



# Biodiversity Change in the Anthropocene

iDiv Annual  
Conference 2019  
Abstract book

Topic session 1  
Thursday, 29 August  
12.45–14.30  
Conference room 1AB

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Climate effects on biodiversity depend on spatial grain,  
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Mediterranean marine protected areas have higher  
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The Decade of Ecological Restoration: Plans for Required  
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Site-selection bias can negatively affect estimates of biodiversity change

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Microbial community assembly: disturbance responses in microbial communities across environments

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**Lara Luisa Escherich**, *Poster*

Patterns in phenology and traits in plant populations from Botanical Gardens and their natural habitat

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Global Meta-Analysis on Soil Biodiversity response to Chemical Stressors

**Jeroen Everaars, *Poster***

Pollinator communities of alpine meadows now and in the past

**Markus Bernhardt-Römermann, *Poster***

sREplot – Resurvey vegetation plots in biodiversity research

**Malte Jochum, *Poster***

Effects of exotic earthworm invasion on forest soil fauna communities

**Eleonore Louise Slabbert, *Poster***

Scale-dependent impact of land management on above- and belowground biodiversity

## **Topic Session 1: Biodiversity Change (in the Anthropocene): 29.Aug., 12.45 - 14.30**

Session keynote

### **Hillebrand, Helmut**

University Oldenburg

Helmholtz Institute for Functional Marine Biodiversity

### **Changing biodiversity in changing environments: temporal turnover across scales of time and space**

This presentation summarizes three important questions on the quantification and interpretation of biodiversity change under rapid environmental change. Based on recent debates on how much biodiversity loss there is, I first ask how much biodiversity changes over time. Using classical monitoring data sets, I decompose different aspects of temporal turnover with a main focus on marine communities. Then I ask how we can overcome the limited inference on human impacts on biodiversity which I we face given the short time frame of most of our observational data. Here, linking recent ecology and paleoecology opens fruitful analyses, exemplified by two studies on planktonic marine Foraminifera. Finally, I ask what upper constraints on temporal turnover exist. Based on a distributed global grassland data set, it turns out that temporal shifts in species identity are only possible if a minimum spatial beta-diversity exists, which highlights the importance of addressing both spatial and temporal changes in biodiversity.

### **Co-Authors:**

Hillebrand, Helmut

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**Topic Session 1: Biodiversity Change (in the Anthropocene): 29.Aug., 12.45 - 14.30**

Standard talk

**Pereira, Henrique Miguel**

Martin-Luther-University Halle-Wittenberg

### **Global trends in biodiversity and ecosystem service from 1900-2070**

Biodiversity and ecosystem services are being degraded globally, but quantification of historical trends and future scenarios has been limited by uncertainties. Here we present the first multi-model analysis with a set of harmonized land-use and climate change scenarios. We brought together ten biodiversity models and six ecosystem function and ecosystem services models to assess impacts of land-use and climate change scenarios up to 2050 and to hindcast changes to 1900. Biodiversity loss from land-use change is projected to keep up with historical rates or reduce slightly, but when combined with climate change it is projected to accelerate. During the 20th century there were increases in provisioning services at the cost of declines in regulating services. The same overall trend is projected to happen in coming decades, although with variation across scenarios. Renewed efforts are needed by governments if the 2050 vision for the Convention of Biological Diversity is to be met.

**Co-Authors:**

Pereira, Henrique Miguel

## **Topic Session 1: Biodiversity Change (in the Anthropocene): 29.Aug., 12.45 - 14.30**

Standard talk

### **Korell, Lotte**

Martin-Luther-University Halle-Wittenberg

### **Climate effects on biodiversity depend on spatial grain, local climate and magnitude of the experimental manipulation**

Mitigation and adaptation to climate change requires an understanding of the magnitude by which climate change will influence biodiversity of plants across the world's biomes. Manipulative experiments combined with scale-explicit analyses are required to establish climate as the causal driver of biodiversity change. Although such experiments have been conducted for more than two decades in many different ecosystems, we still lack a synthetic understanding of how climate change alters biodiversity. Here we synthesized primary data from 38 climate change experiments and compared the effect of manipulated temperature and precipitation as well as their dependence on background climatic conditions on different aspects of biodiversity across different spatial scales. Species richness and evenness were affected by the magnitude of precipitation manipulation at the plot scale and this effect depended on the background climatic conditions. Heterogeneity from plot to plot increased when precipitation was decreased and vice versa, and as a result it influenced species evenness at the plot but not scale of the whole experiment. With no discernable effects of warming on total abundance and evenness, we conclude that the negative effect of warming on species richness at the plot scale is likely due to the loss of rare species.

