



Institute Report

Institute of Ecology at Leuphana
University Lüneburg

Foreword

2023 was a very eventful year for the Institute of Ecology. We welcomed our new Vegetation Ecology and Biodiversity Conservation professor Sylvia Haider in March, who came to us from the University of Halle. This is a gamechanger for our institute as the professorship has been vacant for a while, although we were lucky to be able to recruit Emanuela Weidlich as a lecturer to bridge the period without a professor. Sylvia brought two PhD students Meike Buhaly (from USA) and Pablo Castro Sánchez-Bermejo (from Spain) with her from Halle. Pablo spent a field season in China collecting functional trait data in the BEF-China tree diversity experiment together with other doctoral researchers from the DFG graduate school “TreeDi”. Meike’s research focuses on range-expanding plant species and their impact on native plant communities (*RangeX* project).

In June Benjamin Delory was offered an Assistant Professorship in Land Use and Biodiversity at the Copernicus Institute in Utrecht, Netherlands and in December 2023 we celebrated the very fruitful eight years we have shared with Ben in the Institute of Ecology and said our goodbyes, proud that he is moving on to bigger things, and sad to see him go. Early in 2023 Dragan Matevski (from Macedonia) joined the lab of Professor Thorsten Aßmann, from Göttingen, and in October Emanuela Weidlich accepted a position as research postdoc in Vicky’s lab group; very soon Joice Klipel will join the group of Sylvia Haider, thus making the institute more diverse and also more Brazilian, and we look forward to this new phase. In terms of professorships, we advertised the Junior Professor in Animal Ecology and Trophic Interactions (tenure track) in October and are interviewing seven candidates coming February 22/23rd in C40 601. It looks like we will soon have a new professor in trophic interactions to complement the research and teaching we are already doing.

This year has been a good year for projects and publications. In the *Grassworks* project, the ecological fieldwork was completed in August, a major milestone now allowing the analysis of the full data set of restored and reference grassland sites across the three regions in Germany (North, Central, South) as well as the integration of social with ecological data. In the BETA-FOR project Pia Bradler started her PhD. Pia explores how an enhancement of structural complexity affects the diversity and functioning of forest understorey vegetation at various spatial scales. Two key publications came out in 2023, one on the topic of Hill–Chao numbers allowing the decomposition of gamma multifunctionality into alpha and beta components in Ecology Letters (Chao et al. 2023, with co-authors Benjamin Delory and Andreas Fichtner from our institute) and another in Science Advances on how the relationship between tree diversity and productivity is modulated by stand structural complexity across mycorrhizal types (Ray et al. 2023, supervised by Andreas Fichtner and with Benjamin Delory as a further co-author from our Institute). Sylvia Haider contributed to a key study on the positive effect of plant diversity on soil carbon and how it is related to climate conditions (Spohn et al. 2023 Nature Communications). Finally, an Afrotropical ground beetle species was named after Prof. Thorsten Aßmann, *Macrocheilus assmanni* Serrano in 2023!

Table of Contents

Foreword	1
Working groups	3
People	4
Projects	9
ChemLEGACY	9
BETA-FOR – ENHANCING STRUCTURAL DIVERSITY IN PRODUCTION FORESTS	11
INPLAMINT	13
GRASSWORKS	16
TreeDi.....	19
Mountain Invasion Research Network (MIREN) / RangeX	22
ÖkoKult.....	25
POEM: PriOrity Effects Mechanisms	28
Restore Rwanda.....	33
Climate Change and Early Humans of the North (CCEHN)	35
Publications	39
All publications in 2023	39
Publication summary 2023	44
Further works in 2023	46
All publications in 2024	48
Further works in 2024	53
Theses.....	54
Master.....	54
Bachelor	54
Technical and administrative staff.....	57
Research	57
Examples from practice	57
Teaching.....	58
“Biotopgarten“	59
Miscellaneous.....	61

Working groups

Ecosystem Functioning and Services

Prof. Dr. Vicky Temperton

Ecology, esp. Animal Ecology

Prof. Dr. Thorsten Aßmann

Vegetation Ecology and Biodiversity Conservation

Prof. Dr. Sylvia Haider

Sustainable Use of Natural Resources

Prof. Dr. Jacqueline Loos

Landscape Change

Prof. Dr. Brigitte Urban

Quantitative Methods in Sustainability Science

Prof. Dr. Henrik von Wehrden

People

Ecosystem Functioning and Services



Prof. Dr. Vicky Temperton
Head of the Group, Head of the
Institute



Inés María Alonso-Crespo
Doctoral researcher



Dr. Miguel Á. Cebrián-Piqueras
Post-Doctoral researcher
Associated member, Social-
Ecological Systems Institute (SESI)



Dr. Benjamin Delory
Post-Doctoral researcher



Lukas Kuhn
Doctoral researcher in cooperation
with the Professorship for
International Sustainable
Development and Planning



Juno Christin Laschke
Doctoral researcher



Tanja Michaela Müller
Office management



Dr. Thomas Niemeyer
Technical and administrative staff



Ioana Alexandra Patru-Duse
Coordinator Grassworks project



Christoph Stegen
Technical and administrative staff



Dr. Alina Twerski,
Post-Doctoral researcher



Dr. Emanuela W. A. Weidlich
Research and teaching associate



Dr. Heike Zimmermann
Lecturer

Ecology, esp. Animal Ecology



Prof. Dr. Thorsten Aßmann
Head of the Group



Estève Boutaud
Doctoral researcher



Dr. Thorsten Buck
Research and teaching associate



Dr. Silke Fottner
Technical and administrative staff



Pascale Zumstein
Technical and administrative staff
and Doctoral researcher



Swantje Grabener
Research and teaching associate
and Doctoral researcher



Dr. Dragan Matevski
Research and teaching associate



Tanja Michaela Müller
Office management



Christoph Stegen
Technical and administrative staff

Vegetation Ecology and Biodiversity Conservation



Prof. Dr. Sylvia Haider
Head of the Group



Pia Bradler
Doctoral researcher



Meike Buhaly
Research and teaching associate
and Doctoral researcher



Pablo Castro Sánchez-Bermejo
Doctoral researcher



Jelena Daniels,
Doctoral researcher



PD Dr. Andreas Fichtner
Research and teaching
associate



Tanja Michaela Müller
Office management



Christoph Stegen
Technical and administrative
staff



Dr. David Walmsley
Lecturer



Susanne Wedi-Pumpe
Technical and administrative
staff

Landscape Change



Prof. Dr. Brigitte Urban
Head of the Group



Karin Dziarski
Office management



Michael Hein
Doctoral researcher



Dr. Martin Theuerkauf
Post-Doctoral researcher

Sustainable Use of Natural Resources



Prof. Dr. Jacqueline Loos
Head of the Group



Pascal Fust
Research and teaching associate



Konrad Gray
Doctoral candidate



Gudrun Harms
Office management



Rhoda Kachali
Doctoral researcher

Quantitative Methods in Sustainability Science



Prof. Dr. Henrik von Wehrden
Head of the Group



Neha Chauhan
Doctoral researcher

Visiting Scientists and Honorary Professorships



Prof. Dr. Werner Härdtle
Guest scientist



Hon.-Prof. Dr. Thomas Kaiser



**Hon.-Prof. Dr. Johannes
Prüter**

Projects

ChemLEGACY

Funding institute: Deutsche Forschungsgemeinschaft (DFG)

Partners: Marina Semchenko (University of Tartu, Estonia), Stefanie Döll (German Centre for Integrative Biodiversity Research (iDiv) Halle-Jena-Leipzig, Germany), Simone Cesarz (German Centre for Integrative Biodiversity Research (iDiv) Halle-Jena-Leipzig, Germany)

Duration: 01.01.2022 – 31.12.2024

PIs in the institute: Benjamin Delory (now Assistant professor at Utrecht University)

Institute staff working on the project: Benjamin Delory

Website: <https://gepris.dfg.de/gepris/projekt/470604360?language=en>

Plants change the biotic and abiotic properties of the soil, thus creating soil legacies that can affect species coexistence through plant-soil feedbacks (PSF). So far, it is largely unknown (1) whether soil chemical legacies originating from changes in the identity, diversity and abundance of soil metabolites can mediate PSF, and (2) whether these PSF can be predicted using plant functional traits. ChemLEGACY is a DFG-funded project aiming to address this knowledge gap.

