UNIVERSITÄT BAYREUTH

INTERNATIONAL OFFICE

General Overview of English-Taught Courses at the University of Bayreuth

Available during Summer Semester 2024

An overview for Winter Semester 2024/25 is expected to be available as of 01.10.2024

Biology, Chemistry and Earth Sciences

Number	Course Title	Duration	Type	ECTS / Credits	Module Description
00073	Non-coding RNA and Epigenetics	2	Lec	9	
00074	Non-coding RNA and Epigenetics (block practical course)	5	Lab	9	
00075	Non-coding RNA and Epigenetics (Seminar for practical course and lecture)	2	Sem	9	
00148	Electrochemistry 2	2	Lec	5	
00366	Advanced polymer materials in batteries	2	Lec	5	
00369	Advanced polymer materials in batteries	1	Tut	5	
00375	Electrochemistry 2	1	Tut	5	
00379	Electrochemistry 2	1	Lab	5	
00381	Fundamentals of Physical Chemistry for Electro-chemical Energy Storage Systems	1	Tut	5	
00427	Major birding excursion Protocol	4.5	Exc	9 /10	Six excursion days (incl. one report) plus active participation in the "Bird Seminar": Active participation in the "Bird Seminar" includes a presentation in the subject area "Evolutionary Ecology of Birds" which is graded.
00436	Major excursion ornithology seminar	4.5	Sem	9 /10	
00478	Statistical Ecotoxicology Seminar	2	Sem		In the seminar, we discuss all kinds of topics relating to ecotoxicology, risk assessment and statistics. This includes discussion of recent publications and R coding sessions. The seminar takes place every Monday at 9:30 am. Registration via the e-learning-extern platform: https://elearning-extern.uni-bayreuth.de/course/view.php?id=1192 (Registration key: statecotox24)
00578	Fundamentals of Inorganic Chemistry for Electro-chemical Energy Storage Systems	2	Lec	5	
00749	Battery Materials I	2	Lec	5	
00751	Battery Materials I	1	Tut	5	
00763	Methods in Dynamic Vegetation Ecology, Module Dynamic Vegetation Ecology	5	Tut	5 /9	The lecture introduces the most important ecological processes for the Earth's vegetation. The lecture conveys that both biophysical laws and the evolutionary history of individual sites are necessary to understand vegetation patterns. Topics include the carbon budget of leaves, plant canopies and vegetation stands, carbon allocation, birth and mortality, and the structure of plant communities and ecosystems. The seminar examines case studies from the application of dynamic global vegetation models (DGVMs) based on original research. The tutorial teaches how to use non-destructive methods to estimate net primary production (NPP). In field exercises, photosynthesis, transpiration, respiration and leaf area are measured and used with the help of the computer language R to estimate NPP. Further computer exercises will teach how to retrieve and use public Earth Observation data useful for vegetation ecology to analyse NPP trends. The tutorials will utilise the Geographic Information System functionality of the R computer language. The findings of the tutorial will be summarised in a project report written in the style of a scientific publication.

