Using artificial intelligence (AI) to answer ecological questions

Possible topics:

1. Improving species distribution models with deep learning (trees on islands / endangered plants in Iberia / birds)

2. Towards mechanistic understanding of ecological systems with "process-informed neural networks"

3. Deep reinforcement learning for implicit modeling of animal movement and organism dispersal in a landscape

4. Comparing performance of different AI and statistical methods

5. Reservoir computing for modeling trends in ecological systems

Start: anytime

Methods:

Field Work

Remote Sensing

Modelling

Experimental

Data Mining

Time Series

Botany

Zoology

No prerequisites except being motivated! Feel free to contact us if interested (and also if you have your own ideas).

Supervisors:

Wilkens, Mbaoma, Beierkuhnlein

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Thesis Topics

BayCEER
Bayreuth Center of Ecology
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Long-term trends in Biodiversity – Climate interactions

Aims: In this experiment that is running since 1996 interactions between biodiversity, climate change, and productivity will be disentangled. Grasslands are important ecosystems for biodiversity research. No other experiment covers such a long period of time enabling to be linked with climatic trends and events.

Start: May/June.

Location: Lindenhof, Bayreuth
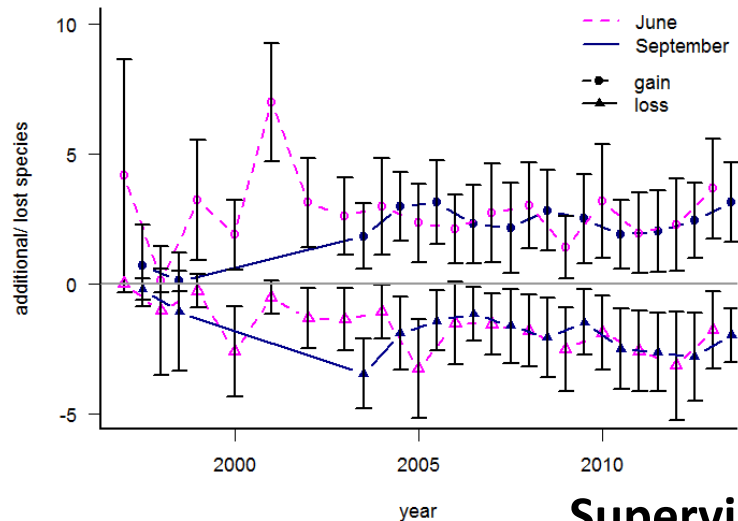
Methods:

Field Work

Remote Sensing

Modelling

Experimental

Data Mining

Time Series

Botany

Zoology

Partners: LBV

Supervisor:
Beierkuhnlein

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Thesis Topics

Bayceer
Bayreuth Center of Ecology
and Environmental Research

Assited Migration – A historic case close to Bayreuth

Aims: Decades ago, a series of rare and protected thermophilous plants have been established at the slope of a limestone outcrop north of Bayreuth. Since then, these species have maintained permanent populations far from their natural range. This case has been documented by the late Dr. Erich Walter. Based on historic documents and previous surveys, a re-survey aims to investigate the state and development of these precious populations.

Skills: Good botanical knowledge,

For Bachelor or Master Thesis

Start: May/June

Methods:

Field Work	**Data Mining**
Remote Sensing	Time Series
Modelling	**Botany**
Experimental	Zoology

Supervisor: Beierkuhnlein

Regeneration or Degeneration – Trends of Forest Springs in the Post-Acid-Rain Era

Aims: Spring ecosystems are highly adapted to specific temperatures and water quality. Changes in their catchments are expected to be reflected in their species assemblages. Acidic depositions were reduced considerably during the last 30 years (by about 90%). However, it is unclear if and to which degree impacted forest ecosystems recover from pollution in times of climate change.

Location: Frankenwald / Fichtelgebirge.