In 2022, we set up a large experiment in which monocultures of 14 grassland species with contrasting trait values were grown in outdoor mesocosms (first picture). We gave one year to the plants to establish. In 2023, we started collecting soil solution from the pots using Rhizon pore water samplers. We did this twice a week for eight weeks between May and July 2023. The collected soil solution was regularly applied to 15 species growing in a greenhouse and selected to represent different regions of the root economics space (second Picture). Control plants received soil solution filtered through activated carbon to reduce dissolved organic carbon (DOC) concentration. We manipulated soil biota using soil sterilisation to quantify the net effect and the soil biota-mediated effect of the soil solution metabolome on plant growth. In July, we stopped the experiment and harvested the plants growing in the greenhouse. After three weeks of root washing, we started measuring leaf and root traits on the plants that grew in the conditioning and feedback modules of the experiment. Metabolomic analyses on soil solution samples are being carried out by Stefanie Döll (iDiv, Germany). Microbial biomass and activity in soil samples collected in the conditioning module of the ChemLEGACY experiment are being measured by Simone Cesarz (iDiv, Germany). Maintaining and running the ChemLEGACY experiment, as well as taking all the measurements needed for the project and processing samples in the laboratory was a lot of work, and it would not have been possible without the help of a team of very motivated student helpers. Although preliminary, our first results suggest that (1) the soil metabolome and the soil biota interactively mediate PSF and (2) seed and root traits can help predict PSF.



Conditioning module of the ChemLEGACY experiment set up on the Rotes Feld campus of the Leuphana University Lüneburg
(© Benjamin Delory).



Feedback module of the ChemLEGACY experiment set up on the Rotes Feld campus of the Leuphana University Lüneburg
(© Benjamin Delory).

BETA-FOR – ENHANCING STRUCTURAL DIVERSITY IN PRODUCTION FORESTS



Funding institute: Deutsche Forschungsgemeinschaft (DFG, German Research Foundation)

Partners: Julius-Maximilians-University Wuerzburg, Georg-August-University Goettingen, German Center for Integrative Biodiversity Research (iDiv) Halle-Jena-Leipzig, Albert-Ludwigs-University Freiburg, TU Dresden, Utrecht University, University Leipzig, Black Forest National Park, University of Bayreuth, Goethe University Frankfurt am Main

Duration: 01.05.22 – 01.05.26

PIs in the institute: Andreas Fichtner, Benjamin Delory

Institute staff working on the project: Pia Bradler

Website: <https://www.uni-wuerzburg.de/en/beta-for/>

The BETA-FOR project aims to explore the impacts of forest homogenization on biodiversity and ecosystem functions. The decline in β -diversity due to increasing human activities has led to large-scale forest homogenization. Through experimental approaches, we aim to develop guidelines for sustainable forest management to reverse negative impacts of homogenization.



Left: Conceptual figure including map of study regions in Lübeck, Hochwald-Hunsrück National Park, Saarland, University Forest Würzburg, Bavarian Forest National Park and Passau. All eleven sites consist of a control and a treatment district, each consisting of nine 50 m x 50 m patches. Right: Patch with standing and lying dead wood in the Lübeck Forest (© Andreas Fichtner).

Within the research unit, we investigate the effects of an enhancement of structural complexity in forests on biodiversity and multifunctionality by comparing a treatment district with a control district. This paired forest landscape design is replicated at eleven sites in Germany (Fig. above). In each treatment district, resource availability has been altered by different combinations of light (open or closed canopy) and dead wood availability (e.g. standing dead wood, logs, stumps). Each of the nine patches in a treatment district has received a different treatment, thus increasing structural beta-complexity, which we expect to influence biodiversity and multifunctionality. Our aim is to establish a connection between β -diversity and multifunctionality and to develop recommendations for long-term forest conservation strategies.

The main objective of our subproject within the research unit is to investigate how a higher spatial heterogeneity in forest structure affects the diversity of vascular plants, terricolous bryophytes, and lichens in the forest understory across spatial scales, and how this modulates above- and belowground functioning in terms of biomass production.

In collaboration with a great team including student assistants, bachelor and master students, technical staff, our colleagues at TU Dresden and across the research unit, we successfully conducted field work in all eleven study regions. 2023 year was the first year in which vegetation surveys were conducted in all 234 patches across the eleven forest landscapes, allowing analyses of structural enhancement in treatment districts compared to control districts across all study regions. Moreover, we sampled aboveground biomass during summer and fine root samples as a measure of belowground biomass production in all patches during autumn. This allows us to link patterns in species richness to patterns in biomass production and to see how this is influenced by the structural enhancement. Additionally, we took hemispheric pictures which enables us to quantify light availability as a key resource for plants in the forest understory.



Left: Successful end to our soil sampling campaign in the University Forest Würzburg with our colleagues from Leipzig and Würzburg. Right: Vincetoxicum hirundinaria (© Pia Bradler).

We are currently working on quantifying how the enhancement of structural beta-complexity influences the taxonomic, phylogenetic and functional diversity of vascular plants across spatial scales (alpha, beta and gamma). Our project and first preliminary results were presented at the GfÖ conference in Leipzig (poster presentation) and during our BETA-FOR project workshop in October. Furthermore, several Bachelor students have successfully finished their theses within our project.

INPLAMINT

Funding institute: BONARES programme of the Federal Ministry of Education and Research (BMBF)



Project number: 031A561A-G

Project team: Free University of Berlin, Helmholtz center in Munich, Universität zu Köln, Universität Kiel, Leuphana University Lüneburg, Nürtingen-Geislingen University of Economy and Environment, Institute of Energy and Environmental Science Heidelberg

Duration: 01.04.2015 – 31.05.2024

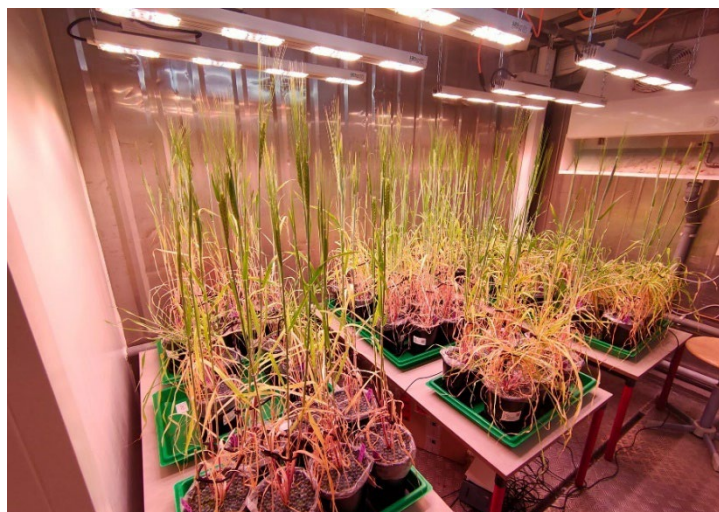
PIs in the institute: Vicky Temperton

Institute staff working on the project: Inés M. Alonso-Crespo

Website: <http://www.inplamint.de>

In 2023 started the last period of the INPLAMINT project (Increasing agricultural nutrient-use efficiency by optimizing PLAnt-soil-Microorganism INTeractions). INPLAMINT is a 9 years project funded by the Federal Ministry of Education and Research (BMBF), with the aim of gaining understanding about the mechanisms of plant-soil-microorganisms interactions as a function of crop rotation, soil type, fertilization and amendment, temperature and moisture. The results of this initiative want to support the improvement of soil functions, nutrient-use efficiency of crop production and develop optimised agricultural management strategies.

During the year 2023 at Leuphana University of Lüneburg we carried out an experiment to assess the interactive effects of drought and high-carbon amendments on carbon and nitrogen dynamics in barley varieties in collaboration with Amit Kumar, working previously in the INPLAMINT project.



Hordeum vulgare and Hordeum spontaneum plants growing in the climate chamber (© Inés M. Alonso-Crespo).

High-carbon amendments are widely used in agriculture to reduce soil nitrogen loss and enhance water retention, mitigating drought effects. Employing a climate chamber experiment, we tested how drought stress combined with wheat-amendments influenced carbon and nitrogen uptake in two barley varieties: *Hordeum vulgare* (domestic) and *Hordeum spontaneum* (wild), thus, shedding light on the complex interactions between drought, amendments, and plant responses under shifting environmental dynamics.



Labeling chambers with barley plants inside (© Inés M. Alonso-Crespo).

The experiment had 6 weeks of regular irrigation followed by 3 weeks of drought. Subsequently, a gas solution with ^{13}C was applied to the plants in a close chamber system. After that, they were labeled with ^{15}N .



From right to left: Amit Kumar, Lisa Herfurth (SHK), Olga Vishnyakova (IAESTE stud.) and Inés M. Alonso-Crespo (©Inés M. Alonso-Crespo)

Nutrients and phospholipid fatty acid from rhizosphere soil samples are currently under analysis in the University of Tübingen, in a collaboration with Prof. Michaela Dippold. Isotope analysis were performed in leaves, roots, and soil material as part of the collaboration process.