Number	Course Title	Duration	Type	ECTS / Credits	Module Description
00764	Dynamic Vegetation Ecology, Module Dynamic Vegetation Ecology	2	Lec	5 /9	The lecture introduces the most important ecological processes for the Earth's vegetation. The lecture conveys that both biophysical laws and the evolutionary history of individual sites are necessary to understand vegetation patterns. Topics include the carbon budget of leaves, plant canopies and vegetation stands, carbon allocation, birth and mortality, and the structure of plant communities and ecosystems. The seminar examines case studies from the application of dynamic global vegetation models (DGVMs) based on original research. The tutorial teaches how to use non-destructive methods to estimate net primary production (NPP). In field exercises, photosynthesis, transpiration, respiration and leaf area are measured and used with the help of the computer language R to estimate NPP. Further computer exercises will teach how to retrieve and use public Earth Observation data useful for vegetation ecology to analyse NPP trends. The tutorials will utilise the Geographic Information System functionality of the R computer language. The findings of the tutorial will be summarised in a project report written in the style of a scientific publication.
00765	Foundations of Dynamic Vegetation Ecology, Module Dynamic Vegetation Ecology	2	Sem	5 /9	The lecture introduces the most important ecological processes for the Earth's vegetation. The lecture conveys that both biophysical laws and the evolutionary history of individual sites are necessary to understand vegetation patterns. Topics include the carbon budget of leaves, plant canopies and vegetation stands, carbon allocation, birth and mortality, and the structure of plant communities and ecosystems. The seminar examines case studies from the application of dynamic global vegetation models (DGVMs) based on original research. The tutorial teaches how to use non-destructive methods to estimate net primary production (NPP). In field exercises, photosynthesis, transpiration, respiration and leaf area are measured and used with the help of the computer language R to estimate NPP. Further computer exercises will teach how to retrieve and use public Earth Observation data useful for vegetation ecology to analyse NPP trends. The tutorials will utilise the Geographic Information System functionality of the R computer language. The findings of the tutorial will be summarised in a project report written in the style of a scientific publication.
01002	Evolutionary ecology seminar for Bachelor's and Master's students, state examination candidates and doctoral students	2	Sem		
20080	Geo-Information Systems II (Introduction to statistical methods for spatial data analysis)	4	Lec & Tut	6	After an introduction to the spatiotemporal data analysis, we will focus on several fundamental statistics and machine learning concepts in regression and classification problems. The course concludes with an overview of the frontiers in spatial analysis and we will see that a large portion of state-of-the-art Geoscientific data science methods are rooted in the methods introduced in this course. The programming language Python will be introduced and exercises will be assigned. With the exercises, the students will learn Python programming and how to use it for spatial data exploration and analysis in both simulated and real-life applications.
20207	Introduction to reactive transport	2	Lec & Tut	5 /9 /10	The fate of contaminants in aquatic systems is closely linked with the transport of water. The goal of this module therefore is to introduce the principles of reactive transport with a special emphasis on groundwater, to consider the physical-chemical properties of the substances, and to discuss this with case studies. The lecture Introduction to reactive transport; (2 WHS) teaches the theoretical foundations of reactive transport (Advection-dispersion-equation, diffusion, reaction kinetics, Monod kinetics, Peclet- and Damköhlernumbers). In the tutorial: Problems in reactive transport (2 WHS) the students will work on tasks covering the material of the lecture and learn how to use the computer code PhreeqC to quantitatively solve transport problems in combination with retention of chemical substances (e. g. application of filterbeds to remove contaminants)
20234	Geomorphology and Global Change (Geomorphology and Global Change: Field Exercise)	2	Tut	5 /6	Field exercise on the topic of geomorphology and global change The geomorphological processes and their changes are worked out together in a specific study area. Together with the lecturers, the students develop an investigation concept for a sub-area of the process and carry out corresponding field investigations and/or analyses using geographic information systems.
20314	Advanced GIS	2	Tut		Students will be trained in creating, handling and analysing geodata using multiple geoprocessing tools. Particular attention will be given to the automatization of workflows, techniques for geodata management, and creation of high-quality cartographic visualisations.
20315	Working on large data sets with R	1	Tut	2 /5 /9 /10	
20527	Research Module	8	Pro	5	
20553	Dynamic ecosystem modelling	4	Lec & Tut	5	Complex dynamic ecosystem models are crucial to understand the mechanisms that shape ecosystems, project their fate under different scenarios and communicate ecosystem functioning and the consequences of human-ecosystem interactions. This course covers the basic tools that are necessary to apply such models, e.g., choose the right model structure and complexity, run sensitivity analyses, calibrate the parameters, and quantify model uncertainty and performance. In addition to the theoretical instruction, all methods are applied in hands-on examples and further developed by the participants within the framework of a final project.
20564	Problems in reactive transport	2	Tut	5 /10	The fate of contaminants in aquatic systems is closely linked with the transport of water. The goal of this module therefore is to introduce the principles of reactive transport with a special emphasis on groundwater, to consider the physical-chemical properties of the substances, and to discuss this with case studies. The lecture Introduction to reactive transport; (2 WHS) teaches the theoretical foundations of reactive transport (Advection-dispersion-equation, diffusion, reaction kinetics, Monod kinetics, Peclet- and Damköhlernumbers). In the tutorial: Problems in reactive transport (2 WHS) the students will work on tasks covering the material of the lecture and learn how to use the computer code PhreeqC to quantitatively solve transport problems in combination with retention of chemical substances (e. g. application of filterbeds to remove contaminants)

