salinity in a coastal frog

Oral

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Abstract

Environmental salinization is recognized as a global threat affecting biodiversity, particularly in coastal ecosystems (affected by sea level rise and increased frequency and severity of storms), and the consequent osmoregulatory challenges can negatively affect wildlife. In order to assess whether coastal species can respond to changes in environmental salinity, it remains essential to investigate the consequences of exposure to salinity in an environmentally-relevant context. In this study, we experimentally assessed the consequences of exposure to environmental salinity in coastal frogs (Pelophylax sp., N=156), using a comprehensive combination of markers of physiology, behaviour and ecology. We demonstrated in a controlled experiment that short-term exposure to salinity strongly affected physiological parameters (salt influxes, water effluxes, immunity-related stress markers) and locomotor performance. Most of these effects were transient (water and salt fluxes, locomotor performance) once optimal conditions resumed (i.e. freshwater). Taken together, our results highlight the need to investigate whether exposure to environmental salinity can ultimately affect individual fitness and population persistence across taxa.

00033
Tracking abrupt shifts in marine fish stock trajectories

Oral

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Abstract

Biological systems do not always respond in a predictable way to gradual change in environmental conditions and human induced pressures. The existence of abrupt shifts in commercial fish populations, in particular, represents a major challenge to sustainable management of marine resources. Textbooks are filled with historical examples of fisheries that collapsed despite efforts in management, leading to both prominent socioeconomic and ecological issues. An abrupt shift describes a sudden jump in a state variable (e.g. biomass) through time and usually results from a strong increase in fishing pressure to which the stock responds linearly. However, an abrupt shift can also be the result of a nonlinear response of the stock to a gradual increase in such pressure. In this case, signals in population dynamics may indicate a loss of resilience before the shift actually occurs. Current methodologies of stock assessment do not usually account for the risk of regime shifts, i.e. abrupt and long-lasting change from high and profitable densities of fish to low levels. However, long time series of fish stock catch and biomass as well as recent developments in dynamical system theory offer a great opportunity to complement traditional stock assessment methods by abrupt shift analysis.
Here, by comparing fish productivity time series that did or did not experience abrupt shifts, we identify which dynamical signatures best characterize trajectories vulnerable to abrupt shifts. We tested this framework on simulated data resembling fish stock trajectories, and on empirical time series using a global stock assessment database. First, we classified trajectories into four classes (no change, linear, quadratic, abrupt) based on a model fitting selection. Second, we computed various dynamical metrics based on the patterns of stock fluctuations (coefficient of variation, skewness, trend in autocorrelation) and identified differences among the four trajectory classes. The results generated by simulated and empirical time series are compared to derive best practices for fisheries management when the existence of abrupt shifts is considered.

00241
Impacts of bark beetle infestations on biodiversity and recreation in protected areas of Central Europe

Oral

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Abstract

Natural disturbances are increasing around the globe and affect all types of forests including protected areas. Previous studies showed contrasting biodiversity responses of different taxonomic groups to disturbance events and largely negative human perceptions of disturbed forest landscapes. Hence, there are conflicting opinions about the appropriate way of managing affected stands in protected areas. Aligning the different objectives of biodiversity conservation and visitor recreation is a prerequisite for disturbance management in protected areas. One key element for assessing the impacts of bark beetle infestations on biodiversity and restorativeness is disturbance severity. Therefore, we selected study sites along a continuous gradient of bark beetle infestation severities in Norway spruce forests in five national parks throughout Europe. On the same study plots we conducted multi-taxon biodiversity surveys and analyzed the restorativeness (i.e., the landscape's ability to renew personal cognitive capacities for forest visitors) using visitor surveys. Biodiversity surveys included vascular plants, epigeic and epiphytic bryophytes, birds, fungi, and arthropods. We used Malaise traps and meta-barcoding to study a broad range of arthropod taxa, including dark and cryptic taxa. Furthermore, we identified order-level community thresholds of disturbance severity and classified species as negative or positive disturbance indicators. Our results show that different disturbance severities lead to differentiated diversity responses. Although restorativeness values were affected by bark beetle disturbance, severely disturbed forests had still high restorativeness. Furthermore, our results illustrate the importance to include neglected and dark taxa in future studies to obtain more detailed impressions of biodiversity responses.

00412
Impact of volcanic sulfur emissions on the pine forest of La Palma, Spain

Oral

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Abstract

The volcanic eruption in autumn 2021 on La Palma, Canary islands, was the largest in historic records of the island. The eruption had a considerable impact on many ecosystems on the island. In addition to the lava stream and significant ash deposition, the volcano emitted 1 Tg of SO_2. The sulfuric emissions impacted the Canary pine (*Pinus canariensis*) forest around the crater, leading to widespread browning of needles.
We used Sentinel-2 remote sensing data to analyze the spatial distribution and intensity of the chlorotic damage after the end of the eruption. Overall, 10% of Canary pine forest and 5.3% of Natura 2000 protected areas on the island were negatively impacted by sulfuric gases. The change in the normalized difference vegetation index (NDVI) exhibited a clear relation with distance, with trees closer to the craters showing a larger decline. Damage was visible up to seven kilometers in all directions.
Due to the extraordinary resilience of Canary pine due to it's adaption to forest fires, we expect most of the affected trees to recover. Our analysis can serve as a reference to assess future ecosystem recovery.

00440
Limited stability of an alternative state - evidence from a field experiment testing volcanic ash effects on mire vegetation

Oral

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Abstract

Disturbance by volcanic ash deposition affects ecosystems to various degrees. In order to elucidate the role of the thickness of the ash layer, the grain size and the timing of the disturbance during the annual cycle of plant growth, a field experiment was established in 2000 in a mire in northern Hokkaido, Japan. Initial patterns of vegetation recovery through secondary succession suggested non-linear relationships between physical properties of the material applied and the vegetation response. Overall, a relatively quick return to a state similar to that before the start of the experiment suggested that deterministic processes drive the resilient behaviour of the plant species involved. However, in the fifth year after the disturbance event, a pronounced increase in cover of *Myrica gale* in some experimental plots indicated that stochastic processes can alter the trajectory of succession. The trend was confirmed for several plots in the eighth year after disturbance, suggesting that alternative stable states may develop. The vegetation survey was repeated in 2020 to check whether the alternative states still persisted. The results showed that, although *Myrica* cover was still raised in the respective plots, the vitality of the dwarf shrubs had declined, and *Sphagnum* cover had increased. These findings support the interpretation that the longevity of alternative stable states in this type of mire plant community is limited, and that processes which negatively affect the growth of *Myrica* gale may eventually ensure the long-term resilience of *Sphagnum*-dominated mire vegetation after disturbance by volcanic ash. We present the plant community responses to the experimental disturbance over 20 years, quantify the indicators for the development of alternative stable states and discuss the available evidence concerning possible mechanisms for the observed patterns. The mechanisms may include biotic interactions between *Myrica gale* and microbial symbionts as well as herbivores and pathogens in addition to competition between peat mosses and vascular plants. We outline further experimental work that is required in order to clarify the relative importance of these mechanisms.

00169
The dimension of stability in multiplex ecological networks

Poster

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Abstract

In nature, species interact in various ways: they eat, compete with and facilitate each other within the same ecological community. However, these different types of interactions have been often considered in isolation in the ecological literature. In particular, we know very little about the stability of communities in which several types of interactions co-occur. Moreover, stability is multifaceted and can be quantified by various metrics (e.g. local stability of fixed points, temporal variability of time series). Previous studies have shown that some stability metrics are closely related in the case of trophic networks, but the question remains entirely open for networks that include different types of interactions, i.e. multiplex networks. Here, we evaluate the effect of incorporating non-trophic (i.e. non feeding) interactions in trophic networks on: 1) the stability metrics individually and 2) the relationships between the stability metrics. Using a bioenergetic resource-consumer model, we simulate communities that include i) only trophic interactions or ii) trophic interactions plus non-trophic interactions. Specifically, we consider four non-trophic interaction types that are known to significantly affect the community dynamics: plant facilitation, competition for space, predator interference and refuge provisioning. We quantify the stability of each community by a number of different stability metrics commonly used in the ecological literature. We find that non-trophic interactions change the different stability metrics individually, as well as their interdependence, compared to a community in which only trophic interactions are taken into account. This result highlights the importance to further incorporate, when possible, several interaction types simultaneously in ecological community models to better understand their stability. Future works could explore the mechanisms underlying the changes in stability induced by the incorporation of non-trophic interactions.

00172
Plant root defence traits mediate yield decline in 19 year old monocultures

Oral

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Abstract

Plants growing in the same monoculture for prolonged periods of time show strong reduction of productivity. In agricultural settings, this phenomenon is known as yield decline. The accumulation of above- and below-ground plant antagonists is one of its major drivers which is why defense traits should help us to improve our mechanistic understanding of yield decline. However, it is still unclear why some species experience stronger yield decline than others. In this study, I investigated the relationship between yield decline and 22 physical and chemical leaf and root defense traits of 27 common grassland species, growing in 5- and 19-years old monocultures.
I hypothesized that root defenses are a stronger predictor of monoculture yield decline than leaf defenses and that physical defenses are a stronger predictor than chemical defenses in roots while leaves show the reverse. I additionally hypothesize that increased defense after 14 years of growing in monoculture (delta defense) is a stronger predictor than mean defense. To test my hypotheses, I summarized plant defenses by running one PCA for leaf and root defense traits, respectively and using the first two principal components to calculate mean and delta defense. The resulting variables were used as predictors of yield decline in a linear model, followed by variance partitioning.
In line with my hypotheses I found that the mean and delta related to root physical defense traits (e.g., specific root length and root diameter) were the stronger predictor of yield decline. However, contrary to our expectation, the delta defense explained similar variance in yield decline than the mean. This outcome can be related to the so called “collaboration gradient” where species on the ‘outsourcing’ side and thus with higher protection against root feeding nematodes had milder yield decline than species on the ‘do it yourself’ side of the collaboration gradient.
The link between root traits and yield decline supports the idea that the accumulation of below-ground antagonists is an important driver of yield decline and shows that root traits can be used to predict long term monoculture productivity trends.

00307
The Altitudinal Gradient of Pollination Networks

Oral

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Abstract

Complex interaction networks, such as those between plants and their animal pollinators, are critical to the maintenance of biodiversity and mediate community responses to global environmental change. Therefore, it is important to understand the patterns and mechanisms of network change across environmental gradients. The abiotic and biotic gradients on mountains have enormous potential to improve our understanding of distributions of species and their interactions along environmental gradients that co-vary with elevations. The decline in species richness with increasing elevation is widely accepted as a general pattern. However, we know relatively little about the altitudinal change in the structure of interaction networks between species. Here, by collecting plant-pollinator networks that were quantified along elevational gradients, we aimed to explore the main altitudinal changes in pollination networks and their biotic and abiotic drivers. We observed a general decrease in network specialization level with increasing elevations. Due to the methodological heterogeneity across studies, we additionally tested how the altitudinal gradient in network structure is regulated by spatial, temporal, and taxonomic grains.

00341
A global meta-analysis on the drivers of mosquito host-feeding patterns

If you have chosen the theme "free topic" please indicate 1 or 2 keywords here.
Disease Ecology

Poster

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Abstract

Mosquito host-feeding patterns are an important factor shaping the mosquito's vector capacity. As the interaction between vectors and hosts determine transmission cycles and risk of pathogen spill over, the understanding of host selection is important in risk assessment for human and animal health. Host selection can depend on intrinsic (e.g. mosquito genetics) as well as extrinsic factors (e.g. host availability). For example, anthropophilic mosquitoes are potential vectors for pathogens transmitted between humans (e.g. chikungunya virus), while opportunistic mosquitoes can serve as bridge vectors for zoonotic viruses (e.g. West Nile virus).

In order to investigate mosquito host-feeding patterns, we collected the data from 339 scientific publications, covering a timeframe of nearly eight decades (1942-2019). We included studies, which sampled engorged mosquito females and screened the bloodmeal for hosts using any serological or molecular biological method. The collected and standardized parameters comprised mosquito species, blood meal hosts, collection method, method for blood meal analysis, time and date, and, if provided, land use and landscape information per study. These data on 544.425 identified mosquito blood meals allow wide range of in-depth analysis of the host-feeding ecology of mosquitoes. For example, 277 of the taxa (57.67%) fed on humans, making them potential vectors of pathogens relevant for public health. Furthermore, the data indicate different host-feeding patterns: while some mosquito species like *Culex quinquefasciatus* show a broad host range, clear preferences for non-human mammalian species are evident for *Culex tritaeniorhynchus*. This comprehensive meta-analysis helps to understand the interaction between mosquito and host species to understand global transmission patterns of mosquito-borne pathogens.

00512
The potential of metabarcoding plant components of Malaise trap samples to enhance knowledge of plant-insect interactions

Oral

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Abstract

The worldwide rapid declines in insect and plant abundance and diversity that has occurred in the past decades has gained public attention and demand for political actions to counteract these declines are growing. Rapid largescale biomonitoring can aid in observing these changes and inform decisions for land management and species protection. Malaise traps have long been used for insect sampling, and when insects are captured in these traps, they carry traces of plants they have visited on the body surface or as digested food material in the gut contents. Metabarcoding offers a promising method for identifying these plant traces, providing insight into which plants insects are directly interacting with at a given time. To test the efficacy of DNA metabarcoding with these sample types, 79 samples from 21 sites across Germany were analysed with the ITS2 barcode. This study, to our knowledge, is the first examination of metabarcoding plant DNA traces from Malaise trap samples. Here we report on the feasibility of sequencing these sample types, analysis of the resulting taxa, the usage of cultivated plants by insects near nature conservancy areas, and the detection of rare and neophyte species. Due to the frequency of contamination and false positive reads, isolation and PCR negative controls should be used in every reaction. Metabarcoding has advantages in efficiency and resolution over microscopic identification of pollen, and is the only feasible method to identify the other plant traces from Malaise trap preservative, and we expect that it will have broad utility for future studies of plant-insect interactions.

Ecology, functioning and evolution of urban and anthropized systems

00152
Challenging the sustainability of urban beekeeping using evidence from Swiss cities

Poster

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Abstract

Urban beekeeping is booming, heightening awareness of pollinator importance but also raising concerns that its fast growth might exceed existing resources and negatively impact urban biodiversity. To evaluate the magnitude of urban beekeeping growth and its sustainability, we analysed data on beehives and available resources in 14 Swiss cities in 2012–2018 and modelled the sustainability of urban beekeeping under different scenarios of available floral resources and existing carrying capacities. We found large increases in hives numbers across all cities from a 3139 hives in tota in 2012 to 6370 in total in 2018 and observed that available resources are insufficient to maintain present densities of beehives, which currently are unsustainable

00290
How do tree microhabitats affect bats and birds in cities?

Poster

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Abstract

Urbanization is increasingly threatening biodiversity, so it is important to find solutions on how to preserve biodiversity in urban areas. Tree microhabitats are key structures used by birds and bats for nesting and roosting. So far, their effects on birds and bats have been studied mostly in forest ecosystems, but little is known on their role in cities. The aim of this was to investigate the role of tree microhabitats for bats and birds on public urban squares. Specifically, we tested (i) if microhabitat abundance and richness had an effect on bats and birds, in addition to square properties, and (ii) whether certain microhabitat types (i.e., cavities) had an effect on certain bat and bird functional groups based on their preferred nesting site.

In Munich city (Germany) we inventoried more than 6000 trees on public squares and recorded more than 3000 habitat trees. Microhabitat indices were analyzed to explain previously collected data about bat and bird abundance and diversity on the same squares. Bats and birds were divided in functional groups based on their preferred nesting site (i.e., cavity-nesters and open-nesters) and were modelled against cavities and epiphytes. Our findings confirmed the importance of a high vegetation cover and large square size, but, surprisingly, microhabitats did not have a significant effect on bats and birds. Even cavities did not have a significant effect on cavity-roosting bats and cavity-nesting birds. Also, epiphytic and epixylic structures did not affect tree-nesting birds.

Our study shows that maintaining green areas in cities is key for bat and bird conservation. Contrary to expectations, proportion of green area and square size are even more important than the habitat quality as indicated by tree microhabitats. However, further analyses are needed to understand their dynamics and link with biota. Assessing structural elements together with life-history species traits is fundamental. Additionally, monitoring of parks and riparian areas can offer more insight on the occurrence of bats and birds in cities. These results confirm that urbanization has a general negative effect on bats and birds and integrating this knowledge in careful planning can help conserve biodiversity in cities.

00310
3-D land-cover-based fine-scale urban connectivity model for bird functional groups

Poster

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Abstract

Cities are heterogeneous landscapes composed of various fragmented land covers and urban elements. Some land covers and urban elements impede the movement of species and lower the survival rate, while others are used by urban animals for nesting and foraging. Although many birds live in cities, the necessary proportion of vegetation and resistance value of urban elements for each bird species or function group are poorly understood. Three-dimensional (3-D) fine-scale spatial data can be helpful in understanding how birds differently respond to urban habitats such as trees, shrubs, and grass. We developed a fine-scaled 3-D land-cover-based urban connectivity model for bird functional groups in Munich, Germany. We classified the land cover by normalized difference vegetation index (NDVI) derived from colour-infrared orthophoto, digital height model derived from digital surface and terrain models, and Urban Atlas LCLU 2018. The classification comprises high-, medium-, and low-rising buildings, trees, shrubs, grass, streets, water bodies, and agricultural land. The connectivity model used a graph theory approach to simulate home range locations based on resource availability and accessibility. The functional groups were classified by three traits of foraging substrate, nest location, and home range size associated with habitat and resistant categories of our connectivity model. The required proportion of grass, shrub, and tree layers and the maximum distance between resource patches to support the home range and the resistance value of each urban element (e.g., high-rise building and street) were parameterized for each functional group. For parameterizing the connectivity model of each functional group, observed bird data from city squares in Munich in 2017 was used. We see different required proportions of vegetation layers and resistance values for urban elements in different bird functional groups. We also see the different maximum distance between resource patches by home range size of functional groups.

00455
Heterogeneous ornamental-wildlife plantings on semi-extensive roofs : success and interest for novels ecosystems research

Oral

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Abstract

Green roofs are a solution that is becoming widespread in cities. However, currently, the majority of green roofs are extensive, i.e. with a shallow substrate thickness of about 5-10 cm and covered with Sedum species, a genius of species that are found in many Mediterranean regions, very resistant to drought. According to current research, the thickness of the substrate and the local vegetation are very important to promote biodiversity. As conditions are harsh on a roof, many studies have tested only whether sedums could have a facilitating effect on some local species. We decided to test the effect of commonly used ornamental plants on a wild seed mixture in a semi-extensive framework. We set up a mesocosm experiment on two roofs near Paris France. We tested three vegetation communities, an ornamental community, a wild seedling, and the mixing of both treatments. We planted those communities in 2019 and we measured the coverage, the number of species, the number of individuals per species, the number of flowers and we recorded the pollinator visitation in summer 2020 and 2021. We found that mixed communities provide the highest level of plant cover and the highest level of Shannon diversity index. We also found that the wild community differs depending on the presence or absence of ornamental plants. Some species are inhibited by ornamental species and others benefit from them, altering the flowering of the species and thus the reception of pollinators. The living heterogeneity of the habitat developed in the mixed modules can be an interesting solution to allow the establishment and development of certain native species on green roofs. Through this study, we show the importance of diversified local species for biodiversity.

00494
Study of ecosystem services generated in an experimental design combining green roofs and photovoltaic panels.

Poster

M. Belin [1, 2], J.C. Lata [2], J. Birot [3], E. Gendreau [2], Y. Marcangeli [2], D. Carmignac [2], X. Raynaud [2]

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Abstract

The increasing of urbanization in already big cities led to increasing loss of natural environment and the decrease of associated ecosystem services, and increasing pressures such as pollution and soil sealing. All those elements have significant consequences on biodiversity and human societies. Roofs, as space, became more and more attractive to be used as production space or for vegetated roofs. The development of green roofs is associated to several ecosystems services they may provide such as air quality, regulation and quality of runoff water, or pollination. One of the key parameters to be estimated is the extent to which these green roofs can be multifunctional, and to what extent the services are not antinomians.
In this study, we combine on a model site photovoltaic panels and green roofs to increase roofs multifunctionality. In particular, we aim to understand how this combination will play on the ecosystem services provided such as quantity and quality of runoff water, carbon storage, pollination, thermal comfort and electricity production, and the interactions between them.

In this context, the key parameter at the interface is the substrate, which influences all parameters either directly or indirectly through feedbacks. Adding a solar panel on a vegetated roof can influence and change the characteristics (eg. pH, water content, organic matter and C:N content, microorganisms) of the substrate (eg. through water drainage or temperature), as the influence of impacted plant populations (eg. through root exudation). In return, impacted plant populations can more or less cool the panel and then help produce more electricity. We created multiple systems to test these hypotheses: we used 3 levels of plant biodiversity in different experimental units with or without solar panel with a standard substrate depth. These combinations were compared to a “substrate only” control with and without solar panels. We will present the pros and cons of the results of the first two years of system operation.

00568
Insect habitat features in urban gardens vary across urbanization gradients, and key structures predict bee and non-bee pollinator abundance

Poster

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Abstract

Urban gardens can support various insect pollinator species through the provision of food and nesting resources in otherwise mostly resource poor environments. Usually, insect pollinators depend on different flower, nesting and water resources within their radius of activity. For example, for small wild bees, this range is usually just a few hundred meters, which makes the proximate availability of food resources, nesting material and nesting places incredibly important. Yet, we are largely missing standardized methods to assess and quantify these habitat features of urban gardens that may allow pollinating insects to thrive.

In this study, we developed a new way to characterise diverse insect pollinator habitat structures in urban gardens that we predicted to influence the abundance and diversity of insect pollinators, particularly wild bees. Over two field seasons in 31 urban gardens in Munich and Berlin, we characterized and counted: available plant species, flower abundance, percentage cover of herbaceous layer, perennial plants, shrubs, deciduous and conifer trees, open soil, sand, stone, mulch, litter layer, marrow plant stems, number of wild bee nesting aids, lying or standing and dry or moist dead wood, rubble-, gravel-, sand heaps, dry stone walls, standing artificial-, semi-natural- and temporary water as feeding or nesting resources.

We show how the abundance of insect pollinator habitat features relate to the abundance of different bee and non-bee pollinator groups in gardens, and discuss how this method can be a standardized tool to investigate and develop recommendations to create specific structures that promote insect pollinators in urban environments.

00622
Impact de la lumière artificielle sur les arthropodes : une vue du sol

If you have chosen the theme "free topic" please indicate 1 or 2 keywords here.
ALAN

Oral

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Abstract

Over the past decade, scientists have become aware of the detrimental effects of artificial light at night (ALAN) on ecosystems. It is now known that artificial light can alter circadian cycles, nocturnal movements and can attract or repel species.
Furthermore, estimates show that in Europe, artificial light is increasing by 5 to 16% per year, while 99% of Europeans already live in polluted air. Moreover, the effect of artificial light is localized in environments that are already under strong anthropogenic pressure due to urban encroachment, thus accentuating the fragmentation of nocturnal habitat.
Nevertheless it appears that there is a real need to complete the knowledge on ALAN effect by in-situ pluritaxonomic observations as most studies are concentrated on a few taxa. In this framework, this study aims to analyze the impact of artificial light on ground biodiversity, while contributing to the implementation of dark infrastructure at the city scale. This work is part of a University Chair called Noz Breizh, organized in 3 axes : a social aspect, an axis focused on new technologies and a other one on biodiversity.

In this perspective, different taxonomic groups were studied: arthropods, avifauna, amphibians and chiropterans. The composition of these different communities was analyzed, using different methods, along a gradient of artificial light, on three study sites, ranging from suburban dry grasslands to urban parks. We have demonstrated the link between the entomofauna present and the plant associations through botanical inventories.
This presentation will focus only on arthropod communities. Nevertheless, to assess the communities mentioned above, we deployed recorders at our study sites to generate soundscapes based on an artificial light gradient. The epigean fauna was sampled using Barber pitfall traps, the soil fauna was also characterized (Berlese), and finally the epiphytic arthropod communities were characterized along several transects. The aims are to present the results concerning the specific and Beta diversity of the different sites ; the sampling strategy, designed to collect information on biotic communities subjected to light pollution,; and finally to understand how artificial light can cause changes in biodiversity.

00634
The influence of artificial light at night on movement activity and predation rates in grassland communities

Poster

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Abstract

Artificial light at night (ALAN) is predicted to have far-reaching consequences for natural ecosystems due to its influence on organismal physiology and behavior, species interactions and community composition. Movement and predation are fundamental ecological processes whose consequences at the community-level are known to be of critical importance to ecosystem functioning. The natural movements and foraging behaviors of nocturnal invertebrates are particularly sensitive to the presence of ALAN. However, we still lack quantitative evidence of how these fundamental processes respond to ALAN within a community context. We assembled communities of nocturnal ground-dwelling beetles (Carabidae) to quantify their movement activity and predation rates across a gradient of skyglow intensities for the duration of two simulated natural moon cycles. Using an RFID sensor array, we continuously tracked the movements of individual beetles within near-natural and fully-controlled experimental grassland-patch landscapes. We show that ALAN increases the movement activity of most nocturnal Carabid species, even at low levels of artificial light exposure. By using sentinel prey (plasticine caterpillar dummies), we show that predation rates also increase along the gradient of increasing artificial light exposure, both at the edge of grassland patches and within their interior. By quantifying how ALAN affects two fundamental ecosystem processes embedded in a realistic community context, we contribute towards a more mechanistic understanding of the implications of this global change driver for species interactions and communities.

