Infrastructure, data, knowledge and services provided by the eleven Core Projects of the Biodiversity Exploratories

Content

Introduction

Currently there are ten core projects in the Biodiversity Exploratories (BE). They provide infrastructure, coordination and essential basic data and knowledge on climate, land use, biodiversity and ecosystem processes for all BE-projects, including longer-term monitoring. As part of the next phase, we also envision a social-ecological core project (new core project 10).

Core projects 1 (Biodiversity Exploratories Office), and **2 (Local Management Teams**) provide general and regional coordination. **Core project 4 (Central Data Management)** provides services to support the creation of high-quality FAIR data that can be shared between projects, re-used for all projects across all phases, and shared with and re-used by the scientific community and the general public. **Core project 11 (Synthesis)** provides exemplary synthesis across projects according to the guiding questions of the Biodiversity Exploratories, organises courses and synthesis teams and events and provides a helpdesk function on analysis and synthesis.

Below, we summarise the data, knowledge and services provided to the contributing projects by core projects 3 and 5-10. The list contains services provided to contributing projects during the current phase of the BE (2023-2026). Furthermore, we give a short outlook on future services to be offered by these core projects for 2026-2029, of course pending these projects will be granted.

Table 1: Services provided in the 7th phase (2023 – 2026) by core projects 1, 2 and 4.

This table provides an overview of the datasets created and offered by the core projects Biodiversity Exploratories Office (BEO), Local Management Teams (LMT), and Central Data Management (BExIS Team) as a service in the 7th phase of the Biodiversity Exploratories and whether it is planned to continue these in the next 8th phase (2026-2029).

Dataset	Main information	BExIS Dataset-ID	Plan for new phase
Land use in grasslands: raw data from annual landowner interviews	Summarisation of management information collected since 2006 for all grassland plots based on annual interviews of the respective farmers, land owners or tenants involved in land management activity.	31767	Planned to continue

Input data of all grassland plots for Land-Use Intensity Index (LUI) calculation tool since 2006 - revised 2023	Values for the land management components mowing, grazing, and fertilization derived from the land use survey. Inout for LUI Tool.	31661	Planned to continue
BE fieldwork overview table - 7th phase	Collection of information about planned fieldwork provided by all projects.	31520	Planned to continue
BE fieldwork overview table - previous phases	Collection of information about done fieldwork provided by all projects.	31519	Planned to continue
Land-use intensity index (LUI) calculation tool of the Biodiversity Exploratories project for grassland survey data from three different regions in Germany since 2006	Tool that calculates the land-use intensity (LUI) index.	31514	Completed
List of synthesis proposals in the Biodiversity Exploratories	Overall overview of all proposed synthesis ideas inside the Exploratories project with a yearly updated status.	31504	Planned to continue
Basic information and coordinates of all grassland joint experiment plots	Overview of all plots and the applied experiments of the 2019 installed joint multi-site experiment.	31307	Completed

Borders of all three regions of the Biodiversity Exploratories project	Actual borders of the three exploratory regions.	31234	Completed
Overview maps of all plots in the three regions of the Biodiversity Exploratories	Overview maps for the three exploratory regions with all grassland and/or forest plots (including the joint multi-site experiment plots).	31151	Completed
Land use in grasslands: raw data of singular plot treatment on the new experimental grassland plots	Singular, non-repeated treatments on the joint multi-site experiment grassland plots are listed.	31134	Completed
BE fieldwork overview table 6th phase since 2020	Collection of information about planned fieldwork provided by all projects.	31081	Completed
Land use in grasslands: raw data of yearly owner interviews on the new experimental grassland plots	Summarisation of management information collected for all joint multi-site experiment grassland plots based on annual interviews of the respective farmers, land owners or tenants involved in land management activity.	31001	Planned to continue
Observation of landuse and landuse change (2006-2019, all exploratories)	Observation of landuse and results of conducted surveys with farmers and landusers, and the documentation of landuse change over the years.	27166	Completed

Coordinates and Inventory Overview of all Grid Plots (GPs)	Coordinates and overview on which inventory took place for each grid plot.	20907	Completed
Basic Information of all Experimental Plots (EPs)	Major information to all experimental plots like coordinates, soil types, height above see level, main tree species, ...	20826	Completed
Forest EP - forest management	Information about management activities like timber harvesting of the forest administration or the forest owner on the EPs.	20055	Planned to continue
Observation of landuse and landuse change (2006-2009, all exploratories) - Comments	Documentation about the landuse and landuse change dataset.	13447	Completed
Slope, aspect, and elevation derived from Digital Terrain Model for all plots (GP)	Slope, aspect, and elevation have been derived from DGM-data.	11603	Completed
Plot coordinates, access roads, parking places, and rescue points as gpx files	Several GPX files with the plot coordinates, parking places and rescue points are provided here.	11540	Completed