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20577	Research Module	8	Pro		
20576	Introduction to Environmental Analytical Chemistry	2	Lec & Tut	5 /10	The lecture provides basic knowledge for water, gas, soil sampling and stabilisation, for determination and critical evaluation of simple chemical parameters by means of electrochemistry, photometry and titrimetry. All these methods will be applied in practice to topics already known from Module C1 (e.g. calcite-carbonic acid equilibrium or Fe-sulphide redox reactions). Planning, preparing, and conducting a field sampling trip and practicing laboratory routines such as preparing standards from salts or concentrated solutions, doing calibrations, standard additions and other quality control are part of the course. Basic information on determination of major and trace elements with chromatography and spectrometry will be given in the lecture.
20580	Environmental Soil Physics	3	Lec & Tut	5	Environmental Soil Physics is an interdisciplinary course that explores the fundamental principles and processes governing the physical behaviour of soils within the context of environmental systems. The course comprises both theoretical and laboratory components, where the following topics are covered: soil hydraulic properties, soil structure, water flow in soils: i) macropore flow; ii) evaporation; iii) transpiration; and reactive transport of chemicals in soils. Special emphasis is placed on understanding soil physical processes in relation to the temporal and spatial scales, as well as their description using fundamental theories. Participation in both courses is mandatory. Theoretical Part: Environmental Soil Physics In the theoretical part, students will be describing the data that they produced in the laboratory part, with modern soil physical theories. The following theories will be analysed: Different models (empirical vs physically based) for describing Soil Hydraulic Properties. Insights on using advanced imaging techniques and algorithms to characterise soil structure and identify soil constitutes (grains, particulate organic matter, pores, etc). Main theory on simulating water flow in soils. Discuss limitations and theory extensions. Main theories on describing root water uptake (macroscopic vs microscopic approaches). Main theories and algorithms to simulate soil water evaporation. Effect of soil structure. Main theory on reactive solute transport in unsaturated soils
20581	Field and Lab Soil Physical Experiments	2	Tut	5	Environmental Soil Physics is an interdisciplinary course that explores the fundamental principles and processes governing the physical behaviour of soils within the context of environmental systems. The course comprises both theoretical and laboratory components, where the following topics are covered: soil hydraulic properties, soil structure, water flow in soils: i) macropore flow; ii) evaporation; iii) transpiration; and reactive transport of chemicals in soils. Special emphasis is placed on understanding soil physical processes in relation to the temporal and spatial scales, as well as their description using fundamental theories. Participation in both courses is mandatory. Laboratory Part: Field and lab soil physical experiments In the laboratory part, students collaborate with lecturers to design and execute an experimental campaign, setting up laboratory experiments to quantify different physical processes. The data from the laboratory part will be the basis for testing different theories in the theoretical part. The following physical measurements will be conducted: Characterization of Soil Hydraulic Properties from saturation to oven dryness Characterization of Soil Structure and its effect on soil hydraulic properties Water flow experiments under steady-state and transient conditions Drying out experiments and quantification of root water uptake Evaporation experiments Solute transport experiments for well and poorly structured soils
20621	Principles of Remote Sensing (Methods of Environmental Geography)	2	Crs	5 /10	In this course, students will learn about the principles and applications of remote sensing. First, they will learn the basic concepts within lectures, and then they will learn how to process satellite images and generate maps in a practical way. They will be provided with various exercises with clear user-guides and manuals for practical sessions and will do some assignments for the final evaluation.
20658	Statistical data analysis with R	2	Lec & Tut	3	Topics covered in the course include: using R and RStudio, descriptive statistics and visualisation, hypothesis testing, linear models, generalized linear models, mixed models, confounders, causality and Directed Acyclic Graphs (DAGs), data management and experimental design.
20853	Lecture Integrative biomolecular structure modelling	2	Lec	9	During the beginning of this lecture series, we will discuss structural biology in general followed by lectures about contributing methods (structure predictions, NMR spectroscopy, X-ray crystallography, cryo-EM, small-angle scattering, EPR, FRET, cross-linking mass spectrometry). To avoid redundancy we will focus on which restraints are useful for integrative approaches. This will be followed by explanations about how to combine restraints from these methods in an efficient way, depending on what complexes are investigated (protein-protein, protein-nucleic acids). Later, computational tools and platforms will be introduced and how to best apply them for certain complexes. Lastly, we will discuss the problem of how to handle dynamic molecules, like intrinsically disordered proteins and RNA. Obtaining models of these kind of complexes are challenging and ensemble modelling is therefore a major focus. The lecture, seminar and practical will be generally in English. In the seminar, we will discuss new and relevant literature, which is in relation to the lecture and practical, which helps to deepen the students' understanding of the topic and it will be discussed in the group. Here, we will also focus on assessing the articles critically. In the practical, we will try to provide insights into the difficulties of integrative modelling and how to find solutions. Hands-on experience on computational tools with existing data will be taught. Topic 1 (18.4.) Introduction to structural biology, its importance in understanding biology and integrative structure modelling 2 (25.4.) Methods for structural biology I: Protein structure prediction 3 (2.5.) Methods for structural biology II: NMR and restraints for integrative modelling 4 (16.5.) Methods for structural biology III: X-ray crystallography (Pravin Jagtap) 5 (23.5.) Methods for structural biology IV: cryo-EM (Pravin Jagtap) 6 (6.6.) Methods for structural biology V: restraints from other methods (XL-MS, FRET, EPR, small-angle scattering) 7 (13.6.) Combining restraints for modelling and computational tools for structure calculations 8 (27.6.) Integrative modelling of protein-nucleic acid complexes 9 (11.7.) Structure and function: how to decipher the meaning of a 3D structure model 10 (18.7.) Highlights in integrative modelling and future challenges
20788	M3 Research Plan - Designing and Presenting a Research Plan	2	Sem	5	For the thesis seminar, the student attends the group seminar of the group they do their thesis with, presents the scientific content of a current research paper, and critically evaluates the quality of research and presentation. Feedback will be given from other members of the group seminar. In the seminar 'research plan' the students learn in the respective work groups based on literature research how to define and limit their upcoming M.Sc. thesis, how to draft precise work hypotheses that can be verified/falsified, how to identify required instrumentation and how to establish a realistic schedule for the project that can be controlled via well-defined milestones.