During the year 2023, a collaboration was also established with INPLAMINT partners at the University of Kiel. Samples of wheat and barley shoots from two trial fields in Kiel were received at the Leuphana University in Lüneburg. The aim of this collaboration was to analyse carbon and nitrogen and their ratio in the samples in order to detect differences between treatments. In one field, water regimes and residue types were manipulated. In the other field, different concentrations of three different residues were applied.

The plant material was divided into shoots and grains, milled, tinned and processed with the elemental analyser. These last analyses were carried out by Thomas Niemeyer.

GRASSWORKS

Funding institute: FEdA programme of the Federal Ministry of Education and Research (BMBF)



Partners: Technical University of Munich, Anhalt University of Applied Sciences, Thünen-Institute (Institute of Biodiversity), University of Greifswald, DVL

Duration: 01.11.2021 – 31.10.2024

PIs in the institute: Vicky Temperton, Jacqueline Loos

Institute staff working on the project: Ioana Alexandra Dușe, Christin Juno Laschke, Alina Twerski

Website: <https://grassworksprojekt.de/>

2023 was the second year of the inter- and transdisciplinary research project Grassworks. Researchers from the fields of ecology, social science, environmental economics, and governance are working together to understand how and under what conditions grassland restoration is successful (and under what conditions it is less successful in some cases). The project focuses on three model regions in the North, Central and South of Germany, which differ in their ecological, social-ecological, and socio-economic conditions.

The aim of the ecological research in Grassworks is to analyse the ecological success of various restoration measures in Germany. To achieve this, we analysed the second half of a total of 40 restored grassland sites in the northern project region in 2023. To analyse differences in biodiversity and ecosystem functions, we compare them with 10 non-degraded (positive reference) and 10 degraded sites (negative reference). This year, the second half of the reference sites was sampled.



Species-rich grassland at the Elbe River near Bleckede (© Juno Laschke).

The selected restored sites cover a wide range of conditions, such as the age of the grassland (time since restoration), restoration method (management adaptation, direct harvesting, regional or cultivar seed mixtures), and grassland types. This approach will ensure the transferability of the results. In addition, it is important to map the gradient of restoration success across sites in order to learn from both successes and failures. In 2023, finding positive reference sites in good ecological condition was a major challenge. Species-rich grassland is rare, and even sites that had been classified as species-rich meadows according to the habitat type *LRT 6510* 10 years ago proved to be unsuitable for our project, as their condition had deteriorated significantly.

To enable the most comprehensive comparison of biodiversity and ecosystem functions (ESF) between the sites in all three regions, several parameters were analysed on a 200 m × 5 m transect on each site: Vegetation, wild bees & butterflies, and soil.

To study the vegetation, both the species composition and structural parameters were analysed on 4 m² plots per 50 m transect section.

Sampling of wild bees and butterflies will illustrate the restoration success at higher trophic levels. Wild bees and butterflies were recorded by netting the four 50 m sections of each transect. This method was carried out for both butterflies and wild bees four times per site between May and August (i.e. once a month).



Left: *Bombus lapidarius* on *Centaurea jacea*, agg. Right: mating *Polyommatus icarus* on *Lotus corniculatus* (© Juno Laschke).

Soil samples were taken from two soil depths (0-10 cm and 10-30 cm) to analyse the soil for its soil organic carbon (SOC), soil density and microbial biomass. These values will determine the carbon content of the topsoil as well as the biotic functionality, which can influence the success of restoration.

From March to August, a team of researchers consisting of a post-doc, a PhD student, two bachelor candidates, four student assistants and three international interns collected data for countless hours each day that the weather would allow it. Together with the data from the other two project regions, we have created an enormous data set over the last two years, which forms a stable basis for comprehensive analyses in the final phase of the project in 2024.

TreeDì

Funding institute: Deutsche Forschungsgemeinschaft (DFG, German Research Foundation) and University of Chinese Academy of Sciences (UCAS)



Partners: German Centre for Integrative Biodiversity Research (iDiv) Halle-Jena-Leipzig, Martin Luther University Halle-Wittenberg, Friedrich Schiller University Jena, Leipzig University, Dresden University of Technology, University of Göttingen, University of Chinese Academy of Sciences

Duration: 2018 - 2027

PIs in the institute: Sylvia Haider, Andreas Fichtner

Institute staff working on the project: Pablo Castro Sánchez-Bermejo

Website: <https://www.idiv.de/en/treedì.html>

"TreeDì - 林地 - TreeDiversity Interactions: The role of tree-tree interactions in local neighbourhoods in Chinese subtropical forests" is an International Research Training Group involving both German and Chinese institutions. TreeDì's objective is to understand how tree-tree interactions in local neighbourhoods of varying diversity translate into the observed positive tree species richness effects on key ecosystem functions at the community scale. To do so, our work primarily focuses on BEF-China (<https://bef-china.com/>), a tree diversity experiment located in Xingangshan (BEF-China), in Jiangxi province, Southeast China. Specifically, the experiment is located in a subtropical region dominated by evergreen broad-leaved forests with a unique evolutionary history where certain tree lineages have radiated enormously. This area features evergreen broad-leaved forests with a distinct evolutionary history, characterized by significant radiation within certain tree lineages. With its rich diversity of woody species thriving naturally, these subtropical forests offer an unparalleled setting for delving deeper into the dynamics of woody species interactions. In the experiment, local tree species were planted in plots with different levels of diversity: seven levels of tree species richness (0, 1, 2, 4, 8, 16 and 24 tree species) combined with four levels of shrub species richness (0, 2, 4, 8 shrub species).



View of the BEF-China experiment from the top hill (© Pablo Castro Sánchez-Bermejo).

By bringing together experts and doctoral researchers from research institutions located in Germany and China, TreeDì creates a stimulating network of scientists. At Leuphana, researchers are engaged in various subprojects within the graduate school. Specifically, Andreas Fichtner is involved in the subproject “Spatial aboveground complementarity”, which aims to understand how tree-tree interactions drive spatial complementarity in tree crowns. Further, Pablo Castro Sánchez-Bermejo and Sylvia Haider are involved in the subproject “Complementarity through trait variation” which studies the intraspecific variation in leaf functional traits as response to tree diversity.

In 2023, all subprojects of TreeDì focused on the study of interactions between trees and shrubs and their effects on ecosystem functioning. To achieve this, we carried out a coordinated fieldwork campaign in August and September 2023. We sampled shrubs and the trees surrounding them in different plots varying in tree diversity and composition. Various measurements were conducted, including individual tree and shrub size, leaf trait assessments, evaluation of leaf herbivory and fungal infestation, soil microbial community activity analysis through soil core sampling, and terrestrial laser scanning to investigate spatial complementarity. In the specific case of the subproject “Complementarity through trait variation”, more than 6,000 leaves from trees and shrubs were collected for the assessment of morphological and chemical properties of leaves. This dataset is allowing us to understand how trees and shrubs adapt their leaf strategy to their biotic context. In the subproject “Spatial aboveground complementarity”, terrestrial and personal laser scanning techniques were used to accurately quantify the three-dimensional structure of trees, shrubs and communities. This allows us to explore how diversity-mediated structural changes translate into canopy complementarity.



Terrestrial laser scanning of an experimental plot of the BEF-China experiment (©Tama Ray)

Mountain Invasion Research Network (MIREN) / RangeX

Funding Institute: Deutsche Forschungsgemeinschaft (DFG); BiodivERsA

Partners:

MIREN: Conicet Ianigla (AR), Montana State University (USA), University of Antwerp (BE), Universidad de Concepción (CL), ETH Zurich (CH), La Trobe University (AUS), University of Kashmir (IN) + additional regional partners

RangeX: ETH Zurich (CH), University of the Free State (ZA), Aarhus University (DK), University of Bergen (NO), Swedish University of Agricultural Sciences (SE), University of Gothenburg (SE), CNRS / Université de Picardie Jules Verne (FR), Universidad de Concepción (CL), University of Pretoria (ZA)



Duration:

MIREN: 2005 – ongoing

RangeX: 04.2021 – 03.2025

PIs in the institute: Sylvia Haider

Institute staff working on the project: Meike Buhaly (Leuphana), Lucia Santoianni (visiting researcher from University of Molise, ITA)

Website:

MIREN: <https://www.mountaininvasions.org/>

RangeX: <https://rangex.w.uib.no/>

2023 was the third year of work on the RangeX project and consisted primarily of writing and data analysis. The RangeX project is a Biodiversa project that seeks to better understand the processes and impacts of plants that are expanding their ranges following climate warming, and to use this knowledge to inform the development of policy regarding range-expanding plant species. We focus on mountain ecosystems as an ideal model system to address our research questions.



Lonquimay Volcano in Chile, site of the 2022 MIREN meeting (© Meike Buhaly).