Methods:

Field Work	Data Mining
Remote Sensing	**Time Series**
Modelling	**Botany**
Experimental	Zoology

Supervisor: Beierkuhnlein

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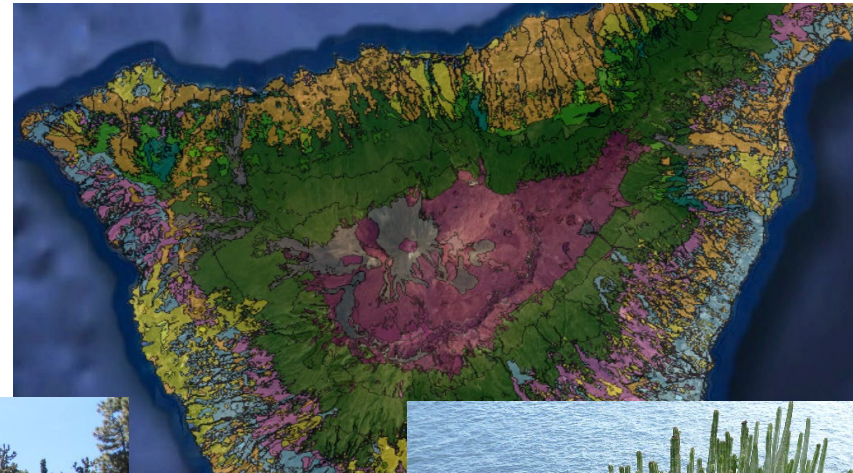*Thesis Topics*

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Sensitivity of Canary Islands Ecosystems to Climate Change

Aims: To assess the risks related to climate change for Canary Islands ecosystems, we will detect the spatial distribution of ecosystems and characterise their biodiversity. In-situ monitored classifications shall be compared with remote sensing. Consequences for climate change impacts, nature conservation and protected areas will be highlighted.

Start: Anytime

Methods:

Field Work   **Data Mining**

Remote Sensing   Time Series

Modelling   **Botany**

Experimental   **Zoology**

Supervisors:

Beierkuhnlein, Walentowitz

biogeografie
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Thesis Topics

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and Environmental Research

Declining Tree Species (Genera) Diversity during the Pleistocene in Europe

Aims: The Peistocene depauperation of European forest ecosystems causes a particular sensitivity towards climatic changes. Here, we will investigate the role of climatic fluctuations for species extinction and develop perspectives for measures to ensure ecosystem functioning under changing climatic conditions.

Start: anytime

Location: Central Europe

Methods:

Field Work	**Data Mining**
Remote Sensing	**Time Series**
Modelling	Botany
Experimental	Zoology
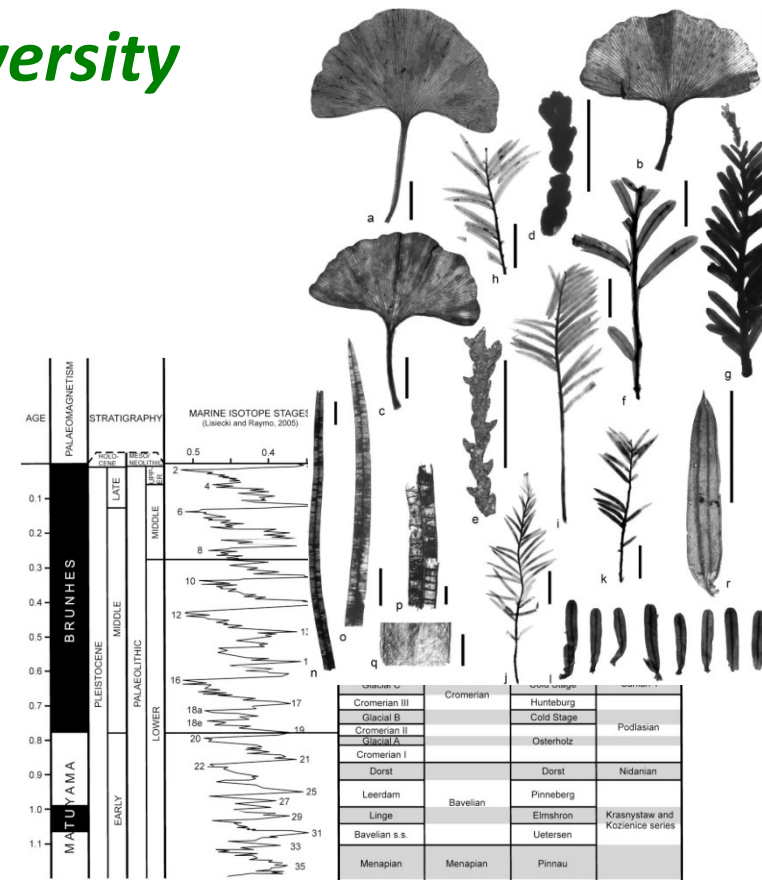
Projects: Initiative for a large research consortium on „extinction"