Number	Course Title	Duration	Type	ECTS / Credits	Module Description
20817	Trends in quantitative ecosystem research	2	Sem	2	Ecological publications with a focus on methodological advancements.
20872	Research training I (Science School)	2	Sem	10	Topic: Climate Change Adaptation in the district of Forchheim General framing: The underlying research questions of the Research training I (RTC) will focus on urban or rural heat islands in the wider region of Forchheim. Therefore, measurements will focus on different areas with varying house densities and land cover. Different methodological approaches are involved, including bike surveys, weather station measurements, remote sensing approaches and small aircraft based measurements with a thermal camera. The students will actively take part in an ongoing research project in collaboration with the district of Forchheim. Therefore, we will jointly establish a network of climate stations situated in different settlements and locations. Furthermore, linear and areal measurements will be planned and conducted. The research project will also benefit from preliminary surveys of 2021 and advance respective analysis. Each student will have to develop a more detailed research question that is connected to respective measurements with the support of the lecturers. Organisation: A Microsoft Teams channel is the basic platform to organize the course. There, we will share findings from the 2021 study, small files, scripts and documents. Personal meetings will be held on demand. Tentative schedule and organisation: - April: Initial online meeting to discuss organisation. Survey of existing reports and files. Formulation of associated research questions by students. Collection and preparation of existing data with support of the lecturers. - May (before the heat wave period): instrumentation of selected locations with weather stations and data loggers - May-August: field measurements of the research training (students), bike and flight campaigns (weather dependent) - September - early October: data readout and collection of weather stations and data loggers - End of November and December 2021: final data analysis + report writing - Costs: travel costs will be covered by the University - Field trips will be on a daily basis or several consecutive days (situation dependent)
20921	M2 Research Module - Research Project	8	Pro	5	Content depend on current research projects of the selected research group. M2 is usually performed on a research group of one of the lecturers of the study programme Environmental Chemistry. Other research modules inside or outside the University of Bayreuth can only be taken after prior approval by the board of examiners. In agreement with the respective supervisor, the M2 module may include experimental work in the field or laboratory, a literature review, attending seminars of the research group, workshops or conferences with an own presentation and/or the compilation of a research report.
20956	Microplastics in the environment	1	Lec	9	The lecture covers the following main topics: Formation of microplastics, detection of microplastics in environmental samples, occurrence of microplastics in different environmental compartments and ecological risks of microplastics.
20958	Microplastics in the environment	1	Sem	9	In the practical part, basic knowledge of accurate and precise scientific work in the areas of sampling, sample preparation, analysis and detection of microplastics in various environmental samples (air, water, soil, biota) is taught. The knowledge will be used to develop and work on projects for the detection of microplastics in different environmental samples in small groups. The participants will present the results obtained in the exercises together for each subgroup in a presentation during the seminar. An article from a specialist journal will then be discussed on the respective topic, which each course participant will be asked to read in advance.
20959	Exercise - Microplastics in the environment	7	Tut	9	In the practical part, basic knowledge of accurate and precise scientific work in the areas of sampling, sample preparation, analysis and detection of microplastics in various environmental samples (air, water, soil, biota) is taught. The knowledge will be used to develop and work on projects for the detection of microplastics in different environmental samples in small groups. The participants will present the results obtained in the exercises together for each subgroup in a presentation during the seminar. An article from a specialist journal will then be discussed on the respective topic, which each course participant will be asked to read in advance.
20977	Ecological microbiology: Literature seminar	2	Sem		
21008	Population ecology advanced seminar for B.Sc. and M.Sc. students, state examination candidates and doctoral students	2	Sem		
21150	Climate Data Modelling	2	Tut	5	The module will address climate variability and climate change and provide insights into statistical and modelling approaches. It provides knowledge of climate data sources and formats and the applications of climate models. Modelling will include climate extreme events, e.g., drought and wet conditions.
21207	M3 Paper Seminar	2	Crs	5	For the thesis seminar, the student attends the group seminar of the group they do their thesis with, presents the scientific content of a current research paper, and critically evaluates the quality of research and presentation. Feedback will be given from other members of the group seminar. In the seminar 'research plan' the students learn in the respective work groups based on literature research how to define and limit their upcoming M.Sc. thesis, how to draft precise work hypotheses that can be verified/falsified, how to identify required instrumentation and how to establish a realistic schedule for the project that can be controlled via well-defined milestones.
21525	Environmental Microbiology Project	2	Tut	5 /10	
21645	Fundamentals of Physical Chemistry for Electrochemical Energy Storage Systems	2	Lec	5	
21646	Electrochemistry 1	2	Lec	5	