Basic information of all exploratories	Main geographic and environmental characteristics of the three Exploratory regions.	1580	Completed
Basic information and coordinates of field plots of the Biodiversity Exploratories project	Basic information for investigation areas (plots) of the Biodiversity Exploratories project with degraded coordinates for the public section.	1000	Completed

Service Table Core Project 3: Instrumentation and Remote Sensing

General information: Core project *'Instrumentation and Remote Sensing'* collects, prepares, analyses and provides data on the environment. It maintains a large network of climate and environmental monitoring stations, covers the remote sensing-based collection of plot and Exploratory wide data (platforms so far: UAVs, airborne, satellite), and processes the data to provide Analysis Ready Datasets (ARD) to all projects of the Exploratories. Using tailored analytical database modules which are developed and maintained by this project, and which are available through BExIS (Core 4), it provides on the fly visualization and processing functionality to all projects to support the individual research studies by deploying specifically tailored and spatially explicit variables for research into biodiversity ecosystem functioning and ecosystem services.

Furthermore, this project provides individual consultation and training workshops to help researchers to integrate climate and geospatial data into their research. See also: https://www.biodiversity-exploratories.de/en/about-us/infrastructure/instrumentation-and-remote-sensing/

Table 2: Services provided in the 7th phase (2023 – 2026) by core project 3.

This table provides an overview of the datasets created and offered by the core project Instrumentation and Remote Sensing as a service in the 7th phase of the Biodiversity Exploratories and whether it is planned to continue these in the next 8th phase (2026-2029).

Land use type	Dataset	Main information	Method	BExIS Dataset-ID	Plan for new phase
Full coverage of the three Exploratories	Analysis ready satellite data	Continuous and regular time series of Copernicus and Landsat satellite images are acquired, pre-processed and provided via RSDB	Data pre-processing and time series interpolation is done with standardized workflows	30969	Planned to continue
Full coverage of the three	High resolution Digital	The Digital Orthophotos (DOP) provide georeferenced	The images are processed by the federal survey administrations	30996	Will be updated

Exploratories	Orthophotos (DOP)	aerial images including the blue, green, and red bands.	and provided by BKG.		
Selected grassland EPs and experiments	UAV image collection	RBG & multi-spectral high-resolution images are collected over grassland plots multiple times a year	Images are collected using standardized workflows including geometric corrections and radiometric calibration	27730	Support for UAV campaigns will be continued
Selected forest EPs and FOX plots	UAV image collection	High-resolution RGB images and point clouds are collected every three years	Images and point clouds are collected using standardized workflows	31877	Will be updated
Full coverage of the three Exploratories	Digital Landscape Model (DLM)	Description of the topographic objects of the landscape in vector format based on the definitions of the ATKIS® object type catalog (ATKIS®-OK).	The DLM is generated by the federal administration surveys.	27728	Will be updated
Full coverage of the three Exploratories	Land cover data	Land cover information using the Corine Landcover classification (CLC) for the years 2021, 2015 and 2018	Land cover data is provided by the BKG	27727	Will be updated

Buffer of 500m around all EPs	Plot Surrounding Maps (PSM)	High-resolution thematic maps of the landscape surrounding the EPs including single trees and hedges	Visual interpretation of high-resolution aerial images	31454	Support for mapping campaigns will be continued
All EPs of the three Exploratories plus the FOX plots	Plot-Level Climate Data	Climate measurements: • Temperature above and below ground • Radiation upward and downward, longwave and shortwave • Precipitation • Soil moisture • Barometric pressure • Wind direction, velocity, gust • Relative air humidity	Climate-station measurements and interactive processing software ("TubeDB")	19007	Will be continue (and extended)

All plots of the three Exploratories	Plot-Level Climate Data	Climate data for public audience: • Temperature above and below ground • Sunshine duration • Precipitation • Soil moisture • Wind direction, velocity, gust	Derived from dataset 19007	24766	Planned to continue
	Management of remote sensing data	Types of managed data: (multiband) (time series) raster, point clouds, vector features, voxels	Software for management, visualization and processing ("RSDB")		Software development will be continued
	Processed camera-trap images	Processing of camera-traps image collections with box positions of animal occurrence.	ML based detection, management with software "PhotoDB"		Planned to continue
	Management of large audio data archives		Developed Software "AudioDB"		Software development will be continued