00670
Introducing native plant species to increase regional biodiversity on extensive green roofs in northwestern Germany

Oral

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Abstract

Ongoing urbanization leads to a decline of the spatial extent of green infrastructure in many cities. Consequently, important ecosystem functions like water retention or temperature regulation and the habitat function for biodiversity are negatively affected. Green roofs can mitigate negative environmental effects of urban densification to some extent. However, conventional green roofs are mostly species poor and often contain non-native plant species and cultivated varieties of succulents. We studied the suitability of native plant species of regionally typical dry sandy grasslands (Koelerio-Corynophoretea) for extensive roof greening in northwestern Germany. We developed species-rich seed mixtures containing native plant species of regional origin and constructed various nesting sites for insects in order to improve the habitat function of extensive green roofs (EGR) for regionally typical insect species. We tested the effects of different measures of species introduction (seeding, transfer of raked material from a natura 2000 site) as well as the effects of different substrates and layering on vegetation establishment and persistence on EGR of 500 m² to 10000 m² area. Total species richness of vascular plants reached 41-53 species on plots with raked material in year 1, decreased to 24-35 species due to drought in year 2, but increased again to 46-47 species in the third year after higher precipitation. Sun-exposure and low water availability also had a negative effect on mean plant species richness per 1 m² on plots established by seeding. Mean species richness was significantly higher on sunny plots with higher water availability and on shaded plots. In this presentation, we will point out key results of our ongoing experiments and give recommendations for successful roof greening aiming to increase the habitat function of green roofs for flower-visiting insects.

00002

Inventory of phytoremedium plant species of hexavalent chromium near the route of the Oued Mellah

Poster

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Abstract

The purpose of this study is to identify the plants located next to the Mellah Valley, which has the ability to cope with the pollution that occurs, hexavalent chromium. The results showed that there was a significant amount of hexavalent chromium,which determined the plant at 9.2 mg / kg and the soil at 35 mg / kg, classified as hazardous, which has a negative impact on the environment. in place and on the one hand. Another major pollution phenomenon is the pollution of groundwater by this pollutant.
The main source of this contamination is the effluent discharged by the tannery of the valley, which contributes negatively to the high degree of pollution without an effective mechanism to reduce this pollution.

00088
Bti-based mosquito control alters natural benthic macroinvertebrate communities and dragonfly emergence

Poster

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Abstract

Bacillus thuringiensis israelensis (Bti)-based larvicides are widely used to control mosquito populations and considered to be environmentally safe for non-target organisms. However, recent studies found that Bti can reduce the number of non-biting chironomids (Diptera: Chironomidae). As chironomid larvae are a key food source for many aquatic predators, such as dragonfly and damselfly larvae (Odonata), the reduction of chironomids can affect the macroinvertebrate community composition in aquatic-terrestrial ecosystems by bottom-up effects. We applied the maximum field rate of Bti to six ponds a replicated freshwater pond system, a total of three times, while the remaining six ponds were untreated. Three weeks after the last Bti application, we found a significant reduction of chironomid larvae up to 40% in Bti-treated ponds and a difference in macroinvertebrate community composition driven by the reduced number of chironomids and Libellulidae (Odonata) in Bti-treated ponds. Additionally, the number of Odonata exuviae (cast-off skin) that we collected during the second year of the experiment to determine long-term effects of Bti on the number of emerging dragonflies (i.e., Libellulidae), was significantly reduced in Bti-treated ponds by 55%. Since Odonata larvae are not directly susceptible to Bti, our results suggest an indirect effect of Bti on Libellulidae larvae due to reduction of chironomids as prey and therefore reduced emergence success. The effect of Bti is not limited to the reduction of a single taxa, i.e. chironomids, but cascades on to the aquatic food web and the linked terrestrial ecosystem.

00124
Environmental impregnation of bee-products in different ecosystems

If you have chosen the theme "free topic" please indicate 1 or 2 keywords here.
pollinators indications contaminants

Poster

S. Jurjanz [1], L. Delagneau [2], D. Rodrigues [3], L. Jouanet [2], C. Aubry [3], C. Collas [1]

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Abstract

Several studies have highlighted the role of pollinators such as bees as environmental sentinels, reflecting the quality of their ecosystem through their sensitivity to environmental contaminants.The study of the impregnation of bee products by different families of contaminants in various ecosystems represents a challenge for different stakeholders. Therefore, an original consortium was set up with a local beekeepers' organization (CETA GN), municipal park and garden managers (city of Nancy) and researchers (URAFPA). The experimental device aims to monitor the environmental impregnation of honey in 5 sites distributed on 4 types of environments, contrasted in anthropic activity and potential sources of contaminants. Honey was samples in two sites of urban areas (city center), a peri-urban area in a residential zone of the cities' periphery, a rural area within crop fields as well as a rural forest area. The honey was taken in spring and in summer 2022, in 2 to 3 hives per site to analyze metallic trace elements (MTE) such as Cd, Pb, Cr, Cu and Zn, but also polycyclic aromatic hydrocarbons (PAHs) and some pesticides. If today the maximal permissible concentrations of PAHs and MTE in honey are not yet regulated, the MRLs for several pesticides have been set in national and European regulations. In addition, the hives will be characterized by a diagnosis of the bee colony (size and activity, reproduction activity, health status) at each sampling date. Indeed, the diversity of exposure of these environmental situations may differently affect the bee colonies and the produced honey, both in terms of quality and quantity. These overall results will allow to reflect the risks of transfer of contaminants in the different situations and to hierarchize the exposure risks for honey producers and consumers, in order to locating honey production in areas with low transfer risks. A better knowledge of which families of contaminants can be revealed by the analysis of bee products and which families are hardly recovered in honey would allow to precise the presence of which contaminants can be indicated by bee products. This latter information will be very useful for scientists and land managers.

00269
Exposure of herbivores to arsenic from soil - the case of horses grazing on a geochemical anomaly

Poster

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Abstract

Wild or domestic herbivores can ingest soil during grazing and be exposed to environmental soil-bound contaminants such as metallic trace elements or organic pollutants. More, soils in some geographical areas present geochemical anomalies, which raises the question of animal exposure. Horses can graze close to the ground and could thus achieve significant soil ingestion, but literature is scarce. Arsenic is a prohibited element in equine and its control in urine and blood is based on threshold. Detection of non-compliant horses suggested possible plot-to-animal transfer of arsenic from soil. The experiment was performed at the IFCE platform of Chamberet (France, SECCAs-2 project) to study the environmental sources of arsenic contamination in horses. 16 saddle mares were monitored during successive grazing on 2 plots naturally enriched in arsenic (NEA1, NEA2, 64-139 mg As/kg soil). In parallel, 3 control mares were monitored during grazing on a plot with low arsenic concentration (LAC, 13-44 mg As/kg soil). Three field campaigns were conducted in 2020 (July and October) and 2021 (April) with sampling of individual faeces, soil and grass for each plot, and water of wetlands for NEA1 and NEA2 located near a river. Arsenic was analysed in all samples and in monthly urine samples. The daily soil ingestions were assessed from the titanium (soil marker) contents in faeces, grass and soil. Daily soil ingestions were estimated from 0.8 (NEA2, April) to 14.4 (LAC, October) % of total diet (about 98 to 1464 g dry soil/animal) (period × plot interaction: $P<0.001$). The highest values (October) could be partly explained by the heavy rainfall leading to soiled grass ingestion. In this study, ingested soil can induce 9 (LAC, July) to 77 (NEA1, October) mg of ingested arsenic and result in urine concentrations widely exceeding the threshold. Ingested soil can contribute up to 70% to arsenic ingestion while ingested grass and water may represent 30 and 1 % respectively and did not explain alone the urinary arsenic levels. This work shows that soil ingestion can be a major route of horse exposure to arsenic when grazing on a contaminated area, a soil analysis is therefore recommended.

00273
Assessing the effects of plastics contamination on the structure and functions of stream microbial communities

Oral

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Abstract

We assessed the impact of adding plastics with different physico-chemical nature (non-biodegradable (NB) and biodegradable (B)) on the biomass and functions of stream microbial communities by comparing empirical data with data from model. This study was performed with data from a colonization experiment in the field (model approach) and data from a microcosms experiment in which surfaces of substrata were controlled (microcosms approach). We compared six different scenarios: 1) sediment + rocks (covering 50% +50% of the benthic surface area); 2) sediment + rocks + NB plastic (50% + 50% + 60%); 3) sediment + rocks + B plastic (50% + 50% + 60%). And, conditions 4, 5 and 6 tested the buffering capacity of adding Alder leaf litter (30% of the benthic surface area) in mitigating plastics impact on stream microbial communities functioning. We calculated the microbial density and activity per stream or microcosm level by upscaling microbial biomass and activity data by their respective surface area.

In the microcosm experiment, the addition of B plastic increased alkaline phosphatase (PHO) activity in leaves (43.7 ± 24.8 % comparing to the control without plastic), while the addition of NB plastic increased the b-D-glucosidase (GLU) activity in rocks (473.2 ± 127.5 % comparing to the control). The presence of microorganisms on plastics could indirectly explain the increase of PHO and GLU activities on other substrata as result of competition for dissolved organic matter (DOM) resources.

The three upscaled enzymatic activities GLU, PHO and N-acetyl-glucosaminidase (NAG) tended to increase after adding leaf litter in the microcosm (95.7 ± 41.37 %, 46.2 ± 32.7 %, 60.2 ± 26,1 %, respectively, comparing to the control without leaves) and model approaches (99.4 ± 52.4 %, 58.9 ± 27.5 %, 47.5 ± 26.3 %), but little after adding plastics. Results from the microcosms experiment confirmed the validity of the model. Adding leaves certainly contributed to increase microbial activities in the aquatic system, while activity contribution from plastics can be negligible comparing to other natural substrata and/or decrease the activity of neighbor substrata.

00294
Identifying pesticide cocktails across France

Oral

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Abstract

Wild organisms are exposed to complex mixtures of pesticides owing to the considerable diversity of both available substances and agricultural practices. The study of pesticide mixtures is essential because of potentially strong synergistic effects, making mixture effects not predictable from the effects of single compounds. However, to date, little is known about the composition of mixtures to which living organisms are exposed in natura. In part, this is because combinations of active substances are much larger than the research effort than can be invested into their study.
We aimed at identifying cocktails composition and characterising the spatial structuration of substances purchased in France, using a database of pesticide purchases: the French National pesticides database (BNV-d). We developed a statistical method based on a mixture model to cluster postcodes according to the identity, purchase probability and purchased quantity of substance.
We identified 18 groups of postcodes, much lower than the possible combinations of all 279 substances used over 5631 postcodes. Although no spatial information was included in the mixture model analysis, the postcode groups had a strong spatial structure and close cocktails of substances tended to be spatially close. Relying on probabilities obtained from the mixture model, in the cocktails, we distinguished two types of active substances of particular interest. First, “core” substances constitute all groups as they are highly probable in all postcode groups. They include three pyrethroid insecticides, seven herbicides (including glyphosate) and four fungicides (including triazoles). Second, “discriminating” substances were defined as substances with a large variability in the probability of purchase across postcode groups. Ultimately, cocktails are composed of different number of substances with high probability, from 15 to 105 substances.These differences in pesticide purchase among groups seemed related to differences in crop composition but not only. In particular regional effects seem to be strong, and could be related to various potential determinant from climate to the structure of pesticide market.
Our study provided key information on the composition of pesticide mixture in France that will hopefully be of interest for future ecotoxicological studies to characterise the actual impact of pesticide mixture on biodiversity.

00460
Can we easily read-across in ecotoxicity data? A case study with two dreissenid species exposed to three psychotropic drugs.

Poster

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Abstract

Pharmaceuticals are a large family of organic compounds, widely distributed worldwide due to medical and veterinary uses. All these compounds in their original form, as well as their metabolites and degradation products, are considered as "contaminants of emerging concern", with still knowledge to acquire on their fate and effects on non-target aquatic organisms. Knowing more about the ecotoxicity of pharmaceuticals will allow environmental risk assessments to be improved, predictive modelling to be refine, and more focused management measures to be developed and implemented. Identifying approaches to read-across pharmaceutical safety information to non-target species represents a major research need to assess environmental hazards. The objective of our work is to compare the effects of three psychotropic compounds, either of the same therapeutic family or of similar chemical structure (i.e. testing of the “chemical read-across” approach), on two freshwater bivalves, Dreissena polymorpha and Dreissena rostriformis bugensis (i.e. testing of the “biological read-across” approach). Bivalves will be exposed for 14 days to sertraline, paroxetine (two antidepressants) and chlorphenamine (an antihistamine drug with similar chemical structure as sertraline) alone at two concentrations (0.5 and 5 µg/L). Mixture effects were also assessed. A targeted set of biomarkers will be studied, linked to important physiological functions, related to the neuroendocrine system, antioxidant defences, and energy metabolism, as well as proxys of bivalve’s ecological roles (filtration, oxygen consumption and mineral contents). Potential differences between males and females will also be assessed. Differences in the biological responses of the two species and the two sexes are likely, but similarities between the effects of the three compounds on the targeted biological functions can be expected. This ongoing work will determine the sizes of these differences and effects. Since the two dreissenid species are also invasive species, our work will also provide key elements in the understanding of the defence mechanisms of the two dreissenid species, that could be a relevant way to better predict their invasion dynamics.

00524
Combined effects of floods and pesticides on stream biofilms

Poster

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Abstract

This study examined the effect of floods and pesticides on the structure and functions of stream biofilms. Biofilms were exposed to three different hydrological conditions (constant flow (CF), short floods (SF), long floods (LF)) and later contaminated with a cocktail of pesticides composed by an herbicide (terbuthylazine), a fungicide (tebuconazole) and an insecticide (imidaclopride), each at a concentration of 15 mg/L in a four-week microcosm experiment. Stressors effects on biofilms were examined through the analysis of dry weight, bacterial density and chlorophyll-a concentration, as well as respiration, photosynthetic activity and carbon-source utilization profiles. Biofilms exposed to floods were thinner (10 mm in SF and 40 mm in LF) than those exposed to constant flow (80 mm), but more dense as observed by their higher dry mass per surface area values. The floods had weak impact on the chlorophyll-a concentration but significantly decreased bacterial density as well as respiration rates. Contrarily, the cocktail of pesticides temporarily increased bacterial densities and chlorophyll-a in the same manner in the three hydrological conditions tested. The photosynthetic efficiency and carbon-source utilization profiles in biofilms were affected by floods only after 7 days of having been exposed to the cocktail of pesticides. The effects of floods were stronger than those of pesticides in the structure and functions of biofilms. Mostly additive effects between stressors were observed rather than interactive effects.

00637
Effects of essential trace metal elements on non-essential trace metal elements' toxicity on the zebra finch in a context of urban pollution

Poster

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Abstract

Trace metal elements (TME) are divided into essential TME, that have a role in animal's metabolism and physiology, but can be toxic at high concentrations, and into non-essential TME that do not have biological functions. Widely none for their acute toxicity, a concern is rising about their relevance in the context of urban pollution especially on sentinel organisms like birds. Indeed, in urban areas, there is often a diffuse pollution of a mixture of TME which can cause cocktail effects. For example, some essential TME (e.g. Zn) are antagonist with non-essential TME (e.g. Cd or Pb). Also, TME are known to induce oxidative stress which can result in telomere shortening, knowing that telomere attrition can be an index of longevity in some species. This study focused on the impact of essential TME on non-essential TME's toxicity in a cocktail of diffuse pollutants on zebra finch's (Taenopyggia guttata) physiology and behaviour. We conducted an experiment on 80 adult males in controlled conditions. During 65 days, birds were exposed to different TME cocktails at urban relevant concentrations in their drinking water containing variable amount of Zn, Cu and Ni and fixed amount of As, Cd and Pb. To mimic environmental conditions, half of the birds had ad libitum feeding and the other half had intermittent feeding. Non-invasive monitoring was performed by analysing behaviour with RFID tag, and physiology with feather and blood samples. Birds exposed to cocktails containing essentials TME showed a significantly smaller water consumption and a significantly smaller bioaccumulation of Cd in their feathers. Non-essentials TME were only bioaccumulated in feathers for birds exposed to TME in water whereas essentials TME were bioaccumulated in feathers of all groups even the one without essentials TME. This pattern could be explained by the presence of essentials TME in the food. No impact of food availability or TME exposition on mortality, body mass, adiposity or telomere length has been shown in this study. Those results suggest that birds can cope with the level of contamination tested. Further analyses should provide information on the impact of the treatment at a molecular scale.

00676
No impacts of azoxystrobin-based fungicide on bumblebee colonies in dose-response experiment mimicking fungicide decline

Oral

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Abstract

Fungicides are often applied to flowering crops despite their potential to negatively affect bees. Azoxystrobin is a systemic fungicide that is applied to a wide variety of crops globally. Recent studies suggest that azoxystrobin can harm bees at field-realistic concentrations but effects were inconsistent between bee species, crops and studies. Contrary results may in part be due to subtle differences in exposure levels.

To assess the potential impacts of the azoxystrobin-based fungicide Ortiva on the colony development of bumblebees (Bombus terrestris), we conducted a highly replicated dose-response experiment with a unique study design. Rather than individuals, 42 colonies with the possibility to forage freely were exposed to degrading rather than constant fungicide concentrations through syrup. One set of colonies received a field-typical sequence of doses and additional sets of colonies received either a multiple or a fraction of these doses (factors: 0, 0.5, 1, 2, 4, 8).

Preliminary results show, however, no impact on colony growth even at high doses despite similar syrup consumption rates. Azoxystrobin may reduce pollen quality rather than affect bees directly as no effects were observed when exposure was exclusively through syrup while a previous semi-field experiment found negative effects on B. terrestris only when colonies were exposed through foraging on a high-quality pollen source. Alternatively, the absence of impacts in our study could be due to the potential disappearance of volatile co-formulants that were previously shown to harm bumblebees.

00689
ALAN locally alleviates the impact of drought on leaf litter decomposition

Poster

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Abstract

Mankind has dramatically transformed its environment worldwide leading to increasing pressures on natural communities. Notably, physical alterations such as land use changes have been the most conspicuous. Indeed, stressors, such as changes in flow and light regimes have been jeopardarsing the integrity of natural communities at a fast pace due to their association with urbanisation and agricultural expansion.
However, despite the expansion of artificial light at night (ALAN), little is known about the effects of ALAN on ecosystem functions such as decomposition, even less when in combination with other stressors such as drought. In this experiment we used a flow-through, outdoor stream mesocosm system to investigate the effect of ALAN and drought on the decomposition of organic matter. Our overall aims was to investigate the changes in leaf litter decomposition rates under multiple stressors and how this could be influenced by the spatial distribution of stressors in the river network. Our results showed that alone, ALAN had a limited impact on the decomposition of organic matter, however when combined at the local scale it cancelled the negative effects of drought via an increase in the decomposition rate. This unexpected result suggests that more work is required to fully understand how urban expansion might influence the metabolism of streams and rivers.

00129
Change or leave: adaptive strategies facing environmental variability

Oral

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Abstract

Current climate change is expected to change current conditions, but also to increase climatic variability. To face environmental changes, individuals can adapt to new local conditions with adaptive phenotypic plasticity and genetic adaptation (Chevin & Hoffmann, 2017; McGaughran et al., 2021), or disperse to find a new habitat patch with favorable conditions (i.e., habitat choice) (van Doorn et al., 2009). Habitat choice and phenotypic plasticity can be viewed as opposing strategies (Edelaar & Bolnick, 2019). However, dispersal rate and phenotypic plasticity might not be negatively correlated, and not considering their potential interaction could lead us to under- or overestimate an individual's tolerance to environmental changes (Turko & Rossi, 2022).
Furthermore, the relationship between dispersal rate and phenotypic plasticity might depend on the rate of the changes. Adaptive phenotypic plasticity should be favor in fluctuating environments (Gomez-Mestre & Jovani, 2013) because it allows individuals to maintain their fitness under a wide range of environmental conditions. On the other hand, if environmental changes are faster than the time organisms need to express phenotypic plasticity, we could expect dispersal to be favored.
In this study, we tested effects of the rate and the amplitude of temperature change on the expression of phenotypic plasticity and habitat choice with a laboratory experiment in microcosms. Specifically, we measured dispersal rates and phenotypic plasticity of different genotypes of *Tetrahymena thermophila* in monocultures in two-patch systems after an increase in temperature, varying its rate and its amplitude in a fully-factorial design. Our results suggest that, with increasing environmental variability and extreme events due to ongoing climate change, the adaptive strategies of individuals facing these environmental changes might be modified.

00147
Adaptive potential of salinity-induced cell death in a halotolerant microalgae in fluctuating environments

Oral

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Abstract

Phenotypic plasticity, whereby a given genotype expresses different phenotypes in different environments, enables organisms to cope with fluctuating environments. Plasticity is considered adaptive when it increases fitness across environments, while fitness reduction induced by environmental changes is generally considered as passive influences of stress. Recently, we have shown that a given strain of the halotolerant unicellular alga Dunaliella salina displayed repeatedly a massive demographic decline when exposed to successive hyperosmotic stress. However, this population decline was positively correlated to higher subsequent growth rate in the following days, compared to non-declining strain. Furthermore, the declining strain remained in high frequency in long-term cocultures with non-declining strain in salinity-fluctuating environments over 26 weeks. Thus, could such salinity-induced cell death, leading to severe population decline, be interpreted as adaptive plasticity? And how may selection operate on such a trait in fluctuating environments? To investigate these questions, we modelled two alternative hypotheses to explain these observations: 1) the release of beneficial material by dying cells is adaptive for the population under stressful environment, or 2) there is a trade-off between salinity tolerance traits and reproduction. We estimated the parameters of the models from the monocultures experimental data in order to simulate the outcome of co-cultures dynamics. Here, we present the preliminary results of fitting the cocultures simulations on the cocultures experimental data. Regardless of mechanism underlaying the decline-rebound pattern, our results show that fluctuating environments might select for faster decline in response to stress.

00515
Can we use morphological traits to estimate genome size in fossil plants?

Poster

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Abstract

Genome size (GS) varies by several orders of magnitude in land plants. It has been linked to both extinction selectivity and diversification following adaptive radiations, with whole genome duplication (WGD) events thought to be a driver of both taxonomic diversification and morphological evolution. The only empirical evidence for GS changes in the past comes from the fossil record, with cell size, and in particular stomatal guard cell length (GCL), showing a positive correlation with GS. The most common and abundant plant fossils however are sporomorphs (pollen and spores), which if leveraged as a palaeo-genome size proxy would allow for a more complete picture of GS variation through time than is available from leaf and cuticle fossils alone. To date there is mixed evidence for a relationship between GS and sporomorph size, however: within species comparisons across ploidy series suggest a positive correlation, while broader scale, among-taxon comparisons indicate at best only a weak control of GS on sporomorph size. Here, we investigate this problem using (a) direct measurements of angiosperm pollen size and GCL, and (b) a literature compilation of pollen and spore size across a range of plant groups. While GCL and GS are positively and linearly related to each other, pollen size is weakly correlated with GS and is strongly phylogenetically structured. A predictable relationship between genome size and sporomorph size is not supported by this study, and future research should focus instead on developing GCL as a palaeo-genome size proxy.

00527
Genetic and phenotypic variation in Romanian beech along an altitudinal gradient.

Poster

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Abstract

Climate factors are shaping the genetic variation of species at different spatial scales. Most studies have focused on the influence of climatic conditions on the distribution of species' genetic diversity at broad geographical dimensions, while local scale studies, and especially along steep environmental gradients, are getting less attention. Here we investigate the fine scale spatial genetic structure and the genetic diversity of European beech in five populations along an altitudinal gradient, ranging from ca. 550m to ca. 1450m a.s.l. in the Carpathian Mountains, near Brasov city. We also study the physiological diversity, hypothesizing that environmental conditions at local scales affect the phenotypes of each population. A total of 100 adult trees were sampled from each of the 5 natural populations and analysed using 12 microsatellite markers, of which 6 are located in expressed regions of the genome. From the same populations, a subset of 30 trees per population, were characterized phenotypically. Seasonal leaf senescence and bud burst were monitored in autumn and growing season of 2021. Among others, our study showed high genetic diversity with a slightly decreasing trend with increasing elevation. As opposed to this, the fine scale spatial genetic structure showed a decline with increasing elevation, indicating a stronger family structure in lower elevation populations. Surprisingly this trend contrasts with the population density, as in low elevation populations beech was the dominant species and more admixed with other species in higher elevations.

00678
The smallest DNA phages, two sister Microviridae clades that followed different paths to reduce their genomes

Poster

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Abstract

Small circular single-stranded DNA viruses of the Microviridae family are both prevalent and diverse in all ecosystems. They usually harbor a genome between 4.3 and 6.3 kb, with a microvirus recently isolated from a marine Alphaproteobacteria being the smallest known genome of a DNA phage (4.248 kb). A subfamily, the Amoyvirinae, has been proposed to classify this virus and other related small Alphaproteobacteria-infecting phages. Here, we report the discovery, in meta-omics datasets from various aquatic ecosystems, of 16 complete microvirus genomes significantly smaller (from 2.991 to 3.692 kb) than known ones. Phylogenetic analysis reveals that these 16 genomes represent two related, yet distinct and diverse, novel groups of microviruses, amoyviruses being their closest known relatives. We propose that these small microviruses be members of two tentatively named subfamilies Reekeekeevirinae and Roodoodoovirinae. Known microvirus genomes encode many overlapping and overprinted genes that are difficult to predict using standard bioinformatic tools. To help identify all genes in these novel small microvirus genome, we completed standard gene prediction with various additional information including protein conservation, amino-acid composition, DNA sequence and selection pressure estimations. Despite this comprehensive approach, only 4 to 5 genes could be identified per genome, with a number of overprinted genes lower than in phiX174. One hypothesis is that these small genomes tend to reduce both their number of genes and the length of each gene, leaving no place for more variable gene regions that could harbor overprinted genes. Even more surprisingly, these two Microviridae groups had specific and different gene content, and major differences in their conserved protein sequences (one group encoding capsid proteins containing a protrusion and the other likely an additional spike protein) highlighting that these two related groups developed different strategies in genome reduction with optimal coding capacity. The discovery of these genomes and the detailed prediction of their genome content expand our understanding of ssDNA phages in nature and is further evidence that these viruses have explored a wide range of possibilities during their long evolution.