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21647	Electrochemistry 1	1	Tut	5	
22524	Introduction to Environmental Microbiology	2	Lec	2 /5 /9 /10	
22657	High-performance materials for electrochemical energy systems	2	Lec	7 /9	The lecture presents properties, processing and materials for electrochemical energy storage. Electrochemical fundamentals and cell concepts of modern accumulators and fuel cells are covered. The focus will be on materials and how their properties affect the properties of battery cells. The following aspects are covered: i) Concepts of modern batteries and fuel cells ii) Electrochemical cells and electrode processes (charge transfer and material transport) iii) Cathode and anode materials: synthesis, structures and properties iv) Cathode and anode materials: phase diagrams and functional principles v) Separators and electrolytes; ionic, superionic and solid electrolytes vi) Characterisation methods for battery materials including operando analyses
22658	Practical course - High-performance materials for electrochemical energy systems (short practical course)	6	Ins	7	Using selected examples, students are introduced to methods and cell concepts focussing on materials used in modern rechargeable batteries. Under the guidance and supervision of experienced members of the participating research groups, this includes in particular electrochemical methods with a focus on structural and electronic characterisation in order to elucidate the different behaviour of the materials used in terms of crystal structures (diffraction, structure refinement) and local structure (NMR, PDF, EXAFS). Operando analytics is used as a tool to observe the cells at 'work' and thus draw conclusions about the choice of materials.
22659	Practical course - High-performance materials for electrochemical energy systems (long practical course)	8	Ins	9	Using selected examples, students are introduced to methods and cell concepts focussing on materials used in modern rechargeable batteries. Under the guidance and supervision of experienced members of the participating chairs, this includes in particular electrochemical methods with a focus on structural and electronic characterisation in order to elucidate the different behaviour of the materials used in terms of crystal structures (diffraction, structure refinement) and local structure (NMR, PDF, EXAFS). Operando analytics is used as a tool to observe the cells at 'work' and thus draw conclusions about the choice of materials.
24008	Ecological Climatology	2	Sem	5 /6	Climate is a major determinant of the distribution of global terrestrial ecosystems. Simultaneously, these ecosystems are agents of the climate system as they cycle energy, water, nutrients and trace gases. Ecological Climatology is hence a framework to address the coupling of climate and ecosystems and understand their dynamics in space and time.
24009	Ecological Climatology	2	Tut	5 /9 /10	In addition to the seminar, this course covers practical contents of the Ecological Climatology module.
24022	Experimental Ecology	2	Tut	5	General concepts of experimental ecology will be introduced initially using ongoing field experiments as model ecosystems. Here, the focus of interest are effects of global change drivers om biodiversity and ecosystem functions. Guided by instructors, students will develop their own hypothesis within an ongoing research activity, collect and evaluate their own data. In doing so, students will learn about the potential and limitation of experimental approaches. Thus, students will become familiar with different methods of collecting and evaluating data in experimental ecology.
24050	Vegetation Science	2	Lec	2 /5 /9 /10	Contents of the module are current approaches in vegetation science, in vegetation mapping and in monitoring changes in vegetation pattern and dynamics. Students will develop an understanding of the functional characterisation of habitats and of scale dependence in vegetation ecology. They will develop the ability to recognise the role of disturbance regimes for vegetation dynamics and develop an understanding of data processing requirements for linking vegetation ground data with remote sensing derived information. Thus, students will become familiar with different theories and methods of collecting and evaluating data in plant ecology.
24059	Scientific writing in biogeography and disturbance ecology	1	Sem	2 /5	Different trans-disciplinary manuscripts, both in content and methods, are offered, reviewed and discussed in small groups.
24075	Field course Vegetation Science	2	Ins	2 /5 /9 /10	Based on theoretical knowledge about different approaches in vegetation science, various methods of data recording are applied to in the complex terrain of the European Alps that offers a large diversity of habitats and vegetation structures. Site conditions and ecosystem processes are related to key plant functional traits and vegetation pattern. Methods includ-ing floristic relevés, vegetation transects, systematic trait data recording, biometry, biomass harvests, and spatial assessments (mapping, remote sensing).
24078	Lecture (Bio-)Analytics: QM and Metrology	2	Lec	7 /9	Analytics is a metrological (measuring) science. The lecture introduces the analytical process and the basics of metrology and result evaluation and provides an overview of the closely related quality management in the laboratory. Applications and fundamentals from the fields of spectroscopy (e.g.: qNMR as an example of quantitative reference method, IR etc.), separation methods and mass spectrometry are presented, as well as an introduction to OMICS methods focussing on metabonomics. Topic-related exercises complement the lecture (part of the VL).
24079	Small group practical course in (bio)analytics: QM and Metrology	7	Ins	7 /9	Students learn to view the analytical process in its entirety, to interpret analytical results critically and to formulate them in a legally compliant manner. Part of the internship is a seminar with a graded presentation (in English).
24300	Lecture Special Natural Product Chemistry	2	Lec	7 /9	You will find all relevant information on this course in good time in e-learning for the corresponding lecture (see link below). PLEASE REGISTER FOR THE CORRESPONDING LECTURE IN E-LEARNING. All further communication will take place via the e-learning platform or via email to the persons enrolled there.
25180	Trends in Biogeography	1	Sem	5	Different transdisciplinary publications, both in content and methods, are offered and discussed in small groups.