In case of being granted, core project 3 intends to continue several services (as shown in the table abvove) and plans to add the following additional services in the 8th phase (2023-2026) of the Biodiversity Exploratories:

- Plot-level climate data for the new cropland plots

- Extended set of plot-level bioclimate-indicators and bioclimate-anomalies including cold, warm, wet and dry spells derived from the climate station network
- High-resolution maps of primary climate variables covering the entire area of the Exploratories derived from the climate station network

Service Table Core Project 5: Plants

General Information: Since the beginning of the Biodiversity Exploratories, the core project Plants addresses the diversity of vascular plants, lichens and mosses in both grassland and forests and so provides long-term data on these diversities. It estimates intraspecific variation of selected functional traits of plants to provide an additional level of diversity and provides, as a major ecosystem process, the above-ground productivity of grassland vegetation and understorey vegetation in forests. It furthermore supports the grassland experiments REX & LUX and forest experiments FOX. Finally, we recorded the cover of all plant species (cultivated species and weeds) on the newly selected agricultural fields and measured their biomass production in summer for both cultivated plant and weeds. It is planned to continue these services for the upcoming 8th phase (2026-2029).

Table 3: Services provided in the 7th phase (2023 – 2026) by core project 5.

This table provides an overview of the datasets created and offered by the core project Plants as a service in the 7th phase of the Biodiversity Exploratories and whether it is planned to continue these in the next 8th phase (2026-2029). See also https://www.biodiversity-exploratories.de/en/projects/plant-diversity-and-plant-related-processes/

Land use type	Dataset	Main information	BExIS Dataset-ID	Plan for new phase
Grassland EPs	Vegetation Records for Grassland EPs, 2008 - 2024	Cover of all plants in spring	31893	Planned to continue
Grassland EPs	Biomass data (all grassland EPs, 2009-2024)	Plant aboveground biomass	31892	Planned to continue
Forest EPs	Vegetation Records for 151 Forest EPs, 2009 – 2023	Cover of all plants in spring and summer	31614	Planned to continue
Grassland	Vegetation Records 2020-2024 for new grassland	Cover of all plants in spring	31923	Planned to continue

	experiment REX and LUX			
Forest	Vegetation Records 2020–2023 for new forest experiment FOX	Cover of all plants in spring and summer	31673	Planned to continue
Forest EPs	Understorey biomass	Biomass of all plants in the understorey	Upcoming	Planned to continue
Forest EPs	Soil seed bank	Plant species in the soil seed bank 2024	Upcoming	Will be available for 2024
Agricultural Fields	Vegetation Records 2024	Cover of plant species in summer	Upcoming	Planned to continue
Agricultural Fields	Biomass production	Biomass of cultivated species and weeds	Upcoming	Planned to continue

Service Table Core Project 6: Forest structures

General information: Core project 'Forest structure' focuses on the repeated inventory (every 5-6 years) of all forest plots and provides detailed data on all forest stands. Coordinates for each tree > 7 cm at breast height and its diameter and species identity is available. Aggregated information on the stand level such as stand volume, basal area, stand growth, amount of deadwood, tree species composition is provided as well as specific stand structural attributes. For trees < 7 cm at breast height the core-project provides densities and species identities using size classes. Additional information for EPs includes data on forest management intensity (ForMI and SMI indices), tree harvests, tree mortality, and type and density of tree related microhabitats. Core forest structure also contributed significantly to design, planning and implementation of the FOX gap and deadwood experiment. We developed guidelines for plot selection, inventoried the trees on FOX plots, planned the gap cutting and worked out the procedure for allocating deadwood items. Coordinates, dimensions and species identity of living trees as well as deadwood stem sections is available. Currently, the core-project works on quantifying above- and belowground gap closure in FOX.

Table 4: Services provided in the 7th phase (2023 – 2026) by core project 6.