For our work in RangeX, we primarily use data collected by the Mountain Invasion Research Network (MIREN), a consortium of researchers all aiming to understand the effects of global change on species' distributions and biodiversity in mountainous areas. MIREN was founded in 2005 with a focus on global monitoring of non-native plant invasions in mountains but has since expanded to the study of species redistribution under different drivers of global change including biological invasions, climate change, and land-use change. MIREN consists of standardized vegetation surveys along elevation gradients to evaluate and quantify the process and mechanisms that are shaping mountain plant communities at regional to global scales.



Vegetation sampling site near the Teide in Tenerife (© Meike Buhaly).

In 2022, our field work on the island of Tenerife was completed for both internal analysis as well as an addition to the MIREN global dataset. 2023 was spent answering questions such as: how do non-native species alter community composition over time on Tenerife? Are non-native species homogenizing communities at the regional to global scale? Can we predict range shifts of plant species in mountains using functional, range, and distribution traits? Look for these publications in the coming year!



RangeX team in Glengarriff, Ireland (© Meike Buhaly).

In November, the RangeX team met in Glengarriff, Ireland for a productive writing retreat where we developed a framework to predict range shifts using a variety of biological and distribution traits.

ÖkoKult

Funding institute: The joint project entitled "Securing ecosystem services and biodiversity of extensively managed cultural landscapes (ÖkoKult)" is funded by the Federal Ministry of Education and Research (BMBF) and the Federal Agency for Nature Conservation (BfN) with funds from the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) as part of the joint funding initiative "Research to implement the national biodiversity strategy" (F&U NBS).



Duration: 01.08.2016 - 31.01.2023

PIs in the institute: Vicky Temperton (prior to his retirement Werner Härdtle)

Project Coordinator: David Walmsley

Institute staff working on the project: [Estève Boutaud](#), Dragan Matevski, David Walmsley, Jelena Daniels, Werner Härdtle, Vicky Temperton

Website: <https://oekokult.de/>

After six years of data collection, 2023 was a year dedicated to data analysis and reporting in the interdisciplinary research project "Safeguarding ecosystem services and biodiversity in extensively managed cultural landscapes" (ÖkoKult).

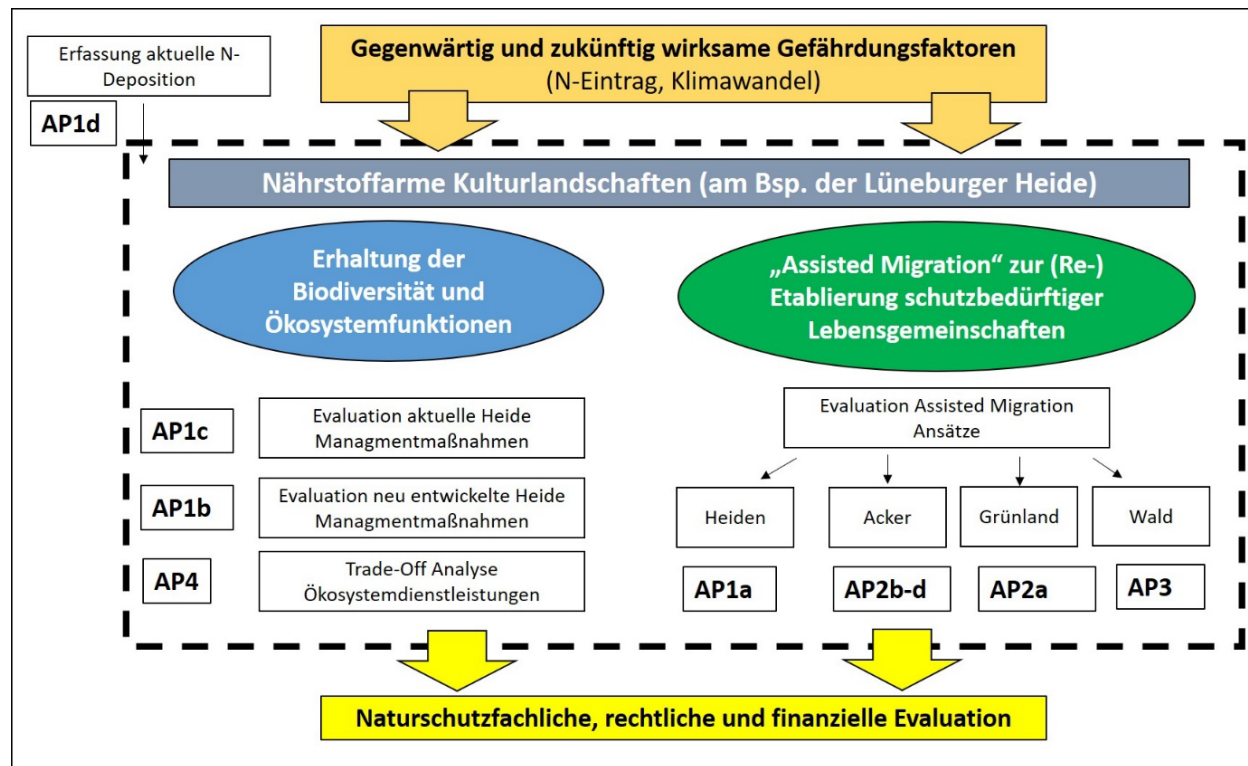
The aim of the interdisciplinary working group was to record and safeguard the ecosystem services of cultural landscapes with habitat complexes consisting of extensively used fields, heathland and open land/forest transition areas. To this end, from 2017 on numerous experimental research sites were established in the Lüneburg Heath nature reserve. Biodiversity conservation in form of habit restoration and restitution, the development and assessment of novel and classical heathland management practices, as well as socioecological research on the value of the cultural landscape were the main areas of investigation.

Calluna vulgaris (Common Heather) dominated heathlands in the Lüneburg Heath Nature Reserve provide many important ecosystem services such as carbon and nitrogen storage, fresh water supply to Hamburg as well as high recreational and value. Additionally, they are home to a large number of increasingly endangered animal, plant and fungal species that are characteristic of such acidic and above all nutrient-poor habitats. However, such habitats are under major threat due to global environmental change, the most important factors being atmospheric nitrogen deposition, habitat fragmentation and climate change. Current studies show that the interaction of these factors is exacerbating the negative effects on the vitality of heathlands. It is therefore important to develop new management measures that take account of the risk factors and to test them in practice under scientific supervision. For a more detailed description of the many nature conservation efforts associated with the project we refer the reader to the website (www.oekokult.de).

One novel maintenance measure that is being tested as part of the project is once-off mowing followed by moss removal, termed by the team as "scarification". Scarification removes the dense cushions of moss that have developed under areas of heather which hinder the regeneration of the heather. The dense moss

cushion also has an influence on the nitrogen balance of the heathland that has not yet been fully researched, but initial investigations show considerable amounts of nitrogen accumulate herein. As the operational partner, the Stiftung Verein Naturschutzpark Lüneburger Heide (VNP) developed the novel heathland management device which removes a large fraction of the thick moss layer after mowing has taken place. David Walmsley and Jelena Daniels are currently working on analysing the data related to the effect of this novel management technique on nitrogen cycling (including gaseous emissions) as well as its direct effect on the vegetation cover and nutrient balances.

Dragan Matevski and Estève Boutaud are currently testing the effectiveness of this method on biodiversity conservation of arthropods (carabids and spiders) in comparison to heather mowing and unmanaged control sites. Moreover, they are testing if the previous land use on certain study sites (for ex. military presence in 1963-1994) impacts the effectiveness of the management measure. As of now, the preliminary results suggest that scarification would benefit carabid diversity, and here in particular that of heathland specialists, whilst the benefits of scarification for spider diversity were only apparent in sites that lacked military presence in the past. We hope to get this and additional research from the project published during 2024.



Overview of key questions (blue and green circle) and structure of the subproject (AP = working package).



Left: Experimental site after scarification. Right: Using the newly developed scarification machine (© VNP Archiv, Dirk Mertens).