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26352	Lecture Experimental Plant Ecology	1	Lec	5	
26353	Exercise Experimental Plant Ecology	4	Tut	5	
28000	Geographical colloquium	2	Coll	3	
28004	Micrometeorological and atmospheric chemistry seminar (Geoecology T1 / M2 for final theses in micrometeorology)	2	Sem	5	
28041	Basic Laboratory and Field Method Training (C2)	2	Tut	5	The lecture provides basic knowledge for water, gas, soil sampling and stabilisation, for determination and critical evaluation of simple chemical parameters by means of electrochemistry, photometry and titrimetry. All these methods will be applied in practice on topics already known from Module C1 (e.g. calcite-carbonic acid equilibrium or Fe-sulphide redox reactions). Planning, preparing, and conducting a field sampling trip and practicing laboratory routines such as preparing standards from salts or concentrated solutions, doing calibrations, standard additions and other quality control are part of the course. Basic information on determination of major and trace elements with chromatography and spectrometry will be given in the lecture.
28051	Inorganic Pollutants and Nutrients (C3)	2	Lec		The lecture focuses on geochemical and biological influences on biogeochemical cycles of selected metal(oid)s, rare earth elements, and radionuclides. In addition to classical pollutants (As, Sr, Cs, Cd, U) elements are considered, which also serve as nutrients (Mn, Fe, Co, Cu, Zn). The influence of the availability of certain elements on important ecosystem functions, such as biomass production, will be presented. In the seminar environmental forensics a historical or current case of contamination will be discussed. Students will form teams that represent contrasting and potentially conflicting interests. They will gather scientific expertise to create a causal chain from contamination event to its cause and will present and defend their findings e.g. in the form of a court hearing.
28061	Environmental Forensics (C3)	2	Sem		The lecture focuses on geochemical and biological influences on biogeochemical cycles of selected metal(oid)s, rare earth elements, and radionuclides. In addition to classical pollutants (As, Sr, Cs, Cd, U) elements are considered, which also serve as nutrients (Mn, Fe, Co, Cu, Zn). The influence of the availability of certain elements on important ecosystem functions, such as biomass production, will be presented. In the seminar environmental forensics a historical or current case of contamination will be discussed. Students will form teams that represent contrasting and potentially conflicting interests. They will gather scientific expertise to create a causal chain from contamination event to its cause and will present and defend their findings e.g. in the form of a court hearing.
28123	Spatial Statistics and Visualisation with R	2	Tut	3 /5 /10	Spatial data require specific methods of analysis. Different methodological approaches will be presented and practically implemented with the statistical software R. An exemplary selection of covered topics are: Visualization of spatial data, spatial point pattern analysis, variograms, and the modelling of areal data.
28368	Modelling Ecosystem Services with the Soil and Water Assessment Tool	2	Lec & Tut	5 /9	The Soil and Water Assessment Tool (SWAT) is a widely used simulation model to predict the impacts of land use and climate change on ecosystem functions of small watersheds and large river basins. This course will introduce the major principles of the SWAT model and its subroutines from climate and hydrology to nutrient cycles and plant growth. We will explore how to set up the model for a watershed, learn about model calibration with observation data, and we will evaluate potential environmental impacts of land use or climate change with respect to ecosystem services.
28588	Statistics with R	2	Tut	2 /6 /9	The course provides basic knowledge for students on how to start programming with the open source software R to implement statistical models on environmental data sets and interpret the results obtained. All these methods will be practically applied in the computer lab. Basic information on how to create statistics in R will also be given during various lectures. This is an introductory course and prior knowledge of programming is not required. Workload for students: This is a block course (six sessions in total). Each session covers a specific topic on how to perform statistical analyses on environmental data in R. Each session is divided into a lecture part and a practical part. Please note that this is an introductory course and no prior knowledge of programming is required. Please contact Dr. Arabi via - behnaz.arabi@uni-bayreuth.de - if you have any questions about this course.
28630	Geographies of Environment and Development	2	Sem	5 /6	The concept Development or Under-development has been considered "perspectived" after dependency theories and alternative approaches failed to offer `one-cap-fits all' explanation for the trajectory of development process in different geographies. Impacts of human-environment-society interrelations are context-specific too. Despite this latest progress in development studies research, knowledge about causes, nature and effects of environmental change and development practices are continually framed, legitimised and communicated via myths, grand narratives, and discourses based on a series of `accepted` conclusions, global standards or blueprints. The framing of interventions by development actors/agencies purported to produce `desirable` outcomes takes similar forms. It thus becomes crucial to uncover `taken-for-granted' representations and vested interests that underpin mainstream environmental and development policy interventions. This module introduces students to theories, current trends/patterns of events and scientific methods to understand the nexus of environment, society and development in the global south from a cross-disciplinary perspective of human, political and environmental geography. Students will learn concepts for the study of physical, political and socio-economic dimensions of environmental change. Thus, students can locate environmental trends/change, environmental control, development discourses, and development practices. At the end of this module, students are expected to gain rich insights into theoretical and conceptual approaches of the geographical-society-environment research in the development context in the global south and employ such critical perspectives in their respective research projects.