This table provides an overview of the datasets created and offered by the core project Forest structures as a service in the 7th phase of the Biodiversity Exploratories and whether it is planned to continue these in the next 8th phase (2026-2029). See also https://www.biodiversity-exploratories.de/en/projects/forest-structure-properties-structure-and-management-of-the-forest-experimental-plots-2/

Data set	Main information	BExIS Dataset-ID	Plan for the new phase
Forest EPs: Forest management	Annually resolved harvest quantities for all forest EPs starting from 2009/10.	31217	Planned to continue
Forest EPs: Forest management intensity	Annually resolved management intensity SMI for all forest EPs starting from 2009/10.	31217	Planned to continue
Forest EPs: Forest inventory of living trees	Complete list of all single trees (> 7 cm DBH) with their coordinates,	2009/10: 18268 2014/15: 21426	Planned to continue

	sizes and species identities. 4th forest inventory.	2023/24: 31487	
Forest EPs: Stand properties and stand structure	Stand characteristics, forest structure measures and tree species composition based on the 4th forest inventory.	2009/10: 22786 2014/15: 22766 2023/24: Upcoming	Planned to continue
Forest EPs: Forest inventory of dead standing trees	Complete list of trees that died between the 3rd an 4th forest inventory (> 7 cm DBH) with their coordinates, sizes and species identities.	2014/15: 23368 2023/24: Upcoming	Planned to continue
Forest EPs: Growth, harvest and natural mortality	Forest growth, harvest and natural mortality for the period between 3rd and 4th forest inventory.	2014/15: 22846 2023/24: Upcoming	Planned to continue
Forest EPs: Forest inventory of small trees	Density and species identity of small trees (< 7 cm DBH) for diameter classes.	2014/15: 26806 2023/24: Upcoming	Planned to continue
Forest EPs: Forest inventory of tree regeneration	Density and species identity of tree regeneration < 1.30 m in height for height classes in years 2014/15.	2014/15: 26787 2023/24: Upcoming	Planned to continue
Forest EPs: Deadwood inventory	Volume of large and small deadwood items by tree species identity, origin and decay stage. 3rd deadwood inventory.	2012: 24546 2017/18: 24526 2023/24: Upcoming	Planned to continue in 9th phase
Forest EPs: Microhabitats survey	Abundance of tree related microhabitats by MH types. 2nd microhabitat survey.	2017/18: 23646 2023/24: Upcoming	Planned to continue in 9th phase

Forest EPs: Terrestrial laser scanning	Canopy cover and other forest structural measures from TLS.	2014/15: 27828 2023/24: Upcoming	Planned to continue
FOX: Forest inventory of living trees	Complete list of all single trees (> 7 cm DBH) with their coordinates, sizes and species identities.	31226	Completed in the 7th phase
FOX: Experiment factor gap size	Size of the gap from terrestrial laser scanning for FOX G and GD plots.	31228 31897	Planned to continue
FOX: Experiment factor: Deadwood	Volume of deadwood logs placed on FOX D and GD plots.	31228 31897	Completed in the 7th phase
FOX: Experiment factor deadwood	Origin, location and volume of deadwood logs for FOX D and GD plots.	Upcoming	Completed in the 7th phase
FOX: Gap closure	Density and composition of tree regeneration for all FOX plots by species identity and tree size.	Upcoming	Planned to continue

If further granted, core project 6 intends to continue several services (see table above) and plans to offer some new services.

In particular, Core 6 would like to provide the following services in the 8th phase (2026–2029) of the Biodiversity Exploratories for all forest EPs:

- Forest types, stand age, forest management intensity, deadwood properties, microhabitats
- Forest inventory of living and dead standing trees
- Stand properties and stand structure and stand composition
- Growth harvest and natural mortality
- Forest productivity
- Tree diameter distribution
- Forest inventory of small trees and tree regeneration
- Browsing percentage of tree seedlings and saplings by animals
- Density and composition of tree regeneration in the FOX experiment.

Service Table Core Project 7: Arthropods

General information: Core project 'Arthropods' focuses on the yearly monitoring of arthropod species and ecological processes. We deliver species-level data time series for all grassland EPs. In forests, data are available yearly for VIPs and triennially for all EPs. Ecological processes (seed depletion, dung decomposition, predation) are assessed yearly. The core project also provides data on arthropods in the FOX and the grassland experiments.

We also provide a functional trait database of arthropod species collected in the Exploratories to facilitate trait analyses and syntheses.

Furthermore, we coordinate the BELongDead wood decomposition experiment and have monitored the insects emerging from the logs every year since the beginning. In addition, we coordinate the 3-yearly campaign to document wood decay and organize regular meetings to foster exchange and synthesis among people involved in the BELongDead experiment.

Table 5: Services provided in the 7th phase (2023 – 2026) by core project 7.

