UNIVERSITÄT BAYREUTH

Module Handbook

Ecological Forecasting M.Sc.
University of Bayreuth

General Information and Reading Notes

A central component of the Bologna process is the modularisation of degree programmes which means a switch from the former course system to a modular system by grouping thematically related courses into course bundles – or modules.

This module handbook contains the description of all modules offered in the degree programme. The module handbook gives an overview and provides students, prospective students, and other interested persons with information on the content of the individual modules, their qualification goals, as well as qualitative and quantitative requirements.

Table of Contents and Index

The table of contents provides an overview of the module areas and modules of the degree programme. The information in brackets after the title of a module contains the date on which its description was last updated. Example of notation: 24W denotes the winter semester 2024/25, 25S denotes the following summer semester 2025.

The index at the end of the module handbook lists all modules of the degree programme in alphabetical order.

Module description

The description of a module includes its learning content, objectives, and assessment methods. For modules with multiple assessments, the weight of each assessment toward the final grade is specified. The *examination and study regulations* for each degree program define the scope and duration of assessments.

The QR code in the description links to the module's website. There, you can find the courses that belong to this module and see which other degree programs include this module.

Legal Disclaimer

Module descriptions provide students with detailed information regarding the content and the structure of the modules of a degree program. Only the relevant *examination and study regulations* are legally binding.

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Fak229451: Ecological Forecasting

Valid from: 01.10.2026

Teaching language	Duration	Contact hours (in hours)	Self-study hours (in hours)
English	two semesters	60	90
Credit points (CP)	**Frequency**	**Person responsible for the module**	
5	winter semester	Higgins, Steven; Prof. Dr.	

Assessments

Title:	Weighting:	CP:
Term paper or Presentation or Written assignment	1	5

Learning objectives

Explain the key principles, objectives, and disciplinary perspectives that define the field of ecological forecasting.

Analyse and critically evaluate real-world case studies to understand how ecological forecasts are constructed and utilised.

Discuss the roles of prediction, uncertainty, and adaptive management within the ecological forecasting framework.

Integrate knowledge from ecology, statistics, modelling, and decision science to describe the interdisciplinary nature of forecasting.

Identify and assess existing forecasting challenges, and articulate criteria for selecting an appropriate challenge for further study.

Learning contents

This module introduces students to the core concepts, scope, and disciplinary perspectives of ecological forecasting. Through lectures, case study readings, and seminar discussions, students gain a comprehensive understanding of how ecological forecasts are developed, interpreted, and applied across diverse ecological contexts. The module also introduces the concept of forecasting challenges, providing a basis for the later Forecasting Challenge module.

Type and scope of the courses

Lecture (2 SWS), Seminar (2 SWS)

Literature:

Dietze (2020) Ecological Forecasting. Princeton University Press

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Fak229453: A Primer in Ecology

Valid from: 01.10.2026

Teaching language	Duration	Contact hours (in hours)	Self-study hours (in hours)
English	one semester	60	90
Credit points (CP)	**Frequency**	**Person responsible for the module**	
5	winter semester	Steffan-Dewenter, Ingolf; Prof. Dr.	

Assessments

Title:	Weighting:	CP:
Term paper or Presentation or Written assignment	1	5

Learning objectives

Describe and explain key ecological concepts such as fitness, niches, life histories, population dynamics, and community interactions.

Analyse the interrelationships among ecological processes at individual, population, community, and ecosystem levels.

Critically reflect on major theoretical frameworks and their relevance for understanding ecological patterns and dynamics.

Harmonise ecological terminology and conceptual understanding to support interdisciplinary collaboration within ecological forecasting.

Develop and communicate a coherent synthesis of ecological theory that integrates multiple perspectives and concepts.

Learning contents

This module introduces students unfamiliar with ecology to important ecological concepts, and for students who are familiar with ecology, it serves to harmonise concepts and terminology. Key concepts discussed include fitness, the niche, life history theory, demographics, competition, stoichiometry, disturbance, succession, and diversity partitioning. The first two weeks are structured around morning lectures introducing concepts, followed by independent reading, and concluding with afternoon seminars where students engage in discussions reflecting on the concepts. The module concludes with a seminar where students propose a new synthesis for ecology.