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### **Topic Session 1: Biodiversity Change (in the Anthropocene): 29.Aug., 12.45 - 14.30**

Standard talk

#### **Blowes, Shane**

Martin-Luther-University Halle-Wittenberg

#### **Mediterranean marine protected areas have higher biodiversity via increased evenness, not abundance**

Protected areas are central to biodiversity conservation. For marine fish, Marine Protected Areas (MPAs) often harbour more individuals, especially of species targeted by fisheries. But how local-scale responses combine to affect regional biodiversity, a management concern for spatial networks of MPAs, remains largely unknown. Using standardized underwater visual survey data from 43 MPAs and 41 fished areas in the Mediterranean Sea, we quantified how species richness changed inside MPAs as a function of spatial scale. At both local and regional scales, increased species evenness caused by increased numbers of common species was the most important proximate driver of higher diversity in MPAs. Site-to-site variation in the composition of common exploited species was also higher among protected sites. Although MPAs are known to influence fish community abundance and biomass, we found changes to the relative abundance of species dominated the biodiversity response to protection. MPAs had more relatively common species, which in turn led to higher diversity for a given sampling effort. Moreover, greater site-to-site variation in numbers of common exploited species meant that local scale responses inside MPAs were magnified at the regional scale. Quantifying how multiple components of biodiversity respond across spatial scales will strengthen regional conservation efforts.

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## **Topic Session 1: Biodiversity Change (in the Anthropocene): 29.Aug., 12.45 - 14.30**

Standard talk

### **Ladouceur, Emma Rachel**

Martin Luther University Halle-Wittenberg

Helmholtz-Centre for Environmental Research - UFZ

### **The Decade of Ecological Restoration: Plans for Required Urgent Synthesis of Restoration Across Ecosystems and Treatments**

The recently declared 'Decade on Ecological Restoration' by the United Nations represents a timely opportunity to develop an integrative path forward for restoring ecosystems. There is a need to create a living data repository where restoration successes (and failures) are collated and made freely available. Restoration has been taking place globally, for decades, across ecosystems, with millions spent. Different restoration 'actions' have been taking place, depending on the definitions and targets of individual projects and context. Data collected are used for monitoring, which are sometimes published, sometimes not. Projects and investment continue, the results affecting legacies for decades. We are developing a large, cross-cutting and collaborative effort to compile data from across the world, across ecosystems and across restoration efforts. We plan to publish an open-access data paper, maintain and grow a database, and lead the syntheses of these data in order to move forward into this dawning decade with a better understanding of success and failures. We invite anyone involved in restoration, in any corner of the world to join us and donate existing data to be a part of an effort to quantify success and synthesize the future of ecological restoration.

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## **Topic Session 1: Biodiversity Change (in the Anthropocene): 29.Aug., 12.45 - 14.30**

Speed talk

**Mentges, Andrea**

Leipzig University

### **Site-selection bias can negatively affect estimates of biodiversity change**

Estimates of biodiversity change are essential for the management and conservation of ecosystems. Accurate estimates of biodiversity change rely on the selection of representative sampling sites. Here, we study the effect of biased site selection on biodiversity trend estimates. We simulate biodiversity change in a virtual landscape and track the observed biodiversity in a smaller subset of this area (i.e. sampling site). We compare three site-selection strategies: random site selection, bias towards densely populated sites, and bias towards species-rich sites. In our simulations, biased site selection negatively affected biodiversity trend estimates. We show that the impact of a site-selection bias can even outweigh the underlying biodiversity trends, i.e. while the true trend in the landscape is positive, the observed trend in the sample is negative. Thus, site-selection bias could impact the magnitude as well as the estimated direction of biodiversity change. Awareness of this potential bias is needed for the design of new studies on biodiversity change, monitoring, and the interpretation of existing data.

#### **Co-Authors:**

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## **iDiv Annual Conference 2019**

**Topic Session 1: Biodiversity Change (in the Anthropocene): 29.Aug., 12.45 - 14.30**

Speed talk

**Guerra, Carlos A.**

Martin-Luther-University Halle-Wittenberg

### **Global projections of the soil microbiome in the Anthropocene**

Soil microbes are essential for maintaining life-supporting ecosystem services, but projections on the effects of global change scenarios are lacking. Using a global database of soil microbial amplicon sequencing obtained from 231 ecosystems across six continents, we projected past and future trends of the soil microbiome. We find that both climate and land-use change will increase the local richness of bacteria, but will also result in an overall global homogenization of these communities. Our results further provide evidence that models not accounting for interactions of land use and climate with other environmental factors (such as pH and vegetation cover), will fail to provide reliable predictions of the soil microbiome. Our novel projections predict fundamental changes in the distribution of microbial communities globally and pave the way for more reliable predictions of the fate of soil biodiversity and forecast changes in ecosystem functioning in the Anthropocene.