This table provides an overview of the datasets created and offered by the core project Arthropods as a service in the 7th phase of the Biodiversity Exploratories and whether it is planned to continue these in the next 8th phase (2026-2029). See also https://www.biodiversity-exploratories.de/en/projects/arthropods-and-arthropod-related-processes/

Land use type	Dataset	Main information	Method	BExIS Dataset-ID	Plan for the new phase
All VIPs	Arthropod mediated processes on VIPs	Ecological processes (seed depletion, dung decomposition, predation) measured annually since 2017	Seed trays, dung packages, dummy caterpillars	e.g. 31378, 31379	Planned to continue

Forest VIPs	Window traps on forest VIPs	Flying insects have been sampled annually since 2008; abundance information on many taxa, species-level data on Coleoptera and Hemiptera	Flight interception traps	22007	Planned to continue
Forest EPs	Window traps on forest EPs	Flying insects have been sampled triennially in 2008, 2011, 2014, 2017, 2020, 2023; abundance information on many taxa, species-level data on Coleoptera and Hemiptera	Flight interception traps	22008	Planned to continue triennially
FOX experiment	Window traps on FOX	Flying insects have been sampled annually in all FOX plots (including controls) since 2020; abundance information on many taxa, species-level data on various taxa, including Coleoptera and Hemiptera	Flight interception traps	31245	Planned to continue
FOX experiment	Arthropod mediated processes on FOX	Ecological processes (seed depletion, dung decomposition, predation), measured in all FOX plots (including controls) in 2020 and 2024	Seed trays, dung packages, dummy caterpillars	30904, 30938	Planned to continue triennially

Grassland EPs	Sweep-net samples in grassland EPs	Arthropods sampled annually with sweep-nets since 2008; abundance information on many taxa, species-level data on Araneae, Coleoptera, Hemiptera, Orthoptera	Sweep-net transects	21969, 31488	Planned to continue
Grassland experiments	Suction sampling on RPs/UPs	Arthropods sampled biannually with suction sampling in all RPs/UPs (including controls) in 2021 and 2023; identification by meta-barcoding	Biocoenometer	No data yet	Planned to continue biannually
Grassland experiments	Arthropod mediated processes on RPs/UPs	Ecological processes (seed depletion, dung decomposition, predation), measured in all RPs/UPs (including controls) in 2021 and 2023	Seed trays, dung packages, dummy caterpillars	31115, 31113	Planned to continue biannually
Agricultural plots	Suction sampling on agricultural plots	Arthropods sampled with suction sampling in 2024; abundance data per higher taxonomic level	Biocoenometer	No data yet	Planned to continue

All plots	Arthropod trait data	Traits have been measured and collated from literature for almost all collected species	Morphological measurement; life-history from literature	e.g. 31122, 31418	Planned to continue
All plots	Checklist for arthropod species names	Checklist for all scientific binomials (genus, species) used in the monitoring data of Arthropods Core	Compiled from literature	31355	Planned to continue
BeLongDead	Saproxylic beetles and other taxa	Specimens collected with deadwood eclectors from 2010-2021	Deadwood eclectors	31123, 31124	Planned to continue until logs are decayed
BeLongDead	Coordination	Information on who did what when and where on the log, since 2010 BELongDead maintenance	Information compiled through questionnaires and in 2 meetings per year, photos of logs, marking of logs	e.g. 18726, 16429, 16386	Planned to continue
BeLongDead	Wood decay	Weight loss of 1140 BELongDead logs since 2010 in 29 VIPs	Sampling and measurements every 3 years (last: 2021)	e.g. 27126	Planned to continue
Grassland EPs	LUI	Land-use intensity index and components, LUI niche for species	Development and enhancement of methods and tools to analyse land-use	e.g. 25086	Planned to continue

			intensity and effects		
Forest EPs	ForMIX	Forest Management Index based on tree species composition, deficit in deadwood availability, tree removal and stand maturity	Development and enhancement of methods and tools to analyse land-use intensity and effects	31855	Planned to continue

Service Table Core Project 8: Microorganisms

General Information: Core project Microorganisms is in charge of long-term monitoring of the biodiversity of soil microorganisms for all plots and large-scale experiments (in the current phase FOX, REX I + II, LUX and the agricultural fields). Inventories based on high-throughput amplicon sequencing are available for fungi (based on ITS2 marker), arbuscular mycorrhizal fungi (based on 18S rRNA marker gene), bacteria (V3-V4 region of the 16S rRNA gene marker) and archaea (V1-V3 region of the 16S rRNA gene marker). Archaeal and virus inventory is also based on shotgun metagenomics sequencing for selected plots. Metagenomes also provide inventories of functional genes as well as reconstructed MAGs (metagenome-assembled genomes) of highly abundant taxa. Apart from the provided data, core project Microorganisms is responsible for long-term storage of soil samples and extracted nucleic acids (DNA and RNA) for future work. Facilitating access to sequencing (Illumina, Pacbio) and assisting with molecular work and bioinformatics after next-generation sequencing are additional services provided.