Type and scope of the courses

Lecture (2 SWS), Seminar (2 SWS)

Literature:

Krebs, CJ (2013) Ecology: The Experimental Analysis of Distribution and Abundance. Pearson.
Bowman, Hacker, S, Cain ML (2017) Ecology. Sinauer.

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Fak229454: A Primer in Scientific Programming

Valid from: 01.10.2026

Teaching language	Duration	Contact hours (in hours)	Self-study hours (in hours)
English	one semester	60	90

Credit points (CP)	Frequency	Person responsible for the module
5	winter semester	Hotho, Andreas; Prof. Dr.

Assessments

Title:	Weighting:	CP:
Presentation or Written examination or Semester-long tasks	1	5

Learning objectives

Apply fundamental programming concepts and workflows to ecological modelling and data analysis tasks.

Write, document, and debug code in R, Python, and C++ using professional development environments.

Use version control systems (Git, GitHub) to manage code collaboratively and transparently.

Implement programming practices that support reproducible and open scientific research.

Evaluate and select appropriate programming tools and approaches for solving specific ecological forecasting problems.

Learning contents

This module introduces students to scientific programming concepts and tools essential for ecological forecasting. It provides a foundation for the modelling and data analysis skills developed in later modules. Students learn the principles of professional, collaborative, and reproducible programming through practical exercises. The module focuses on coding practices relevant to ecological modelling and data science, with hands-on experience in R, Python, and C++, and in using tools such as VS Code, Git, and GitHub within an open-science framework.

Type and scope of the courses

Exercise (4 SWS)

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Fak229455: Probability Theory

Valid from: 01.10.2026

Teaching language	Duration	Contact hours (in hours)	Self-study hours (in hours)
English	one semester	60	90
Credit points (CP)	**Frequency**	**Person responsible for the module**	
5	winter semester	Hülsmann, Lisa; Prof. Dr.	

Assessments

Title:	Weighting:	CP:
Presentation or Written examination or Semester-long tasks	1	5

Learning objectives

Explain and apply key concepts of probability theory, including random variables, distributions, and expectation.

Compute and interpret joint, marginal, and conditional probabilities in ecological contexts.

Describe and apply Bayesian reasoning to represent and update uncertainty.

Use probability theory to quantify and communicate uncertainty in ecological forecasts.

Integrate probabilistic thinking into subsequent modelling and statistical analysis modules.

Learning contents

This module provides an introduction to probability theory for Ecological Forecasters. Concepts taught include analysis, random numbers, probability distributions, expectation, moments; joint, marginal and conditional distributions; Bayesian thinking; and uncertainty. The module is structured around practical exercises exploring the concepts introduced in the lectures using real-world examples.

Type and scope of the courses

Exercise (4 SWS)

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Fak229457: Deep Learning

Valid from: 01.10.2026

Teaching language	Duration	Contact hours (in hours)	Self-study hours (in hours)
English	one semester	60	90
Credit points (CP)	**Frequency**	**Person responsible for the module**	
5	winter semester	Hotho, Andreas; Prof. Dr.	

Assessments

Title:	Weighting:	CP:
Presentation or Written examination or Semester-long tasks	1	5

Prerequisites

None; prior experience with scientific programming is recommended.

Learning objectives

Explain the core principles and architectures underpinning deep learning models.

Evaluate the suitability of different deep learning approaches for various ecological forecasting tasks.

Interpret and compare model performance using appropriate validation and benchmarking methods.

Critically discuss the limitations, interpretability, and uncertainty of deep learning models in ecological applications.

Integrate conceptual understanding of deep learning into later thematic and applied modules within the program.