POEM: PriOrity Effects Mechanisms

Funding institute: Deutsche Forschungsgemeinschaft (DFG)

Project number: 420444099

Duration: 01.03.2020 – 29.02.2024

PIs in the institute: Vicky Temperton, Benjamin Delory (now Assistant professor at Utrecht University)

Institute staff working on the project: Inés M. Alonso-Crespo, Thomas Niemeyer, Christoph Stegen

Partners and external PIs: Michael Schlöter (Helmholtz Zentrum München - Germany) and Hans de Kroon (Radboud University – Nijmegen – The Netherlands)

Website: <https://www.leuphana.de/institute/institut-fuer-oekologie/ecosystem-functioning-and-services/forschung-projekte.html>



Priority effects occur when an early-arriving species arrives in a system, preempting and modifying the niche, thus influencing the establishment of late-arriving species. This order of arrival can influence coexistence between species when it is strong enough, steering the trajectories of plant communities in various directions. The POEM experiment is a long-term experiment located in the Luneburg Heathland, in which, by altering the order of arrival of three functional groups of plants (PFG), grasses, forbs and legumes, we study how priority effects affect ecosystem functioning, above and belowground, and plant diversity and composition in dry acid grasslands. By replicating the experimental design in different years, we also aim to find out how different weather conditions in the year of initiation modulate the results of priority effects. Three sub-experiments have been already initiated, POEM2020, POEM2021 and POEM2023. One of the sub-experiments, POEM2021, is also equipped with a minirhizotron imaging system to monitor in a non-destructive way root growth and vertical root distribution and how the order of arrival of the PFG affect them.

The funding period of the POEM project ended in February 2023. However, a cost neutral extension was granted in order to continue the work.



POEM field site. June 2023 (©Inés M. Alonso-Crespo).

POEM 2nd phase. POEM2023. In April 2023, a third sub-experiment, POEM2023, was established as part of the 2nd phase of the POEM experiment. The experimental site of this sub-experiment was ploughed and weeded, raked and stones were removed. The plots were established and the first sowing took place on 17 April 2023. The second sowing was postponed to one year to test whether a longer sowing interval increases priority effects.



POEM field site. POEM2023, sowing day (© Inés M. Alonso-Crespo).

During the Spring-Summer season 2023 several works were performed at the POEM experiment as part of the 1st POEM phase:

Maintenance. As regular part of maintenance of the POEM sub-experiments every two weeks the monoculture plots of the sub-experiments were weeded, eliminating the unsown species from the plots. The surroundings of the experimental plots were mowed frequently. In August, the plots were mowed.



Mowing of POEM2020 Thomas Niemeyer and Christoph Stegen mowing POEM2020 experimental plots (© Inés M. Alonso-Crespo).

Minirhizotron images. In the sub-experiment POEM2021, images at different depths were taken once a month until July with the minirhizotron system.



Minirhizotron images. Inés M. Alonso-Crespo taking MR images in POEM2021 experimental plots (© Inés M. Alonso-Crespo).

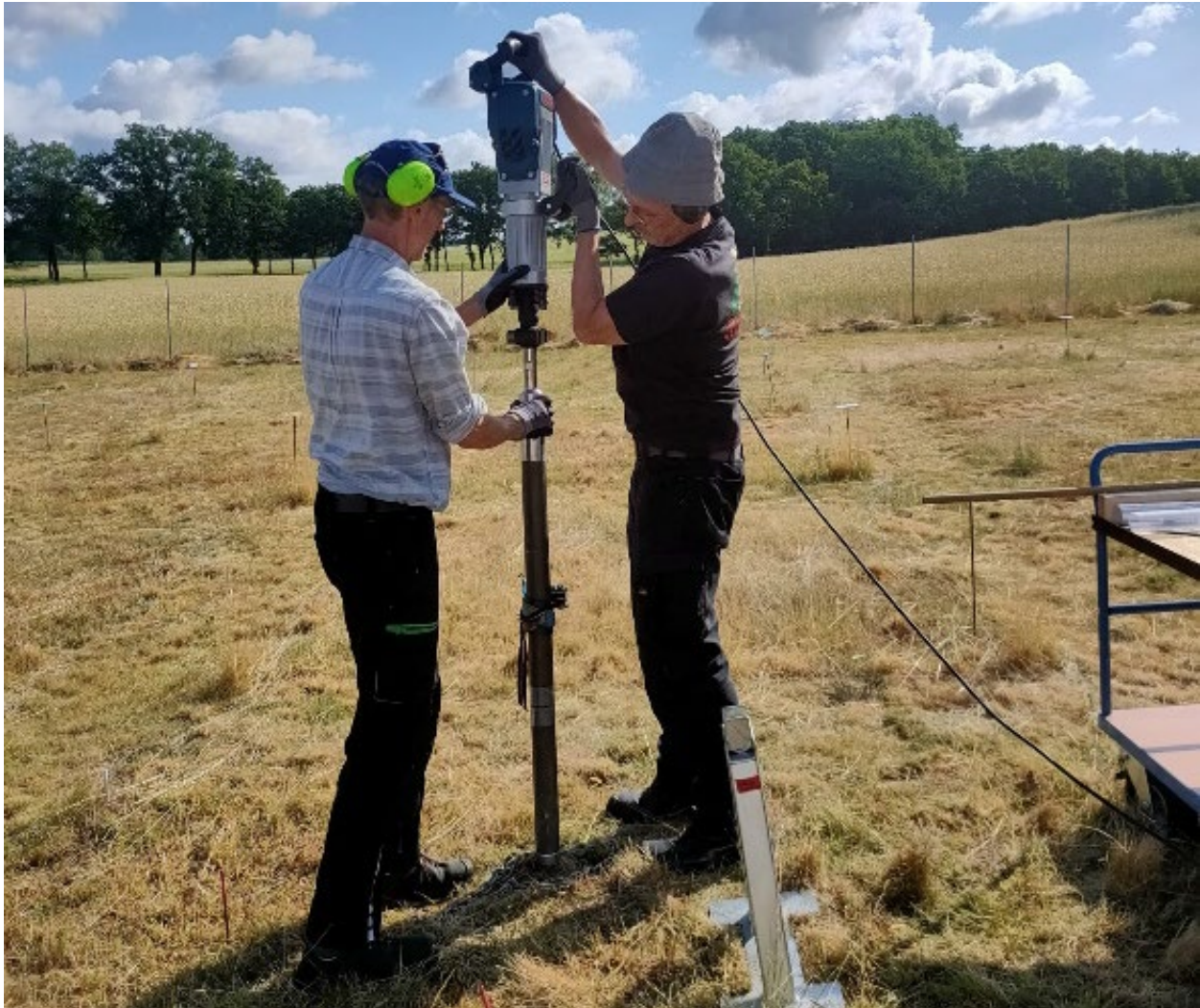
Harvest and presence/absence data. From 20 to 23 June 2023, the first two sub-experiments, POEM2020 and POEM2021, were harvested. In groups of two, plots were harvested to species level with two 20x50 cm quadrats randomly placed in the plots avoiding the edges. Species were identified in situ. Plant material was dried and weighed at the end of harvesting. So far, four POEM2020 seasons and three POEM2021 seasons of aboveground data have been collected.



POEM harvest. From left to right: Johan Busse Von Colbe (bachelor student), Thomas Niemeyer and Inés M. Alonso-Crespo (© Inés M. Alonso-Crespo ©Olga Vishnyakova).

POEM 1st phase paper. After four seasons of aboveground data and a period of 800 days of image acquisition belowground, the first POEM paper was produced. Although not yet published, a pre-print of these years of work can be found here: <https://www.biorxiv.org/content/10.1101/2023.11.14.566982v1>

msGBS analysis: After 2 and 4 years after the start of POEM2020 and POEM2021, 6 root cores per plot were collected. The cores were divided into 5 layers and pooled. The aim of these cores is to understand the species-specific contribution to the vertical distribution of roots. In June 2023, root cores from the fourth year of POEM2020 were collected, a total of 192 samples (39 plots x 5 layers). The samples were cleaned in the following months to extract the roots from the samples.



Root core extraction. Thomas Niemeyer and Christoph Stegen extracting root cores in POEM2020 (© Inés M. Alonso-Crespo).

msGBS plant individuals collection. In order to obtain reference samples for the msGBS DNA sequencing technique, individual plants were collected from all species present at the POEM site, including sown and un-sown species. Shoots and roots were traced together to avoid collecting different species. Above and below ground plant material was cleaned and stored.

Analysis. Analysis of the first batch of roots (POEM2020) will be analysed in Radboud University (The Netherlands) as of February 2024.

Carbon story. As part of another project funded by the Deutsche Bundesstiftung Umwelt (DBU), Milosz Rembowski collected root cores in the POEM 2021 sub experiment in July 2024 to test a proof of concept: whether the order of arrival of plant functional groups effects found on rooting depth so far can also be detectable using normal root coring as

opposed to the more technically sophisticated mini-rhizotron techniques. To relate the root results to the already available belowground data obtained by the imaging system, minirhizotron images were also collected on all plots where cores were taken one day before collection. Intriguingly both the mini-rhizotron and the root core data did correspond generally to one another, but neither showed the root cloud at lower depths (it seems to have disappeared) and hence we are planning to now continue measuring root dynamics in POEM 2021 as of March 2024, so see if the cloud has really disappeared or may have reappeared.