Supervisors:
Beierkuhnlein, Steinbauer

Trends in the Diversity of Mammals in Ancient Egypt between 4500 and 500 BC

Aims: Ancient Egyptian civilization lasted for several 1000y and yielded very precise documents for species in hunting scenes. Mammals are very well covered.
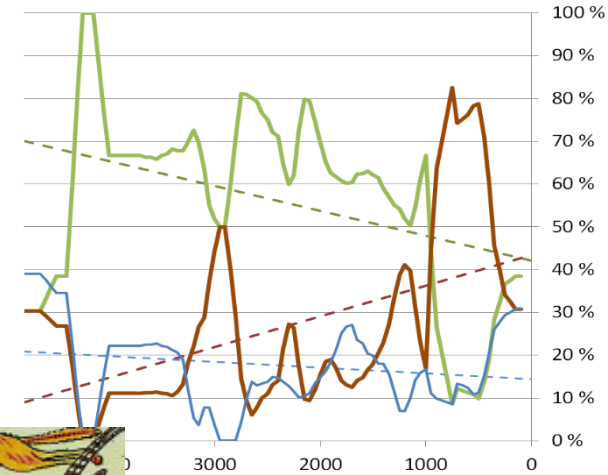
Data: Existing data set with 1500 records for 80 species

Start: anytime

Methods:

Field Work

Remote Sensing

Modelling

Experimental

Data Mining

Time Series

Botany

Zoology

Supervisor: Beierkuhnlein

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Thesis Topics

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Functional Traits and Hotspots of Threatened Plant Species

Aims: Threatened species are not stochatically distributed and are expected to exhibit characteristic traits. Here, we will identify species with declining populations in Central Europe.

Spatial hotspots of populations decline will be detected and functional traits of declining species will be worked out.

Start: anytime

Location: Germany

Methods:

Field Work	**Data Mining**
Remote Sensing	Time Series
Modelling	**Botany**
Experimental	Zoology

Achillea ptarmica agg.	Not Threatened
Achillea roseoalba Ehrend.	Highly Threatened
Achillea salicifolia Besser	Not Threatened
Achillea setacea Waldst. & Kit.	Threatened
Achnatherum calamagrostis (L.) P. Beauv.	Not Threatened
Achnatherum splendens	Not established
Acinos alpinus (L.) Moench	Not Threatened
Acinos alpinus subsp. alpinus	Not Threatened
Acinos arvensis (Lam.) Dandy	Near Threatened

Projects: Initiative for a consortium on „extinction"

Supervisors:
Beierkuhnlein, Walentowitz

Grass Species Dominance at Landscape Scales

Aims: Allergic reactions to grass pollens are increasing. Specific immunotherapy is restricted to a very limited set of grass species that does not represent the grasses dominating our landscapes. Here, we investigate diversity patterns and dominant grass species in landscapes close to pollen traps and we identify the abundance of those species are involved in prick tests.

Start: Summer 2022

Location: Bavaria

Methods:

Field Work | Data Mining
Remote Sensing | Time Series
Modelling | **Botany**
Experimental | Zoology