Learning contents

This module introduces the theoretical and methodological foundations of deep learning in the context of ecological forecasting. Students gain an understanding of how deep learning models function, how they can be evaluated, and when they are appropriate for specific ecological forecasting tasks. The module covers model architectures, training principles, performance evaluation, and comparative model assessment. Students learn to critically assess the suitability of different model classes—including convolutional neural networks (CNNs) for spatial data, recurrent neural networks (RNNs), long short-term memory networks (LSTMs), and Transformers for temporal forecasting, as well as graph neural networks (GNNs) for ecological network data. Specialised architectures such as autoencoders, generative adversarial networks (GANs), and diffusion models are also introduced.

Type and scope of the courses

Exercise (4 SWS)

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Fak229458: Statistical Modelling

Valid from: 01.10.2026

Teaching language	Duration	Contact hours (in hours)	Self-study hours (in hours)
English	one semester	60	90
Credit points (CP)	**Frequency**	**Person responsible for the module**	
5	winter semester	Higgins, Steven; Prof. Dr.	

Assessments

Title:	Weighting:	CP:
Term paper oder Presentation or Written assignment	1	5

Learning objectives

Explain the principles underlying statistical modelling of ecological data.

Construct and fit linear, mixed-effects, and Bayesian hierarchical models to ecological datasets.

Implement MCMC and related computational methods for model inference and uncertainty estimation.

Apply time series and state-space modelling approaches to analyse temporal ecological data.

Evaluate and interpret model results, explicitly distinguishing among different sources of uncertainty.

Communicate and justify model assumptions, structure, and outcomes in an ecological forecasting context.

Learning contents

This module focuses on the statistical modelling of ecological data. It develops students' ability to construct, fit, and interpret statistical models that represent ecological processes, while explicitly accounting for uncertainty. Topics range from basic statistical concepts to linear mixed-effects models, Bayesian hierarchical models, Monte Carlo Markov chain methods, inverse modelling, time series, and state-space models. Case studies will focus on analysing plant and animal distribution, abundance, and demographic data while fully accounting for model, observation, driver, and process uncertainty. The module will use a combination of lectures, case study analyses, practical exercises and independent project work.

Type and scope of the courses

Lecture (2 SWS), Exercise (2 SWS)

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Fak229471: The Philosophy and Behavioural Economics of Decision Making

Valid from: 01.10.2026

Teaching language	Duration	Contact hours (in hours)	Self-study hours (in hours)
English	one semester	60	90
Credit points (CP)	**Frequency**	**Person responsible for the module**	
5	summer semester	Rich, Patricia; Prof. Dr.	

Assessments

Title:	Weighting:	CP:
Semester-long tasks	1	5

Learning objectives

Understand and be able to explain the principles of rational decision-making, especially as reflected in axiomatic approaches to utility theory.

Identify and analyse common deviations from rationality as described by behavioural economics.

Critically evaluate the assumptions and limitations of different decision-making models.

Apply decision-making concepts to ecological and environmental case studies, including political and policy contexts.

Integrate philosophical and economic perspectives to support adaptive management and forecasting-informed decision-making.

Learning contents

This module introduces students to the theoretical foundations of decision-making, combining perspectives from philosophy and economics. It provides students with tools to understand, analyse, and critically assess human decision-making in ecological, economic, and political contexts. Core topics include probabilistic beliefs and uncertainty, (axiomatic) rationality, and utility theory. Important choice anomalies and alternative models from behavioural economics are introduced. Finally, decision-making in the political context is discussed.

Type and scope of the courses

Lecture (2 SWS), Exercise (2 SWS)

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Fak229473: Remote Sensing

Valid from: 01.10.2026

Teaching language	Duration	Contact hours (in hours)	Self-study hours (in hours)
English	one semester	60	90

Credit points (CP)	Frequency	Person responsible for the module
5	summer semester	Ullmann, Tobias

Assessments

Title:	Weighting:	CP:
Term paper or Presentation or Written assignment	1	5

Learning objectives

Explain the fundamental principles of remote sensing and Earth observation.

Acquire, process, and analyse remote sensing data for ecological and environmental applications.

Apply advanced image processing and modelling techniques to generate actionable products, such as land cover classifications and predictive models.

