Exploratories for Functional Biodiversity Research





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The three large-scale research sites, so-called Exploratories, are located in the Swabian Alb, the Hainich-Dün region and the Schorfheide-Chorin biosphere reserve. All three Exploratories are located in large protected areas and are characterized by agricultural and forestry use of different management intensity. They differ in their landscape structure and climatic conditions.

Background

Since 2006, the German Research Foundation (DFG) funds three exemplary large-scale and long-term research platforms, the **Biodiversity Exploratories.** These Exploratories combine the assessment of biodiversity of different plants, animals, fungal and microbial taxa with measurements of ecosystem processes, and with experimental manipulations. Their goal is to unravel causal relationships between land-use, biodiversity and ecosystem functioning. Thus, they provide a scientific platform for biodiversity research in real landscapes.



Currently, over 250 scientists from different research fields, organized in 42 projects from 47 institutions cities are involved.

The Biodiversity Exploratories are characterized by their:

- Interdisciplinarity: different scientific disciplines work together on the same plots with the same main objectives.
- <u>Completeness</u>: almost the entire biodiversity, spanning all trophic levels, is recorded.
- Long-term nature: studies on the same plots since 2006.
- <u>Comparability</u>: measures are taken on all plots of the three Exploratories with the same methods.

Main objectives of our interdisciplinary research:

- Relationship between biodiversity of different taxa and level
- Role of biodiversity for ecosystem processes and ecosystem services

Influence of different land use intensities on biodiversity and ecosystem processes

Project structure

Core Projects

The core projects of the Biodiversity Exploratories emerged from the establishment of the Exploratories (2006–2008). Since 2008, they provide project infrastructure and collect important basic information and long term monitoring of land use, diversity and ecosystem processes for all projects. In addition, they coordinate project-wide activities such as large-scale experiments. Currently there are ten core projects, which include:

• Local Management Teams for each Exploratory. These are the first point of contact for the landowners, public authorities, and the local press. They also maintain the plots and instrumentation, and support scientists during their fieldwork.

Stations. • Climate 300 Monitoring Environmental observation Units and 4 towers collect data on soiland air temperature moisture.

• Central database BExIS. It connects all projects in a web-Plant Arthr Nicro Soils based data exchange and supports field work. **Ecological Synthesis** • Central coordination. The Biodiversity Exploratories **Contributing projects** Office (BEO) enables smooth academic coordination and administration, organizes events and oversees public relations.

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Exploratories – Design

A core principle of the Exploratories is that all projects use the same study plots in all three Exploratories. Studying the diversity of above and below ground taxa and many ecosystem processes on the same plots allows quantitative synthesis of research results.

Study plots:

An hierarchical plot design with plot categories of differing research intensity have been set up in each exploratory (see graph below). In total, 300 experimental plots (EPs) are used in a large number of experiments. These reveal the causal relationships between land use, biodiversity, and ecosystem processes e.g. productivity, biomass, nitrogen and phosphorous cycling, soil aggregation, and pollination.

Large-scale experiments:

In 2020, new large-scale experiment plots in forest and grassland were established by the core projects. In these, biodiversity is manipulated directly and indirectly across whole landscapes. These are:

Reduced land-use intensity experiment (REX): This experiment asks whether reduced land-use intensity in grasslands will affect the diversity and function of grassland, and if it is necessary to sow additional plant species to increase diversity?

Land-use experiment (LUX): This experiment asks how changes in individual components of land use (mowing, grazing and fertilization) affect the biodiversity and the ecosystem processes.

Forest gap experiment (FOX): This experiment aims to elucidate the effects of two important factors related to forest management: 1. the change in abiotic conditions due to the opening of the canopy, 2. the availability of biotic resources as a function of logging.

Contributing Projects

The core projects are complemented and greatly expanded by a large number of contributing projects, which are dedicated to more specific research questions.

In the current project phase (2020–2023), there are 32 contributing projects. This open project structure allows the future entry of new working groups and innovative research questions.

Hierarchical plot design in each exploratory

Hierarchical plot design in each exploratory with the different plot categories (left) and the large-scale experiments in grassland (REX, LUX) and forest (FOX) as well as impresssions from the establishment of the large-scale experiments in 2020.

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