Number	Course Title	Duration	Type	ECTS / Credits	Module Description
28800	A10: Land Use Change and Microclimate	2	Lec	5	Land use and land cover (LULC) change from local to global scales is an important aspect of global change and acts as both a responder to social-economic demands and as a driver of societal development. At the heart of these feedback processes is the biogeochemical cycling of heat, water, carbon, and reactive species creating specific microclimates between the land surface and the near-surface air, both of which comprise the `critical zone` containing almost all terrestrial life including human activities. The microclimate and thus the state of the critical zone is important for identifying sustainable solutions in a rapidly changing world impacted by urbanisation, agricultural expansion, afforestation, and desertification. Students will first develop a conceptual problem- and process-oriented understanding of how LULC changes impact the microclimatic cycling of heat, water, carbon, and other trace gases in a classroom setting. Next, they will apply their skills by designing, conducting, analyzing, and interpreting field measurements of heat, water, and radiative fluxes across the soil-air-plant continuum across contrasting land use types (grassland, urban land cover) to understand the urban heat island and agricultural cool islands. Methods include commonly applied micrometeorological experimental techniques and models including the Bowen-ratio, Penman-Monteith evapotranspiration, and Soil-Vegetation-Atmosphere Transfer (SVAT) models.
74004	Excursion	1	Exc	4 /5	Global Change Ecology Overview Module Two Excursions (1 semester hour, 1 credit point)
74005	Jour fixe	2	Sem	5	
74011	Extreme Events	2	Sem	5	
74013	Water resources in a rapidly changing world - impacts and challenges	2	Sem	5	The module is divided into a lecture/tutorial about fundamental hydrological processes and a seminar with interactive content. The focus of the lecture are the hydrological cycle and the water balance equation. Processes of water movement through the compartments of the atmosphere, biosphere and geosphere and their interactions are discussed in detail. Furthermore, aspects of chemical and ecological water quality and strategies for protecting surface- and groundwater are presented. In the seminar, we discuss current risks for and impacts on water resources in a global context. Students select a topic and present the results of their literature review to their fellow students, with the aim to stimulate a critical discussion also of potential mitigation strategies. The student presentations may be complemented by presentations of external experts.
74020	Development and Change of Biodiversity	2	Lec	5	The lecture deals with the evolution of variety on earth, prior major extinctions, the significance of the variety of ecosystems functions and current trends.
74027	Global Change Impacts on Species Distributions	2	Lec & Tut	5	Species occurrence data wrangling, environmental covariates, species distribution modelling (single SDM), joint species distribution modelling (JSDM), anthropogenic influences on species distributions, machine learning algorithms, SDM-ensembles.
74028	Global Change Impacts on Species Distributions	2	Tut	5	Species occurrence data wrangling, environmental covariates, species distribution modelling (single SDM), joint species distribution modelling (JSDM), anthropogenic influences on species distributions, machine learning algorithms, SDM-ensembles.
74031	Soil Carbon and Global Change (GCE:B6c (field lab course)	1	Tut	5	The course prepares you for the lecture on Soil Carbon turnover (B6a). Please note that we can take only 10 participants. You will start at the 8th of April at 8:45 with field work. We meet you then in the seminar room H7 in the Dr. Hans-Frisch-Str. 1-3, 95448 Bayreuth (here the Soil Ecology has its rooms and labs). For the lab work we will split the course into groups with 5 persons. From April 09th to April 12th you work in the lab (Soil Ecology, Dr. Hans-Frisch-Str. 1-3, 95448 Bayreuth). One group will work in the morning from 8 to 12 am and the other group will work in the afternoon from 13 to 16 pm. Please email your preference and we will sort you into the groups. Hoping to see you soon!
74038	Globalisation of Economies and the Environment	2	Sem	5 /6	The seminar discusses what effects global trade, particularly of raw materials, induces due to the use of terrestrial and marine ecosystems. In order to reduce negative effects, environmental policy measures such as environmental standards play a special role. However, national environmental policies and different environmental policy standards between trading partners can also distort competition. Global market changes, environmental impacts and policy measures are critically reflected.
74040	Global change Policy, Contracts and Administrative Strategies (CBD and IPBES)	2	Sem	5	
74041	Economics of Global Environmental Change	2	Sem	5 /9	
74047	Methodology of social sciences	2	Sem	3	This module provides a general and broadly understood introduction to problems, approaches, and debates in social science methodologies. The main aim is to make MSc scholars familiar with prominent `epistemological schools`, methodological angles and language(s), to provide a solid grounding in the key issues and a critical understanding of them. The method course is divided into two parts: (1.) Philosophy of social science, epistemology and ontology and (2) Introduction into understanding and applying relevant geographical methodological approaches (with some prominent methods to be addressed).
74051	Foundations of Biogeographical Modelling	2	Lec & Tut	2 /5 /10	Data sources, data processing, variable selection, vegetation models, distribution models, home range analyses