Critically evaluate the quality, accuracy, limitations, and uncertainties of remote sensing data and derived products.

Integrate remote sensing outputs into ecological forecasting workflows to support scientific and management decisions.

Learning contents

This module introduces students to satellite- and drone (UAV)-based Earth observation, covering the fundamentals of remote sensing for environmental and geospatial applications. The module includes lectures on the basics of remote sensing, practical exercises focused on data acquisition using drones, and seminars on software applications and data processing techniques. Students will learn advanced image processing, analysis, and modelling methods to generate higher-value products, such as land cover classifications and predictive models, supporting decision-making in various scientific and applied fields.

Type and scope of the courses

Lecture (2 SWS), Seminar (2 SWS)

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Fak229474: Forest Ecosystem Ecology

Valid from: 01.10.2026

Teaching language	Duration	Contact hours (in hours)	Self-study hours (in hours)
English	one semester	60	90

Credit points (CP)	Frequency	Person responsible for the module
5	summer semester	Bässler, Claus; Prof. Dr.

Assessments

Title:	Weighting:	CP:
Term paper or Presentation or Written assignment	1	5

Prerequisites

Completion of Foundations Modules

Learning objectives

Explain the ecological and biophysical processes underlying forest dynamics and biodiversity.

Apply ecological forecasting techniques to analyse and predict forest growth, structure, and species interactions.

Collect, process, and integrate field and remote-sensing data relevant to forest monitoring and modelling.

Evaluate the role of uncertainty in forest forecasts and communicate the implications for sustainable management.

Synthesize theoretical, empirical, and modelling perspectives to inform transformative, climate-smart and adaptive forest management.

Learning contents

This module introduces students to fundamental and novel approaches in forest ecology and allows them to apply their forecasting skills to typical challenges in quantitative forest ecology. Students explore themes including forest growth and regeneration dynamics, tree demography, forest structure, forest management, species diversity, and interactions of trees with forest-associated organisms. The course comprises short lectures, a seminar on climate-smart forestry research, fieldwork on forest monitoring principles, and a practical data analysis and modelling section. Example forecasting tasks include inverse modelling of seed dispersal kernels, data assimilation for growth trend modelling, and species detection using camera traps, soundscapes, and citizen-science data.

Type and scope of the courses

Lecture (1 SWS), Exercise (4 SWS)

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Fak229475: Open Ecosystem Ecology

Valid from: 01.10.2026

Teaching language	Duration	Contact hours (in hours)	Self-study hours (in hours)
English	one semester	90	60
Credit points (CP)	**Frequency**	**Person responsible for the module**	
5	summer semester	Jentsch-Beierkuhnlein, Anke; Prof. Dr.	

Assessments

Title:	Weighting:	CP:
Contribution or Presentation or Semester-long tasks	1	5

Prerequisites
Completion of Foundations Modules

Learning objectives
Describe the ecological characteristics and processes shaping open terrestrial ecosystems.

Apply forecasting and modelling techniques to quantify biodiversity patterns, community dynamics, and ecosystem functioning.

Collect, analyse, and interpret field and remote sensing data to evaluate environmental drivers of ecological change.

Assess how climate variability, land-use change and anthropogenic stressors affect open ecosystems and their services.

Integrate vegetation and functional trait data to forecast ecological responses to environmental change.

Learning contents
This module introduces students to the ecological principles and quantitative approaches relevant to open ecosystems, including seminatural grasslands. Students develop an understanding of the biodiversity, community dynamics, and ecosystem functions characteristic of these environments, and learn to apply ecological forecasting tools to assess and predict their responses to environmental change. Core topics include community assembly, habitat conversion, landscape modification, and the impacts of climate change and extreme weather events on biodiversity and biotic interactions. The module combines field-based data collection, and analytical exercises. Example forecasting applications include modelling community dynamics from field resurvey data and remote sensing data, predicting vegetation change along altitudinal gradients, and analysing community assembly using interaction networks and functional traits.

Type and scope of the courses
Exercise (5 SWS)

Literature:
Wohlgemuth T, Jentsch A, Seidl R (2022): Disturbance Ecology. Springer.