This proof of concept would then be used to take root cores in a demo priority effect plot within the Grassworks project where priority effect treatments had been set up with a local farmer near Gifhorn. In addition, we took the opportunity to see whether there is any clear connection between root biomass at different depths (0-25cm and 25-50cm) and soil organic C stocks near the roots. We did not find a clear correlation in this case and this was not affected by soil depth.



From right to left: Lisa Herfurth (SHK), Milosz Rembowski (DBU project) and Olga Vishnyakova (IAESTE stud.) dividing soil cores in layers after extraction (© Inés M. Alonso-Crespo).

Restore Rwanda

Funding institute: DFG

Duration: 01.10.2023-30.06.2027

PIs in the institute: Vicky Temperton

Institute staff working on the project: Verene Nyiramvuyekure

Website: <https://ecosystemrestoration.net/>

Restore Rwanda otherwise known as “A Social-Ecological Systems Approach to Inform Ecosystem Restoration in Rural Africa” is a DFG Research Unit (Forschungsgruppe) started in October 2023. Since then we have been preparing a full group field reconnaissance trip to Rwanda in January and part of February 2024, which we have just successfully complete including two key workshops with scientists and practitioners at the end of January 2024. The Kickoff-meeting of the consortium happened on Dec 14 & 15, 2023 at Leuphana University Lüneburg, and this marked the official start of the work of our research unit funded by the German Research Foundation which will specifically approach ecosystem restoration from a social-ecological systems perspective. The meeting had two main goals, one that we get to know each other better (as we wrote the proposals mainly meeting only online) and to consolidate the plans for the different SPs.



Ngororero district of the Western Province, Rwanda (© Verene Nyiramvuyekure).



Nyabihu district of the Western Province, Rwanda (© Verene Nyiramvuyekure).

Climate Change and Early Humans of the North (CCEHN)

Funding institute: Lower Saxony MWK with funds from the zukunfft.niedersachsen program of the VolkswagenStiftung

Partners: Niedersächsisches Landesamt für Denkmalpflege, Hannover; Leibniz University Hannover; LIAG Institute of Applied Geophysics, Hannover; Friedrich-Alexander Universität Erlangen-Nürnberg; Georg-August-Universität Göttingen; Helmholtz-Zentrum hereon; NihK Wilhelmshaven

Duration: 01.11.2022 – 31.10.2025

PIs in the institute: Brigitte Urban, Andreas Fichtner

Institute staff working on the project: Michael Hein, Martin Theuerkauf, Maike Grehl, Alexis Badai Samudra

Website: <https://ccehn.de/>



The CCEHN project: The current human-made climate change affects all spheres of our society and its impact on the planet's ecosystems is yet unknown. By exploring past human-environment-climate relationships, we can infer socio-behavioural responses to climatic and environmental shifts. Furthermore, palaeo-climate modelling and the reconstruction of palaeo-landscape can provide important insights into natural climate shifts.

The aim of our project is to investigate the evolutionary roots of human adaptation to climatic and palaeoenvironmental shifts at the northern limit of their former distribution area. Here, the glacial/ interglacial cycles led to enormous climatic and environmental changes. The archaeological record of Lower Saxony, with several outstanding sites, shows that early humans inhabited this area since about 300.000 years, but it is unclear whether this happened mostly during the temperate phases, or also during colder periods. To better understand human adaptational behaviour, we propose to: (1) study the palaeoenvironment, palaeo-climate change, and landscape evolution on a macro, meso and micro scale, (2) link the resulting data to the archaeological record and (3) finally establish a high-resolution chronological framework for the period from c. 300.000 years to 40.000 years ago (Marine Isotope Stage 9 to 3) (from the CCEHN-Website).



Team discussion at the archaeological site in Lichtenberg, Wendland (© Marcel Weiß).

In May and October 2023, site investigations were carried out at the Neanderthal Micoquien site of Salzgitter-Lebenstedt (ca. 60.000 yrs. old), which is very rich in faunal and plant remains characteristic for a glacial environment, by means of percussion coring. The aim of the project was (i) to identify stratigraphically intact layers that correspond to the sediment sequence from the 1952 and 1977 excavations and (ii) to recover undisturbed sediment cores to obtain sample material for palynology and luminescence dating in order to better understand the bio- and chronostratigraphy of the site.

In August 2023 field work was carried out during a two-week campaign in Lichtenberg/Wendland (Fig. above). During this time, 15 cores (up to 11 m deep) were taken and two archaeological profiles were cut (Figs. below). The aim is to gain a better understanding of the lake level fluctuations of the palaeolake and thus of the areas of the lake shore relevant to settlement from the Eemian to the middle Weichselian period (see also [press article](#)).



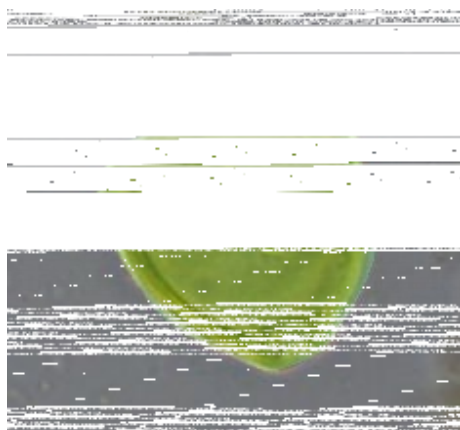
Left: Drilling at Lichtenberg (© Brigitte Urban). Right: 9 meters of cored lake sediments and soil (© Brigitte Urban).

At the archaeological excavation site Schöningen 13 II (Fig. below), at the spear base and the so-called Lower Berm, samples from the oldest interglacial and post-interglacial deposits from the Reinsdorf cycle were taken in May by colleagues from the University of York, UK, in collaboration with the University of Cambridge, UK and Leiden NL, for the relative age determination method of amino acid racemization (shells of the fresh water mollusc *Bithynia tentaculata*).



"Speersockel", archaeological site Schöningen 13 II (organic mud layer 4ab contained the world oldest wooden hunting weapons), ca. 300.000 years old (from Urban et al., 2023).

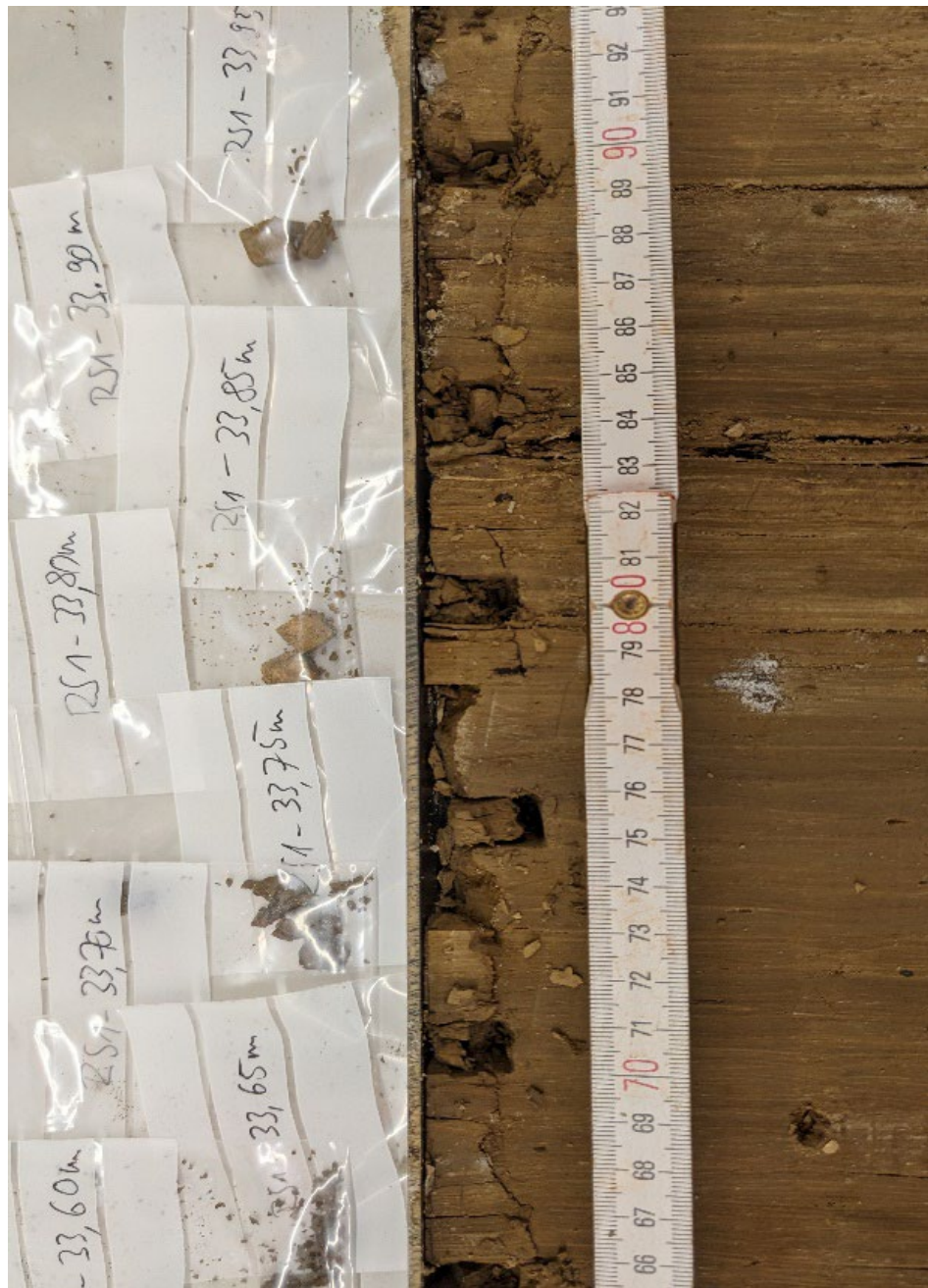
Another focus of the work in 2023 was the further development of automatic palynomorph recognition, which is intended to improve the time-consuming counting process and thus the faster and statistically much more reliable production of palynological results. In addition to the actual recognition of pollen, the automatic measurement of pollen was developed using the example of birch pollen. With the help of the size, the proportion of shrub and tree birch pollen in a sample can be estimated and thus the Pleistocene and Holocene vegetation can be reconstructed much more accurately (Fig. below).