00058
The role of stem diameter in tree hydraulics – insights from pure and mixed stands of European beech and Douglas fir during four consecutive years

Poster

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Abstract

In forestry, stem diameter changes were traditionally considered unidirectional: every year, a new growth ring is formed. However, on a smaller time scale, stem diameter can tell much more, including the current water status of the tree – data that is delivered by high-resolution dendrometers. Since 2018, we have been monitoring stem diameter of pure and mixed stands of European beech and Douglas fir in north-western Germany with a 10-minute resolution. Despite individual differences, we found species-specific patterns in growth as well as in tree water deficit. Notably, these species-specific patterns also differed between pure and mixed stands. Our data suggests that mixing European beech and Douglas fir has a positive effect on the water status of both species, thus pointing to a higher stand drought tolerance.

00090
PINUS HALEPENSIS RESILIENCE TO DROUGHT ACROSS ITS DISTRIBUTION RANGE

Oral

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Abstract

Extreme drought frequency and intensity have increased in the Mediterranean basin since the 1950s and this trend is expected to continue in the next decades, which may strongly affect forest ecosystems productivity, functions and health. Indeed, tree growth decrease is a well-described effect of drought due to the reduction in photosynthesis and in cambial activity. However, we still don't understand well how the climatic conditions occurring in the years before, during and after a drought modulate tree growth resilience to this event, especially along a species distribution range.

To tackle this question, we gathered 4632 pre-existing Aleppo pine (Pinus halepensis Mill.) tree-ring width series from 281 sites located in 11 countries across the Mediterranean basin representing the entire geographic and bioclimatic range of the species. Resilience was defined as the ability of a tree to reach its pre-disturbance radial growth levels. We quantified resilience and its two components, resistance and recovery - respectively accounting for the impact of the perturbation and the capacity of the tree to recover from it - for each site and for each year of the period 1950-2020. Drought intensity was assessed using SPEI (Standardized Precipitation Evapotranspiration Index), a climatic water deficit index.

We found that (a) resilience depends more on pre- and post-drought conditions than on the drought intensity itself. It is lessened by favorable pre-drought conditions and improved by favorable post-drought conditions; (b) there is no drought intensity threshold under which resilience or its components would be strongly reduced; and (c) in accordance with previous studies, trees growing in more arid sites are more sensitive to variations in drought conditions: they show a lower resistance to drought but a better recovery.

Our results highlight the importance of taking into account drought conditions of the preceding and following years when studying resilience to drought and its components. Aleppo pine shows a high plasticity in its resilience across its distribution range, making it a species of great interest for adaptive forest management strategies in the context of climate change, such as assisted population migration.

00102
Soil silicon enhances growth and modulates foliar nutrient concentrations in tropical tree species

Poster

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Abstract

Plant silicon (Si) can mitigate effects of abiotic stressors, act as herbivory defence, and enhance nutrient use efficiency as well as plant performance. Trees of tropical lowland forest grow on P-deprived soils, and are exposed to intense herbivory and seasonal drought, and might thus benefit from high Si availability. It is known that plant-available soil Si varies strongly within and across tropical forest habitats, and that Si uptake varies across tropical tree species. However, how soil Si affects tropical tree growth and foliar chemistry remains largely unexplored.
We experimentally manipulated soil-available Si for seedlings of 12 tropical tree species, with Si concentrations mirroring 85 % of the variation of plant-available soil Si across the Isthmus of Panama. We analysed aboveground growth, foliar Si, P, C and N concentrations as well as nutrient stoichiometry and assessed their responses to soil Si across and within species.
Foliar Si concentrations increased considerably along the soil Si gradient in most species, with the strength of responses positively correlated with the species' physiological Si uptake capacities. Plant growth increased and foliar nutrient stoichiometry changed with soil Si in 3 and 4 species, respectively, regardless of their Si uptake capacity. Foliar C and N concentrations decreased with soil Si in several species, yet without influencing foliar C:N ratios. Instead, C:N ratios increased in those species that showed positive growth responses to soil Si. Response of foliar P concentrations showed opposing trends in two species, paralleled by changes in foliar N:P and C:P ratios.
Our results suggest that plant-available soil Si increases growth and modulates foliar stoichiometric ratios in a substantial number of tropical tree species. Species-specific enhancement of plant growth mediated by soil Si might lead to changes of competitive rankings in tropical plant communities along natural soil Si gradients. Furthermore, variation in foliar C:N and C:P, as well as foliar Si concentrations itself, across habitats with different soil Si should influence ecological processes such as herbivory and litter decomposition. Variation in plant-available soil Si should therefore have pervasive implications for plant performance, species distribution and ecosystem processes in tropical forests.

00105
How to find the right host - Olfactory signals as cues in bark beetle host selection

Poster

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Abstract

Due to advancing climate change, the vitality of many coniferous forests has been impaired in recent years. Increased occurrence of climate extremes including storms or droughts has led to a greater vulnerability of trees towards biotic agents, such as the European spruce bark beetle *Ips typographus*. While many aspects of the beetle's life cycle are well understood, there are still large knowledge gaps concerning the selection of suitable host trees by pioneer in early spring. Pioneer beetles, often physiologically exhausted after a long overwintering diapause, have to find host trees with low defences that allow them to successfully colonize the tree and establish the first seasonal beetle generation. Hence, the host choice of pioneer beetles is of upmost importance for bark beetle population growth and epidemiologic dynamics. A century-old hypothesis suggests that beetles might follow olfactory signals to indicate the physiological condition of host trees and identify trees with low levels of defence. Yet, this hypothesis has not been thoroughly tested and still lacks empirical evidence. Here we discuss potential alternative host selection mechanisms and present our methodical approach for quantification and qualification of olfactory signals mediated by tree stem emissions of volatile organic compounds. We show first results of our investigations on weakened and healthy spruce trees which might serve pioneer beetles as cues during host tree selection.

00165
Arthropod communities in a post-mining, actively restored forest resemble communities in a natural forest in Ghana

Oral

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Abstract

Post-mining restoration approaches should provide sustainable solutions for recovering biodiversity in an Afrotropical region that experiences massive deforestation. A key biodiversity component that is impacted by mining activities which should therefore be targeted by restoration activities, are diverse and functionally important arthropod communities. Arthropods provide several important ecosystem services that contribute to human well-being. Previous studies focussed on the effects of land-use changes on arthropods in other parts of the world, but the consequences of post-mining management decisions on arthropods in the Afrotropical region remain severely understudied. We sampled the activity density of epigeal arthropod communities in the two distinct seasons (dry and wet) across four alternative land-use types (i) unrestored former mine site, (ii) actively restored forest, (iii) agroforestry plantation and (iv) natural forest as a reference using pitfall traps. A total of 43364 individual arthropods assigned to 78 taxonomic groups representing 14 order/sub-order, 28 beetle families and 25 spider families were recorded for the four land-use types in two seasons. Arthropod community composition differed significantly between land-use types and seasons. The differences between land-use types did depend on the season. Similar patterns were observed for both the spider and beetle communities. The arthropod communities at the unmanaged former mine site are unique for both seasons, followed by a gradient from the agroforestry plantation to the restored forest and the natural forest communities with increasing activity densities of Blattodea, Hymenoptera, Coleoptera and Araneae along that gradient independent of the season. The restored forest plots have an intermediate position between the agroforestry plantation and the natural forest arthropod communities, with beetle and spider communities also showing significant recovery with time. The differences in arthropod communities between the land-use types were, however, explained by a significant proportion of vegetation attributes of each land-use type. The active forest restoration approach in the studied post-mining area is a more promising approach than agroforestry to drive arthropod communities towards a comparable state observed in the natural forest. Leaving former mining sites unmanaged is not a sustainable option for restoration targeting arthropods, as communities were far from the reference natural forest.

00185
Aspen trees can switch their diet from carbohydrates to lipids under severe carbon limitation

Poster

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Abstract

Carbon (C) assimilation can be severely impaired during heat and drought periods, making trees strongly dependent on the use of C reserve pools for survival. Because methodological challenging, quantification of lipids as reserve pool is rather rare and most often only sugars and starch are assessed. We chose a lipid-storing species (Populus tremula hybrids) as a model system to investigate whether metabolism during periods of stress may access and use lipid pools. To produce such a stress situation in mature trees, we permanently interrupt C transport by girdling (6 control and 6 girdled). Our three campaigns coincided with the exceptionally dry and hot period in 2018 and 2019 in Central Europe and a climatically rather normal year in 2021.
We monitored the ratio of CO2 efflux to O2 influx (Apparent Respiratory Quotient) and δ13C of respired CO2, both indicators for substrate use in respiration. Further, we assessed C reserve pools (sugars, starch, neutral lipid concentrations). We applied a staining method with an Oil-Red-O solution to visualize spatial distribution of neutral lipid droplets in histological slices of stem cores. Image analysis of the areal proportion of the droplets allowed quantification of neutral lipids.
ARQ values below 1 indicated a substantial break-down of lipid molecules in respiration of girdled trees. Significantly lower δ13C of respired CO2 corroborated the switch towards lipid consumption in respiration of girdled trees. In agreement, the staining method showed high amounts of lipid droplets. However, we did not detect differences in sugar and starch pools between treatments until 2021, likely because the extreme hot and dry years 2018 and 2019. The impact of these years on tree physiology was apparent by increased δ13CO2, indicating stomatal closure and reduced leaf gas exchange in response to drought stress. When climate conditions were rather normal in 2021 control trees showed greater carbohydrate concentrations than girdled trees.
Our study shows that poplar switch in metabolism to survive periods of severe stress. Considering the assessment of lipids stores and their utilization are of great importance when investigating responses of tree C budget to ongoing global warming and climate extremes.

00205
Integrating Tree Species Identity and Diversity in Particulate Matter Adsorption

If you have chosen the theme "free topic" please indicate 1 or 2 keywords here.
"Biodiversity and human health" Keywords: particulate matter, biodiversity

Oral

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Abstract

Ambient air pollution is linked to a plethora of human health problems, and is one of the leading five health risks worldwide, especially affecting urban populations. Trees and forest ecosystems have a direct effect on air quality regulation, and can significantly reduce air pollutant concentrations, therefore reducing detrimental effects on human health.
We investigated four species (*Acer platanoides* L., *Tilia cordata* Mill., *Quercus robur* L., *Carpinus betulus* L.) grown in monocultures and in two and four species polycultures. The amount of particulate matter (PM) on the leaves of these species was determined by washing and fractionation of the PM into $PM_{2.5}$, PM_{10} and PM_{100} size classes using a filtering method. The leaf area index was estimated by litter collection. The amount of $PM_{2.5}$ per m^2 leaf area was significantly higher in *T. cordata* compared to *Q. robur* and *A. platanoides*, and in *C. betulus* compared to *A. platanoides*. The leaf area index in monocultures was similar for all species except *T. cordata* which was considerably lower. Overyielding of LAI was shown in the two species polyculture of *T. cordata* and *A. platanoides*, and also in the four species polyculture. In polyculture, higher amounts of PM were determined in the two species polyculture of *Q. robur* and *C. betulus* and also in the four species polyculture. The result show that both tree identity and mixture influence the amount of PM in the canopy, and this is related to tree leaf traits, and also to overyielding of LAI in the polyculture.
In the polycultures, the most significant increase in removal of PM occurred in $PM_{2.5}$ class, which is considered to be the most detrimental for human health. Airborne $PM_{2.5}$ are of practical relevance to ambient air quality management worldwide, given the vast epidemiological and toxicological evidence on adverse health effects. There is great potential for using selected tree species and mixtures to yield the most effective air cleaning potential in condensed urban areas, suggesting the need to rethink traditional urban greening projects accompanying climate change mitigation strategies.

00240
Effects of competition reduction on intra-annual radial growth of European beech at stem base and crown base.

Poster

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Abstract

Forest management affects individual tree growth dynamics at different stem heights. Management practices such as the shelterwood system, by modifying individual tree's architecture have implication for European beech stands' structure.
The study investigated how above-ground biomass is allocated at stem base (breast height) and at crown base (below the first major branch) in two different management conditions. We measured radial increments throughout the vegetation periods of 2015 and 2016 in two differently managed European beech (Fagus sylvatica L.) stands in central Germany. In one stand, trees had been repeatedly released from competition while the other remained unmanaged for about 40 years.
Results showed that stem base and crown base area-increments of trees in the managed stand were higher than in the unmanaged stand. In the managed stand, the correlation between diameter increments at both heights was strong (R2= 0.57 – 0.71) especially at early spring; in the latter stand and in 2015, the average diameter increments at stem base (6.3 ± 0.06 mm) surpassed the one at crown base (5.3 ± 0.04 mm). Conversely, in the unmanaged stand, the average diameter increment at the stem base (3.1 ± 0.05 mm) was slightly lower than at crown base (3.2 ± 0.03 mm). At both stands, diameter increment started in average earlier at crown base (3rd May 2015 in the managed site and 11th May 2015 in the unmanaged) than at stem base (7th May 2015 in the managed site and 17th May 2015 in the unmanaged). However, stem base increment started earlier and lasted longer in the managed stand (start: 7th May 2015; end: 22nd August 2015) than in the unmanaged stand (start: 17th May 2015; end: 5th August 2015).
Our results confirm that competition reduction affects growth dynamic differently along the stem, with increased growth patterns and duration even more intensely at stem base than at crown base. Further research is recommended to test whether different growth patterns and tapers of residual trees at managed and unmanaged stands have implications for biomass and carbon storage modelling.

00247
Effects of elevation and temperature on the diversity and structure of mountain forests in the Bavarian Alps

Poster

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Abstract

Mountain forests are of great importance for various ecosystem services, including the provision of habitat for numerous species of conservation concern. However, changing climatic conditions pose major challenges for mountain forest ecosystems. Projections forecast an increase in temperatures in the Alps twice as high as in the adjacent lowlands. Therefore, forests in the Alpine region are particularly severely affected by the effects of climate change which are expected to have a massive impact on forest communities. Previous studies have already shown that with increasing temperatures species distributions can shift to more favourable climatic conditions in higher elevations or latitudes. Hence, it is of great interest for forest conservation to examine how changing climatic conditions in the Alps affect single species and communities depending on different forest structures. In our study, we use a space-for-time approach to mimic changes in temperature over time and analyse the distribution of species along an elevation gradient. We established two elevation gradients in three strictly protected forest reserves within the Bavarian Alps ranging from the montane to the subalpine level: one located on a south-facing slope, representing heat-favoured locations and the other including predominantly north-facing slopes. We selected 48 study sites across both gradients and gathered data on forest stand structure (living stock, dead wood, regeneration), and species composition with focus on ground vegetation, birds, and arthropods. In addition, we installed a camera trap at each study site, to infer habitat use by mammals and forest grouse species. Microclimate at each site was measured via two temperature loggers. We aim to model the effect of forest structures and temperature on species communities to gain insights into the adaptability of different species and how this may change under projected future climate conditions We discuss how the results of this study can be utilized to derive management recommendations for the preservation of functional and species-rich mountain forests within the framework of integrative forest management.

00330
Autumn phenology of wood growth in deciduous forest trees: contrasting patterns between aboveground woody organs and coarse roots

Oral

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Abstract

Phenology, the study of reoccurring annual life cycle events, is important to understand the functioning of forest ecosystems. While leaf phenology has been extensively studied, less is known about wood growth phenology. Xylem growth represents about 30% of the annual forest biomass production, with the wall thickening cells (WTC) as the main process responsible for it. It is generally assumed (and applied in forest growth models) that the end of wood biomass accumulation in autumn (WTCend) is concurrent across woody organs, i.e. branches, stems and coarse roots, independently of the tree species. However, this has never been tested in deciduous forest trees. We hypothesize that WTCend occurs first in stems, as branches and coarse roots are storage organs and thus can grow longer. Moreover, we hypothesize that pioneer species, tolerant to harsher environmental conditions, have later WTCend than late-successional species. We studied mature European beech and common birch in natural forests (1 year) and saplings of beech, birch, pedunculate oak and common aspen in pot experiments (2 years) in Belgium. Samples of wood from stems, branches and coarse roots were taken in late summer, autumn, winter and next spring. We analyzed the percentage of wood tissue in WTC phase (%WTC), as well as WTCend (date when WTC < 0.5%). We observed that in mature beech and birch trees, WTCend was reached concurrently in branches and stems. For both species, coarse roots presented 5% of WTC in winter. For samplings, the same trend was observed with branches and stems generally reaching WTCend concurrently and WTCend was later for pioneer species compared to late-successional species. For the four's species, coarse roots continued to grow and accumulate biomass in winter and next spring with the mean coarse root %WTC varying from 2.7 to 7.8%. Winter coarse root growth is likely to represent a non-negligible biomass accumulation at forest stand level. Our understanding of plant dormancy must be reconsidered for belowground woody organs. Modelling coarse root growth over winter might be relevant for models of forest growth that want to provide a realistic representation of carbon storage in winter and resource remobilization in spring.

00383
Effects of heterogeneity on the functional-phylogenetic and taxonomic diversity of forest fauna

Oral

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Abstract

Heterogeneity in forests could affect biodiversity not only by increasing the number of niches but also via neutral processes, such as increases in resources and the spatial partitioning thereof. Comparisons of the relationships between environmental heterogeneity and different dimensions of diversity, i.e. taxonomic and functional-phylogenetic, can help to disentangle these processes. We examined the effects of different facets of heterogeneity in forests, including deadwood richness and forest structure, vegetation diversity and structure, and micro-scale topography, on the taxonomic and functional-phylogenetic (ecological) diversity of nine animal groups: moths, true bugs, phytophagous, saproxylic, necrophagous and carabid beetles, spiders, birds, and bats. We predicted that increases in the number of niches would be reflected in its parallel relationships with both taxonomic and ecological diversity whereas neutral processes would change taxonomic diversity without substantially impacting ecological diversity, instead increasing ecological redundancy. We then showed that while all of the examined taxonomic diversity-heterogeneity relationships were positive, half were accompanied by increases in ecological diversity and half by an increase in ecological redundancy. Taken together, niche-based and neutral processes both affect diversity and sometimes act in concert.

00406
Effects of the 2018 summer drought on Central European forests: a remote sensing perspective using Dynamic Habitat Indicators

Poster

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Abstract

The severe drought in 2018 affected forests across central Europe including Germany. To understand the spatial variation of this event, e.g. for management or policy development, remote sensing tools can be applied. One promising approach, especially in times of increasing data availability, is the use of multitemporal satellite data to compute Dynamic Habitat Indicators (DHIs) that capture changes in minimum and cumulative productivity as well as seasonality. To our knowledge, the use of DHIs to analyze drought events is underexplored. Thus, the aim of our study was to evaluate the health status of forests under drought conditions using spaceborne DHIs. The coniferous forest in the federal state of Hessen in Central Germany were our test case. The calculation of the DHI was based on the Normalized Difference Vegetation Index (NDVI) product of the Copernicus Global Land service. DHI_{Hesse} was computed over the time period 2017-2020 with an interval of 10 days. The health status was derived from ortophoto analysis and using data from state forestry service Hessen-Forst. First, analysis of variance was used to compare health status across the DHI components. Then, we calculated the difference between the years using ANOVA and breakpoint analysis with the aim of understanding the impact of drought on productivity across the years. The results showed that the DHIs have changed significantly in all years between healthy and damaged sites. Further, indicators have not reached pre-drought conditions, yet. Productivity and seasonality, based on NDVI analysis, have changed, but trends, for example increases of both greenness and seasonality, can differ at local level. The most severe negative changes are noticed between 2017-2018 and 2018-2019, while comparing 2018 to 2020 shows improvement. Our analysis demonstrates the potential of DHIs derived from satellite data to capture the effect of drought events of Central European forest ecosystems, but trends might differ locally. Since the base data is available at global level, this approach can be tested in other regions or ecosystems.

00434
Assessment of habitat vulnerability for a better adaptation of forests to climate change

Oral

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Abstract

Effects of climate change over temperate forest ecosystems are increasingly visible. Most of the tools developed to evaluate the risks associated to climate change mainly focus on individual tree species (phenology, productivity, overmortality, distribution, etc.), without an integrative outlook of ecosystems' vulnerability. To meet the urgent need of adaptation, it is imperative to determine the climatic vulnerability of forest habitats in order to better support them in current upheavals.
We put forward a methodology to evaluate forest habitats vulnerability to climate change that can be used either for a territorial or for a stand scale of study. It is based on an index approach, with indexes related to the different components of vulnerability -exposure, sensitivity and adaptive capacity-. Exposure indexes study how the climate evolves inside the habitat's range of distribution, and how the habitat is exposed to pests or pathogenic fungi for its main tree species. Sensitivity indexes include habitat, tree and floristic species distribution modelling and projection under several scenarios of climate change. Sensitivity also relies on dieback measurements. Finally, adaptive capacity considers information about i) the potential extension of the habitat's distribution range, ii) habitat successional stage, iii) traits of the main tree species composing the habitat, field data related to iv) stand structural diversity, v) tree species richness, vi) historical and geographical context. Once the indexes are determined, they are combined to characterise the vulnerability status of the habitat. According to the estimated level of vulnerability, management recommendations falling within the concept of adaptive silviculture are suggested in order to anticipate and mitigate the effects of climate change. Management recommendations draw on experiments and practices already implemented in the study area, as well as discussion with local stakeholders, so that they best respond to the issues of the territory. In addition, test parcels can be set-up to try adaptive silviculture techniques based on scientific literature.

00467
Scale-dependent displacement effects of wind turbines on bats and birds in managed forests

Poster

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Abstract

To mitigate climate change, an increasing number of wind turbines is being built in forests. Turbine construction is preceded by environmental impact assessments to ensure that wind turbines are installed only in managed or degraded forests. Yet, the impact of wind turbines in managed forests on animals is poorly understood. To tackle this research gap, we monitored common bats and birds along an impact-gradient of wind turbines in 24 temperate forests in Hesse, Germany. We found strong effects of forest structure and season on both, bat and bird communities as, for instance, bat and bird communities were positively related to structurally rich forests. In addition, bats specialized on forests, i.e. narrow-space foragers, showed a decreased activity close (< 400 m) to especially large wind turbines. In contrast, the abundance of common birds decreased by -24% across managed forests with more and larger wind turbines. These studies highlight that environmental impact assessment favouring wind turbine construction in managed or degraded forests may minimize, but does not prevent negative, scale-dependent impacts of wind turbines on forest animal communities. We conclude that the current practice of ecologically compensating only the area directly lost to wind turbine construction needs to be expanded to include compensation for indirect, large-scale negative impacts of wind turbines on managed forest ecosystems.

00498
Plant hydraulic behaviour is dynamic in two woody Mediterranean species

Oral

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Abstract

Recent advances in plant hydraulics indicate that the hydraulic behaviour (i.e. the degree of isohydricity) of plants might be more flexible than previously thought. While there is now evidence that seasonal abiotic factors, such as vapour pressure deficit or photosynthetically active photon flux density, can modify the isohydricity in plants, less is known about the effect of biotic factors, such as plant-plant interactions. To test the dynamic of hydraulic strategies, we investigated the impact of both, abiotic and biotic factors on the hydraulic behaviour of cork oak (*Quercus suber*) and gum rockrose (*Cistus ladanifer*), two species with contrasting drought adaptation strategies. The combined rain exclusion and shrub invasion experiment in a Mediterranean cork oak ecosystem in Portugal resulted in four different experimental treatments: 1) Control *Q. suber* trees, 2) *Q. suber* invaded by *C. ladanifer*, 3) *Q. suber* with a rain exclusion of 45% and 4) *Q. suber* with invasion and rain exclusion. As a measure of isohydricity, we used the response of midday leaf water potentials to declining pre-dawn leaf water potentials. This analysis revealed that both species, independent of the treatment, shifted their hydraulic behaviour from wet to dry seasons in response to seasonal abiotic conditions. Interestingly, invaded *Q. suber*, independent of the additional rain exclusion, expressed a modified isohydricity compared to uninvaded *Q. suber* in the dry phases. Lower sap flux densities and stomatal conductance of invaded trees connected to lower leaf area index and reduced stem growth, point towards a more conservative strategy of *Q. suber* under *C. ladanifer* invasion. Here, the strong competition for water resources in the topsoil with *C. ladanifer* during times of low water availability was most likely the major cause for this more conservative behaviour. In conclusion, we demonstrate that the isohydricity of *Q. suber* and *C. ladanifer* can be modified by both, abiotic and biotic factors. Thus, the hydraulic behaviour of plants should be seen as flexible and dependent on its abiotic and biotic environment, rather than a fixed plant intrinsic trait.

00502
The domino effect of spring and fall phenological shifts: how long does it last?

Oral

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Abstract

Warming-induced advance of the growing season and delay in senescence timing have both been shown to impact future phenology timing in temperate trees. How far in the future such domino effects can be detected and how they interact is unclear although such knowledge is necessary to understand growing season changes. Artificial warming was induced in greenhouses on three-year old *Fagus sylvatica* and *Betula pendula* trees. Spring warming, fall warming, spring and fall warming or no warming was administered to each set of 15 trees in greenhouses in 2020. Spring and fall phenology of the trees were tracked for two years post warming manipulation. In 2020, spring warming advanced leaf-out by two and two and a half weeks for birch and beech, respectively under a mean warming of 5°C. In the same year fall warming delayed fall senescence under a mean warming of 4°C by two and a half weeks in both species. An interacting effect of spring and fall warming was only found for beech, whereby fall warming with no prior spring warming delayed senescence by an extra week compared to the delay in trees with prior spring warming. In the second growth season (2021), under ambient conditions, spring phenology was delayed by one week in birch trees and by half a week in beech trees which had experienced fall warming. Spring warming did not affect subsequent spring leaf out under ambient conditions in both species. No warming effects could be detected on senescence in 2021 and spring leaf out in 2022 under ambient conditions. Therefore, effects of spring and fall warming seem to not be additive, whereby the domino effect of spring and/or fall warming is mostly limited to one subsequent phenological event.