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Fak229476: Systems Ecology

Valid from: 01.10.2026

Teaching language	Duration	Contact hours (in hours)	Self-study hours (in hours)
English	one semester	60	90
Credit points (CP)	**Frequency**	**Person responsible for the module**	
5	winter semester	Diamantopoulos, Efstathios; Prof. Dr.	

Assessments

Title:	Weighting:	CP:
Term paper or Presentation or Written assignment	1	5

Prerequisites

Completion of Foundations Modules

Learning objectives

Explain the principles of systems ecology and their relevance to ecological forecasting.

Design and conduct experiments quantifying interactions within the Soil–Plant–Atmosphere Continuum.

Develop and implement mechanistic models using differential equations to simulate ecological processes.

Apply state-space and MCMC methods to calibrate models and quantify uncertainty in forecasts.

Integrate experimental, theoretical, and computational approaches to improve predictive understanding of ecosystem dynamics

Learning contents

This module trains students to use systems ecological thinking as a means to improving ecological forecasts. Using the Soil-Plant-Atmosphere Continuum (SPAC) as a case study, students conduct hands-on experiments measuring plant water use and the soil water balance with weighing lysimeters. Students develop a SPAC model, thereby gaining experience in scientific programming of ordinary differential equations. This model is then calibrated using the lysimeter experiment data with a state-space modelling approach. Students thereby gain experience with using Monte Carlo Markov chain methods for near-term forecasting with uncertainty assessments.

Type and scope of the courses

Lecture (1 SWS), Exercise (3 SWS)

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Fak229477: Aquatic Ecology

Valid from: 01.10.2026

Teaching language	Duration	Contact hours (in hours)	Self-study hours (in hours)
English	one semester	60	90

Credit points (CP)	Frequency	Person responsible for the module
5	summer semester	Laforsch, Christian; Prof. Dr.

Assessments

Title:	Weighting:	CP:
Contribution or Presentation or Written assignment	1	5

Prerequisites
Completion of Foundations Modules

Learning objectives
Explain ecological and ecotoxicological principles relevant to forecasting in aquatic systems.

Apply QSAR and trait-based models to predict contaminant effects on aquatic organisms.

Model dose–response relationships and derive species sensitivity distributions to assess ecological risk.

Integrate empirical data, statistical modelling, and forecasting methods to evaluate ecosystem-level impacts.

Critically assess the applicability and uncertainty of forecasts used in aquatic ecosystem management and policy frameworks.

Learning contents
This module introduces students to aquatic ecology and ecotoxicology with an emphasis on forecasting contaminant effects in aquatic systems. Students explore the structure and functioning of lentic (standing water) and lotic (flowing water) ecosystems, as well as coastal environments, within the regulatory context of the European Water Framework Directive. The module trains students to apply forecasting approaches to assess ecological risks and predict contaminant impacts across species and levels of biological organisation. Forecasting exercises include modelling dose–response relationships, predicting adverse effects for untested compounds using Quantitative Structure–Activity Relationship (QSAR) models, performing trait-based predictions of species sensitivities, and extrapolating laboratory findings to ecosystem-level outcomes through species sensitivity distributions.

Type and scope of the courses
Seminar (2 SWS), Exercise (3 SWS)

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Fak229478: Innovation Projects for Sustainability

Valid from: 01.10.2026

Teaching language	Duration	Contact hours (in hours)	Self-study hours (in hours)
English	one semester	60	90

Credit points (CP)	Frequency	Person responsible for the module
5	winter semester	Jakob, Eva; Prof. Dr.

Assessments

Title:	Weighting:	CP:
Presentation or Written assignment	1	5

Prerequisites

Completion of Foundations Modules

Learning objectives

Apply project development methodologies to develop sustainability-oriented projects.

Identify target groups and assess stakeholder needs.

Analyse funding mechanisms and develop financially and operationally viable project concepts.

Collaborate effectively in interdisciplinary teams to plan and implement innovation projects.

Communicate and defend project ideas professionally.