Supervisors: Beierkuhnlein

Phylogenetic and Functional Diversity Patterns in Pinus
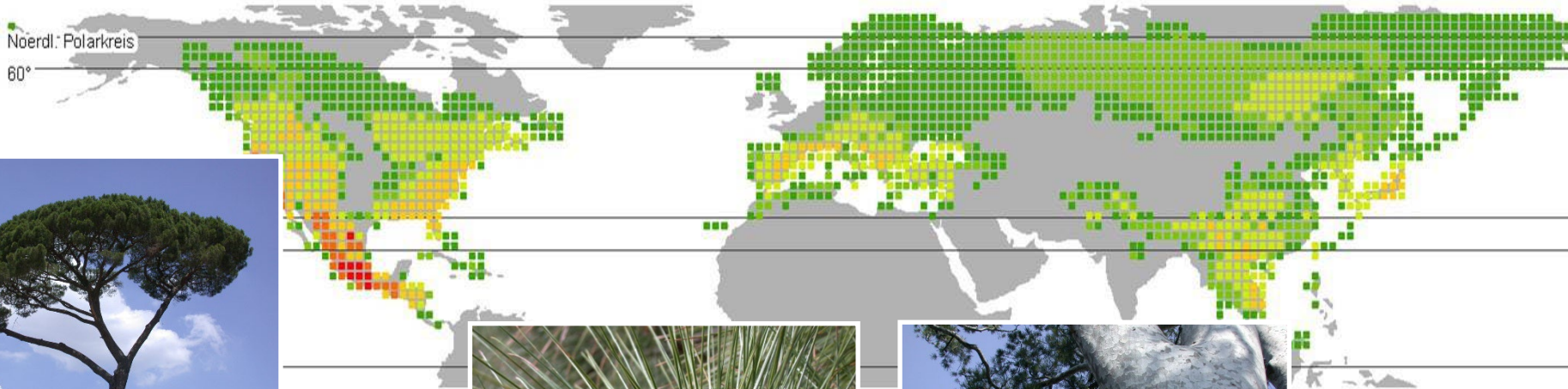
Start: Anytime

Data: Existing data set with 120 species ranges

Methods:

Field Work	**Data Mining**
Remote Sensing	Time Series
Modelling	**Botany**
Experimental	Zoology

Aims: Pines are important tree species for ecosystem functioning and forestry. For this reason, the genus is well investigated. A global compilation and a functional analysis of traits is missing.

Supervisors: Beierkuhnlein

Distribution of Grass Species in Bavaria

Aims: As standard tests for pollen allergy are limited to 5 grass species, existing information on grass species occurrence in Bavaria will be compiled and diversity and dominance patterns will be derived based on maps of „Bayernflora".
This data source delivers a high precision of records for most grass species. We will combine this spatial information with flowering data for grasses.

Start: anytime

Location: Bavaria

Methods:

Field Work	**Data Mining**
Remote Sensing	Time Series
Modelling	**Botany**
Experimental	Zoology

„Grasses"

Supervisors: Beierkuhnlein

biogeografie
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Thesis Topics

Bayceer
Bayreuth Center of Ecology
and Environmental Research
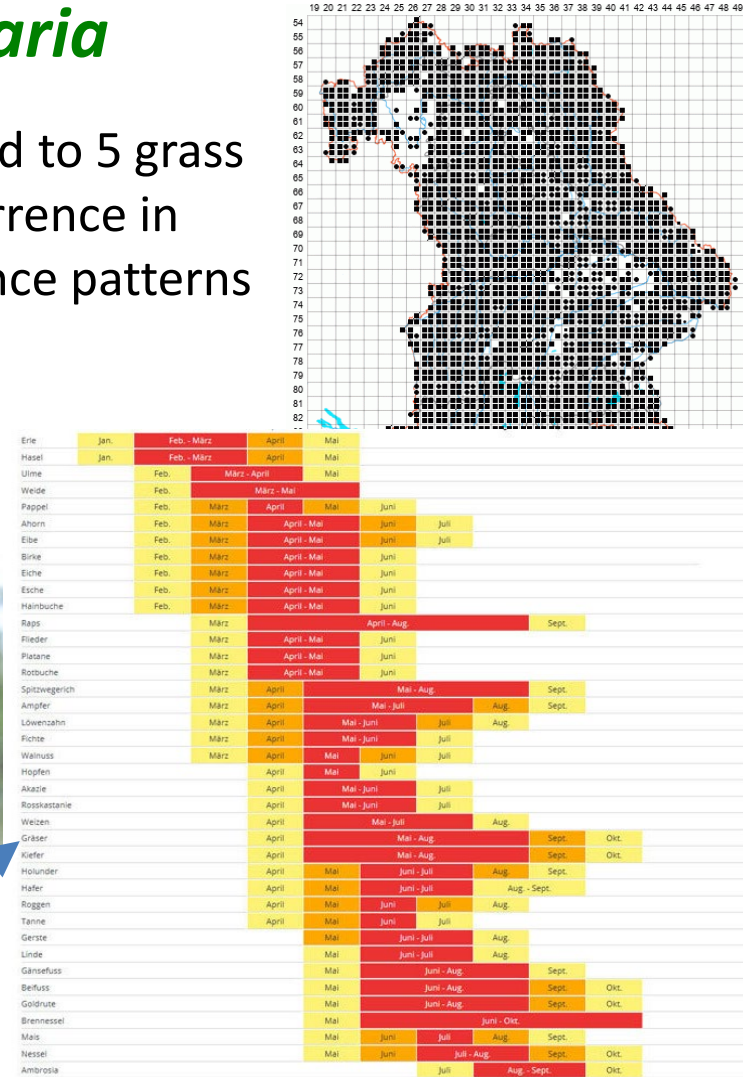
Global terrestrial biome classifications