00508
Phenotypic plasticity and genetics in the adaptation of forest trees to climate change: results from large-scale provenance trials

Poster

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Abstract

Most climate models for the 21st century predict rates of change much faster than the natural capacity of forest trees to adapt through migration or natural selection. For this reason, it is likely that phenotypic plasticity will play an important role in the adaptation of forest trees to climate change during the course of the current century.
We investigated the phenotypic plasticity of three economically and ecologically important forest tree species (beech, spruce, Douglas fir) by using large networks of international provenance trials. The trials contain the same provenances grown under widely different climatic conditions, covering a significant proportion of the climatic range of the species, which enables to quantify the effects of climate on the growth performance of the provenances.
Furthermore, the availability of measurements of survival, height, and diameter for individual trees (as opposed to pooled within provenances) made it possible obtain additional information on the source of the variability in growth performance. By analysing the correlation between growth and climatic distance, it was possible to determine if the variations in growth measured were due to genetic effects, environmental conditions, an interaction of the two, or intrinsic individual variability.
The results from our work elucidate the relative importance of genetic effects and plastic response in the species studied, and can be used by stakeholders to better inform their decision-making processes, allowing them to focus on the most relevant source of growth performance variability.

00532
Effects of biodiversity on the 3D structure of the forest: A comparison across BEF experiments using TLS

Oral

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Abstract

Tree species richness (TSR) has proved to play a crucial role to maximize ecosystem functioning in forests, e.g. promoting productivity and biodiversity across trophic levels.However, it remains unclear the mechanism by which the tree affects the complexity of the forest.
Here we made use of biodiversity-ecosystem functioning (BEF) experiments associated to TreeDivNet and to the high-resolution technology terrestrial laser scanning (TLS), which allows measuring the three-dimensional (3D) structural elements of trees, to compare the effects of tree species richness on stand structural complexity across different biomes.

00533
Impacts of tree species conversion on understorey vegetation communities in context of climate change

Oral

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Abstract

Climate change requires adaptation of forest management. Because of the long life span of trees that slows down adaptation, woodlands are sensitive to environmental disruption. Since several tree species are more adaptative than the natives to global change, conversion of dominant tree species could be a strategy to fight against its consequences. However, introducing non-native tree species or changing the dominant one could affect the understorey vegetation composition by acidifying the soil, modifying the carbon/nitrogen ratio, changing phosphate availability or opening the canopy. Also, forest history could modulate present understorey vegetation with an unknown magnitude compared forestry practices. In order to test these hypotheses we surveyed the understorey vegetation composition of Fagus sylvatica and Pinus sylvestris stands converted to Quercus rubra, Quercus petraea or Pinus laricio selected for their resistance to drought stress in five Normand forests, as part of the research project FUSEE. We also measured basal area and captured the canopy openness to understand what are the explaining factors of the change in understorey vegetation. We also retrieved LiDAR-based historical information for all stands to document past land uses. We applied Dark Diversity analyses to evaluate understorey vegetation response to tree conversion. Our results showed contrasted effects of deciduous with a relative stability in the composition understorey vegetation of coniferous stands. For instance, converting F. sylvatica stands into Q. petraea impacts the Dark Diversity understorey vegetation community by modifiyng the access to light and nutrients and soil acidity. Converting P. sylvestris stands into P. nigra didn't impact significantly the loss of species. Moreover, historic land uses appeared as an important driver of present understorey vegetation composition as historical events are positively correlated to the loss of several species. The effects of forest stand conversion on vegetation appear to depend on the ecological differences between the adaptive and the original tree species, but the historical context must be taken into account.

00541
Greenness, growth, and daily variations in stem diameter - Linking leaf phenology and wood growth in temperate forest trees

If you have chosen the theme "free topic" please indicate 1 or 2 keywords here.
Physiological Ecology

Oral

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Abstract

A deep understanding of the seasonal patterns of assimilation and growth of trees is needed to estimate the impact of a changing climate on forests. Point dendrometers are excellent tools to track daily variations in stem diameter (tree water deficit) and the seasonal growth patterns of trees. However, the period of radial increment growth (growing period), which can be precisely characterized by point dendrometers, does not necessarily coincide with the period of carbon assimilation and transpiration (vegetation period), i.e., the presence of leaves on a tree. We explore the spatial and species-specific differences in the timing and duration of the vegetation- and growing period, as well as its effect on annual growth. Furthermore, we investigate if and how the patterns of daily variations in stem diameter may potentially be used to infer the presence of leaves on a tree and thereby serve as a proxy for leaf phenology. This would make the point-dendrometer measurements extremely valuable for ground-truthing of remote-sensed leaf phenology.

00573
Winter and spring frost events decrease survival and growth and delay leaf-out in European beech seedlings in the first two years

Oral

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Abstract

Successful regeneration and population establishment is essential for plant species in order to keep track of shifting species distribution ranges due to climate change. However, frost events in winter and spring may limit the poleward expansion of tree species, because cold events may still occur with the same magnitude and frequency in future. As studies on the effect of cold events on the early establishment of tree species are still rare, we studied the separate impact of winter versus spring frost events on the establishment of European beech (*Fagus sylvatica* L.) seedlings, the dominant tree species in Europe, in the first and second year after germination. We also investigated possible memory or carryover effects of consecutive frost events over two years by exposing beech seedlings of cold-marginal (Poland, Sweden) and central (Germany) populations to spring frost after germination in the first year (2016) and to winter as well as spring frost (after leaf-out) in the second year (2017) in a common garden experiment in northern Germany. We assessed survival in 2016 and 2017, leaf-out in 2017, the chlorophyll content in response to the spring frost event in 2017, and height in autumn 2017. Remarkable, spring frost after germination in the first year more than halved the survival rate, whereas the winter frost and spring frost event in the second year mainly affected growth. The strongest decrease in growth was caused by the spring frost event in the second year. Also remarkably, a single winter frost event delayed the leaf-out by more than 10 days in the second year. In this context, late leaf-out resulted in low to no increment in 2017. In conclusion, especially spring frost events shortly after germination may have the potential to limit natural regeneration at the cold distribution margin due to the low survival rate afterwards. Moreover, frost events in winter can delay phenology, which negatively affects increment rates with potentially negative consequences for competition. Thus, the occurrence of frost events needs to be considered in regard of projected range shifts beyond current cold distribution margins.

00574
Response of birds and bats to outbreaking *Lymantria dispar* caterpillars and aerial insecticide application in forests

Oral

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Abstract

Eruptive population events of forest insect species regularly attract the interest of ecologists but also often evoke debates among stakeholders concerning threats that pest control activities and outbreaks pose to forest communities including higher trophic levels like birds and bats. Lymantria dispar (formerly known as “gypsy moth”) is the most serious native defoliator in mixed oak-broadleaf forests in Central Europe. We deployed a full factorial study design with 11 replicates to investigate the impact of L. dispar outbreaks and aerial application of the insecticide Mimic (tebufenozide) on the breeding performance of cavity nesting birds and the activity of bats. Nest boxes and bat calls were monitored in the peak year of a L. dispar outbreak, during which half of the plots were treated with Mimic, as well as in the following year when L. dispar populations had widely collapsed and no further treatments were applied.
Birds and bats showed different reactions to the insecticide application. While breeding in birds was impaired in the year of application and to some extent in the year after, bat activity was mostly higher in stands treated with Mimic compared to control. Outbreaking L. dispar densities also differed in their effect on both groups. Breeding of birds was not affected by L. dispar density in the first year. In the second year, however, when L. dispar populations were already collapsed, our models showed a significant negative effect of density on the breeding of birds. Bats showed lower activities in sites with highly abundant L. dispar caterpillars in the year of outbreak while it was vice versa in the second year of our study. We conclude that consequences of insecticide treatment and caterpillar outbreaks can not be generalized from studying one organism and that for birds, prey abundance might be the important factor while for bats canopy cover may be more important.

00596
Lantana camara can aid mitigating environmental and social challenges in the Western Himalaya

Oral

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Abstract

We assessed the plant communities in pine forests of the Western Himalaya with a special focus on tree regeneration under different categories of L. camara cover. We found a trend of increasing tree regeneration with increasing L. camara cover. Diverse forests are key to maintain the flow of ecosystem services under changing environmental conditions. L. camara is seen as a barrier in the transformation of open, tree species poor forests into dense, species rich forests. So far, the forest management in the Western Himalaya has no other answer to the vast and dense cover of L. camara in around 60% of the forests than the eradication of the species. However, the literature clearly indicates towards an increase in soil fertility (increasing N, P, K and SOC) under L. camara. To understand the tree regeneration dynamics in dependency of the cover with L. camara, we assessed the woody vegetation in three clearly distinguishable categories of L. camara cover (0, 40-60 and 80-100 %) each represented by 4 replicates consisting of 3 plots each. We found a significant decrease of the vegetation cover, other than L. camara, especially in the ground vegetation ($p<0.05$) as well as a significant increase of tree cover in the 0 to the 40-60% L. camara cover category which remained stable under 80-100% cover. The number of seedlings and saplings tended to increase with increasing L. camara cover along with a shift from light demanding to shade-tolerant tree species. Human caused forest impacts like fire and lopping decreased with increasing L. camara cover. The advantages of L. camara in improving site conditions and nursing tree regeneration are nullified under L. camara eradication programs. The diverse tree regeneration under the L. camara cover is an asset in the establishment of resilient forests that can maintain the flow of services under a changing climate. Managers should concentrate on developing appropriate silvicultural tools to utilize this asset.

00659
Multitrophic analysis of fungal communities by metatranscriptomics of forest soils

Poster

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Abstract

In forest soils, fungi impact tree health and productivity, and they are undoubtedly major players in carbon sequestration and biogeochemical cycles. Fungi play a key role in the two major life-supporting processes in forest ecosystems: plant growth and plant decomposition. Indeed, they belong to large ecological guilds, such as saprotrophs, parasites (or pathogens) and mycorrhizal symbionts. The comparison of the genomes from soil decomposers, wood decayers and ectomycorrhizal (ECM) symbionts has revealed several independent lifestyle transitions from saprotrophism to mutualism in fungal lineages. No study has yet compared the functions expressed in situ by these major fungal guilds in different forest soils, through the effective expression of genes related to the decomposition of soil organic matter. Here, we used a metatranscriptomic to characterize the environmental RNA extracted from four forest soils (boreal, temperate and Mediterranean biomes) in Europe and Canada. Using a dedicated fungal mRNA annotation pipeline and the JGI MycoCosm database (1000 Fungal Genomes Project), we compared the expressed functional activities of the main ecological guilds of soil fungi. We focused our analysis on transcripts coding for fungal N-foraging and N-mobilization pathways and the different families of transcripts related to the degradation of SOM: plant cell wall (PCW) degrading enzymes and fungal cell wall (FCW) degrading enzymes (DE). Our results demonstrated that genes encoding PCW Carbohydrate-Active Enzymes (CAZymes) were significantly more expressed by saprotrophic fungi than by ECM and pathogenic fungi at the fungal community level. The genes coding for secreted FCW. On the other hand, saprotrophic and symbiotic guilds expressed in a similar way and at a high-level gene related to FCWDE families. While the expression of genes encoding secreted proteases were similar between these three guilds, the transcripts for N-related transporters and inorganic ion transporters were highly expressed in ECM fungi compared to the other groups of fungi. Metatranscriptomic opens a new area in microbial functional ecology research.

00660
Biochemical and microbial drivers involved in the decomposition processes of fungal necromass in forest soils

Poster

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Abstract

In forest, the decomposition of plant organic matter (OM) is one of the major processes for biogeochemical cycles. A large part of this OM carbon is incorporated within the soil microorganisms responsible for this decomposition, in particular the fungi. As a consequence, they will produce variable chemical qualities of fungal necromass, itself degraded by soil microbial communities. The present study aims to shed light on the decomposition dynamics of microbial (fungal) OM in forest soils. Under the effect of two types of forest management (export, or not, of logging residues), we quantified the decomposition of different fungal necromasses, characterized by contrasting biochemical qualities (melanin rate and C/N/P). A DNA Stable-Isotope-Probing approach was used to evaluate the competition between different microbial guilds (saprophytic fungi, ectomycorrhizal fungi and bacteria) for nutrient mobilization. The C, N, P composition and the melanin content of fungal OM are the major characteristics that explain its decomposition rate in the soil. The coupling of biogeochemistry, chemistry and microbial ecology allowed us to i) characterize the succession of microorganisms involved in the decomposition of fungal necromass, ii) demonstrate the effects of the quality of this OM on its decomposition and its relative stability in soils, and iii) evaluate the consequences of silvicultural management (export of logging residues) on the functioning of microbial communities involved in this decomposition.

00666
Effects of trees structural traits on their response to storm

Poster

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Abstract

Storms represent the most serious disaster for German forests (Knoke et al., 2008), and are prone to happen more often with climate change. In forests the turbulent nature of wind makes it difficult to model or plan. Tree movement is correlated with the passage of wind gusts over the forest, which have a long temporal scale but a small spatial scale (Coutts & Grace, 1995). Studies on management effects showed that timber removal and selective thinning were more important than stand density, soil and site conditions or topographic variables to explain sensitivity to storm (Albrecht et al., 2012). This suggests that a finer scale of observation may be necessary to understand the predisposition of a tree to storm damage. In particular, a tree can damp its own oscillation by friction with its neighbors or by transferring the energy to branches and twigs with higher frequency agitation (Coutts & Grace, 1995). Hence, here we observe the effect of individual tree structure and local environment on the damage it undergoes.
The EnriCo (RTG 2300) experimental sites correspond to 8 sites located across Lower Saxony. Each site is a quintet of pure and mixed plots, with either pure European Beech (Fagus sylvatica), pure Douglas fir (Pseudotsuga menziensii), pure spruce (Picea abies) or mixed European Beech – Douglas, European beech – spruce. Each plot is 50 by 50 meters, with a buffer zone of 10 meters. On 4 of these sites, we observed damages from the February 2022 storm, with a total of 27 uprooted trees, mainly conifers. All the sites were scanned with terrestrial mobile laser scanner (LiDAR) before (July 2021) and after (March 2022) the storm. From the laser 3D point cloud we extracted trees structural (crown size, tree height) as well as architectural traits (number of branches).
Our hypothesis is that more complex trees have higher capacity to damp their own oscillation. Therefore, we expect the uprooted trees to be in average less complex than the non-uprooted ones. Understanding the effect of tree architectural traits on their vulnerability to wind gusts and damages could help us adapt our forest management practices.

00685
Mechanized forest operations as an emerging driver of understory vegetation change - 50 years of plant communities' composition in the Amance forest (France)

Poster

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Abstract

In 1971, then in 1990, floristic surveys were carried out at the intersections of a systematic grid covering the Amance forest, a mixed hardwood forest in the Lorraine Plain (northeast of France). In 2022, 50 years after the first study, 164 of these plots were re-visited. To read the recent silvicultural history of the forest at the plot level, this third campaign recorded both the presence of plant species and their location intra-plot with sub-plot surveys according to soil disturbances: on vehicle trails, wheel ruts, pits or mounds. The dynamics of understory vegetation were studied for individual species and for plot and intra-plot plant communities using correspondence analysis and bioindication values from the Baseflor database. Results showed a continued increase in species' richness and clear directional shifts in communities' composition between 1990 and 2022 compared to 1971-1990. Three potential explanations for the shift between 1990 and 2022 were assessed: continued eutrophication, climate change and silvicultural disturbances. Slowing rates of increase in bioindicated nitrogen and decreasing rainfall acidity and nitrogen deposition suggest atmospheric deposition may no longer be a key driver of vegetation change, unlike between 1971 and 1990. The rise in air temperatures observed in the Amance forest since 1990 is not reflected in the vegetation. On the contrary, there has been a decline in plant bioindicated temperatures, indicating a lack of adaptation to climate change and a growing climate debt. Concomitant decreases in ancient forest species and increases in nonforest ones point to an increase in disturbances. Significance of skid trails and wheel tracks for shifts in the correspondence analysis suggest these disturbances may be linked to mechanized logging, shown by archival data to have become widespread over the past decades. With comparisons of bioindication values outside of trails, on trails and in wheel tracks, machinery's impacts on soil is the most likely explanation of understory vegetation shifts. Our observations are amongst the first to document the impacts of mechanization on forest plant diversity beyond experimental trials and show that it is an emerging driver of large-scale biodiversity change.

Landscape ecology

00022
Disentangling forest effects on grassland plant diversity and forage yields

Oral

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Abstract

Understanding ecological spill-overs between land-use systems is essential for collaborative landscape management, particularly for site-specific management that reflects opportunities for both biodiversity conservation and agriculture. Forest-grassland transition zones are sites that can support the needs of diverse species, while also generating forage for dairy and meat production. While the edge effect hypothesis suggests that plant diversity is typically higher at the forest boundary edge and decreases further into the field, grassland forage yields have been found to be low closest to forest edge. This trend is often explained with competition and micro-climate effects. We studied the effect of forest edges on the relationship between grassland plant diversity and forage yield quantity and quality (% crude protein) in 20 different fields, throughout the Uckermark, in north-eastern Germany. Each field had one transect, which in turn had sampling points at the forest edge (0m), and into grassland fields (4,8, 16, and 32m). In the spring of 2020 we inventoried vegetation and harvested forage, which was dried, weighed, and then analyzed for its quality. Although plant diversity and productivity were lower at the forest edge, forage quality was higher at the forest edge than further into the field. Plant communities drive these relationships, which are affected by distance to forest in the study region. These different plant communities at the forest edge which might be meaningful for increasing overall plant diversity and providing nourishing forage for livestock in the context of land-use system interactions.

00402
Assessing the spatial patterns of functional connectivity across multiple species and taxonomic groups in Switzerland.

Poster

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Abstract

Functional connectivity defines the potential connection between two localities through species movement. It relates to the ability of a species to move or disperse among habitats and plays a key role in sustaining metacommunity processes. In this study, we aim to quantify the probability that two communities are functionally connected through species dispersal using a new index that incorporates geographic distances, environmental distances and functional trait similarity. We considered functional traits related to mobility, reproduction, environmental niches and diet. We tested this approach on bees and birds across Switzerland. We present spatially explicit, nationwide, connectivity networks for both taxonomic groups. Validation of these networks confirmed their capacity to predict community taxonomic and functional composition as well as the abundance of selected species with different traits. Finally, comparisons of network structure among taxonomic groups revealed clear hot and cold spots of functional connectivity in Switzerland. The new index can strengthen our understanding of species movement patterns within taxonomic groups. In turn, this can improve our understanding and capacity to predict the role of species movement for metacommunity dynamics and biodiversity maintenance. The new index can also guide current and future conservation efforts by identifying localities that play a key role for species movements and helping the prioritization of nation-wide biodiversity conservation efforts.

00487
Habitat fragmentation per se and species diversity: The influence of local extinctions and species clustering

Poster

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Abstract

The consensus that habitat fragmentation is a key factor contributing to the decline of species diversity has recently been challenged by Leonore Fahrig. Based on empirical findings she disputed, that "habitat fragmentation per se" negatively impacts diversity, thus reviving the "single large or several small" (SLOSS) debate. Her argumentation for a diversity enhancing effect of fragmentation has been supported by neutral models analyzing the effect of inter patch isolation on species diversity. Using a spatially explicit, neutral simulation model we extend these models to take account for the influence of ecological drift and intra-fragment species clustering due to limited dispersal. We find that fragmentation increases global, but decreases local diversity, prominently so if fragments become more isolated. We demonstrate that occasional extinctions of local communities may substantially enhance local and particularly landscape diversity. Cluster formation is a key mechanism reducing local diversity and the combined effect of extinctions and cluster formation can create complex interactive effects of fragmentation and isolation on diversity. We conclude that - although in most cases fragmentation decreased local and increased landscape diversity - universal predictions concerning the SLOSS debate should be taken with care.

00682
Pronounced genetic structuring of a fossorial rodent across a small spatial scale, affected by landscape structure

Poster

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Abstract

The spatial genetic structure and diversity of species is determined by a combination of environmental features (i.e. abiotic and biotic factors, landscape structure) and the species' dispersal ability. Fossorial species, i.e. species adapted for digging, usually show enhanced differentiation between sub-populations even on small spatial scales. Analysing the genetic structure of fossorial species with relatively limited dispersal capabilities, thus provides insights into a species adaptations towards its environment, particularly in harsh and heterogeneous ecosystems. The giant root-rat (GRR, Tachyoryctes macrocephalus) is a fossorial rodent confined to the afro-alpine ecosystem of the Bale Mountains in southeast Ethiopia. The limited dispersal ability and the small area of distribution makes the GRR a suitable study species to understand genetic structuring in relation to environment features. In our study, we analyse the population structure and phylogeography, spatial genetic diversity, and the association of these to geographic distance, vegetation, and landscape structure. We use complete mitochondrial and low-coverage nuclear genomes of 77 individuals sampled from eight localities across its entire distribution range. We reveal a pronounced structuring in two larger populations, with no indication for gene flow between the populations. On a local scale, i.e. a maximum of 12 km between localities, we found genetic differentiation, but no sub-population structuring and no differences in genetic diversity. Genetic differentiation appeared to be driven by pronounced landscape structures such as steep slopes, especially those dividing the two major populations in the centre of the species' range. In contrast, geographic distance was less important. Despite the presumed low mobility, we see that GRRs can perpetuate gene flow across larger distances, but not across geographic barriers. Species with reduced mobility in such ecosystems therefore could be ideal model organisms to study microevolutionary processes and adaptive potential towards changing environmental conditions.

00027
SORTEE: promoting open, reliable, and transparent ecology and evolutionary biology

If you have chosen the theme "free topic" please indicate 1 or 2 keywords here.
Open Science, Scientific Reproducibility in Ecology and Evolution

Poster

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Abstract

Science and society benefit when scientists conduct research in a transparent, reproducible, and collaborative fashion. SORTEE (the Society for Open, Reliable, and Transparent Ecology and Evolutionary biology) was founded in December 2020 with the aim of bringing together researchers working to improve reliability and transparency through cultural and institutional changes in ecology, evolutionary biology, and related fields. In 2021, over 800 researchers became members of SORTEE and registered for the Society's first annual virtual conference. This poster will showcase SORTEE's success and activities thus far and provide conference attendees with information and resources on how to engage in open, reliable, and transparent research practices. Links will be drawn to recommendations on open science practices from a recent perspective article "Towards open, reliable, and transparent ecology and evolutionary biology" published in BMC Biology 2021.

00050
The French biodiversity data Hub (PNDB), a virtual biodiversity data infrastrucutre for and by researchers.

If you have chosen the theme "free topic" please indicate 1 or 2 keywords here.
Open Science, Biodiversity data

Oral

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Abstract

The French national biodiversity data hub ("Pôle National de Données de Biodiversité" - PNDB) is a national e-infrastructure created in 2018 led by the National Museum of Natural History, and contributing to the Open Science policy of the Ministry of Higher Education, Research and Innovation (MESRI).
PNDB contributes to building an integrative framework taking into account biodiversity over the long term (since the origins of life to future models), at all biological scales (from the molecule to the socio-ecosystem), and in all its interactions, by providing tools and services for the description, access, validation, analysis and reuse of biodiversity data.
With the diversity and complementary type of research biodiversity data (information systems, institutional warehouses, research infrastructures as observatories, experimental devices, Natural History collections, etc.), but also from public policy data, the missions of the PNDB is deeply based on the FAIR approach (Findable, Accessible, Interoperable, Reusable), and consist:
- to provide direct access to datasets and metadata (data stay in providers and/or curators), associated services and products derived from analysis;
- to identify gaps in terms of support and bridges between the communities producing and using data. ;
- to facilitate the sharing of good practices with other research communities, promote the sharing of data and their reuse.
- to promote consistency with national, European and international efforts relating to access to and use of research data on biodiversity, promotion of products and services.
PNDB offers support and facilitation around the understanding, sharing and using of biodiversity data for scientific communities. It offers services and adapted tools based on existing technologies throughout the data cycle, from the development of data management plans to the production of indicators including data papers publication (eg. data "FAIRization", catalog of metadata, application to generate and share metadata, analysis platform, summer schools, data access, training, guidance,).
Thanks to its nomination in 2022 as a thematic reference center of the MESRI, PNDB will contribute to promoting the FAIR approach, to increase the skills of the scientific communities around open science and stimulate interactions between producers and users of biodiversity data.

00057
Mapping microclimate variations using near-surface temperature modelling: validation of the *Microclima* R package on the scale of the Compiègne forest and its surroundings

Poster

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Abstract

Climate conditions matter for soil biodiversity in agroecosystems. However, the microclimatic temperatures perceived near the soil surface by species are different from ambient-air temperatures (cf. macroclimate) as measured by weather stations. To predict microclimate temperatures, Maclean et al. (2019) developed a mechanistic model relying on microclimatic processes that govern fine-scale variation of soil surface temperature. Here, we aim implement the Maclean et al. (2019) model by integrating data on temporal changes in vegetation height, before verifying the validity of the model outputs in closed and open environments using microclimatic temperature data, as collected in 2018-2019 by 50 sensors installed in the Compiegne Forest and its surroundings. We generated hourly maps of soil surface temperature between February 2018 and October 2019. Our results show a strong correlation between predicted and observed temperatures ($R^2 = 0.945$). Some sensors placed in open habitats recorded higher temperatures than those predicted by the model. Conversely, few sensors in forest habitats observed lower temperatures than those predicted by the model. By separating days into different time periods, we show that these differences between predicted and observed temperatures are time dependent (positive differences in the afternoon and negative differences at the end of the night and beginning of the morning). We also analyzed the relationships between the R^2 and the environmental parameters, which allows us to know under which environmental conditions the strongest correlations between predicted and observed temperatures are observed. Our study thus allows us to better optimize the modeling of predicted temperatures and highlights the need to validate predictions with observed temperature data in both forest and open habitats. Based on our findings, we conclude that the model can be extended to other territories that do not have in-situ microclimate measurements data to predict soil surface temperature variations. In the context of climate change, this work and future research would allow us to determine which agroecosystem states maintain a favorable soil surface temperature for species living near the soil surface.