Learning contents

This module develops students’ abilities to design, implement, and communicate sustainable innovations with measurable ecological and social impact. Working in interdisciplinary teams, students apply principles of design thinking, project management, and entrepreneurial strategy to develop real-world sustainability projects. Through iterative prototyping and testing, participants adapt their ideas based on feedback from peers, stakeholders, and mentors. The course integrates market and stakeholder analysis, identification of target groups, funding and partnership opportunities, and the design of viable revenue or implementation models. The module culminates in a pitch event where teams present their innovation concepts and implementation strategies.

Type and scope of the courses

Seminar (2 SWS), Project (2 SWS)

Literature:

Plattner, Hasso, Christoph Meinel, and Ulrich Weinberg. (2009) Design thinking. Landsberg am Lech: Mi-Fachverlag.
Shepherd, D. A., Patzelt, H., & Breugst, N. (2024). 66 Simple Rules for Entrepreneurs: A Roadmap for Improved Performance. Springer Nature.

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Fak229479: Eco-evolutionary Dynamics

Valid from: 01.10.2026

Teaching language	Duration	Contact hours (in hours)	Self-study hours (in hours)
English	one semester	60	90

Credit points (CP)	Frequency	Person responsible for the module
5	winter semester	Feldhaar, Heike; Prof. Dr.

Assessments

Title:	Weighting:	CP:
Term paper or Presentation or Written assignment	1	5

Prerequisites
Completion of Foundations Modules

Learning objectives
Explain key concepts of eco-evolutionary dynamics and their role in shaping ecosystem responses to environmental change.

Develop and analyse quantitative models linking population dynamics and evolutionary adaptation.

Interpret and evaluate empirical evidence for rapid evolution and phenotypic plasticity in natural systems.

Integrate ecological and evolutionary theory to improve forecasts of species persistence and community dynamics under global change.

Critically assess model assumptions, data requirements, and sources of uncertainty in eco-evolutionary forecasting.

Learning contents
This module examines feedbacks between ecological and evolutionary processes and their implications for forecasting species and community responses to global change. Students explore how evolutionary dynamics—such as genetic adaptation, phenotypic plasticity, and selection—shape and are shaped by ecological processes, including population growth, competition, and environmental variability. The course combines theoretical lectures with quantitative modelling exercises in which students simulate demographic and evolutionary processes. Through literature analysis, students critically evaluate empirical studies illustrating rapid adaptation in natural and anthropogenic environments.

Type and scope of the courses
Lecture (2 SWS) , Exercise (3 SWS)

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Fak229480: Biodiversity Conservation

Valid from: 01.10.2026

Teaching language	Duration	Contact hours (in hours)	Self-study hours (in hours)
English	one semester	60	90
Credit points (CP)	**Frequency**	**Person responsible for the module**	
5	summer semester	Steinbauer, Manuel; Prof. Dr.	

Assessments

Title:	Weighting:	CP:
Presentation or Written assignment or Semester-long tasks	1	5

Prerequisites
Completion of Foundations Modules

Learning objectives
Explain the principles of evidence-based and adaptive biodiversity conservation.

Apply modern monitoring techniques and data sources to inform conservation decisions.

Use predictive modelling tools such as species distribution models and optimisation algorithms to support conservation planning.

Integrate ecological forecasting with structured decision-making and adaptive management under uncertainty.

Critically assess the social, political, and institutional contexts influencing conservation practice and policy implementation.

Learning contents
This module focuses on evidence-based biodiversity conservation and the application of ecological forecasting to inform adaptive management and policy decisions. Students learn how forecasting tools, modern monitoring techniques, and decision-support frameworks can be combined to enhance conservation outcomes. The course introduces monitoring methods such as acoustic sampling, automated image classification, and environmental DNA (eDNA) analysis, as well as predictive approaches including species distribution modelling and social media analytics. Beyond technical skills, students engage with the institutional, political, and societal dimensions of conservation, examining structured decision-making under uncertainty, systematic reserve design, optimisation approaches, and connectivity modelling for biodiversity protection.