Fossil pollen grain of *Betula spec.*

Further pollen analyses were carried out on profiles from Schöningen (Lower Saxony) and Rederstall (Schleswig-Holstein) (Fig. below). The Rederstall profile is one of the best profiles of the Eemian interglacial and the early Weichselian glacial in northern Germany. In principle, it is well suited for the application of quantitative methods of vegetation reconstruction such as ROPES. However, the pollen data from the early 1980s are not suitable for such applications. The profile is therefore being reworked in the CCEHN project. To this end, a section of 4 m was initially re-sampled at 5 cm intervals in 2023 (71 samples in total). By the end of 2023, 28 of these samples had been prepared and processed using automatic pollen detection. Pollen recognition is already

predominantly good here, but will be further improved with new training data. The work will be continued in 2024.



Sampling of the Rederstall research drill

Publications

All publications in 2023

1. Ackerschott, A., Kohlhase, E., Vollmer, A., Hörisch, J., & **von Wehrden, H.** (2023). Steering of land use in the context of sustainable development: A systematic review of economic instruments. *Land Use Policy*, 129, 106620.
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42. Staude, I. R., Segar, J., **Temperton, V. M.**, Andrade, B. O., de Sá Dechoum, M., **Weidlich, E. W.**, & Overbeck, G. E. (2023). Prioritize grassland restoration to bend the curve of biodiversity loss. *Restoration Ecology*, e13931.
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Publication summary

Table: Summary of all journals in which publications have been published, including the number of publications in the corresponding journal and the Journal Impact Factor (JIF, based on Clarivate - Web of Science).

Journal	Number of Publications	Journal Impact Factor (JIF)
Oikos	3	3.4
Nature Ecology & Evolution	2	16.8
Nature Communications	2	16.6
Science Advances	2	13.6
New Phytologist	2	9.4
Sustainability Science	2	6.0
Ecosphere	2	2.7
GAIA-Ecological Perspectives for Science and Society	2	2.2
Nature Sustainability	1	27.6
Global Change Biology	1	11.6
Current Forestry Reports	1	9.5
Ecology Letters	1	8.8
Land Use Policy	1	7.1
Ambio	1	6.5
Global Ecology and Biogeography	1	6.4
Ecological Monographs	1	6.1
Communications Biology	1	5.9
Journal of Ecology	1	5.5
Ecosystems and People	1	5.3
Ecological Applications	1	5.0
Plant and Soil	1	4.9
Global Ecology and Conservation	1	4.0
Quaternary Science Reviews	1	4.0
Basic and Applied Ecology	1	3.8
Plos One	1	3.7
Insect Conservation and Diversity	1	3.5
Biodiversity and Conservation	1	3.4
BMC Ecology and Evolution	1	3.4
Restoration Ecology	1	3.2
Conservation Science and Practice	1	3.1
In silico Plants	1	3.1

Journal of Vegetation Science	1	2.8
Oecologia	1	2.7
Ecology and Evolution	1	2.6
Quaternary Research	1	2.3
Boreas	1	2.2
Journal for Nature Conservation	1	2.0
Wildlife Research	1	1.9
E&G Quaternary Science Journal	1	1.8
Tuexenia	1	1.2
African Journal of Ecology	1	1.0
Baltic Forestry	1	0.8
Journal of Mediterranean Earth Sciences	1	NA
Urban Transformations	1	NA
World Development Sustainability	1	NA

Further works

Book chapter:

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Contributing author IPBES Invasive Alien Species Report (chapter 5): **Emanuela Weidlich**

Sankaran, K. V., Schwindt, E., Sheppard, A. W., Foxcroft, L. C., Vanderhoeven, S., Egawa, C., Peacock, L., Castillo, M. L., Zenni, R. D., Müllerová, J., González-Martínez, A. I., Bukombe, J. K., Wanzala, W., and Mangwa, D. C. (2023). Chapter 5: Management; challenges, opportunities and lessons learned. In: Thematic Assessment Report on Invasive Alien Species and their Control of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. Roy, H. E., Pauchard, A., Stoett, P., and Renard Truong, T. (eds.). IPBES secretariat, Bonn, Germany. <https://doi.org/10.5281/zenodo.7430733> [Titel anhand dieser DOI in Citavi-Projekt übernehmen]

Publications

All publications in 2024

1. Bektaş, B., Chisholm, C., Egelkraut, D., Lynn, J., Block, S., Deola, ..., **Haider, S.**, ..., & Alexander, J. M. (2024). Colonization and extinction lags drive non-linear responses to warming in mountain plant communities across the Northern Hemisphere. *Ecography*, Artikel e07378. Vorzeitige Online-Publikation.
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Further works

Author Collaboration of "The pace of life for forest trees.", Bialic-Murphy, L., McElderry, R. M., Esquivel-Muelbert, A., van den Hoogen, J., Zuidema, P. A., Phillips, O. L., ..., & **Klipel, J.** (2024). The pace of life for forest trees. *Science (New York, N.Y.)*, 386(6717), 92-98.

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Theses

Master

More is not always better: Philosophical Insights into the Cost-Benefit Analysis for the 2030 Agenda and the Sustainable Development Goals

Environmental Justice in the Environmental Legislation in Mexico

Transformation towards the sustainable management of peatlands: a characterization of farmer's roles

Attitudes of Active Residents toward Utility-Scale Solar Development on Maui

Impacts of *Urochloa* Species on Ecosystem Services in Brazil

Oil Spillage, Human Right Violation and Environmental Degradation in Nigeria's Niger Delta: A Critical Analysis

Förderung von Artenkenntnissen in der Schule – Lösungsansätze am Beispiel vom ‚grünen Klassenzimmer‘

Salzwiesen ganzheitlich erleben und verstehen: Entwicklung eines Umweltbildungsprojekts für Grundschulkinder in den Salzwiesen vor St. Peter-Ording

Exploring values assigned to nature by participants in a citizen science project in Nigeria

Inwieweit kann das Kohärenzgefühl von Grundschüler*innen im Sachunterricht durch forschende Einblicke in die Prozesse der menschlichen Atmung gesteigert werden

Einsatz eines interaktiven Experimentiervideos im Vergleich zu einem Demonstrationsversuch im Sachunterricht am Beispiel des Themas Solarzelle

Atlantic forest systematic review on coastal zone conservation

Bachelor

Plant responses to soil chemical legacies can be predicted by seed traits but not by leaf traits in a grassland experiment

Einfluss einer Erhöhung der strukturellen Beta-Komplexität auf die Diversität und Produktivität der Krautschicht in Buchenwäldern

Root economics traits predict plant responses to soil chemical legacies in a grassland experiment

The Understanding and Incorporation of Recognition as a Dimension of Environmental Justice in Conservation Research

Effects of structural beta complexity on species diversity and composition of understorey plant communities in beech (*Fagus sylvatica* L.) forests

Indigenous People's and Local Communities' Subjectivities in Conservation Intervention Research – A Decolonial Analysis

Evaluation des Erfolgs der Renaturierung von Grünland Norddeutschlands anhand der Diversität von Tagfaltern und Widderchen“

Die Umsetzung der gesetzlich festgelegten Bildungsaufgabe in niedersächsischen Naturschutzgebieten – Ein Vergleich eines Nationalparks und eines Naturparkes

A comparison of dung beetle diversity in relation to the application of antiparasitic drugs to cattle in the Lower Saxony Elbe Valley Biosphere Reserve

Priority effects in dry grasslands: How does the order of arrival of plant functional groups during assembly affect the aboveground biomass productivity and community structure?