00145
Introduction to NFDI4Biodiversity and its education activities

If you have chosen the theme "free topic" please indicate 1 or 2 keywords here.
Research Data Management, Training and Education

Poster

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Abstract

Ecological questions and the data needed to answer them are increasing in complexity. This leads to large amounts of data collected during individual research projects and the need to integrate heterogeneous data from various sources to recognize patterns on a large scale. The increasing demand for high-quality data and the processing of heterogeneous data sets requires raising awareness of Research Data Management (RDM) and advanced skills in the data processing. Interdisciplinary concepts such as data literacy and (Findable, Accessible, Interoperable, Reusable; FAIR4S-framework of the EOSC) as well as discipline-specific knowledge e.g. the use of RDM tools and software require specific training offers. The educational activities in NFDI4Biodiversity foster practices of these concepts and skills and will contribute to the necessary cultural change.
NFDI4Biodiversity is a consortium under the umbrella of the National Research Data Infrastructure dedicated to mobilising biodiversity and environmental data for collective use. The goal of our education activities is to establish the teaching of FAIR Research Data Management as a core topic and thus ensure that current and future generations of scientists will possess profound knowledge in these topics. To transfer knowledge from specific disciplines to users and to develop training offers, NFDI4Biodiversity works closely with its partners. For instance, in cooperation with the Ecological Society of Germany, Austria and Switzerland (GfÖ), a winter school for the training of PhD students and early career researchers to specifically face the demands of ecologists. Further, together with the University of Bremen Research Alliance, we participate in the training of Data Scientists and Data Stewards and raise awareness of the specific requirements in biodiversity-related topics. Via our helpdesk service, we provide support in RDM, questions related to career stage, specific needs and target groups (e.g. lecturer, stakeholder, group leader). We offer individual roadshows, lectures and a one to one support in the development of Data Management Plans (DMPs) for scientific research projects. We are guided by the motivation that stakeholders from science, politics and nature conservation need reliable data to make better contributions to the understanding and conservation of global biodiversity.

00190
INCIDENCE OF PREDATORY MITES (ACARI: PHYTOSEIIDAE) AND SPIDER MITES (ACARI: TETRANYCHIDAE) ON GUAVA, CITRUS AND GRAPES IN RELATION TO DIFFERENT ABIOTIC FACTORS.

Poster

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Abstract

Mites are tiny creatures belonging to class Arachnida and subclass Acari. Mites pose a severe problem to plants attacking crops, fruits and vegetables worldwide. Spider mites are one of the most important groups of mites in the class Arachnida, which are considered as pests of different agricultural crops, fruits, orchards, ornamental plants and forest trees. Different methods were used for mites control since long, but biological control considered to be preferred due to the lethal effects of pesticide application. In present trial, the study was conducted on the population dynamics of predatory mites (Phytoseiidae) and spider mites (Tetranychiidae) in different fruit plantation. The fruits like grapes, guava and citrus are cultivated at a large scale in Pakistan, which are attacked by different insect pest species. Due to the economic importance of fruits, the study was planned to observe the population of predatory and spider mites in relation to different abiotic factors during the period of May-August, 2021. The information collected showed that the maximum predatory mites population was observed during 4th week of August on guava (6.57 on per leaf basis) and the minimum population was recorded during the 3rd week of May on citrus (0.27). Abiotic factors like maximum and minimum temperatures 0.945 & 0.958 and rainfall showed a positive correlation as 0.001, while relative humidity negatively correlated as -0.993 against the predatory mite population in guava. The same trend was seen on grape and citrus as well. Maximum population of spider mites was observed during 4th week of July on grapes (8.91) and the minimum population was observed during the 3rd week of May on guava (0.65). Abiotic factors like maximum temperature and minimum temperature showed a positive correlation as 0.747 and 0.741, while relative humidity and rainfall showed a negative correlation as -0.701 and -0.037 against the spider mites population in grapes. The same trend was seen in other two plantations as well.

00340
A simple camera trap with automated insect detection for Monitoring and Citizen Science

Oral

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Abstract

Regular monitoring of insect populations is essential to investigate potential drivers and their impact on insect decline, as well as controlling the effectiveness of different countermeasures. However, traditional monitoring methods (e.g. Malaise traps) can lead to high time and labor costs, and generated data often has a relatively low spatial and temporal resolution. Innovative, noninvasive monitoring methods could extend the ecologists' toolbox and also be used by non-expert citizen scientists. Currently, several devices are available for automated insect monitoring using optical or optoelectronic sensors, but complicated assembly and programming can be an obstacle to wider deployment apart from specialized user groups. Several companies from the agricultural sector offer subscription-based renting of devices for automated pest monitoring, which are easier to use. Combining scientific requirements (open source, standardized, low-cost) with the ease of use of commercial products, we are developing a camera trap for automated monitoring of flower-visiting insects. The device is based on a Raspberry Pi Zero 2 W in combination with the OpenCV AI Kit (OAK-1), a camera with an AI-enabled chip. Due to its low power consumption, a small 9 W solar panel is sufficient to power the device. Two lithium-ion batteries as backup power source and the PiJuice Zero HAT for precise power control make the device truly self-sufficient and enable continuous monitoring during a whole season. A specifically trained YOLOv5s detection model running on the camera chip detects insects landing on a platform with artificial flowers in real-time. To avoid repeated counting of an individual insect in the same frame, an object tracker is used to track insects moving on the platform. For each detection, a crop of the insect is saved, combined with relevant information like confidence score, tracking ID and exact recording time. This data is ready to be used to train classification models or for inference with available models (e.g. iNaturalist, ObsIdentify). Assembling and programming the camera trap is easy, even for beginners. All Python scripts are based on open source resources available on GitHub. A dedicated website with detailed instructions will allow everybody to build their own smart camera trap.

00411
Developing new Methods for Woodcock Monitoring

Poster

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Abstract

Whilst Biodiversity declines are drawing more and more attention recently, dynamics ultimately leading there have been rather unexplored. Declines in population sizes of invertebrates or birds often lack in relatable data to draw reliable conclusions on underlying dynamics. To understand reported declines in bird populations, high-quality monitoring data is urgently needed.
We will present a framework to monitor the (yet) abundant Eurasian Woodcock (*Scolopax rusticola* L. 1758) on a statewide scale using automatic acoustic loggers and an automated species identification approach.
We designed the suggested Method to install a continuous long-term monitoring, meeting expectations on consistent quality while being cost-effective and simple to apply. Evaluations on species identification performance, as well as tests to assess the power of detection across different placement scenarios, will be presented.
The former experiments showed that there is no difference in detection rates between human automatic recordings, when the device is placed properly. Differences in automatic and manual species identification were larger. The species identification algorithm missed 43% of events identified by ear. However, occurrences of the woodcock were discovered reliable (94%) over the course of the survey on plot level. Remarkably, no false-positive identification by the automated identification occurred. These results contribute to other advantages (continuous recording over 2 – 3 months, labour efficiency), underlining the potential of automated bioacoustics for long-term monitoring.
In the future, streamlined data management and automated handling procedures could help to make this method accessible for all kinds of institutions when the focus should be on the environment, not the computer.
The presented monitoring technique could serve as a scheme for a lot more (audible) species and has great potential in assessing population trends effectively.

00421
Developing a remote sensing based monitoring system for quantitative and qualitative changes of traditional orchards in Hesse, Germany

Poster

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Abstract

Traditional orchards are an important element of the cultural landscapes as they provide or enhance a wide range of ecosystem services, for example related to carbon sequestration, provision of food and biodiversity. In Germany, the number and area of such orchards are declining, and maintenance can be challenging. The monitoring of traditional orchards is quite labour intensive as they are rather small landscape elements with a scattered distribution. The main objective of our study is to explore how methods of remote sensing can contribute to a landscape scale monitoring. More specifically, we aim to identify qualitative and quantitative parameters specifically fitted to the characteristics of traditional orchards that can be derived from multitemporal airborne laserscanning (LiDAR) point clouds and aerial imagery at single tree and site level.

Our study area is the Federal State of Hesse (Germany), and pre-studies are completed for selected sites in Hesse. We identified both quantitative (e.g. planting and removal of trees, gaps in tree rows, changes in tree density) and qualitative parameters (e.g. shrub encroachment, tree age classes) that are important for monitoring. We derived these parameters from publicly available LiDAR data as well as colour infrared and true-colour airborne images. We applied methods of remote sensing such as tree crown segmentation as well as machine learning using free and open source software to map the relevant parameters and tree properties. As reference information for the accuracy assessment, field data regarding these parameters was collected on site and single tree level. In a preliminary study, we segmented trees of a large traditional orchard area with an accuracy of 93 % (n = 949). Random Forest classifiers for the tree age classes successfully classified the vast majority of young and newly planted orchard trees and a majority of the mature and old ones.

These and other preliminary results indicate many possibilities and some limitations of remote sensing to aid monitoring efforts of traditional orchards in Germany. In the future, we will apply our methods to more traditional orchards in Hesse and investigate the possibilities of drone imagery for monitoring efforts.

00446
Using pixel- or superpixel-based segmentation for efficient classification of green roof digital images and rapid estimation of plant species abundance

Poster

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Abstract

Green roofs are “nature-based solutions” that may provide numerous ecosystem services in the context of urban greening. Vegetation development in strong interactions with green roof media and microbial communities play a key role in the ecosystem multifunctionality of these green infrastructures. Consequently, research on plant selection has increased in recent years in order to expand the list of species able to grow on green roofs in cold or arid climates, with special efforts to clarify the relationships between species diversity, functional traits and ecosystem services. There is still a need, however, for carrying out long-term vegetation survey to avoid premature conclusions regarding plant adaptation as well as to better understand the ecosystem functioning and ecological trajectories of these engineered ecosystems. Nevertheless, vegetation cover determination on green roofs may rapidly become time-consuming and quite tedious, especially in the case of densely covered mixed species roofs or due to plant species (sometimes overlapping) with similar leaf shape and colours (e.g. sedums). Therefore, the aim of this work was to investigate the ability of two freely available plugins, which were recently developed for the open-source image analysis software Fiji (a distribution of the free ImageJ platform, initially dedicated to biological image analysis), to rapidly and efficiently perform supervised machine-learning for the classification of green roof vegetation from photographs. Two workflows are thus described, depending on the use of the “Trainable Weka Pixel Segmentation” or the “Trainable Superpixel Segmentation”, and compared with the traditional “point frame measurement” method for plant abundance determination at the species level. Both machine-learning based methods performed very well regarding image classification efficiency and reproducibility (using fast random forest algorithm), with the best results obtained with a minimum image label number of 16 per object category to be classified (pouzzolane, moss, sedum and grass species). Moreover, preliminary image segmentation into superpixels with jSLIC (Simple Linear Iterative Clustering) with an initial grid size of 1 (and a minimum label number of 4 per object category to be classified) allowed for highly satisfactory classification results in a few seconds only, which would facilitate the use of such imagery tool for routine survey.

00613
Modeling of a climate-adapted tree species distribution for Germany based on National Forest Inventory and remote sensing data. Tree Species Project

If you have chosen the theme "free topic" please indicate 1 or 2 keywords here.
Forest Inventory, Tree Species Map

Poster

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Abstract

Forest ecosystems are strongly influenced by climate change and currently one of the main concerns of forestry is the development of adaptation strategies. Knowledge of the occurrence of specific tree species in a given area, combined with current and future local growing conditions, is essential to carry out the design of adaptation scenarios for the future.
This requires accurate information with high spatial and temporal resolution. With the "Tree Species" project, we want to provide a database and models to select tree species adapted to the changing climate and local habitat conditions in Germany.
Such data, which are essential for good forest management planning, are not yet available at the national level in Germany. In particular, spatially explicit data on the current distribution of tree species, which could be used to develop maps and decision-support tools, is lacking.
The current distribution of tree species will be determined within the project itself based on spatial and temporal remote sensing data from the Copernicus program. Artificial intelligence algorithms are used to classify the time series. Data from the National Forest Inventory are also used to obtain the required training data.
The first step in our project is to develop an up-to-date map of the occurrence of tree species based on these data.
The following results and products are to be developed and made freely available as part of the project:
1. Analysis of high-resolution digital ortho aerial photographs (DOP)
- Development of a method based on 'deep learning' for detection of individual trees and delineating tree crowns,
- Development of a method for estimating local species composition,
- Application of the above studies (a) and (b) on all inventory plots for which suitable images are available.
2. Analysis of Copernicus satellite data
3. Development of recommendations for species composition adapted to climate and stand condition.
Expected results:
- Map of tree species composition for the whole of Germany, including the most dominant species,
- Map of resistance indicators,
- Map showing the optimal distribution of tree species adapted to habitat conditions and future climate,
- Recommendations to help strengthen stable forest ecosystems.

00683
SORTEE: promoting open, reliable, and transparent ecology and evolutionary biology

Poster

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Abstract

Science and society benefit when scientists conduct research in a transparent, reproducible, and collaborative fashion. SORTEE (the Society for Open, Reliable, and Transparent Ecology and Evolutionary biology) was founded in December 2020 with the aim of bringing together researchers working to improve reliability and transparency through cultural and institutional changes in ecology, evolutionary biology, and related fields. In 2021, over 800 researchers became members of SORTEE and registered for the Society's first annual virtual conference. This poster will showcase the SORTEE's success and activities thus far and provide conference attendees with information and resources on how to engage in open, reliable, and transparent research practices.

00684
Designing of a long term environmental observatory around an industrial project: Ex of Andra - Ope

Poster

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Abstract

Our societies are campaigning for tight regulation on environmental impacts, pushing the industries to invest in environmental monitoring programs though out the life cycle of projects.
From 2007, the French National Agency for radioactive waste management (Andra) in charge of implementing the Cigéo project, a deep geological disposal for High Level Nuclear Waste (HLW) and Intermediate Level-Long lived Nuclear waste (IL-LLW), set up a long-term environmental observatory (Observatoire pérenne de l'environnement, Ope), before any construction started. If Cigéo project is accepted, Ope will then be an exceptional environmental monitoring tool recording, over the Cigéo secular operating period, the evolution of its rural host territory currently dominated by agriculture and forestry.
Ope facilities and monitoring programs on water, air, soil and biodiversity were set across a 350km2 area to record any changes in ecosystems quality, to identify the origins of these changes and to discriminate those of the Cigéo project from those due to other origins (climate, socio-economic drivers, input of human activities..).
From the beginning, Ope was not strictly defined by regulatory demands but went further. It took part in national/international environmental research programs such as the French soil quality monitoring programs (INRAE) or ICOS for greenhouse gases. Ope therefore provides a multidisciplinary, multiscale set of environmental data. The Ope also aims to develop interactions with local communities to address their needs through for instance contribution to the design of tailored made decision tools on land management or targeted education programs on environmental issues. To comply with regulation demands for a more integrated approach to impact assessment, the Ope is continuing its evolution and started to include human activity monitoring and ecosystemic services evaluation.

00112
Socio-ecological niche differentiation for two Génépi species subject to natural harvesting

Oral

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Abstract

Ecological niche differentiation is a key element in our understanding of patterns of species' distributions. As the Anthropocene has advanced, human impacts on species have become a major factor affecting species' distributions, a subject that has primarily been studied in relation to climate change. However, human effects on wild species can be more direct, e.g. hunting and natural harvesting.
Génépis are Alpine wormwoods (*Artemisia eriantha, A. genipi, A. glacialis, A. umbelliformis*) originally used for herbal teas, and harvested nowadays mainly for the preparation of liqueurs. These species are quite rare as they mainly grow above 2400 m.a.s.l., but little is known about the impacts of human harvesting on their distribution. In addition, in the southern Alps the four species occur with overlapping distributions.
Here we propose a comparative study of two of the Génépi species, *A. umbelliformis* and *A. glacialis*. We first focus on their ecological niche at regional and local scales, and then integrate information on natural harvesting to compare their socio-ecological niches. We include broad-scale topographic comparison of Génépi sites in the southern Alps, fine-scaled field measurements of soil, biotic and abiotic conditions where plants grow, and field counting of flowering stems remaining after a season of harvesting, for ca. 30 sites in the Mercantour National Park. Sites were chosen in order to compare sympatric and allopatric populations of each species.
We found no marked difference between the ecological niche of *Artemisia umbelliformis* and *A. glacialis* for abiotic factors structured at a broad scale, but detected significant soil and biotic cover preferences, which are factors varying on a fine scale. The rate of natural harvesting is highly variable between sites and may be linked to the ecological niche in an indirect way, through accessibility and density of plants and populations. Interviews with park management staff suggest that non-ecologic variables are important for the choice of sites of harvesting, e.g. uses and a sense of place.
Transdisciplinary approaches are essential to understand the socio-ecological niche of Génépi species, and this knowledge is central for conservation in order to maintain traditional practices and sustainable use of a rare resources.

00279
Recreation, pastoralism and biodiversity : how does the environment contribute to their spatial coexistence ?

Poster

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Abstract

The expansion and diversification of recreational practices in mountain areas lead to an increase in conflicts with other uses of these areas, particularly those related to pastoralism, and to higher potential impacts on biodiversity. Understanding the factors involved in the coexistence of all these uses in space and time would give stakeholders the keys to mitigate, avoid or reduce conflicts and impacts. Nevertheless, existing studies rarely integrate the diversity of uses of mountain socio-ecosystems by humans and non-humans at a fine spatial scale. Moreover, the specific influence of environmental factors on the coexistence between biodiversity and human activities is poorly identified. Our objectives are i) to explore the spatial associations between uses of mountain spaces related to various human and animal activities, ii) to identify geographical areas of coexistence between multiple uses along the season, and iii) to determine the spatial characteristics associated with these multiple uses.

We mapped the uses of three categories of activities: wildlife (black grouse lekking and breeding), recreation (hiking and mountain biking), and pastoral (sheep bedding and grazing), in a Natura 2000 area located in an alpine mountain range during summer (Belledonne, northern French Alps). We believe that the environment, its structure, resources and functions affect the spatial organization and coexistence of uses in the study area. Based on the biogeographic concept of abiotic and biotic filters and dispersion as factors of species distribution and considering the anthropisation of the environment and its temporal dynamics, our analysis framework decomposes spatial resources into six major dimensions (biomass, vegetation structure, abiotic conditions, spatial context, dynamics and infrastructures) for which we computed about forty variables. We then used spatial analysis and multivariate statistics to characterize the areas of coexistence between human and animal activities.

Our integrative approach allowed us to identify environmental characteristics of potential conflict zones, and to measure the strength of spatial dependence between different activities. These relationships may also change over the season. However, some other factors such as past user behaviour, external information and local policies also affect the distribution and coexistence of living beings in the mountains.

00317
Symbio(s)cene: Arts & sciences collaboration for an era beyond the Anthropocene

Poster

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Abstract

Symbio(s)cene is a non-profit initiative with a vision to contribute to shaping a new mindset that promotes thinking beyond the Anthropocene. The biodiversity and climate crises make global, profound and transformative change urgently necessary. We are convinced that a new way of thinking, rooted in a renewed humans-nature relationship, is necessary to promote this change. It requires a new awareness of nature, an openness to and appreciation of other living things, and a new aesthetic that appreciates the beneficial character of natural materials and structures. With the Symbio(s)cene initiative, we want to show examples that demonstrate that a future worth living in is already within reach, and we want to contribute with projects that accelerate the emergence of a new mentality that embraces a positive human-nature relationship. The distinctive proposition of our initiative is a holistic approach that interconnects sciences and arts – giving space to both cognitive and emotional dimensions of knowledge. The poster will present our motivation and goals, and will provide examples for current and future activities.

00416
Assessing stakeholders' perspectives on cultural ecosystem services provided by urban trees

Oral

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Abstract

This research presents a participatory technology method for assessing stakeholders' perceptions of cultural ecosystem services provided by urban forests in Karlsruhe, Germany. While urban trees provide diverse cultural ecosystem services which are non-material values people obtain from nature including leisure, aesthetic pleasure, physical and psychological benefits, and spiritual experiences, limited research has analyzed stakeholders' perspectives and included them in urban forest management. To incorporate residents' views on cultural ecosystem services to urban forest management, this research conducts an interdisciplinary and socio-ecological assessment of cultural ecosystem services of urban trees in Karlsruhe, Germany with surveys. Structured questionnaires are conducted in summer and winter for the two consecutive years to examine changes in perspectives over time and season. By interviewing diverse stakeholders, the difference between stakeholder groups in viewing cultural ecosystem services provided by urban forests is investigated. The result of the study will provide insights into improving criteria and indicators for cultural ecosystem services to make a systemic decision on urban forestry management, including perspectives on diverse stakeholders and citizens.

00420
The impact of structural diversity on the socio-ecological significance of urban green spaces - introduction to a new project

If you have chosen the theme "free topic" please indicate 1 or 2 keywords here.
Urban ecosystem services

Poster

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Abstract

Urban green spaces help to mitigate local impacts of climate change through temperature regulation and habitat provisioning for urban wildlife. In addition to their biophysical-climatic and ecological effects, urban green spaces (UGS) can also improve the physical and mental well-being of urban residents by providing space for relaxation, recreation and socializing. Although the socio-ecological significance of UGS is becoming increasingly relevant in urban planning, the health-promoting influence of UGS across different spatial and structural gradients is not well understood. How does the UGS size influence the perceived well-being? Which green structures are particularly responsible for the positive bioclimatic and health effects of UGS? Our research on various UGS in Munich, Germany aims to describe the relationship between human well-being, the structural diversity of UGS, their plant species composition and the microclimate. We predict that even small UGS can already provide valuable ecosystem services. Furthermore, we hypothesize that many distributed, small UGS can have a higher socio-ecological effect on an urban environment compared to a few large ones. Here we present our interdisciplinary approach that combines qualitative social science with quantitative natural sciences to investigate 60 differently-sized UGS within the city of Munich. This includes: (i) a detailed structural analysis of the selected UGS using new methods in terrestrial mobile laser scanning; (ii) biodiversity and temperature monitoring within and outside the UGS to evaluate the microclimatic and ecological dynamics; (iii) surveys and interviews on the health effects and the social significance of UGS; and (iv) citizen science approaches to source locations of important UGS in the city. The findings will inform city planning on how UGS can be designed, protected and developed to create spaces for urban residents to meet and relax and to improve urban climate.

00516
Opportunistic plant observations capture shifts in species phenology

Poster

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Abstract

The number of dedicated observers in phenological observation networks is steadily decreasing, thereby lowering the quality of phenological interpolation products. The timing of plant observations performed by users of plant identification apps may help to provide additional data on the phenology of various species. As users are often attracted by plants in specific phenological periods (e.g., flowering/fruiting), a peak in observation numbers is often detectable. Here we compare the patterns in the timing of observation data for certain species and compared it for two subsequent years.
We compiled plant observation data originating from different plant identification services for the years 2020/2021. For 27 species, we compared the peaks of measured observation as well as interpolated peaks derived from an SVM model on a scale of 50x50km grid cells across Central Europe. The peaks of opportunistic species observations show a delayed phenology in 2021 when compared to 2020 for most species. The phenological shift amounts to two weeks in spring and early summer, levelling out towards the end of the vegetation period. Reference observations obtained from National Meteorological Services show similar patterns of plant phenology.
We conclude, that plant phenologies derived from unstructured plant observations provide temporally fine-grained information on phenological events that can be used to inform phenological observation networks or parameterize models. However, an important bottleneck is the number of available plant observations per area.

00576
A CITIZEN SCIENCE-BASED WILD BEE MONITORING APPROACH- HOW VOLUNTEERS WITHOUT TAXONOMIC KNOWLEDGE SURVEY CAVITY-NESTING HYMENOPTERA

Oral

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Abstract

Wild bees are important pollinators of numerous wild and cultivated plants. The occurrence and abundance of wild bees are mainly influenced by the presence of food and nesting resources within a radius of a few hundred meters. In order to be able to relate changes in abundance and diversity of cavity-nesting wild bees to heterogeneity of agricultural landscapes, and thus to advice policy-makers, there is a need to survey wild bees at long-term. To tackle this issue, we designed a wild bee monitoring scheme. One of the main objectives of the monitoring is to integrate volunteers in data collection and in species identification.

Nesting aids are used as a non-lethal and citizen science-based sampling method to survey cavity-nesting taxa in agricultural landscapes. Due to the simple handling and the possibility to follow the development of wild bees, they enjoy great popularity with volunteers. Taking monthly photos of each nesting board from April to September, volunteers without taxonomic expertise collect unbiased data of occupation rate and species. In order to ensure that this approach allows non-disruptive monitoring of local populations, we compared occupation rate, diversity and development of the taxa between controlled and uncontrolled nesting aids. There was no significant difference with regard to the parameters mentioned.

Furthermore, we studied whether volunteers can additionally be involved in species identification. After conducting identification courses during monitoring season, twelve participants attempted to identify cavities of 50 nesting aids, relating to 4,203 cavities. In total, the identification success rate reached 92.4 %. 2.8 % of the cavities contained taxa that could not be classified and 4.8 % were not correctly identified by volunteers. In principle, nesting aid inhabitants of larger cavity diameters and those with clearly recognisable characteristics for identification were correctly identified more often.