Type and scope of the courses
Exercise (4 SWS)

Literature:
Sutherland, William J. (2022) Transforming Conservation: A Practical Guide to Evidence and Decision Making. Cambridge, UK: Open Book Publishers.

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Fak229481: Pilot Study

Valid from: 01.10.2026

Teaching language	Duration	Contact hours (in hours)	Self-study hours (in hours)
English	one semester	0	150

Credit points (CP)	Frequency	Person responsible for the module
5	every semester	Ullmann, Tobias

Assessments

Title:	Weighting:	CP:
Written assignment	1	5

Prerequisites
Completion of Foundations Modules

Learning objectives
Design and implement a field, laboratory, or computational study ad-dressing an ecological forecasting question.

Apply principles of experimental design, data generation, and uncer-tainty quantification to real-world ecological systems.

Estimate sampling effort and identify key sources of uncertainty af-fecting forecast reliability.

Collect, manage, and document data according to open science stand-ards and reproducible workflows.

Reflect critically on the study design in the context of the forecasting objectives.

Learning contents
The Pilot Study module provides students with hands-on experience in designing and implementing ecological studies that generate data suitable for forecasting applications. Working under the supervision of a faculty member within the Ecological Forecasting program, and optionally in collaboration with an external partner organisation (re-gional, national, or international), students undertake an independent research internship.

Within this framework, students learn to identify relevant research questions, select study gradients or treatment levels, design appropri-ate sampling schemes, and estimate sampling effort to achieve fore-cast precision targets. The internship may focus on experimental, ob-servational, or modelling components, depending on the context and host institution. In many cases, the Pilot Study provides preliminary data and conceptual groundwork for the subsequent Master Project.

Students may complete between one and three Pilot Study modules (each 5 CP), depending on their individual study plan.

Type and scope of the courses
Project

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Fak229484: Forecasting Challenge

Valid from: 01.10.2026

Teaching language	Duration	Contact hours (in hours)	Self-study hours (in hours)
English	one semester	10	140
Credit points (CP)	**Frequency**	**Person responsible for the module**	
5	summer semester	Higgins, Steven; Prof. Dr.	

Assessments

Title:	Weighting:	CP:
Presentation or Written assignment	1	5

Prerequisites

Completion of Foundations Modules

Learning objectives

Plan and execute a collaborative ecological forecasting project from data collection through analysis and evaluation.

Apply advanced forecasting and modelling techniques to real-world ecological data.

Manage the complete data life cycle in accordance with open science standards, including documentation, sharing, and reproducibility.

Coordinate logistical, financial, and scientific tasks within a multidisciplinary research team.

Communicate forecasting results effectively through scientific reports and presentations, including interpretation of uncertainty and limitations.

Learning contents

The Forecasting Challenge module provides students with practical experience in collaborative, interdisciplinary ecological research through participation in a real-world forecasting challenge. Students plan and execute a complete research workflow as a single cohort, from data collection to model implementation and forecast evaluation.
Challenges may be designed internally or aligned with international initiatives such as the National Ecological Observatory Network (NEON) Forecasting Challenge, in which participants predict forthcoming ecosystem data based on past observations. Whenever feasible, the module includes a field campaign—potentially abroad—to broaden the students' practical experience in ecological data collection and cross-cultural scientific collaboration.
Students are responsible, with academic support, for the financial, logistical, data management, and scientific design components of the challenge. The work is conducted in accordance with open science principles, including transparent data handling, reproducible analysis workflows, and open dissemination of results.

Type and scope of the courses

Project

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Fak229485: Research Proposal

Valid from: 01.10.2026

Teaching language	Duration	Contact hours (in hours)	Self-study hours (in hours)
English	one semester	14	136

Credit points (CP)	Frequency	Person responsible for the module
5	winter semester	Higgins, Steven; Prof. Dr.

Assessments

Title:	Weighting:	CP:
Written assignment	1	5

Prerequisites

Completion of Foundations Modules

Learning objectives

Formulate a coherent and feasible research question within the scope of ecological forecasting.