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## **iDiv Annual Conference 2019**

**Topic Session 1: Biodiversity Change (in the Anthropocene): 29.Aug., 12.45 - 14.30**

Speed talk

**Jurburg, Stephanie D**

Leipzig University

### **Microbial community assembly: disturbance responses in microbial communities across environments**

Microbial communities are ubiquitous and perform essential ecosystem services in the environments they inhabit. While microbiome responses to perturbations have been extensively studied in the medical, veterinary, Earth, and marine sciences, the available literature is field-specific, and whether community assembly following disturbance is similar across the wide range of environments which Bacteria inhabit remains unknown. Here, we compiled publicly available datasets describing microbial community dynamics during the first month after an environmental change or disturbance. Our meta analysis included community census data from 67 time series from 21 studies spanning the aquatic, soil, and mammalian host environments. Immediately after disturbance, mammalian microbiomes exhibited the highest turnover. Following an environmental change, seawater microbiomes tended towards a higher between-replicate variability, while mammalian microbiomes tended towards a lower between-replicate variability, and soil microcosms exhibited mixed response. Finally, unlike mammalian and soil experimental systems, seawater mesocosms increasingly diverged from their pre-disturbance state over time. Our findings begin to shed light on the similarities and differences between microbial community turnover across environments.

#### **Co-Authors:**

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## **Topic Session 1: Biodiversity Change (in the Anthropocene): 29.Aug., 12.45 - 14.30**

Poster

**Jardine, Emma**

Friedrich Schiller University Jena

### **Botanical gardens as a global phenological observations network**

Changes in plant phenology are happening across the globe and are linked to rising temperatures. Climate-driven changes in phenology, which vary substantially among species and locations, are altering ecological relationships; carbon, nutrient, and water cycling; species competition, composition, and interactions; and the ability of species and populations to persist. Despite herbaceous species representing over half of the plant diversity on Earth, phenological research has traditionally focussed on woody taxa. It is therefore important that we fill in the gaps in our knowledge for non-woody plants. A globally co-ordinated research effort across many geographic locations and taxa is needed in order to better understand the drivers, mechanisms and implications of phenological shifts and to develop management strategies in response. Furthermore, plant functional traits provide a promising way to predict species phenology and phenological response to environment. Botanical gardens, with their diverse collections of plants can facilitate both the monitoring of phenology and measurement of functional traits, which have the potential to predict phenological patterns and shifts, across large numbers of taxa and across broad spatial gradients. Here, we present protocols for monitoring phenology on herbaceous species and their traits that are employed the the PhenObs network.

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## **Topic Session 1: Biodiversity Change (in the Anthropocene): 29.Aug., 12.45 - 14.30**

Poster

**Escherich, Lara Luisa**

Friedrich Schiller University Jena

### **Patterns in phenology and traits in plant populations from Botanical Gardens and their natural habitat**

Changes in climate and land-use currently lead to a loss of biodiversity, which makes it a relevant topic in our society. It has been shown that changes in climate are also leading to changes and shifts in the growth periods and the development of plants. Because of that it is important to monitor the phenology of plants, to estimate the impact of climatic changes.

The present study shows the comparison of the phenology and other functional traits of plant populations of species in the Botanical garden Jena, with those observed in their natural habitats in the Pennickental in Jena. We chose 15 species from three different habitats (forest, grassland, ruderal), which are monitored during the vegetation period in 2019, following the protocols of the PhenObs network. In addition will also record different plant traits to survey the performance of the population answering following questions "Does the phenology of plant species in the Botanical Garden differ from species in their natural environment?", "Do the same plant species differ in their functional traits?" and "How does the habitat influence plant phenology and performance?". This poster gives an overview on the first results and discusses the consequences for phenological monitoring under controlled conditions.

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## **Topic Session 1: Biodiversity Change (in the Anthropocene): 29.Aug., 12.45 - 14.30**

Poster

### **Malladi, Sandhya**

German Centre for Integrative Biodiversity Research

### **Global Meta-Analysis on Soil Biodiversity response to Chemical Stressors**

Soil biodiversity is important for humanity due to the many ecosystem services it provides but it is increasingly threatened by a range of global change drivers, including pesticides. While there have been relevant studies carried out to assess these impacts, most have focused on specific parameters and are context-dependent (looking at soil fauna in specific geographic or climatic zones). This study aims to undertake a synthesis of already published data in order to identify global trends and patterns and go beyond the context dependencies, answering the following questions: What global impacts do pesticides have on soil biodiversity? How, if at all, do these chemical stressors contribute to the reduction in soil fauna biodiversity? In addition, we will attempt to understand if pesticides of different classes have distinctive impacts on soil fauna due to their differences in mode of action and properties. We hope to pioneer the collation of literature available on the impact on soil ecosystem services across pesticides, biomes and soil fauna groups while highlighting the discrepancies between responses of different taxonomic and functional groups. This meta-analysis would help us better understand the consequences of anthropogenic activities as it pertains to chemical stressors thereby identifying important global trends.