The monitoring approach presented here allows volunteers to participate without taxonomic knowledge. Thus, it represents a way of responding to the great willingness in society, including farmers, to get involved in wild bee conservation. Moreover, this non-lethal sampling approach enables to raise the awareness about the underlying relationship between wild bee diversity and heterogeneity of the surrounding agricultural landscape.

00581
The Attitudinal Space Framework: embracing the multidimensionality of attitudinal diversity

Oral

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Abstract

Attitude polarization describes an increasing attitude difference between social groups and has important ramifications for the social, political, and economic aspects of peoples' lives. For instance, attitude polarization among conservation stakeholders can strongly affect the management of natural resources. The recognition that attitude polarization is a multidimensional phenomenon has gained momentum, but a unified framework to study polarization across multiple dimensions is lacking. We fill this gap by introducing the Attitudinal Space Framework (ASF) inspired from functional ecology, implementing a distance-based approach that fully quantifies attitudinal diversity and characterizes weak and strong polarization across multiple dimensions. We highlight two key measures – attitudinal extremization and attitudinal dispersion – as indicators to quantifying across- and within-group patterns, and illustrate their relevance with two case studies. First, we examined attitudes towards wolves that had been extirpated and are currently recolonizing in Germany. Surprisingly, despite lower appreciation of wolves and higher desire for control in the recolonized regions, we did not find differences in attitudinal extremization or dispersion, suggesting only weak attitude polarization between regions with and without wolves. Second, to demonstrate the broad applicability of the ASF, we show that affective polarization in the US electorate is weaker than previously thought. We show that in both Democrat and Republican partisans, attitudinal dispersion increased between 1988 and 2008, indicating that both groups have become more heterogenous and are less polarized than expected based on mean differences alone. These results illustrate how the ASF is applicable to a wide range of social-ecological systems, and how it can shed new light on the mechanisms underpinning attitude polarization.

00628
NOZ BREIZH UNIVERSITY CHAIR

If you have chosen the theme "free topic" please indicate 1 or 2 keywords here.
Night natural corridors

Poster

E. Hernandez Gonzalez [1], X. Dauvergne [1], S. Gallet [1], O. Augereau [2], C. Fraïsse [1]

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Abstract

The Noz Breizh Chair is a scientific consortium created in 2021 and launched with the help of the UBO Foundation. This scientific chair aims to design transdisciplinary scientific programs and organize multi-partner scientific projects related to the night and nocturnal activities. Our case studies are located in Brest Métropole.
There are three areas of research (social, technological, ecological) which, through an interdisciplinary approach, establish a dialogue and co-design theoretical and practical tools.
1. Social
This area of research is dedicated to the analysis of the social practices of the city at night. It is based on scientific methods used in urban planning and sociology in order to understand and identify urban polarities related to nocturnal urban practices. Its aims are to conduct a detailed analysis that takes into account both people and activities of the night city, with the objective of improving the management of urban light policies (private and public). We work in partnership with sociologists and psychologists.
2. Technological
This research area studies the role of public lighting of the “smart city” from a critical perspective, particularly with regard to the use of digital technologies in connection with the lighting network. We will explore the relationship between digital solutions and energy saving, as well as potential solutions to measure the impact of artificial light on biodiversity. We work in partnership with specialists in engineering and technology.
3. Ecological
This third area of research identifies the nocturnal biodiversity of the defined study area beyond the most commonly studied species (e.g. chiropterans). The results can inform our hypotheses on the potential impact of decreased artificial light pollution on biodiversity. We work in partnership with researchers in ecology, biology and botany.
We propose to present our first steps and protocols set up within the framework of the Noz Breizh Chair.

00644
WHY IS THE ROLE OF BIODIVERSITY SO HARD TO RETELL? DYNAMIC EFFECTS IN PUBLIC BIODIVERSITY NARRATIVES

If you have chosen the theme "free topic" please indicate 1 or 2 keywords here.
Systems Thinking

Poster

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Abstract

While attributes of (mal)functioning ecosystems are mainly assigned to the professional disciplines of ecology and conservation, the relevance of biodiversity and ecosystems also becomes more important in public communication in a world of climate change. However, especially when compared to the climate crisis, the global decline of biodiversity appears to be more challenging to communicate. This may be due to several reasons, many of which boil down to the complexity of biodiversity and its functions, or to the complexity of human relationship with the environment.

In public discourse we stumble over facts and conditions which make it difficult to comprehend the importance of biodiversity for the resilience of ecosystems under a multitude of pressures. These facts and conditions include the conflict between species- and ecosystem-focused conservation, the lack of knowledge regarding the significance of resilient ecosystems in the face of climate change, as well as human value systems regarding relationship between human society and wild and captivated animals. Guilty conscience and a sense of powerlessness, arising when we are confronted with complex problems which we are jointly responsible for, represent another obstacle. For many people, civilized human life appears to be detached from nature, whilst sustainable decision making processes demand general appreciation of well-functioning natural systems as valuable common property as a basis.

Here, we explore dynamics in environmental psychology and major characteristics of the complexity of biodiversity conservation to gain insights into how the public narrative of biodiversity conservation can be improved towards increased awareness in society. To investigate these psychological and biodiversity-related factors, we use systems approaches from the field of Systems Thinking, such as System Dynamics and Critical Systems Heuristics. We argue that illustrating the abovementioned factors in more detail allows for observing significant obstacles and attributes which need to be considered when retelling the role of biodiversity to the public.

From a systemic analysis of biodiversity narratives novel approaches can be derived. Enhanced insight into predominant dynamics in public biodiversity discourses holds the potential of revealing hindering characteristics. These can serve as guiding reference points for the development of a successful public biodiversity communication.

Phenotypic plasticity, epigenetic, and environmental change

00669
The impact of increased nighttime temperature on the phenotype of a vertebrate ectotherm and its plastic aspects

Poster

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Abstract

Several recent studies show that climate warming is happening asymmetrically, with nocturnal temperatures increasing at a faster pace than diurnal temperatures, in some cases at double the rate of warming. Still, in most studies focusing on global warming, temperature increments are considered as constant over a 24h cycle or as a purely diurnal factor, leaving the effects of nocturnal warming largely unknown. Because ectotherms rely on external heat sources to optimize their body temperatures and physiological functions, they have been recognized to be among the most vulnerable species to global warming. In ectotherms, previous work has shown that an increase of only 2°C is sufficient to induce a disproportionate increase in metabolic expenditure. Warmer nights may expand ectotherms' species thermal niche and open new opportunities for prolonged activities and improve foraging efficiency. However, increased activity may also have deleterious effects on energy balance if exposure to warmer nights reduces resting periods and elevates resting metabolic rate. We designed an experiment to test whether increased nocturnal temperatures is beneficial or deleterious to ectotherms. We designed an experiment design in which we exposed lizards to a full-factorial combination of elevated daytime and night time temperatures. Before the treatments began and then after 6, 12 weeks of treatment; we measured different phenotype traits like: Diurnal and nocturnal metabolic rates, Thermal preference, Sprint performance and Activity pattern. This design allows us to asses potential plasticity in the complex multivariate thermal-metabolic phenotypes of lizards subject to warming at different times of the diel cycle. The aim of this project is to enrich our fundamental knowledge on the future impacts of global warming on ectotherm populations in order to better predict and mitigate the outcomes of continued warming.

00121
Multiple global change factors affecting the plant community

Poster

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Abstract

Plants are subject to various human-induced stresses due to global environmental change. Among the anthropogenic factors are higher temperature and drought as well as different biocides and other chemicals, microplastics, heavy metal pollution and increased salinity. Yet, experiments involving multiple global change factors are rare. Here we present preliminary findings of a field experiment that includes ten single-factor-treatments and a factor gradient in which up to ten global change factors were combined. Different species of plants show different patterns in the percent cover per plot, quantity of flowers, and other fitness-related parameters suggesting differences in tolerance to multiple stresses. We discuss these species-specific responses in terms of long-term effects on plant communities.

00229
Contrasting ionomic signatures of plants growing on metalliferous soils in New Caledonia

Oral

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Abstract

The island of New Caledonia in the south West Pacific has particularly large surfaces of ultramafic substrates which have low concentration of macronutrients (N, P, K) and excess of metals (Cr, Mn, Ni). It has nevertheless a rich and unique flora with a unique shrubby vegetation, maquis, and is considered as a biodiversity hotspot. The flora encompasses a large number of metal hyperaccumulating plants, which are able to accumulate in their leaves metals at concentrations 100 to 1000 times higher than normal plants. We designed a plot of 20 × 20 m on Ferritic Ferrasols where we sampled all individual plants exceeding 1 m height. We measured the concentrations of 20 elements on 474 individuals representing 37 species and 22 families. The plot includes a large diversity of root symbioses and both Ni and Mn hyperaccumulators. We observed a large diversity of mineral nutrition strategies of plants, and this is in line with the Old Climatically Buffered and Infertile Landscape (OCBIL) theory of Hopper (Plant and Soil, 322: 49-86, 2009) who predicted nutritional specialization on infertile substrates. Nickel and manganese hyperaccumulation can be two different responses to the same soil conditions. An underground niche partitioning for mineral resources could explain the high alpha diversity observed on adverse geological substrates.

00493
The influence of climate and habitat on photosynthetic pathways and chlorophyll fluorescence in a West African savannah ecosystem

Poster

D. Jakubka [1, 2], S.F. Bucher [1, 2], M. Schmidt [3], I. Zerbo [4], S. Traoré [5], A. Thiombiano [5], K. Hahn [6], M. Bernhardt-Römermann [1, 2]

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Abstract

Photosynthesis is one of the key functions in carbon sequestration and basis for life on earth as we know it today. Several photosynthetic pathways evolved independently, the two most abundant being the C3 and C4 pathway. C4 metabolism is beneficial in dry and warm climate due to the possibility to carry out photosynthesis when the stomata are closed. One possibility to characterize differences in plant fitness, i.e. performance at different environmental conditions, are measurements of chlorophyll fluorescence.

Within this study we aim to assess the potential of chlorophyll fluorescence measurements (Fv/Fm and the performance index PIabs) to characterise plant performance and related implications for the abundance and competitive advantages in ecosystems harbouring C3 and C4 plants. Specifically, we will focus on savannah grasslands with a high proportion of C4 plants in Burkina Faso. The study sites describe a strong precipitation gradient, which potentially influences the ratio of C3 to C4 plants.

Our study of 316 species on 181 plots showed that C3 and C4 plants are nearly equally distributed along the precipitation gradient, habitat types and areas with different water availabilities in terms of species numbers (60% C3 plants, 40% C4 plants), but C4 plants always had a higher cover. The chlorophyll parameters were, contrary to our expectations, significantly higher for C3 plants compared to C4 plants. C3 and C4 plants have different investment strategies: While C3 plants have best photosynthetic performance and plant fitness when growing in small patches (despite the influence of habitat or area), C4 plants are fitter (despite the influence of habitat or area) with higher abundance.

With a view to the environmental factors influencing Fv/Fm and PIabs we found skeleton fraction increasing the plant fitness parameters due to the positive effects for plant-available nutrients in the skeleton fraction. The Cation exchange capacity (CEC) of the skeleton part of the soils can be as high as the CEC of fine earth, but in contrast to fine earth stones provide a more favourable environment for nutrient uptake by plants because of the high density of rhizomorphae and therefore hyphae growth and nutrient uptake.

00600
Decoupling eco-evolutionary variation on floral nectar sugar composition across central Europe

Poster

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Abstract

Floral nectar sugar composition (mainly sucrose, glucose and fructose) is widely assumed to reflect pollinators' nutrition demand and foraging behavior, but relative impact of evolutionary and abiotic factors on nectar sugar composition, as well as the generality of these associations across the angiosperms remain unknown. We compiled data on nectar sugar composition for over 400 plant species across central Europe, along with information on phylogeny and plant functional traits such as plant corolla tube length, flower color and floral symmetry to provide a comprehensive assessment of variation in nectar sugar composition. Variation partitioning is used for decoupling different and complementary information about nectar sugar composition and interpreting unique and overlapping contributions. We expect that both evolutionary (phylogeny) and ecological information (plant traits) would be uniquely critical for determining nectar sugar composition at large scales. Specifically, sucrose is more related to phylogeny as well as flower symmetry and corolla tube length. This may give an insight into how important the contribution of evolutionary and ecological processes and their interactions are to observed shifts in population and community characteristics.

00652
Changes in taxonomical diversity in the vineyard flora with succession on abandoned vineyards

Oral

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Abstract

In previous times, vine was cultivated on all slopes surrounding Jena, Germany. This practice was stopped during the late Middle Ages as other sources of income were more rewarding. The vineyards were abandoned, but old plants persisted in some places around Jena. In this project, we investigated the succession on these abandoned vineyards as little is known about these north of the Alps. However, it is critical to study the vineyard legacy to understand the function of the abandoned anthropogenic ecosystems.
We selected multiple sites in the vicinity of Jena, where old wine plants can still be found in the landscape. We identified plants and mosses as a resurvey on the same sites conducted in 2004. Since the last survey, the region was impacted via climate change, invasive species were becoming more dominant in the region and a close by motorway was abandoned in one of the sites.
As the data collection is still ongoing we hypothesize that the vegetation will have changed tremendously since the last survey in 2004, with more thermophile species and also fewer species linked to air pollution due to the motorway.

00063
Effects of tropical tree leaf trait composition on abundance and body mass of herbivorous arthropod communities

Oral

J.E. Schön [1], Y.C. Tiede [1], M. Becker [1], D.A. Donoso [2], J. Homeier [3], O. Limberger [1], J. Bendix [1], N. Farwig [1], R. Brandl [1]

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Abstract

In tropical forests, herbivorous arthropods remove a considerable amount of leaf area, forcing plants to evolve defense strategies. These strategies influence the palatability of leaves. Palatability in turn influences both the abundance and mean body mass of not only individuals but also whole communities of herbivorous arthropods. Among arthropod communities, chewing feeding guilds form the most dominant group. We tested two hypotheses: (1) The abundance of chewers is positively related to the palatability of host trees, (2) a lower palatability leads to an increased mean body mass of chewers (Jarman-Bell principle). We collected leaf chewers and rostrum chewers from 92 tropical tree individuals of 32 species in three plots at 1000 m and 2000 m a.s.l. respectively by fogging tree canopies. For palatability measurements, we measured several leaf traits of each host tree and conducted a feeding trial with the generalist herbivore *Gryllus assimilis* (Orthoptera, Gryllidae). Leaf traits showed complex guild specific effects on chewer abundance. Leaf chewer abundance was positively affected by the experimentally determined palatability, rostrum chewer abundance was not. Neither leaf traits nor the experimentally determined palatability affected leaf chewer mean body mass. Rostrum chewer mean body mass was positively affected by palatability. Thus, leaf traits and an experimentally determined palatability influenced the abundances and the mean body mass of chewing arthropods on the community level. However, the data did not show evidence for the Jarman-Bell principle.

00248
Implications of plant modulation of nitrification for ecosystem structure, functioning and resilience

Oral

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Abstract

Some plants, via their action on soil microorganisms, are able to modulate soil nitrification, i.e. the transformation of ammonium into nitrate. In this theoretical work, we study how the co-variation between plant modulation of nitrification and preference for ammonium vs. nitrate impacts ecosystem properties such as productivity, leaching and overall resilience of the system. While our model is general, we also contrast two empirically based parameter sets derived from two contrasted ecosystems (Lamto savanna (Ivory Coast) and Pawnee short-grass prairie (USA)). Modulation of nitrification can maximize productivity by minimizing nitrogen losses. With the Lamto savanna parametrization, productivity is for instance maximal for plants that slightly prefer ammonium and inhibit nitrification. Such situations however rely on strong positive feedbacks that could cause abrupt shifts from a highly to a lowly productive ecosystem. While contrasted nitrogen preferences offer as expected the possibility of coexistence through niche partitioning, we stress how modulation of nitrification can be framed as a niche construction process that adds an additional dimension to coexistence conditions.

00297
Drought-induced defoliation affects the climatic disequilibrium of recruit communities in Mediterranean shrubland

Poster

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Abstract

Climate change is determining plant community processes, particularly under extreme climatic events, such as droughts. Positive plant-plant interactions (facilitation) are expected to allow recruitment and establishment in populations located far from their respective species' climatic optimum. Therefore, at community level, such interaction would tend to increase climatic debt, i.e., the mismatch between the macroclimatic conditions and the climatic requirements of the existing community. However, this effect could diminish when canopy cover is negatively affected by extreme drought events (i.e., vegetation die-off), thus contributing to assembly processes. Here we analyze the climatic disequilibrium - calculated from species distribution models - of the recruiting plant community across different degree of drought-induced canopy defoliation, also considering facilitation, neutral and inhibition plant-plant interactions estimated from spatial patterns. We carried on the study in a Mediterranean shrubland that suffered an extreme drought episode. Overall, under canopy, the recruiting community exhibited higher climatic disequilibrium than in gaps, as predicted. The facilitated recruiting community growing under dead canopy showed the highest disequilibrium, not very different from the recruiting community growing under unaffected canopy, while the one growing under moderately affected canopy exhibited the lowest climatic disequilibrium. The climatic disequilibrium of the recruiting communities experiencing neutral and inhibited interaction did not vary across the canopy defoliation gradient. These results are explained by a balance between facilitation and competition. Dead canopy would provide some climatic buffering to the recruitment community, thanks to remaining structures, while releasing recruits from resource competition with alive plants; however, this climatic buffering would be lower that under unaffected canopy. These results highlight the importance of climatic buffering in plant-plant interactions, particularly facilitation, to better explain vegetation responses to extreme climate events associated to climate change.

00351
Spatio-temporal variation and spatial synchrony in flight dates in two corn borers

Oral

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Abstract

Spatial synchrony in phenology is ubiquitously observed though populations living in spatio-temporally varying environments are rarely subjected to the same conditions and phenology is influenced by various environmental factors. Identifying drivers and extent of synchrony is essential to better understand population dynamics, interactions and expansions. Such knowledge is notably of major interest to predict responses to climate change or managing pest outbreaks on crops. Indeed, determining the timing of pest emergence and the extent of synchrony among populations could allow predicting why, when and where damages occur and, thus, timely management strategies. We studied drivers of spatial synchrony in flight dates of two multivoltine maize pests, the European and Mediterranean corn borers (*Sesamia nonagrioides* and *Ostrinia nubilalis*), across France. Due to spatial autocorrelation in the environment and dispersal among populations, we expect greater synchrony between populations spatially close. However, environmental heterogeneity at small spatial scales may reduce synchrony between nearby populations and micro-climatic conditions may synchronise distant populations. Therefore, we also expect populations subjected to similar climatic conditions to be more synchronised in flight dates independently of geographic distance. Moths of both species were captured with traps placed in 470-1600 maize fields throughout the flight season between 2004-2021 in 22 metropolitan departments. We identified the flight period of the different generations using mixture models. We will then characterize spatio-temporal variation in flight dates of each generation and test climatic drivers using generalized linear models. We will also estimate spatial (a)synchrony caused by geographic and climatic distance among populations. This study will inform us on the importance of climate on flight timing of corn borers and thus on populations likely to interact. More generally, this study will provide insight on the relative contribution of geographic and climatic distance on spatial population synchrony.

00414
A combination of immediate and lagged responses to autocorrelated climate can benefit or hinder the long-term growth rate of populations

Poster

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Abstract

Climate variability will increase with climate change, and thus it is important for population ecologists to understand its consequences for population dynamics. Four components are known to mediate the consequences of climate variability: the magnitude of climate variability, the effect size of climate on vital rates, covariance between vital rates, and autocorrelation in climate. Recent studies have pointed to a potential fifth component: the different time windows of vital rate responses to climate (vital rates responding to current and lagged climate). We hypothesize that this component might modify the consequences of climatic variability on long-term population growth rates directly and interactively with other components.
Here we investigated the role of all five components on stochastic population growth using simulations of a hypothetical species with vital rates resembling a perennial plant, and simulations on 24 real plant populations (16 species) with existing long-term matrix population models (MPMs).
In the simulations performed on the hypothetical species, we found that including different time windows for vital rates responses to climate can reduce the negative influence of increasing climate variability. This buffering effect was especially strong when climate drivers change vital rates in the same direction, and when climatic autocorrelation is negative. Our analysis of 24 populations shows that the buffering effects seen in the hypothetical species can extend to a diversity of life histories. Moreover, we show that the buffering effect leads to significantly higher population growth rates, even though most populations are subject to a moderately positive autocorrelation.

00465
Tracking the fate of animal-dispersed seeds through the life of a plant

Oral

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Abstract

Seed dispersal by frugivorous animals is expected to be beneficial for the plants they disperse. Yet, evidence for the benefits of animal seed dispersal over the full life cycle of plants have rarely been studied directly. In this study, we explored long-term effects of the seed dispersal mutualism between 20 frugivore species and the population of the mid-successional tree *Frangula alnus* in the old-growth Białowieża Forest (Poland) using animal-explicit, microhabitat-structured integral projections models. Population growth increased by 2.5% when seeds were dispersed by animals instead of gravity. The effectiveness of animal species for seed dispersal was strongly related to the quantity, but unrelated to the quality of seed dispersal. Consequently, simulated species extinction decreased population growth when common rather than rare mutualist species were lost. This highlights the role of frequently-interacting animals for seed dispersal of plants, and suggests that the interaction frequency of species can be used as a surrogate for the effectiveness of species interactions.

00278
Restoring insect diversity in intensive grasslands by establishing native grassland flower strips

Poster

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Abstract

Given a large number of interferences between insect groups as well as different land-use practices, the topic insect restoration rapidly gains attention in ecological complexity, especially if sites are surrounded by landscapes of high habitat diversity. The overarching goal of the study was to investigate whether newly established flower strips will transform intensive grasslands into biodiversity-rich grasslands to conserve native grassland insect diversity. We analyzed how quickly newly established flower strips enhance insect diversity in nearby intensive grassland compared to separated intensive (control) and extensive grasslands. Further, we involved local stakeholders for assessing in a participatory way how the restoration activities were perceived and if they had an impact on aspects such as beauty or attractiveness. Heteropteran bug species richness and syrphid abundance and species richness were significantly highest in flower strips. There was a significant difference between management types regarding the number of bumblebee individuals. Contrary, butterfly abundance and species richness were significantly higher in extensive grasslands compared to flower strips. Heteropteran bug species assemblages in extensive grasslands were significantly different from flower strips, intensive and control grasslands. Further, heteropteran bug abundance and species richness increased with an increase in flower frequency and plant height. Similarly, syrphid abundance and species richness significantly increased with flower frequency but decreased with vegetation structure. Butterfly abundance increased with plant species, however, species richness decreased with plant height. The extensive grassland was valued as being the most natural one and the expected relation between estimated species diversity and aesthetic valuation. Restoring biodiversity in intensive grasslands represents a real conservation challenge. Overall, restoration of insect diversity is a relatively slow process, in which colonization by each insect group is not only limited by local vegetation conditions but is also affected by the presence, distance, and connection to source populations. The results of the present study could be used to push for more active implementation of new flower-rich areas as well as for the conservation of extensively managed grassland that allows both, productive agricultural land use while maintaining and promoting insect habitats and species diversity.

00640
Return of a native Mediterranean ant community after Carpobrotus removal on a small island

Poster

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Abstract

Invasive alien species (IAS) are a major driver of global change and one of the main causes of extinctions on islands. Carpobrotus spp. is one of the most impacting and widespread plant IAS in Mediterranean areas. The study site, Bagaud Island (Hyère archipelago, South of France), was part of a 10-year program of ecological restoration that included the eradication of Carpobrotus spp. In order to study the response of ant communities to the eradication program, samplings were carried out in a control IAS-free area and in an area of the island where the IAS was present. Ants are ideal bioindicators of environmental changes, as they are strongly influenced by their environment. Pitfall traps were set up before (2010 and 2011) and after (2013, 2015, 2017 and 2019) eradication. No major changes were observed in the control IAS-free area. While no major changes of global composition were observed in the invaded area, the community structure changed significantly after eradication. Species and functional richness per trap gradually increased. Six species of common Mediterranean ants were more frequently sampled after the eradication. Carpobrotus spp. eradication increases habitat and feeding resource diversities and generates a modification of the microclimate leading to drier and warmer composition. These changes were favorable to the return of native xerophilic and thermophilic ant in the area. This study confirms the benefits of Carpobrotus eradication for native community recolonization. Moreover, it confirms that ants are good indicators of habitat restoration besides providing essential ecosystem services, such as nutrient cycling, soil aeration and seed dispersion.

00643
Short-term effects of mowing and plant species richness of river dike grasslands on carabids and cicadas

Poster

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Abstract

River dike grasslands provide habitats for insects. To guarantee flood protection, a regular albeit not intensive management is required, and favourable habitats are extensively used semi-natural grasslands. Thus, habitat quality of these grasslands for insects strongly depends on management. Mowing and hay collection always cause insect mortality, whereby the extent can be limited by an adapted mowing regime. Besides the direct effects, mowing regime can influence insects indirectly via vegetation parameters. Thereby, different insect groups react differently, depending for example on their position within the vegetation and their trophic level. Within a two-years field experiment on dikes of the River Inn in southern Bavaria, we therefore investigated the short-term effects of various mowing regimes as well as plant species richness on insects. We tested different cutting times (early vs. late), hay handling techniques (raking vs. suction) and overwintering strips (top vs. middle of the slope). To get an insight in the reaction of insects from different trophic levels and strata, we collected carabids with pitfall traps, and cicadas by sweep net sampling. The first results show a positive effect of early mowing on cicada abundance, while carabid density decreased. Hay handling technique had no significant influence and overwintering strips promoted both insect groups. We conclude that a spatio-temporal variation in mowing dates would benefit most species groups.