Develop a structured, methodologically sound research proposal including objectives, hypotheses, methods, and anticipated outcomes.

Justify methodological choices with reference to ecological forecasting theory and open science principles.

Critically evaluate peer proposals and provide constructive scientific feedback.

Communicate research concepts effectively in written and oral formats.

Learning contents

This module guides students in developing a structured and feasible research proposal for their Master Project. It provides the methodological, conceptual, and communication skills necessary to design and articulate a scientific project within the field of ecological forecasting.
Students participate in a sequence of interactive workshops using collaborative formats such as speed dating, open space, and speed talks to exchange ideas, identify supervision opportunities, and refine research topics. Through iterative drafting, feedback rounds, and peer review, students improve the clarity, feasibility, and scientific quality of their proposals. The process emphasizes formulation of research questions, selection of appropriate methods, data management planning, and the integration of forecasting and uncertainty considerations into the research design.

Type and scope of the courses

Seminar (1SWS), Project

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Fak229486: Peer Review

Valid from: 01.10.2026

Teaching language	Duration	Contact hours (in hours)	Self-study hours (in hours)
English	one semester	14	136
Credit points (CP)	**Frequency**	**Person responsible for the module**	
5	winter semester	Higgins, Steven; Prof. Dr.	

Assessments

Title:	Weighting:	CP:
Written assignment	1	5

Learning objectives

Critically evaluate scientific research products using established peer review criteria.

Provide structured, constructive feedback to improve the quality and clarity of scientific work.

Reflect on the ethical, collaborative, and communicative aspects of the peer review process.

Integrate peer and mentor feedback into the revision and refinement of scientific products.

Contribute effectively to the dissemination of forecasting research through open and transparent scholarly practices

Learning contents

This module formalises the process of scientific peer review as a component of research-based learning. Building on the Research Proposal and Master Project modules, students engage in structured evaluation of their peers' Master Project drafts. The activity emulates the professional peer review process central to scientific communication, fostering critical reflection, academic integrity, and collaborative learning.
The module follows an iterative review structure, allowing multiple rounds of feedback and revision. Students assess their peers' work according to scientific criteria including conceptual soundness, methodological rigour, and clarity of communication. The process culminates in discussions and presentations during the annual program workshop. The Peer Review module overlaps with the final phase of the Master Project to enable timely incorporation of feedback into the final submission. The activities of this module are harmonised with the program's Journal of Ecological Forecasting.

Type and scope of the courses

Seminar (1 SWS)

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Fak229487: Masters Project

Valid from: 01.10.2026

Teaching language	Duration	Contact hours (in hours)	Self-study hours (in hours)
English	one semester	0	900
Credit points (CP)	**Frequency**	**Person responsible for the module**	
30	winter semester	Higgins, Steven; Prof. Dr.	

Assessments

Title:	Weighting:	CP:
Master thesis	1	30

Prerequisites
Successful completion of the Research Proposal module

Learning objectives
Design, conduct, and document an independent research project in the field of ecological forecasting.

Apply appropriate modelling, analytical, and experimental methods to address a defined ecological question.

Manage and analyse data according to principles of transparency, reproducibility, and open science.

Interpret results critically in the context of existing scientific literature and ecological theory.

Communicate research findings effectively in written scientific formats.

Demonstrate project management, problem-solving, and professional research conduct within a fixed timeframe.

Learning contents
The Master Project constitutes the culmination of the Elite Study Program in Ecological Forecasting. Building on competencies acquired in the Foundations, Themes, Pilot Study, and Research Proposal modules, students conduct an independent, research-based project under the supervision of a faculty member associated with the program.
The project involves formulating and addressing a forecasting-related research question, integrating theoretical, empirical, and modelling approaches as appropriate. Emphasis is placed on transparent research design, reproducible workflows, and adherence to open science principles.
Due to the structured cohort format of the program, the Master Project is conducted within a defined timeframe. This structure supports careful project planning, promotes peer exchange during the research phase, and fosters timely completion.

Type and scope of the courses
Project

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