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## **Topic Session 1: Biodiversity Change (in the Anthropocene): 29.Aug., 12.45 - 14.30**

Poster

### **Everaars, Jeroen**

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Helmholtz Centre for Environmental Research - UFZ

### **Pollinator communities of alpine meadows now and in the past**

The biologist Hermann Müller collected pollinator-plant data from 1874 to 1879 in the Alps and with record of date and site. To our knowledge he collected every single insect visitor he found, including small flies. His detailed publication enabled us to revisit those sites in 2016, 2017 and 2018, anticipating with more people a higher sampling effort. As most of the over 10.000 pinned insects are identified at species or genus level now, we can give first insights to changes in the most common species on these alpine meadows covering butterflies, bumblebees, hoverflies and other flies. Especially flies have relatively increased compared to butterflies on the alpine meadows. At species level we see different temporal changes, suggesting multiple drivers.

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Poster

### **Bernhardt-Römermann, Markus**

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#### **sREplot – Resurvey vegetation plots in biodiversity research**

Historical vegetation records open a window into the past, providing key baseline data on historical states in ecosystems. More value accrues when we relocate and resurvey these sites, illuminating just how these systems are changing. Interest in ecological resurvey research has soared, spurring initiatives like sREplot to assemble historical and resurvey records provided by various already existing resurvey networks. Bringing together scientists from different resurvey networks will allow a synthetic view on temporal biodiversity changes across biomes. With this contribution, we present some of the basic outcomes of the two workshops of the sREplot group. Next to highlighting the potential of resurvey studies by presenting some first results, we report on the progress we made in networking and stimulating joint analyses. We encourage the use of synergies between different initiatives.

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## **Topic Session 1: Biodiversity Change (in the Anthropocene): 29.Aug., 12.45 - 14.30**

Poster

**Jochum, Malte**

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### **Effects of exotic earthworm invasion on forest soil fauna communities**

Invasion of exotic earthworms is a global phenomenon, which can alter the biodiversity of plants, animals, and microbes in the invaded ecosystems. For the last ~12,000 years, earthworms have been naturally absent from wide parts of North America but, more recently, have been re-introduced with dramatic consequences. Soil-fauna responses to earthworm invasion are often studied by focusing on single taxa, functional groups or ecosystem components. We present results from four different northern North American forests (three in Canada, one in the US) sampled for soil fauna between 2016 and 2018. We compared species richness, density, biomass, and average body mass of soil macro-, meso-, and microfauna in invaded and non-invaded forest parts. Additionally, we assessed which functional groups and size classes are most heavily affected by earthworm invasion. While invasion had significant effects on all of these groups, magnitude and direction of effects differed between size-, functional, and taxonomic groups. Our results show that while invasive earthworms represent a strong environmental filter for native communities, there are winners and losers of these invasions among the soil fauna and the long-term consequences of this globally important invasion will depend on which roles these soil fauna groups play in their native ecosystems.

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## **Topic Session 1: Biodiversity Change (in the Anthropocene): 29.Aug., 12.45 - 14.30**

Poster

### **Slabbert, Eleonore Louise**

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### **Scale-dependent impact of land management on above- and belowground biodiversity**

Detailed spatial responses of biodiversity to environmental change are of high importance to identify underlying mechanisms causing structural changes to biotic communities. Currently, most research focuses on responses at single spatial grains and of single taxonomic groups. To address these knowledge gaps, we investigated scale-dependent effects of land management (LM) (pastures vs. meadows) and land-use intensity (LUI) in central Germany for plants, fungi and bacteria.

Plants and soil microbe diversity were sampled from plots in pastures and meadows at five study sites along a LUI gradient. Plants were identified to species, while soil microbes to operational taxonomic units. Analyses included diversity partitioning of species richness (S) and biodiversity components (i.e. density of individuals (N); species abundance distribution (SAD) and spatial aggregation) at  $\alpha$ - (plot),  $\beta$ - (turnover) and  $\gamma$ - (site) scales.

Plants and soil microbes had similar response rates at both scales, but the direction of impact on S varied with LUI. Differences across taxa groups were presumably due to varying dispersal abilities and a consequence of historic land-use. Changes in S were driven by altered SAD and aggregation. Our findings provide evidence of scale- and taxa-specific biodiversity patterns in response to LM that are not easily extrapolated along LUI gradients.

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