Table 6: Services provided in the 7th phase (2023 – 2026) by core project 8.

This table provides an overview of the datasets created and offered by the core project Microorganisms as a service in the 7th phase of the Biodiversity Exploratories and whether it is planned to continue these in the next 8th phase (2026-2029). See also https://www.biodiversity-exploratories.de/en/projects/species-diversity-and-community-composition-of-soil-microorganisms-in-grassland-and-forest-ecosystems-along-land-use-gradients-3/

Land use type	Dataset	Main information	Method	BExIS Dataset-ID	Plan for new phase
EPs	Soil fungi	List of ASVs present in all samples from 2023 soil sampling campaign.	Sequencing of ITS2 (DNA-based)	2011, 2014,2017: ID 26467-26473 (updated datasets containing also fungal data from 2021 and 2023, available early 2025)	Planned to continue
	Soil arbuscular mycorrhiza fungi	List of ASVs present in all samples from 2023 soil sampling campaign.	Sequencing 18S rRNA (DNA-based)	2011, 2014, 2017, 2021, 2023: 31947-31957	Planned to continue

	Root fungi	List of ASVs present in forest root samples from 2023 soil sampling campaign.	Sequencing of ITS2 (DNA-based)	no dataset available yet	Planned to continue
	Soil Bacteria	List of ASVs present in all samples from 2023 soil sampling campaign.	Sequencing of V3-V4 region of 16S rRNA (RNA-based)	2011-2021: forests(ID 24868, 25065, 26569, 31801, 31864), grasslands (ID 24866, 25066, 26568, 31800, 31805)	Planned to continue
	Soil Archaea	List of ASVs present in all samples from 2023 soil sampling campaign.	Sequencing of V1-V3 region of 16S rRNA (DNA and RNA-based)	2021: forests (ID 31810, 31812), grasslands (ID 31809, 31811)	Planned to continue
	Soil Virome (selected EPs)	List of ds-DNA viruses and phages present in a subset of samples from 2017 and 2023 soil sampling campaign	Long read – shotgun sequencing of DNA	In progress	Planned to continue
	Soil Functions (selected EPs)	List of functions present in a subset of samples from 2017 and 2023 soil sampling campaign	Short read shotgun sequencing of DNA	31760 In progress	Planned to continue
	Genomes of Keystone Microbial Taxa	In silico prediction of genomes of keystone microbial taxa	Combined analysis of short read and long read shotgun sequencing data	In progress	Planned to continue
	Soil samples	Storage and provision of all samples from 2023 soil sampling campaign	Freezing at -80°C	Done	Planned to continue

	Nucleic acid extracts	Extraction, storage and provision of extracted nucleic acids from all samples of the 2023 soil sampling campaign	Phenol-chlorophorm based RNA and DNA extraction/Kit based extraction (Qiagen PowerSoil)	Done	Planned to continue
FOX	Soil fungi	List of ASVs present in all soils from 2023 soil sampling campaign	Sequencing of ITS2 (DNA-based)	31838-31839	Planned to continue
	Soil Bacteria	List of ASVs present in all samples from 2023 soil sampling campaign.	Sequencing of V3-V4 region of 16S rRNA (DNA-based)	2020-2021: ID 31829	Planned to continue
	Soil Virome (selected treatments)	List of ds-DNA viruses and phages present in a subset of samples from 2017 and 2023 soil sampling campaign	Long read – shotgun sequencing of DNA	In progress	Planned to continue
	Soil Functions (selected treatments)	List of functions present in a subset of samples from 2017 and 2023 soil sampling campaign	Short read shotgun sequencing of DNA	In progress	Planned to continue
	Genomes of Keystone Microbial Taxa	In silico prediction of genomes of keystone microbial taxa	Combined analysis of short read and long read shotgun sequencing data	In progress	Planned to continue
	Soil samples	Storage and provision of all samples from 2023 soil sampling campaign	Freezing at -80°C	Done	Planned to continue