Pollinators in mobile chicken units in Agroforestry on farms

Wahrnehmung von Pflanzen – Neue Narrative als Beitrag zu einer Bildung für eine Nachhaltige Entwicklung

Effects of plant functional group order of arrival on soil solution pH and nitrate leaching in a grassland field experiment

Einfluss des strukturellen Beta-Komplexität auf die Diversität und Artenzusammensetzung von Waldbodenpflanzen – Ergebnisse eines 5-jährigen Buchenwaldexperimentes

Vorkommen und Verbreitung ausgewählter, wertgebender Gefäßpflanzen auf Teilflächen des Nationalen Naturerbes: Binnendünen Nordoe

Analysis of butterfly diversity in grazed grassland areas in the Sude lowlands within the Biosphere Reserve ‚Niedersächsische Elbtalaue‘

Where do all the grasslands go? An analysis of grassland descriptions in the context of climate mitigation

Förderung von Bienen (Anthophila) in Blühstreifen: Welche Rolle spielt die Wahl der Blütmischung?

Effects of canopy conditions on the diversity and biomass production of understorey plant communities in beech (*Fagus sylvatica* L.) forests

Hydrogeological and ground water contamination analyses in Bantarujek and Lemahsugih, Majalengka District, West Java

Priority effects in a grasslands field experiment - How does the order of arrival of plant functional groups influence plant community composition and functioning?

Vergleichende Untersuchung des Heuschreckenvorkommens auf mit Pferden beweidetem und unbeweidetem Sandtrockenrasen der Sudeniederung im Biosphärenreservat ‚Niedersächsische Elbtalaue‘

Investigating the plant diversity connection between restored grassland sites and the surrounding vegetation

Effektivität von Altgrasstreifen für den Insektenschutz am Beispiel der Heuschrecken und Tagfalter

Einfluss der Erhöhung der strukturellen Beta-Diversität auf die Artenvielfalt und Biomasse Produktivität von Waldbodenpflanzen

Palaeolimnological study of Sentani Lake, Jayapura District, Papua Province based on palynological proxy

Auf Waldführung – Das Flow-Learning-Modell nach Joseph Cornell am Beispiel Wald

A comparison of social-ecological practices, processes and structures between German and Romanian wood pastures

Investigating agroforest systems soils

Monitoring of Moths: A Comparison of Self-Made Moth Traps in a Citizen Science Context

Identification of soil Primordial Radionuclides and its implications on environment, case study: Botteng Village, Simboro Area, Mamuju District

Quantifying temporal availability of floral resources in flower strips using a deep-learning algorithm

Technical and administrative staff

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Research

Carrying out safety instructions, purchasing laboratory equipment and consumables, maintaining and repairing laboratory equipment and ensuring the general functionality of the laboratories and seminar rooms in building 13, the Institute's three cars, the climate chambers and the greenhouse at the Rotes Feld site were once again among the basic tasks of the technical and administrative staff in 2023. In the area of research, around 900 soil and plant samples from the projects INPLAMINT, BETA-FOR, ChemLEGACY, BEF China and POEM were analysed for their carbon and nitrogen content for PhD, Master's and Bachelor's projects in 2023. The isotope ratios $\Delta^{15}\text{N}/^{13}\text{C}$ were determined on the mass spectrometer for 700 samples from POEM, the ^{15}N tracer long-term experiment Lüneburger Heide and from IMPLAMINT. The total carbon content (TOC) was analysed for approx. 1,000 samples from ChemLEGACY and Heide-VNP projects.

In the area of animal ecology, two insect monitoring projects were continued in the Lüneburger Heide in 2023. The long-term study on the Möhr grove comprises eight ground traps equipped with Renner solution. The traps of the other monitoring programme are distributed across the nature reserve in six forest plots, each comprising four ground traps and one flight interruption trap filled with propylene glycol in the summer months. All traps are emptied every two weeks, sorted in the laboratory and the ground beetles are identified.

Genetic analyses of ground beetles were carried out for taxonomic questions, but also in various courses. This involves DNA extraction, amplification of the genetic material using PCR, purification and gene sequencing (carried out by another laboratory). Around 100 samples were processed in 2023.

Examples from practice

In 2023, an automated irrigation system for 250 planters was purchased and installed as part of the ChemLEGACY project.



Automatic irrigation system.

The research area in the Lüneburg Heath near Niederhaverbeck was prepared for POEM 2023 and POEM 2024. To this end, the stones in the topsoil were removed, the trial areas were measured and marked and the areas for 2024 were covered with weed fleece.



Research area preparation for POEM.



Pile-driving core probe with electric demolition hammer to take core probes.

For POEM, a pile-driving core probe with an electric demolition hammer and power generator was purchased and 170 cores were taken to determine the root mass to a depth of approx. 50 cm.

In 2023, a total of 35 plots of 400 m² each were treated once in spring and once in autumn with an equivalent fertiliser application of 25 kg/ha to continue the trial areas of the Ökokult project. A quantity of 500 kg of horn grit was portioned and distributed evenly across the trial plots.

Teaching

In the area of teaching, internships were supervised on the Teaching and Learning (B.A.) degree programme, biology as a teaching subject and science as a teaching subject in the winter and summer semesters. These practicals range from providing an "overview of the forms and functions of life, the sciences of anatomy, morphology, zoology and botany" to teaching "basic knowledge of biochemistry, physiology and molecular biology" and developing "well-founded statements

on human anatomy, physiology and pathology" and working on issues relating to "ethological and evolutionary biology content". Students from all of the Institute's working groups were supervised in their Bachelor's and Master's projects, both when taking samples in nature and analysing them in the laboratory. For the modules Introduction to Environmental Sciences/Introduction to Ecology and Fundamentals of Biology - Organismic Aspects and Molecular Aspects, written exams were created using EvaExam, supervised during their completion and then corrected and graded.

In addition to these core tasks, the technical and administrative staff were also represented on the Staff Council and the Faculty Council and were involved as members of appointment committees as well as they are acting as First aider, Safety officer and Fire protection helper. A lot of time was also spent clearing out the cellars in Building 13 in order to prepare them for upcoming renovation work and to plan the new use of the renovated rooms.

“Biotopgarten“

In 1997, a garden was created on the former parade ground of the Scharnhorst barracks, which dares to perform a balancing act between wild nature and tamed culture. By creating different elements from the natural and cultural landscape, the formerly asphalted area has become a colourful world "en miniature", which also serves as a compensation area for the sealing of the area as part of the conversion of the barracks into a university campus. In addition to purely cultural elements such as a cottage garden and extensively utilised orchard meadow through to natural succession areas, essential landscape elements are currently represented here in a small area. From ponds to dry grassland, there are moist, shady to warm, dry sites as well as nutrient-rich and nutrient-poor sites, providing a habitat for a variety of rare native plants (see e.g. following pictures) and animals. This makes the biotope garden a small biodiversity hotspot on the university campus and a much sought-after component for research and teaching. For students and employees, but also for guests, the garden is a popular place to spend time and relax.



Left: *Viscaria vulgaris* Bernh. (Pechnelke), and Right: *Veronica spicata* L. (Ähriger Ehrenpreis).

Three to four student assistants work all year round to maintain and develop the garden. In 2023, the apple trees in the orchard meadow and along the paths were routinely pruned and overgrown shrubs were removed from the hedges. An apple tree (banana apple) was planted at the edge of the path opposite the stone wall. The bee hotel was filled with new nesting material for the wild bees and the brambles were cleared from the reading cairn. In summer, the meadows in the garden and the rough grassland areas bordering the central building were mown and excess biomass was removed from the pond and bank area. A small cereal field was planted not far from the seating area and various berry bushes were planted near the cottage garden. New aromatic and medicinal herbs were planted in the cottage garden itself and the beds were enriched with new soil. Watering was also very labour-intensive again this year, especially the new plantings.



Students and beekeeper Eva Völler inspect the honeybees in the biotope garden.

Together with wild bees and other insects, two bee colonies (see picture above) ensure sufficient pollination in the biotope garden. In 2023, the two colonies produced approx. 75 kg of honey. The honey from the biotope garden can be purchased at the registration counter in Studio 21.

Miscellaneous

What happens behind the scenes at the Institute of Ecology at Leuphana? Discover exciting insights into our research on the Institute's blog *Ecologically Speaking*.

<https://ecology.web.leuphana.de/>