00081
Upscaling of ecosystem services from plot to farm scale: more complex than you might think

Poster

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Abstract

Agricultural ecosystems provide a wide range of crucial ecosystem services (ES) that are essential for human wellbeing. ES are usually assessed on three spatial scales, i.e., the plot, the farm or the landscape. Plot- and landscape-scale ES assessments are frequent, with plot-scale ES being derived by field measurements while landscape-scale ES mostly rely on modelling. So why do we need ES studies on the farm scale?

The ES of a whole farm, i.e., the farm's ES portfolio, considers the unit most relevant for several important drivers of ES such as land use change, farm economics, farming systems and policymaking. When comparing farm-scale ES portfolios, effects of farm structure, production aim and farmers individual approaches such as fertilizer use can be studied. Furthermore, trade-offs among ES that are unavoidable on the plot scale can be tackled at the farm scale. While the latter also applies to the landscape scale, such studies on a wide spatial extent often assess only few ES and/or produce relatively coarse results. Thus, we strongly encourage studies comparing ES portfolios of multiple farms, even if this requires a thoughtful upscaling of plot-level ES to entire farms.

When upscaling ES indicators or measurements from plot to farm (and landscape) scale, we have to consider several aspects, which we discuss here. The main difficulty of upscaling ES is that a simple sum or average of the plot-scale values of a specific ES on a farm only makes sense for a small number of ES (e.g. soil C storage), while many other ES require considerations of e.g. thresholds and/or spatial ES flows (e.g. biodiversity, pest control and recreation), which is closely linked to the different shapes of supply-benefit relationships.

Based on a comprehensive ES mapping on Swiss grassland farms, our study presents several examples to conceptualize options for upscaling ES assessments. This will improve our understanding of the drivers of ES portfolios and thus help optimizing the supply of multiple ES. Outcomes can provide important guidance for future ES research and support studies linking environmental, societal and agricultural drivers of ES at the core unit of agricultural production: the farm.

00274
How diversity and heterogeneity of agropastoral habitats impact the provision of ecosystem services in low mountain region: Evaluation of ES bundles and social expectations.

Poster

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Abstract

The provision of a diversity of ecosystem services (ES) or bundles of ES by semi-natural habitats is a key point for the multifunctionality of a territory. The objective of this PhD work is to assess how the heterogeneity of biodiversity and local conditions can contribute to the provision of a diverse range of ecosystem services that would meet a diversity of societal demands in a small region, the Chaîne des Puys (France). The ES diversity, in connection with intra- and inter-habitat heterogeneity, may be an essential lever to better reason the sustainability of the management of a territory. A condition is however that ES provision meet demands and needs of social actors in the territory.
This project consists in measuring several ES in a panel of grasslands, meadows and heaths habitats occurring in the landscape mosaic of this natural region. Fodder provision, carbon storage, pollination, aesthetics of plant communities, provision of wild edible plants, biodiversity conservation, soil nutrient supply to plants and habitat heritage will be considered. The study is carried out over 6 different phytosociological associations, mown or grazed, with three replicates, i.e. 18 study sites situated within agricultural plots.
We expect a complementarity of the different habitats in the provision of ES, e.g. via a phenological relay effects between plant communities which would allow the establishment of synergies and the avoidance of compromises between ES.
This project presents an applied dimension as it seeks to assess the part of the level of services that is determined by natural data (soil factors, ...) and that which depends on the type or intensity of agropastoral management.
Eventually, these results will make it possible to (i) study the relationships between ES and the different agropastoral habitats, through the identification of bundles and trade-offs of ES between and within each habitat, and (ii) to assess what are the demands and expectations of users and local actors towards agropastoral habitats. Proposals for a management maximizing the expected services can be proposed, which can initiate a "knowledge reach" with the animators relevant to the territory. Initial results will be presented.

00313
Impact of Agroforestry on Insect Pollinators in European Agricultural Land

Oral

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Abstract

Agroforestry has great potential to support biodiversity and associated ecosystem services such as insect pollination. However, research on pollinators in European agroforestry systems is scarce. Our goal is to fill this knowledge gap through sampling insect pollinators in ten agroforestry systems and twenty-two control areas. Sampling was carried out in Spain, Italy, France, and Portugal. The sites comprised both silvoarable and silvopasture, whereby control areas for silvoarable systems were forest and crop fields, and control areas for silvopasture were forest and pastures. Yellow pan traps were used to sample insect pollinators in spring 2022. We expect higher abundance and biomass of pollinators in agroforestry than reference areas due to more heterogeneous microclimate and a higher diversity in floral and nesting resources. Our work is part of the AGROMIX project (https://agromixproject.eu/), aiming to develop agroecological solutions for more resilient land use in Europe

00325
The severity of bacterial canker of kiwi (Actinidia deliciosa) under conditions of abiotic stresses

Oral

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Abstract

Crop plants are often under multiple biotic and abiotic pressures. Pseudomonas syringae pv. actinidiae (Psa, phylogroup 1) strains cause one of the most recent and economically important diseases caused by strains of the P. syringae species complex. The global epidemic has resulted in the destruction of thousands of hectares of kiwifruit worldwide and to significant yield losses. Bacterial canker of kiwifruit affects tree health through different types of leaf and wood tissue alterations, which can lead to decline of tree health and to death. There is no entirely efficient means to cure these perennial plants from Psa infections. Producers have to manage plant health in the presence of the disease over long periods of time, and rely mainly on prophylactic methods including the disinfection of tools, the surveillance of symptoms, and pruning of symptomatic canes. However, symptom expression is variable across time and environmental conditions, and remains hardly predictable especially in the context of climate change. Hence, disease management in perennial crops such as kiwifruit orchards remains difficult due to gaps of information on the effects of abiotic factors on disease severity, and even more so in light of the paucity of investigation on combined stresses. In this project, we have analyzed the effects of different abiotic factors (e.g. relative humidity, temperature, water and nutrient deficiency), alone or in combination, on the severity of symptoms of kiwifruit bacterial canker and on plant health. As an approach to field situations where producers have to manage crop health with established plant diseases, the experiments have been performed in controlled conditions, where abiotic stresses were applied after Psa inoculations to kiwifruit plants. The knowledge derived from these data will yield highlights on how to adjust crop practices for a better management and preservation of plant health when faced with multiple, and potentially changing, abiotic stresses.

00329
Temporal dynamics of *Echinococcus multilocularis* prevalence in red foxes in an endemic area : two contrasted evolutions in North-eastern France.

Poster

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Abstract

Echinococcus multilocularis (*Em*) is the causative agent of alveolar echinococcosis (AE), an expanding zoonosis. Red fox (Vulpes vulpes), the main *Em* definitive host in Europe, is responsible for most of the environmental contamination by shedding infectious *Em* eggs with their faeces. Evidence has been provided that very low density of fox populations leads to lesser contamination (Raoul et al. 2003) but that moderate population control close to the carrying capacity of eastern France ecosystems has no or even adverse effects (Comte et al. 2017). Furthermore, Schweiger et al. (2007), in Switzerland, have reported an increase of human AE cases after a large fox population increase due to vaccination against rabies. Coordinated and locally adapted strategies for prevention must be based on profound knowledge of the parasite's epidemiology. Various carnivore definitive host and several rodent intermediate hosts species carry the parasite. All of those hosts have different and complex ecology and population dynamics which, in turn, impact transmission intensity.
Based on a follow up of *Em* prevalence in foxes in France (2015-2020), ten years after a first survey (2005-2010), we report a slow geographical spread of *Em* and a prevalence increase. In the Meurthe-et-Moselle department specifically, the first survey showed that *Em* distribution in foxes was evenly distributed and prevalence was 54% (CI95% = 42%–64%) without noticeable difference among areas. Ten years after, we report a prevalence exceeding 60% in the northern part of the department contrasting with a low prevalence of 12% in the centre. Red fox abundance indices collected independently by game associations were significantly larger in the area of larger prevalence (IKA = 0.73 CI95% = 0.64–0.96 versus IKA = 0.57 CI95% = 0.52–0.63). Considering the complexity of *Em* transmission systems, one cannot infer solid conclusion from a single circumstantial observation. Our surveys however show the importance of long-term monitoring of a larger number of relevant variables in such systems, and call for replicates on appropriate scales. This would permit to gather enough information to evaluate the cost/benefit of options, for the evidence-based management of the sanitary risk caused by this parasite.

00213
High consistency of trophic niches in generalist microarthropod species (Oribatida, Acari) across soil depth and forest type

Oral

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Abstract

Many traits including trophic niche parameters are attributed to species. However, generalist species may vary in trophic niche with environments, making species-based knowledge hard to extrapolate beyond local food webs. Here we tested trophic consistency in oribatid mite species (Acari), one of the most abundant arthropods that occupy all trophic levels in soil food webs. We used stable isotope analysis to compare trophic niches of 40 Oribatida species that co-occur in litter (O_L) and soil (0–5 cm, mainly $O_{F/H}$, A_H) of five forest types (native European beech, non-native Douglas fir, range-expanding Norway spruce, two beech–conifer mixed forests). Although stable isotope signatures of bulk material differed between litter and soil, $\delta^{13}C$ and $\delta^{15}N$ values of Oribatida species were remarkably stable irrespective of soil depth. Furthermore, Oribatida species were more enriched in $\delta^{13}C$ in European beech than in coniferous forests, but $\delta^{15}N$ values of Oribatida species were similar among forest types across a range of site conditions. We conclude that Oribatida species occupy virtually identical trophic niches ($\delta^{13}C$ and $\delta^{15}N$ values) irrespective of the soil depth they colonize, and that trophic position ($\delta^{15}N$ values) of Oribatida species is highly consistent across forest type. Our findings suggest that trophic position can be used as a trait in community analysis of Oribatida across forest ecosystems. Our results further indicate that trophic niches of generalist species can be highly consistent irrespective of environments.

00299
Impact of riparian plant vegetation on soil carbon dynamics and copper retention

If you have chosen the theme "free topic" please indicate 1 or 2 keywords here.
Anthroprogenic Stressors

Poster

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Abstract

Riparian soils are exposed to different anthropogenic influences such as invasive plants and chemical pollution. Invasive plants are known for their impacts on biogeochemical soil processes e.g. decomposition of biomass due to vegetation patterns or allelopathic effects. This study investigates the copper retention of riparian soil populated by Impatiens glandulifera which is invasive to European soils. I. glandulifera is an annual plant with a fast vegetation cycle producing large amounts of biomass. Soil populated by Urtica dioica acts as a native counterpart. Chemical pollution i.e. copper is originated from agricultural managements. The mobility of heavy metals in soils depend on their chemical speciation, which depends on the physico-chemical environment impacted by the soil microbial community. In order to investigate carbon dynamics and copper retention in riparian zones, soils below these two plants (Impatiens glandulifera and U.dioica) were sampled in depths from 0-20 cm. The soil microbial and physico-chemical response was accessed by micro-respiration experiments and the determination of additional microbial parameters (i.e. ergosterol content, microbial C and N content) as well by general soil properties (EC, pH, CEC) and by characterization of SOM (amount, thermal stability, soluble content, aggregate stability. To compare the copper retention ability both soil samples from the respective plants were homogenized and implemented in leaching columns according to OECD guidelines. A flooding event with copper contaminated water was applied and four different copper extracted in order to access the mobility in the soil column and potential migration to the surrounding environment.

00364
Impact of soil faunal necromass on soil organic matter and microbial diversity

Poster

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Abstract

All animals, regardless of trophic position, will ultimately have their biomass recycled in an ecosystem upon their death, directly by their decomposition or indirectly by the decomposition of the predator that consumed them. Most studies of faunal necromass refer to the decomposition of vertebrates or aboveground animals, but little is still known about the necromass of soil fauna in this context. Due to the high abundance of especially soil invertebrates, we have to expect a huge input of faunal dead biomass throughout the year. We here discuss potential impacts that dead faunal biomass can have on the soil and the soil community. Especially the provision of short-term, high quality food sources for the microbial community does play a major role, as the presence of available chitin might increase certain bacteria and fungi that are able to break down this component. In addition, the microbial community originating from the cuticle and from the gut system of the dead individual might, at least in the short-term, affect the soil microbial community. Overall, due to its high numbers, dead faunal biomass has to be taken into account in local nutrient turnover scenarios.

00428
Effect of intercropping and organic raised-bed gardening on soil nematode community structure and metabolic footprints in tomato small-scale farming

Poster

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Abstract

In this field study, we compared the composition of the nematode communities in three tomato crop associations - bean-tomato, leek-tomato, monoculture -, and under two soil management systems - raised beds vs. flat grounds - to evaluate the impact of intercropping and soil management on the soil health status. The study was conducted in two small-scale farms with different soils (loamy vs. sandy soil) in south-western France in 2018 and 2019, and sampling was done at the end of the tomato season. Nematode communities were identified to the family level, to which colonizer-persister (c-p) values were assigned, and ecological indices and metabolic footprints were calculated. Communities indicated an enriched environment at both sites (Maturity Index <2) and a dominant bacterial decomposition pathway (Channel Index <50). At the loamy site, the crop association had an overall low effect on nematode communities. The only significant effect was the higher fungivore footprint in both associations compared to the monoculture in 2019. The soil food web was also more structured in 2019 than in 2018. At the sandy site, soil management had a larger impact than the crop association on nematode communities. A higher nematode abundance was observed in raised beds, and the communities indicated a soil enrichment in nutrients, but also a less structured food web. The bean-tomato association affected the plant-parasitic nematodes more than the other nematodes, particularly in flat grounds, in which nematodes indicated a nutrient enrichment. In the same association, an increased herbivore footprint and a decreased structure footprint, were observed in both flat grounds and raised beds. Overall, the analysis of nematode communities revealed a soil disturbance associated with the external addition of organic matter and showed a particular pattern of soil-plant interaction in presence of both tomato plants and beans, which may be linked with soil microbial communities and plant exudates. The diverging patterns of the food web structuration between both sites with also different farming history raise the issue of long-term monitoring experiments to better understand the impacts of farming practices.

00025
Ecological modeling reveals the conditionality of multiple stressor interactions

Oral

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Abstract

In most ecosystems, multiple stressors co-occur in space and time and may exhibit complex interactions resulting in non-additive (antagonistic or synergistic) responses of organisms compared to stressors acting individually. Experimental multiple stressor studies have largely focused on effects at the local scale (i.e., a single patch) and synchronized stressor occurrence. Meta-analyses have found few generalities with respect to levels of biological complexity or stressor type as to when non-additive interactions occur. We used two different modeling approaches to identify factors that may explain inconsistencies between experimental studies. First, we used a spatially explicit meta-population model for a river network (Streib et al. 2020 - Ecol. Model. 416) to explore the response of a dragonfly population to stressors with different spatiotemporal profiles at various levels of adaptation. Moreover, we used a seagrass model system (Turschwell et al. - Ecol. Let. 25) to explore the response of different levels of biological complexity (physiological, population and consumer-resource) to multiple stressors. For the river network meta-population model, we found that whether a non-additive interaction occurred depended on the stressor levels and experiment duration (i.e. time point when interaction was assessed). For the seagrass model, we found that the same underlying processes could result in additive or non-additive interactions, with interaction type depending on initial model conditions, experiment duration, stressor dynamics and consumer presence. Given the absence of standardised experimental designs, our results may partly explain the inconsistency between the results of experimental studies.

00085
Estimating process-based model parameters from species distribution data

Poster

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Abstract

- Context: Nowadays, two main types of species distribution models are used to project species range shifts in future climatic conditions: correlative and process-based models. Although there is some continuity between these two types of models, they are fundamentally different in their hypotheses (statistical relationships vs cause-to-effect relationships) and their calibration methods (dependent vs independent of the species observed distributions).
- Objectives: In order to carry out in-depth comparisons of the models, our aim here was to calibrate process-based models in the same way as the correlative models, i.e. using the geographic distributions of species. We investigated the feasibility of using an evolutionary algorithm (called covariance matrix adaptation evolution strategy, CMA-ES) to calibrate these models. This method is well established in some fields (robotics, aerospace research, …), but has been seldom, if ever, used in ecology.
- Methods: Using tree species occurrence data across Europe, we adapted the CMA-ES algorithm to find appropriate values of model parameters. We calibrated simultaneously between ten and one hundred parameters of three ecological process-based models (ForCEEPS, PHENOFIT and CASTANEA). We focused our work on three species: *Fagus sylvatica*, *Quercus ilex* and *Abies alba*.
- Results: We were able to find a parameter combination that suits best with current species distribution for the three species. CMA-ES was more efficient than a commonly used Approximate Bayesian Computation (ABC) method. For example, with PHENOFIT model, CMA-ES was able to converge to an AUC > 0.9 in less than 24 hours. However, some model parameters and processes were strongly dependent, thus different parameter combinations could lead to high model accuracy.
- Conclusions: CMA-ES is an efficient state-of-the-art method to calibrate process-based models with large number of parameters using species occurrence data. This inverse modelling strategy allowed us to efficiently parametrize a distribution-dependent version of each process-based model used in this study. Our next step is to carry out a thorough comparison of different versions of the models, with the final purpose of identifying model weakness and strengths and the causes of their robustness.

00119
Trait-based assembly of mutualistic networks

Poster

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Abstract

Due to continuous degradation of ecosystems, recovering ecosystems such as for example secondary forests play an increasingly important role in biodiversity conservation. Typically, species immigrate into such recovering habitats from the surrounding environment, which thereby serves as a source pool.
An important type of interaction in the recovering ecosystem is mutualism, as it provides ecosystem services such as pollination and seed dispersal. Due to this crucial role for ecosystem functioning and terrestrial biodiversity, it is important to understand how mutualistic interaction networks assemble after disturbance. There exist a variety of theoretical studies of how communities assemble from a species pool and by which rules the assembly process is governed, but these models are usually not applicable to bipartite mutualistic networks.
Here, we assemble bipartite networks of obligate plant-animal mutualists from a species pool, based on a model that was introduced very recently by Becker et al. (2022). Links between plants and animals are defined via trait-matching, and species can have a variable niche width, i.e. be generalists or specialists. In addition to the immigration process, the model includes also population dynamics equations that are supplemented by a demographic noise term. We evaluate the time evolution of network features such as network size, invadability, connectance, and extent of specialization. We explore the influence of model parameters such as the immigration rate, the size of the species pool, the strength of demographic noise, and the presence of facultative mutualists on these findings.

00236
Implications of drift and rapid evolution on negative nicheconstruction

Oral

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Abstract

Organisms constantly modify their surrounding environment, which may in turn affect themselves and other nearby species. Such activities are often termed niche construction. An important property of niche construction is that its consequences can persist for a long period of time, and several subsequent generations can be affected. This phenomenon is known as the niche construction time lags, or ecological inheritance. Studies have suggested that time lags in niche construction can result in the evolution of cooperation. For instance, it can lead to the evolution of contributions to a common good, which is associated with positive niche construction. It can also result in the limitation of a common bad, which is associated with negative niche construction.

Using theoretical models, we study the evolutionary consequences of incorporating time lags in a negative niche construction process: waste production. We consider a population that extrudes waste into its environment as it consumes resources. Higher consumption rates can lead to higher waste production, as it is associated with higher per capita growth and reproduction rates. As toxic effects due to pollution are equally shared among all individuals, higher consumption rates are expected to be favoured.

We showed that increasing consumption rates indeed often evolve. When evolution is rapid, intragenerational time lags are incorporated, and stochasticity is taken into account, however, such an increase is no longer favoured and lower consumption rates resulting in less waste production can be an outcome. Interestingly, in the long term, drift becomes more important than natural selection in limiting higher waste production as population sizes become smaller and selection weakens due to heavy pollution.

00263
Integrated simulation modeling across scales: Simultaneous assessment of land-use change effects on biodiversity and ecological and economic functions

Poster

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Abstract

Understanding the trade-offs between biodiversity and ecological and economic functions and how they vary across space and time is important for long-term landscape management.
To simultaneously assess the effect of land-use change on biodiversity and ecological and economic functions at multiple temporal and spatial scales, we developed the spatially explicit and dynamic tool NL-InVEST which couples an InVEST model with NetLogo. InVEST is a suite of models to map biodiversity and ecosystem services, whereas NetLogo is a programming environment for agent-based models.
We show an application of NL-InVEST to investigate the effects of smallholder-driven land-use change on biodiversity and economic and ecological functions in rainforest transformation systems of Sumatra (Indonesia). To this end, we integrated the model “Habitat Quality” of InVEST with the NetLogo-based model “EFForTS-ABM”. The spatially-explicit model “Habitat Quality” estimates biodiversity for one specific point in time, using habitat quality as a proxy for biodiversity based on a simple habitat analysis. EFForTS-ABM is a spatially-explicit land-use change model, representing a formerly forested landscape in Sumatra, Indonesia with oil palm and rubber fields, managed by individual smallholder farming households (=agents). EFForTS-ABM simulates the effect of land-use decisions of smallholders on economic and ecological functions. Functions can be assessed from local to landscape scales at various points in time. This integrated simulation approach combines the strengths of InVEST as an established and effective tool for evaluating scenarios of future land use and EFForTS-ABM as a tool for simulating the actions of farmers and their interactions with the landscape. We show example results, identifying landscape composition, landscape configuration and plantation age as drivers of landscape-level biodiversity variation.
In conclusion, NL-InVEST is a tool to link the static scenario approach of InVEST with dynamic agent-based models programmed in NetLogo, opening new opportunities for the InVEST model suite. Linking InVEST models with agent-based models opens the opportunity to model the farming behavior of individual farmers in a structurally realistic and mechanistic way. Scenarios can now include policy rules that affect farming decisions and thereby affecting land-use change. We can therefore use NL-InVEST to investigate the economic and ecological consequences of different policy rules.

00293
Mechanistic explanations and hypotheses in ecology: What is that, and how to represent?

Oral

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Abstract

A central aim of ecology is to find mechanistic explanations. Usually it remains unclear, however, what exactly is meant by ‘mechanistic explanation’ or ‘mechanistic hypothesis’. I argue that ecology can benefit from the philosophical discussion of what is a mechanism. In this presentation, I will therefore give an overview of the respective discussion in philosophy of science, and I will suggest an operational definition for ‘causal mechanism’ for ecology.
In invasion biology, the aim is often to find a mechanistic explanation for why species are able to establish and spread in an area in which they did not evolve. With the example of a well-known hypothesized mechanism in invasion ecology, namely enemy release, I will demonstrate how such causal mechanisms can be depicted as causal network diagrams. This approach could facilitate the development of satisfying explanations, enhance clear argumentation and allow more precise linkage of empirical tests to theory.
Finally, I will introduce first suggestions for how hypotheses could be re-formulated to follow a standardized structure, again giving examples from invasion biology. I will discuss how such steps towards more formal language and graphical representation could allow leveraging novel advances in computer sciences like semantic modelling and natural language processing for invasion biology, and in the future more generally for ecology as well.

00304
Effects of landscape structure on community traits, diversity, and local adaptation

Poster

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Abstract

Land-use change alters the structure of landscapes by modifying both the range of environments present in the landscape (composition) and their spatial arrangement (configuration), with important consequences for a wide variety of processes influencing survival and persistence of populations and community composition and function. Understanding the effects of landscape structure is therefore critical to creating effective conservation strategies. We explored the effects of landscape composition and configuration on community diversity, traits, adaptation to local conditions, and dispersal strategies using a spatially explicit, individual-based metacommunity model. Organisms possess traits defining niches for two different environmental attributes,and dispersal traits defining the frequency and distance of dispersal (nearest neighbor or random global dispersal). Both environmental attributes vary spatially and one can vary temporally as well. Simulation results show that landscape composition is the main driver of patterns in diversity, organism traits, and temporal community turnover, with configuration mainly mediating the strength of the relationship. At the landscape level, we found a pattern of decreasing richness and increasing diversity with greater compositional heterogeneity, while temporal community turnover becomes more frequent, indicating that landscape structure and habitat area are important factors influencing demographic stability and extinction rates at the landscape scale. Organism traits increase in variance with greater compositional heterogeneity. At the patch level, we found a consistent, positive relationship between a patch's deviance from the landscape's mean environment and niche optima, tolerances, and dispersal chance, indicating the increasing importance of bet hedging in more extreme or rare environments. Moreover, we find that temporal variability in one environmental attribute can result in increased tolerance and weaker adaptation to local conditions in another environmental attribute due to dispersal related bet hedging strategies.

00322
metaRange in Julia: a process-based model for range dynamics of plant species

Oral

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Abstract

Process-based models incorporating demographic, dispersal and metabolic processes can be powerful tools to forecast species' ranges in the future for different climate and land use change scenarios, as well as to assess the effects of conservation measures on populations. MetaRange is one of these mechanistic models that integrates species-specific parameters such as preferred environmental conditions, biomass, and dispersal ability with demographic rates (e.g. reproductive and mortality rates) derived from local temperature and biomass via the metabolic theory of ecology. Thus, it can predict species' range dynamics without requiring a high number of input parameters. While it was originally written as an R package, we transferred it to Julia language to improve runtime and make it feasible to run on slower machines. Here, we show that performance in the Julia version of the model is significantly enhanced in both computation speed and memory usage and we provide a simple application example.

00328
Foraging personalities modify effects of habitat fragmentation on biodiversity

Poster

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Abstract

Habitat loss undeniably poses a substantial threat to biodiversity, but whether fragmentation per se drives the loss of species is still widely debated. While negative consequences from fragmentation are often anticipated, many empirical studies report positive effects. However, the intrinsic mechanisms governing species' persistence in fragmented landscapes are not yet understood. Using an individual-based community model we investigated consistent personality-dependent differences in foraging behavior among individuals as a possible mechanism underlying the discrepancy of reported fragmentation effects. The mechanistic model simulates the home range behavior of a competitive small mammal community based on the availability of a shared resource and a landscape of fear, in which edge habitat is perceived as risky by the simulated prey animals. However the individuals can differ in how they respond to the perceived, defining a risk-avoiding or a risk-seeking foraging behavior. Our simulations show that differences in risk-taking while foraging in edges are potentially a further mechanism contributing to reconcile the recent debate on effects of fragmentation. Some scenarios confirm the negative effects of fragmentation (e.g. by edge avoidance), whereas others even show positive effects on biodiversity (e.g. by adding intraspecific behavioral variation). Our study highlights the importance of recognizing the behavioral composition of populations and communities for estimating fragmentation effects, because different personalities can influence the coping abilities of animal communities in light of fragmentation.