	DNA extracts	Extraction, storage and provision of extracted nucleic acids from all samples of the 2023 soil sampling campaign	Phenol-chloroform based DNA extraction	Done	Planned to continue
REX I+II / LUX	Soil fungi	List of ASVs present in all samples taken in May 2021	Sequencing of ITS2 (DNA-based)	No complete dataset available yet	Planned to continue
	Soil arbuscular mycorrhiza Fungi	List of ASVs present in all samples taken in May 2021	Sequencing 18S rRNA (DNA-based)	No complete dataset available yet	Planned to continue
	Soil Bacteria	List of ASVs present in all samples from 2023 soil sampling campaign.	Sequencing of V3-V4 region of 16S rRNA (DNA-based)	2021: ID 31936	Planned to continue
	Soil Functions (selected treatments)	List of functions present in a subset of samples from May 2023	Shotgun sequencing of DNA	In progress	Planned to continue
	Soil samples	Storage and provision of all samples from 2023 soil sampling campaign	Freezing at -80°C	Done	Planned to continue
	Soil Virome (selected treatments)	List of ds-DNA viruses and phages present in a subset of samples from 2017 and 2023 soil sampling campaign	Long read – shotgun sequencing of DNA	In progress	Planned to continue
	Genomes of Keystone Microbial Taxa	In silico prediction of genomes of keystone microbial taxa	Combined analysis of short read and long read shotgun sequencing data	In progress	Planned to continue

	DNA extracts	Extraction, storage and provision of extracted nucleic acids from all samples of the 2023 soil sampling campaign	Phenol-chloroform based DNA extraction	Done	Planned to continue
Agricultural fields (Pilot)	Soil Bacteria	List of ASVs present in all samples from 2024 soil sampling.	Sequencing of V3-V4 region of 16S rRNA (DNA and RNA-based)	In progress	Planned to continue
	Soil fungi	List of ASVs present in all samples taken in April 2024	Sequencing of ITS2 (DNA-based)	31960-31961	Planned to continue
	Soil arbuscular fungi	List of ASVs present in all samples taken in April 2024	Sequencing of 18S rRNA (DNA-based)	31958-31959	Planned to continue
	Soil samples	Storage and provision of all samples from 2024 soil sampling campaign	Freezing at -80°C	Done	Planned to continue
	DNA extracts	Extraction, storage and provision of extracted nucleic acids from all samples of the 2024 soil sampling campaign	Phenol-chloroform based RNA and DNA extraction/Kit based extraction (Qiagen PowerSoil)	Done	Planned to continue

In case of further granting, Core project 8 intends to continue several services (as shown in the table above) and plans to add new services that have not been offered yet.

Core 8 intends to provide the following additional services in the 8th phase (2026-2029) of the Biodiversity Exploratories:

- EPs: Soil fungi, Soil arbuscular mycorrhiza fungi, soil Bacteria, soil Archaea, Metagenomes, Soil samples and nucleic acid extracts from all samples of the 2026 soil sampling campaign

- FOX: Soil fungi, soil Bacteria, Soil samples and DNA extracts in all samples from May 2026
- REX/LUX: Soil fungi, Soil arbuscular mycorrhiza fungi, soil Bacteria, Soil samples and DNA extracts from May 2026
- Agricultural fields: Soil fungi, Soil arbuscular mycorrhiza Fungi, soil Bacteria, Soil samples and DNA extracts from May 2026

Service Table Core Project 9: Soil

General information: The core project 'Soils' focuses on (1) the provision of basic information on soil properties and functions at all experimental plots (EPs) and common experimental platforms (FOX, REX, LUX); (2) monitoring of aboveground litter fall in forests and of organic carbon and extracellular enzyme activities in soils; (3) coordinating joint activities of soil groups including the joint soil sampling campaign at the beginning of each phase (see below) to facilitate logistics and to maximize synergies and comparability of results; (4) maintaining a central archive with air dried samples of all aboveground litter and soil samples from previous sampling campaigns.

Table 7: Services provided in the 7th phase (2023 – 2026) by core project 9.