Aims: The terrestrial surface of the Earth can be categorised
into different biome classes, like tropical rainforest, savanna or
tundra. However, there are numerous different biome
classification schemes available. The aim of the thesis is to
quantify the impact that biome classification choice has on
the analysis of ecological and biogeographic data.

Start: anytime

Location: Global

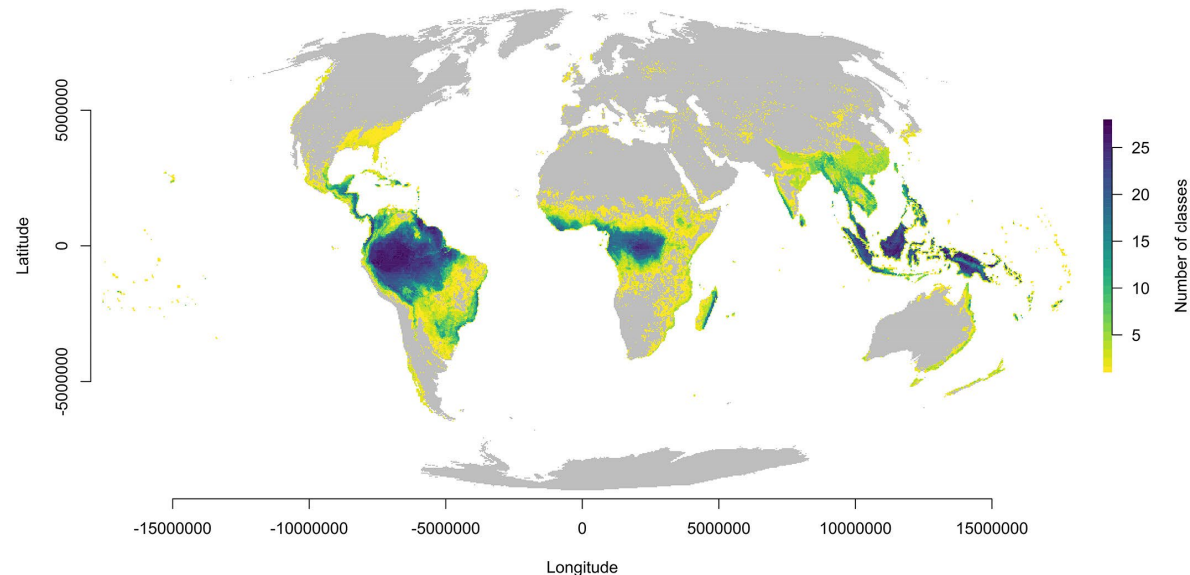**Methods**:

Field Work   **Data Mining**
Remote Sensing   Time Series
Modelling   Botany
Experimental   Zoology

Supervisors: Walentowitz, Beierkuhnlein

Anthropogenic drivers of insular biodiversity change

Aims: Islands worldwide host a unique flora that is highly impacted by anthropogenic activities. While natural impact factors on insular species numbers have been widely analysed, the impact of anthropogenic activities has been little quantified. The thesis aims at quantifying the explanatory power of diverse anthropogenic impact factors on insular plant communities.

Start: anytime

Location: Islands globally

Methods:

Field Work	**Data Mining**
Remote Sensing	Time Series
Modelling	**Botany**
Experimental	Zoology

Supervisors: Walentowitz, Beierkuhnlein