00335
Modeling the influence of ecosystem coupling on ecosystem functions

Poster

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Abstract

Cross-ecosystem flows can be subsidies but can have different effects in recipient ecosystems as prey, detritus or both. Ecosystem connections are affected by global changes, causing impacts on the functioning of recipient ecosystems. Ecological models have been proposed as a tool to identify the mechanisms for how subsidies affect the stability and functioning of recipient ecosystems. However, current models mostly focus on how changes in subsidy affect the stability of recipient ecosystems and rarely study other functions. They also often describe changes in the connections of subsidy and recipient ecosystem in terms of changes in rates of subsidy input. The subsidy rate metric does not capture dynamic feedbacks between subsidy availability and its usage. In this study, we developed a subsidy-recipient ecosystem coupling metric (realized coupling) that involves the interaction of multiple trophic levels, thereby capturing dynamic feedbacks between subsidy availability and its usage. We show how changes in the "realized coupling" affect the production, efficiency, and recycling of the recipient ecosystem. We advance this coupling metric as an empirically measurable and parsimonious way to predict how ecosystems will respond to shifts in connectivity driven by global changes.

00361
How to model horizontal diversity in complex systems?

Oral

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Abstract

Core ecological questions address the consequences of environmental changes on biodiversity, biogeochemical cycling and ecosystem functioning which are approached using large ecosystem models. In these models, it is a challenge to realistically represent the diversity within trophic levels (i.e. horizontal diversity), which influences the strength of trophic interactions and functions/properties such as biomass distributions, resistance against perturbations, and trophic transfer efficiency. Horizontal diversity is often represented using different functional groups with predefined static functional properties within one trophic level, that can be called interspecific trait variation. A high number of functional groups may not coexist and reduces the tractability of the model behavior. Oppositely, too few groups may not reproduce appropriately the naturally high trait diversity. Additionally, horizontal diversity can also arise from intraspecific trait variation within functional groups. If intraspecific is high functional groups might become neutral, whereas when there is none functional properties are static and adaptation occurs only through species sorting. Thus, how do interspecific and intraspecific trait variation affect ecosystem functions and properties? We extended Klauschies *et al.* (2016)'s plankton model, which defines functional groups by using two traits: prey edibility and predator selectivity. These traits are involved in trade-offs: an edible producer grows quickly and has a low natural mortality rate, and a specialist herbivore has a higher grazing rate. The strength of trophic interactions between producers and herbivores are determined by preference functions depending on both traits. Horizontal diversity at the producer trophic level is modeled by a variable number of functional groups and by controlling the trait variation within each group. This allowed us to compare different scenarios, such as a model with few functional groups and high trait variation or a model with many functional groups and little/no trait variation, in terms of biomass distribution, realised functional diversity, prey exploitation efficiency, top yield, flux evenness and stability against environmental changes.

00456
Competition shapes distribution of productivity-related traits in a non-vascular vegetation community

Oral

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Abstract

Many studies have found key roles of environmental filtering and competition in shaping plant community composition in terms of functional traits. However, for non-vascular vegetation communities, it is still largely unknown to what extent selection by the environment or by competition affect the distribution of functional traits. Moreover, it remains poorly explored how the relative importance and potential interactions of these two processes affect community trait distribution. This has implications for the essential ecosystem functions provided by non-vascular vegetation in many regions worldwide. Here we applied a process-based model to simulate the trait distribution of non-vascular vegetation communities at a shaded and at an open site with different microclimatic conditions. We also performed a simulation experiment to understand the impacts of competition on the trait distribution at these two sites. Our results reveal that the water- and productivity-related traits respond strongly to environmental conditions at both the shaded and the open site. Furthermore, competition tends to select productivity-related traits of higher value, and leads to convergence of height and tissue porosity since this is associated with a higher specific thallus area and a lower cost for expansion. Additionally, the competition-constrained trait distributions are stable under various environmental conditions except for tissue porosity that tends to be larger at the shaded site. We conclude that within non-vascular vegetation communities, competition likely leads to the selection of lower construction costs, and more carbon productivity. The presented simulation of within-community trait distribution provides a new insight into trait-based approaches for non-vascular vegetation community ecology.

00582
The mangrove-saltmarsh ecotone: Explaining observed vegetation patterns with a fully coupled mechanistic modelling approach

Poster

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Abstract

(Sub)tropical coastal wetlands often consist of mangrove and salt marsh habitats, where mangroves are mostly located in the lower, regularly flooded zones close to the sea, and saltmarsh plants usually occur in the upper intertidal, dryer and hypersaline zones. The transition between the two habitat types is called "mangrove-saltmarsh ecotone" and is shaped by multiple feedbacks between the local abiotic environment and the prevailing vegetation. We hypothesize that these feedbacks result in characteristic vegetation patterns that are reflected, for example, in the height structure of the vegetation and the sharpness of transition between the two habitat types. While models exist that describe the dynamics of mangroves or saltmarshes separately, an integrative approach that accounts for both vegetation types and their interactions with their biotic and abiotic environment does not exist. Therefore, a mechanistic understanding of the mechanisms underlying ecotone patterns and their dynamics, also under global change, is still missing.
To close this gap, we build on the hybrid process-based simulation system MANGA that describes feedbacks between mangroves and subsurface hydrodynamics. The typical zonation of mangrove forests has already been successfully reproduced with this tool. We are extending the model by a component describing the potential saltmarsh habitat, which requires not only the description of salt marsh plants, but also the unsaturated soil conditions, in which saltmarshes are often found. The final model will describe the interactions between saltmarsh plants, mangrove shrubs, mangrove trees and soil water and thus allow the simulation of the entire mangrove-saltmarsh ecotone. We will use the model to systematically investigate the emergence, persistence and temporal shift of different ecotone patterns under changing hydrological conditions. Here, we introduce our concept of the fully coupled model and will present first results on saltmarsh performance along an environmental gradient.

00598
Modeling pollinator populations in response to land use changes in agroecosystems - A systematic review

Oral

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Abstract

Pollination is a key important ecosystem service to agricultural production. Estimations suggest that it can increases the production of 75% of the 115 most important crops worldwide. With the growing concern over the increasing pressure on pollinator populations related to the landscape simplification and input-based agroecosystems, modelling tools assessing the potential effects of landscape management strategies are increasingly developed. Here, we present the results of a systematic review of spatially models that provide predictions of pollinator populations in response to land use changes across agricultural landscapes. We characterise the considered pollinators and agroecosystems, the different modelling approaches, as well as the main inputs and outputs of models. Existing models have been developed using a multitude of approaches including the distance decay, differential equations, agent-based, and process-based approaches. The majority of these models represent bees, either solitary or social. Furthermore, only some regions of the world are represented by these models. The most reviewed models of solitary wild bees which are generally conceptually simplistic and similar, assign a separate nesting and flowering quality score to each landscape habitat accounting purely for the flight distances of the considered taxa. More recent process-based models include behavioral component assuming that pollinators are optimal foragers, and also account for temporal variation in resources and population growth over time. Models predicting either bumble or honey bees are often dynamic and represent more process, including resources collecting and competition. Two of the most important models of these social bees (BEEHAVE and Bumble-BEEHAVE) adopt an agent-based approach and are conceptually complex. The pollinator abundances and visitation rates, as well as crop production are the main outputs of the reviewed models. Based on our review, we plan to, firstly, compare approaches used for predicting pollinator diversity in response to land use changes, and critically evaluate the assumptions and prediction ability of existing models. Secondly, we identify and discuss the constraints, and opportunities for developing these models. Our ultimate objective is to provide recommendations to aid in the design of future modeling framework for predicting pollinator populations across agricultural landscapes.

00599
Meta-ecosystem modelling of aquatic-terrestrial bottom-up interactions

Poster

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Abstract

Streams networks are coupled with terrestrial ecosystem via the spatial flows of nutrients/pollutants, energy, and organisms. Quantitative reviews demonstrate that these flows are often subsidies that can have consequences for recipient ecosystems. Stream networks is a universal fractal structure that not only defines their hydrology and connectivity, but has also profound biological consequences. This modelling framework focus on the flood-mediated effects of stressors such as aquatic micropollutants and invasive species on terrestrial recipient communities. In an attempt to parameterize our model, we identified that quantitative relationship between pollutants transport from stream to terrestrial area and effect of these pollutants on terrestrial recipient communities are missing. This work involves the development of a stream network model and meta-ecosystem model, which will include the above-mentioned stressors. The model considered the transport of micropollutants, ecosystem functions, and riparian bottom-up plant-herbivore trophic interactions. Empirical data from other Systemlink projects used to test the hypothesis that environmental stressors destabilize the dynamics of the riparian trophic system via bottom-up effects. We applied our model to study the "Dynamics of pollutants transport and pollutant uptake by plants in the riparian zone" and "Impact of random/variable input of pollutants on the plant-herbivore system". The results will come on the poster.

00649
New mesure of the robustifying nature of interaction network and its analytical prediction

Poster

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Abstract

New measure of the robustifying nature of an interaction network and ils analytical prediction
Mario Desallais, Jean-François Arnoldi and Michel Loreau
Abstract
Understanding how different species can coexist is a major issue in community ecology. More specifically, the question arises as to what the role of interaction networks are. In this sense, many authors have focused on what *allows* coexistence, but less have focused on what *maintains* coexistence once it is permitted. In particular, mathematical tools exist to assess the probability of coexistence of communities, knowing a fixed interaction network. We sought to implement the notion of environmental disturbance to these tools in order to derive a value for the robustifying nature of the interaction network. This property corresponds to how the resulting communities are expected to undergo environmental disturbances without losing species. We therefore propose a new measure integrating the notion of disturbance which we believe to be a good proxy of the robustifying nature of an interaction network. Through numerical simulation, we show the difference between this measure and the probability of coexistence. Moreover, we correlate this value to simple properties of the interaction network, such as the number of species, the interaction strength and the structure of the network, allowing us to give a more concrete ecological meaning to this mathematical tool. Namely, the robustifying nature of an interaction network decreases according to three factors. These are the increase in the number of species, the intensification of the forces of interaction and the way in which the structure of the network impacts more strongly on one species than on others. We finally test this analytical prediction by these three factors (species, interaction forces, structure) using an interaction network based on experimental work.

00115
Life history traits as drivers of species assemblage and breeding habitat selection in amphibians of the Upper Rhône floodplain, France

Poster

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Abstract

Over the past decade, river floodplain ecosystems have been among the most altered and threatened environments and amphibians among the most threatened vertebrates (Stuart et al., 2008). The interactions between flood pulses, topographic patterns of floodplain and lateral exchanges of mineral and organic particles, dissolved chemicals and biota, create a complex and dynamic mosaic of interactive terrestrial, aquatic and ecotonal patches in large rivers. Despite amphibians are forming a significant component of wetland foodwebs, their responses to river flow reduction and drought conditions are poorly known.
The objectives of this study are to (i) establish a typology of species assemblages based on observed abiotic and biotic preferences for breeding habitat condition, (ii) relate these patterns to species life history traits, and (iii) provide recommendations for improving restoration design and monitoring.
We investigated species – aquatic breeding habitat interactions of amphibians in 82 sites of the Upper Rhône floodplain that integrate various environmental conditions related to mesological (e.g., site area, depth), physical (e.g., substratum, turbidity) , hydrological (e.g., flooding, water origin) and spatial complexity variables. To test whether species' biological traits influenced species assemblages, we got information on the main traits or tactics for which selection can act (Southwood, 1988): extent of investment in (i) physiological adaptations to unfavorable physical conditions, (ii) defence adaptations, (iii) food harvesting and somatic development, (iv) reproductive activities and (v) tactics for escape in space and time.
We have demonstrated a non-random distribution of species mainly in relation to river disturbance regime to which responded different reproduction strategies (e.g. many small eggs or few large eggs), avoidance or defense capacities of larvae, as well as ability to play with time or space (e.g., split oviposition, reproduction period flexibility, larval development speed, etc). Breeding aquatic habitats act as a templet on which characteristic combinations of anuran species attributes are selected. This study represents an attractive trait-based step in floodplain ecological diagnostic and a tool to support stakeholders in decision-making processes.

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00220
Quantifying relationships between land use, functional diversity, and ecosystem services across European agroecosystems

Poster

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Abstract

Ecological intensification is expected to favour biodiversity, which is in turn expected to benefit ecosystem services. However, recent meta-analyses revealed mixed results regarding relationships between land use, biodiversity, and ecosystem services. Information on the trait composition of biological communities can improve our ability to explain and predict ecological processes. However, trait-based approaches also pose new challenges: Where to obtain trait information and how to code traits? Which and how many traits should be selected? Which among the vast number of indices for functional diversity should be calculated?

In our data-driven approach, we focus on the functional diversity of four key animal groups: bees, spiders, ground beetles, and nematodes. While relationships between functional diversity and productivity are already well studied in plant communities, large-scale functional diversity assessments of important invertebrate groups are still scarce. We present a data structure of how to integrate trait information in species-level community data from various field studies in European agroecosystems. We suggest combining measures of community weighted means (e.g. body size) and Rao's quadratic entropy that cover two complementary aspects of functional diversity (i.e. trait value and variance of traits). Furthermore, these measures are approximately independent of species richness and ecologically meaningful to compare and interpret.

The proposed framework aims to quantify the pairwise effect sizes between land use types (e.g. conventional vs. organic farming) or intensities (e.g. fertilization level) and functional diversity indices for the four taxonomic groups. Similarly, functional diversity will be related to levels of regulating ecosystem services (e.g. pest control, pollination) as well as provisioning ecosystem services (e.g. biomass production, harvest etc.). This meta-analysis approach enables us to maximize the use of different data sources and to combine datasets with information for different parts of the land use-functional diversity-ecosystem services framework. From our perspective, we hope to inspire ecologists to master challenges in trait-based ecology across disciplinary borders and to further stimulate standardized trait approaches to make data and future results more comparable.

00488
Body size and short distance mobility are modulated by field farming system and local habitat characteristics

Poster

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Abstract

Body size is one of the most important traits to understand inter and intra-specific interactions and ecosystem functioning. Habitat homogenisation in agroecosystems is a major threat to Biodiversity. In this study, we investigated how the local habitat conditions (structure and composition) affect the body size and mobility of spiders? We assumed that the differences in habitat structure and management, between organic (OF) and conventional farming (CF), impact directly the prey availability and thereby also intra and inter-specific competition. Twenty pairs of spatially-matched CF vs. OF fields were sampled. Local habitat structure and composition have been recorded also. Prosoma width and length and femora length of 950 individuals belonging to 17 wolf spider species (Lycosidae) were measured. As the prosoma length and width were highly correlated, we used prosoma width as a proxy of body size and femora length as a proxy for short distance mobility.
The body size and femora length of spiders was significantly smaller in OF compared to CF and in females compared to males. Both traits were also negatively correlated to vegetation density and femora length was positively correlated to the proportion of bare soil. Our results suggest that the variation of body size and mobility are affected by the local habitat conditions with higher prey availability in OF compared to CF and a more complex habitat in OF (high and dense vegetation) but on the other hand more intra and inter-specific competition, as potential drivers. Our results also show that the variation in body size and mobility between males and females depends on the wolf spider species. These results partly stem from, but also have implications for their habitat preferences, food limitation as well as intra and inter-specific interactions.

00538
The Ecolopes animal model

Oral

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Abstract

Ecolopes is a European funded project that aims to create an architectural tool to design and renovate city buildings while considering humans, plants, animals and microbes as equal residents in and around the building. Here, we propose a spatially explicit model that simulates the temporal dynamics of an AFG community, while interacting with the plants on a proposed architectural design.

We extend Buchmann et al's allometric home range formation model for herbivorous mammals and bird functional groups to included trophic structure and time. We do this in two ways: firstly, functional traits will include diet preference allowing for trophic levels assignment; thus, extending the original primary consumer model to a multitrophic model, where the home range distribution of lower trophic levels acts as resource landscape for higher levels. Secondly, time is included by considering various time-driven aspects: i) mortality via defined mass-dependent life-span, mortality rate and elimination of animals from landscapes resource changes over time, i.e., resource-driven mortality; ii) new home range formation to exploit newly available resources that result from a changing resource landscape.

Our model will be used to gain a mechanistic understanding of the influence trophic levels and changing resource landscapes have on the temporal and spatial stability of home range community structure. This understanding will be used within the Ecolopes project to create optimal architectural designs that are suitable to the animal, plant, microbe and human residents.

00545
Wild bee body size as a response trait to anthropogenic disturbance in agriculturally dominated landscapes

Oral

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Abstract

Landscape alteration, agricultural intensification and climate change are considered the most important global change factors driving wild bee decline, but little is known about whether these drivers have resulted in changes in the life-history traits of bees. Body size is one of the most fundamental life-history traits with pervasive effects on individual fitness, population dynamics and the structure of ecological networks. Nevertheless, despite its importance, variability in bee body size across environmental gradients has received little attention.

To investigate how bee body size has changed over environmental gradients of anthropogenic disturbance, we measured the body size of 10 wild bee species (*Andrena cineraria*, *A. haemorrhoa*, *A. flavipes*, *Lasioglossum politum*, *Bombus pascuorum*, *B. lapidarius*, *B. hortorum*, *Osmia brevicornis*, *Hylaeus communis* and *Colletes cunicularius*) collected at sites that vary in agriculture intensity and landscape heterogeneity in Saxony-Anhalt, Germany. Our results reveal that i) there has been a shift in bee body size across sites varying in the level of human impact, and ii) the direction of change is not consistent across species. We discuss the eco-evolutionary implications of the effect of agricultural intensification on bee body size and how different bee species might be differentially vulnerable to environmental change.

00546
A 34-year survey under phosphorous decline and warming: Consequences on stoichiometry and functional trait composition of freshwater macroinvertebrate communities

Poster

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Abstract

Nutrient changes and increasing temperatures often are – and will continue to be – main stressors in freshwater systems worldwide. Phosphorous and nitrogen enrichments are expected to favour fast-growing and P-rich taxa, supporting the well-known link between growth rate and body stoichiometry. Under warming consumer communities also shifted towards taxa expressing these traits, but the effect of temperature on an organism's stoichiometry is still rather unclear. As recent studies have shown, other traits, e.g. related to development or feeding, are also linked to body stoichiometry. The integration of stoichiometric traits thus seems to be a promising tool to better understand the mechanisms behind taxonomic and functional community responses to those global stressors. However, analyses on community level and/or on a temporal nutrient gradient so far are missing.
We analysed stoichiometry and functional trait composition of benthic macroinvertebrate communities under temperature and nutrient changes over a 34-year period in the Middle Loire River (France). The environmental changes at this site (warming, decreasing water P) allowed testing the potentially opposing responses to these stressors. We expected that – due to shifts in species composition – both drivers should cause changes in the overall community stoichiometry and functional composition.
The macroinvertebrate community shifted towards P-poor taxa, which caused significant trends in overall community stoichiometry, and therewith also the nutrient pool provided by these consumers (i.e. decrease in %N and %P, increase in N:P). Moreover, high phosphorous concentrations favoured traits indicating a fast development (short life duration, small maximum body size) and detritus feeding, whereas low phosphorous concentrations favoured taxa with a slow development and predators. This followed our assumptions based on ecological stoichiometry theory and suggests that nutrients were a more important driver than temperature. Stoichiometric traits provided a pivotal link between functional trait composition and environmental changes, underlining their potential to help investigating ecological responses to multiple drivers and consequences for ecosystem functioning.

00549
Trait-based approach to disentangle the movement, tolerance and interaction dimensions in salt marsh community assembly

Oral

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Abstract

Community dynamics are determined by dispersal processes, abiotic and biotic interactions. Here we aimed to understand how these processes determine the salt marsh plant community establishment and development under different connectivity conditions using a trait-based approach.
To address the community dynamics and assembly of salt marshes under limited dispersal conditions, we installed 12 experimental islands on a tidal flat in the German Wadden Sea. Each experimental island consisted of three elevational levels corresponding to the vegetation zones in the adjacent salt marsh. Six islands were planted with sods from the lower salt marsh, and six islands were left to display bare sediment. Transplanting communities to different elevations allowed to identify the response time of plant communities to changed environmental conditions and compare it to spontaneous colonisation on bare patches. Experimental plots at the same elevations were established in the adjacent salt marsh on the island of Spiekeroog.
We hypothesize that in the isolated islands, stronger species turnover selects for species with successful colonization and dispersal traits as compared to the Spiekeroog salt marsh. Consequently, along a colonization-competition trade-off, species composition is shifted away from species with strong resource use efficiencies (strong competitors) and towards species that rapidly disperse and colonize open habitats. Whereas abiotic filtering, e.g., the tolerance of salt and inundation stress, still sorts species, biotic filtering such as competition or consumption will be less effective and thus produce more neutral assemblies with regard to traits associated with biotic filters. The relative role of niche-based and neutral dynamics affects the functional divergence or convergence during community assembly.
Using movement, abiotic tolerance and biotic interaction trait dimensions, we calculated mean trait module value for each plot based on all species growing on the plot weighted by their frequency. Likewise we calculated the variation of each trait module, i.e. functional diversity. We then compared the shifts in trait module value and variation over the years between the isolated and connected plots during initial development and during community development starting from lower salt marsh communities on each elevation.

00560
A barrier to global plant invasion ecology: gaps in trait availability for alien species

Oral

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Abstract

The increasing global changes affecting natural ecosystems increase the spread and impact of alien plant species. While native plant community ecology have highly benefited from the functional approach to better understand it, global alien plant functional ecology is still as its infancy. The lack of trait data for alien species in global databases prevents alien plant ecology to seek generality beyond the specificities of invaded ecosystems. In order to properly estimate the trait acquisition to be done, we are performing a thorough review of global trait resources available for alien plants. We are then providing a priority list of species, based on impact of the species and spread, for which the traits data should be first acquired. We believe syntheses efforts from the alien plant community could highly fill this gap.

00569
Is inflorescence preformation in overwintering buds linked to plant functional traits and plant phenology? – a multi-garden approach

Poster

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Abstract

Strong seasonality with pronounced winters is one of the major obstacles for plants in temperate regions. Plants adapt to this shortened growing periods by forming preformation buds in the previous year. Preformation buds can vary in their degree of preformation (Schnablová et al. 2021), from just primordia to entire inflorescences being pre-formed. Previous research showed, that phenology, as a fingerprint of climate change is highly species-specific and might be affected by the long-term adaptations of plants via the preformation of buds. Thus, in this study we want to test how the existence of preformation buds affect phenology in plant populations across eleven Botanical Gardens in the northern hemisphere within the PhenObs network (https://www.idiv.de/en/phenobs.html) and how this makes plant species more variable in their phenological response to changing climate. On the other hand, we want to assess how they affect other proxies for plant performance, such as plan functional traits.
We analysed the degree of inflorescence preformation in addition to monitoring plant phenology across 87 herbaceous species between 2017 and 2021 following the PhenObs protocol for monitoring phenology (Nordt et al. 2021). We focussed on different phenological stages to capture the entire growth period of the plants from initial growth in spring, over flowering phenology, the developments of fruits and senescence in autumn. We additionally assessed leaf and floral traits within the gardens.
We found that the degree of bud preformation has an impact on phenology, however, more so on generative phenology such as first flowering day than on vegetative phenology such as leaf out. When flowers were pre-formed in the previous year, the species flowered much earlier and displayed fruits earlier. Also the variability of phenology across different temperature regimes was affected by the presence of preformation buds. Bud preformation was higher in smaller plants but otherwise had little impact on plant performance assessed via plant functional traits.
In addition to plant functional traits, the inflorescence preformation is a fundamental characteristic of plants determining the timing of life-history events. As this ability is genetically conserved this has to be taken into account when studying species-specific changes in phenology.

00610
Ecological diagnostic tool for metal contaminated soils: use of functional traits of bacteria and invertebrates

Poster

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Abstract

Metallic contamination of soils is known to cause changes in the taxonomic structure of communities living in soils. However, soil functions (eg organic matter degradation) are not systematically affected by metal contamination. One can assume that functional redundancy would make it possible to “functionally” compensate for the regression - or even the disappearance - of species which performed these functions in the original community. In order to make these links between taxonomic diversity on the one hand and ecosystem functions on the other, approaches based on "functional traits" are increasingly used. These approaches are relatively new in soil invertebrate studies and are very recent in the study of bacterial communities and allow comparisons between ecosystems with different taxonomic diversities.

Furthermore, in order to assess consequences of soil metallic contamination, it is necessary to develop diagnostic tools capable of demonstrating the impact level on biological communities. Several tools for assessing soil quality already exist, but they are either based on physicochemical rather than biological indicators, or designed to assess effects of agricultural practices on soils, which does not allow their use. for assessment of contaminated soils. Finally, most of tools used in ecotoxicology are subject to standardizations which are effective in comparing toxicity of single contaminations, but which do not make it possible to account for the in situ observed complexity (frequent multicontamination, heterogeneous soils, numerous communities in interactions…).

In this project, we propose to develop a diagnostic tool that will be based on informations on functional and taxonomic diversities (morphologic and eDNA identifications), acquired on soil invertebrate and bacteria communities, according to the level of metal contamination. Functional and taxonomic diversity data will be used as predictors of models based on Random Forests and Conditional Tree Forests. These models will make it possible to estimate a probability of impact level (low vs. significant) of metal contamination for each site of interest.

Our poster will present the DiagnoTraits project and the first results acquired on the 19 sites sampled during the 2022-spring.

Authors index :

A

B

M

S

T