This table provides an overview of the datasets created and offered by the core project Soil as a service in the 7th phase of the Biodiversity Exploratories and whether it is planned to continue these in the next 8th phase (2026-2029). See also https://www.biodiversity-exploratories.de/en/projects/linking-biodiversity-and-land-use-to-soil-functions

CR: will be continued but in reduced form with focus on FOX plots and EP controls
C: will be continued as part of the joint soil sampling campaign;
NC: one-time analysis; will probably not be directly repeated in next phase

Land use type	Main information	Dataset	Method	BExIS Dataset-ID	Plan for new phase
Aboveground litter fall					
Forest EPs and FOX plots	Aboveground litter fall is collected three times per year (early spring, summer, late autumn) with litter traps; samples are separated into leaves, twigs, fruits and leaves	Aboveground litter fall: total mass per plot and sampling time;	gravimetric	**20126** (EPs since 2015, FOX in progress)	CR
		C, N and S contents	elemental analyses	**20127** (EPs since 2015, FOX in progress)	CR

Mineral soil 0–10 cm, samples collected during joint sampling campaign in Mai 2023					
EPs forest, grassland	Soil characterization	Field protocols	Description	31646	C
		pH	0.01 M $CaCl_2$	31644	C
		water content	gravimetric	31659	C
		bulk density	gravimetric	31876	C
		total C, N, S organic C	elemental analyses	31645	C
		OC, N, stocks	elemental analyses	31876	C
		clay content	estimated from residual water	31779	C
		Olson P	Olson extraction	31863	C
FOX	Soil characterization	Field protocols	Description	31743	C
		pH	0.01 M $CaCl_2$	31728	C
		water content	gravimetric	31727	C
		bulk density	gravimetric	ongoing	C
		total C, N, S organic C	elemental analyses	ongoing	C
		clay content	estimated from residual water	31782	C
		Olson P	Olson extraction	31889	C

REX, LUX grassland	Soil characterization	Field protocols	Description	31744	C
		pH	0.01 M $CaCl_2$	ongoing	C
		water content	gravimetric	31721	C
		bulk density	gravimetric	ongoing	C
		total C, N, S organic C	elemental analyses	ongoing	C
		OC stocks	elemental analyses	31781	C
		clay content	estimated from residual water	31871	C
		Olson P	Olson extraction		
EPs forest and FOX	Soil functions	Extracellular enzyme analyses (acid Phosphatase, beta-glucosidase, sulfatase, N-acetyl-glucosminidas)	Fluorescent substrates	31662 (EP) FOX ongoing	C
		Cmic, Nmic	Chloroform fumigation extraction	ongoing	C
Sampling of the litter layer in forests during all sampling campaigns					

Forest EPs, FOX	Characterization of litter layer	Total mass total C, N, S	elemental analyses	ongoing	C

Description of the general joint soil sampling campaign:

The sampling campaign is traditionally performed in May of the first year of a new funding period (had to be postponed in the ongoing phase due to Covid 19 restrictions). It takes about three weeks and is done in parallel in all three Exploratory regions and covering all EPs and (unless there is no demand) also the experimental plots of FOX, REX and LUX. It is coordinated by the core projects Soil, Microbiology and BEO but requires active contributions from many soil-related contributing projects so that we get enough people for this large endeavor. Thus, every project requiring soil samples should contribute 3 team members for the time of sample collection. Soils will be collected following the same protocol as in previous years to enable coherent monitoring activities (dataset 31037).

Briefly, the focus is on the biologically most active top 10 cm of the mineral soil. In forests also samples of the litter layer are collected. Typically, on all EPs one mixed sample per plot is obtained based on samples taken with a corer (5 cm diameter) from 14 locations along two transects (20 m in grasslands/ 40 m in forests) on the plots. Samples are directly mixed in the field and roots and stones sorted/sieved out (and collected for contributing projects on demand) directly in the field laboratory. Subsamples for each project will be separated, and stored as required at 4°C or -20°C before being shipped to individual institutions. Freezing samples in liquid N2 is possible but requires separate planning.

For the experimental plots also mixed samples from topsoils are obtained and processed but with a reduced number of samples due to smaller plot sizes.

Details and individual demands and requirements of each project will be discussed before and finalized during the general assembly (typically in February).

Service Table Core Project 10: Social Ecology

General information: The core project "Social Ecology" intends to ensure a high-quality research infrastructure for social-ecological research on the causes and consequences of the relationships between land use, biodiversity and ecosystem services. In case of approval, the core project intends to provide the following services: 1) coordinating social-ecological research, e.g. joint surveys and data collection, questions of ethical approval; 2) contact person for regional stakeholder engagement into the research process, e.g. stakeholder mapping and co-design processes; 3) review and collection of existing socio-demographic data from the Exploratories regions; 4) feasibility study to set up a regular social-ecological monitoring on e.g. demand and use of ecosystem services, social-ecological interactions, value change of local and regional stakeholder.

All data collected in this core project will be available to contributing projects via BExIS.