Number	Course Title	Duration	Type	ECTS / Credits	Module Description
74057	Ecosystem Services Assessment of Landscapes	2	Tut	2 /5 /9	In the tutorial, ecosystem services are quantified in selected regions using spatially explicit models. Following this, different land-use change scenarios are assessed simulating the related impacts on multiple ecosystem services.
74062	Advanced Geostatistical Methods	1	Lec	3	
74063	Advanced Geostatistical Methods	1	Tut	3	
74090	In-situ Field Data Recording	2	Tut	5	Findings from biological assessments and records from applied sciences such as forestry, nature conservation, agriculture in the field (basal area, forest successional stages, species, drought impact, tree mortality etc.) are linked with remote sensing data (hyperspectral data, results from remotely sensed field data and products such as FAO land cover classification system LCCS or Global Land Cover - Sentinel 2; LAI records and hemispheric measuring). With selected examples, the potential and limitations of using aircraft- and satellite-based missions for the collection of biodiversity patterns will be shown. Processing steps like dimension reduction, index calculation as well as spatial filters and measures to determine heterogeneity of habitats and ecosystems will be taught.
74091	Remote Sensing Data Analysis	2	Tut	5	Findings from biological assessments and records from applied sciences such as forestry, nature conservation, agriculture in the field (basal area, forest successional stages, species, drought impact, tree mortality etc.) are linked with remote sensing data (hyperspectral data, results from remotely sensed field data and products such as FAO land cover classification system LCCS or Global Land Cover - Sentinel 2; LAI records and hemispheric measuring). With selected examples, the potential and limitations of using aircraft- and satellite-based missions for the collection of biodiversity patterns will be shown. Processing steps like dimension reduction, index calculation as well as spatial filters and measures to determine heterogeneity of habitats and ecosystems will be taught.
74098	Health implications of Global Change	2	Lec	5	The lecture synthesises information on the most important interlinkages between biodiversity, climate change and health. It covers the concepts of one health, and planetary health and includes an overview of related Sustainable Development Goals, and reports.
74099	Current Research in Health implications of Global Change	2	Sem	5	In the seminar we review and discuss current contributions which cover the biodiversity - climate change - health nexus especially for zoonotic infectious diseases and use this knowledge to articulate future research priorities. We are interested in the transmission cycles of the mentioned disease giving us an idea how they are imbedded in the biotic and abiotic environment. Also, the temporal pattern and spatial extent of disease emerge is of interest. We get an overview of important direct zoonotic infections (e.g. Nipah virus infection, Ebola virus disease) and vector-borne diseases (e.g. West Nile Fever, Dengue, Chikungunya virus disease) by developing disease factsheets and presenting them in expert groups. We identify and discus global change drivers promoting or hindering vector establishment and spread, and transmission of diseases such as climate change, conservation and biodiversity changes, land use change, food supply, spillover and transport, and urbanisation. We get to know different methods used to assess vector-borne and zoonotic disease: field methods such as monitoring of vectors, surveillance of diseases, laboratory experiments such as vector-competence studies or competition experiments, and modelling studies projecting risk under environmental change. We will discuss possible approaches to establish an early-warning systems for vector-borne diseases.

Key/Abbreviations:

Adv.Sem	Advanced seminar	Lab	Lab course
Crs	Course	Lec	Lecture
Coll	Colloquium	Pro	Project
Exc	Excursion	PT	Practical Training
ECTS	Credit Points	Sem	Seminar
Ins	Internship	Tut	Tutorial

Please check availability of your chosen subject/course by contacting the respective faculty.
You can find contact details at **www.uni-bayreuth.de/en/study**

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