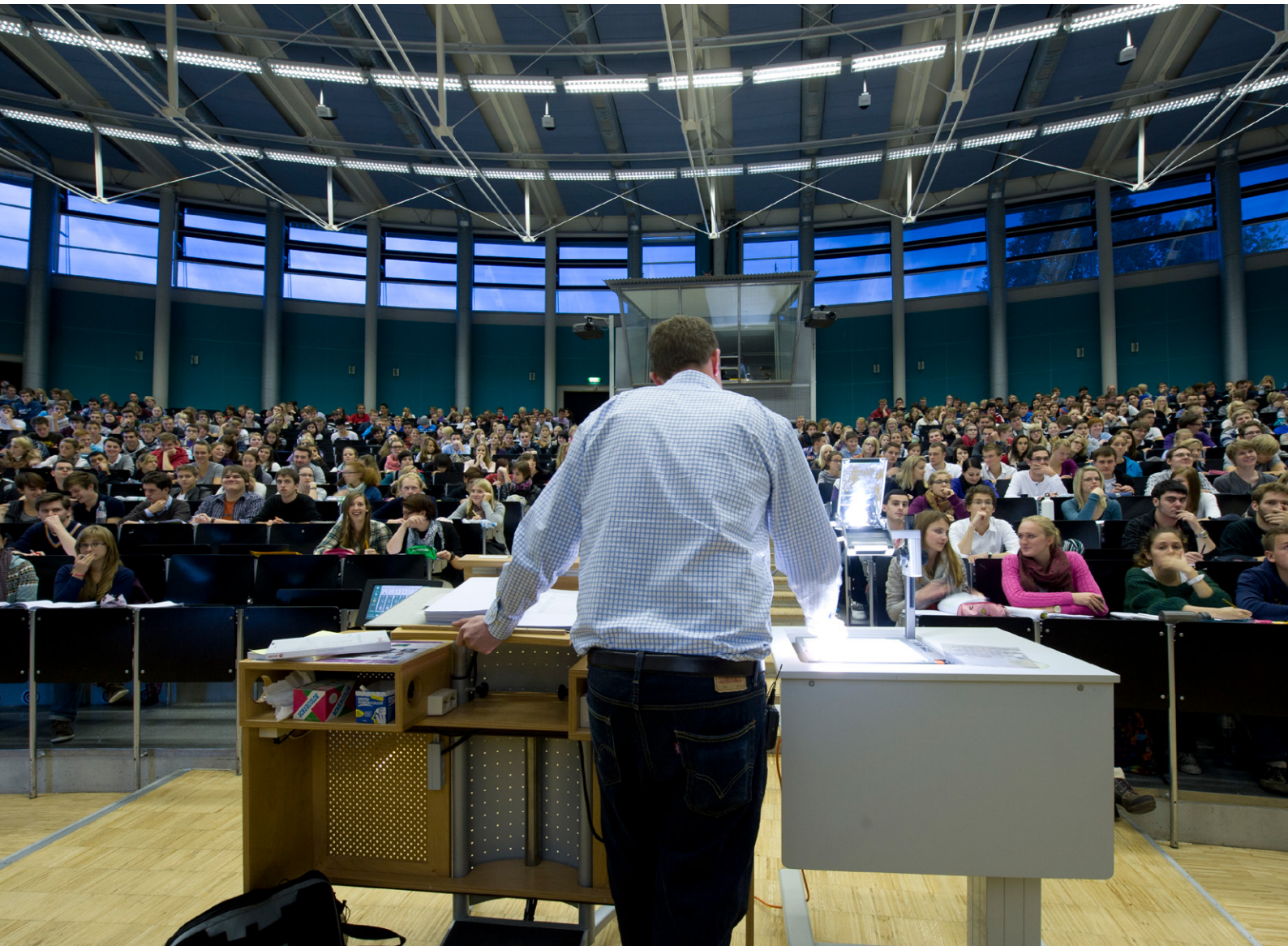
UNIVERSITÄT BAYREUTH

INTERNATIONAL OFFICE

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

Available during the Winter Semester 2023/24

An overview for the summer semester 2024 is expected to be available as of 01.04.2024



Biology, Chemistry and Earth Sciences

Number	Course Title	Type	ECTS / Credits	Duration	Module Description
24175	Electrochemical Energy Systems and Materials (C103)	Le	3	2	
74071	Academic Working Methods and Skills	Le & Tu	2	2	
20357	Advanced Ecotoxicology	S	2,5	2	The module consists of two parts: 1) In the block course "Fundamentals of Ecotoxicology", basic principles of ecotoxicology are introduced and methods of toxicity bioassays and chemical residue analysis are tried out in practice. 2) In the Seminar "Advanced Ecotoxicology" which takes place during the lecture period, the acquired basic knowledge is used to critically reflect on, discuss and summarize current scientific research.
20038	Advanced Remote Sensing	Cs	3	2	In the Advanced Remote Sensing course, students will learn about some advanced skills for image processing and information extraction from satellite optical, thermal and radar data sets. There are two key modules in this course to cover theories and practical exercises. The main focus of both modules is on the most recent and open access satellite images and image processing software programmes. Students will learn how to employ Sentinel-1 SAR images, Sentinel-2 optical images, Sentinel-3 thermal, and Sentinerl-5, mainly in SNAP and ENVI, to solve a real world issue in several fields such as water quality monitoring , oil spill mapping, urban built area extraction, flood monitoring, snow cover mapping, rice detection, crop mapping, land surface temperature estimation, forest and deforestation monitoring, pollution monitoring, anomaly detection, burn indices etc.
28614	Current issues of global change	S	3	2	The topic of global environmental change is highly topical and is becoming increasingly important in public discourse. The first part of this course takes up the most important topics in this regard, discusses scientific contexts and the current state of research. Methodologically, media contributions and specialised publications are linked and discussed. The second part then focusses on measurements and observations of global environmental changes.
28021	Current topics in environmental geochemistry	Cs		2	
20732	Analytical Microscopy in Geomicrobiology and Environmental Science	Le & Tu	5	4	
00635	Atmospheric Chemistry I - Hands-On (A1 Part2 / WV30)	S	2	2	"Atmospheric Chemistry I - Hands On" provides insights into atmospheric historical and recent literature in the format of a Journal Club. With a small, self-organized experiment, concepts of how to obtain and analyse atmospheric data sets are introduced.
01091	Atmospheric Chemistry I - Introduction (A1 Part1 / BGCP2-1)	Le	2,5	2	The lecture "Atmospheric Chemistry I" provides a wide overview of the environmental impact of atmospheric constituents. Fundamental concepts of chemical reactions in the troposphere and stratosphere are introduced. The importance and threat of greenhouse gases, the formation of photochemical smog, and the natural and disturbed ozone layer are examples that are discussed by means of landmark publications and deepened within short exercises.
00578	Basics of inorganic chemistry for electrochemical energy storage systems	Le	5	2	
00579	Battery Materials I	Le	5	2	
00581	Battery Materials I	Tu	5		
28407	Biogeochemical methods in hydrology: Introduction to Aquatic Biogeochemistry	Le	3	2	Part I Introduction to Aquatic Biochemistry
20777	Chromatographic Methods for Environmental Tracer Studies	Le & Tu	5	5	This module introduces analytical techniques using standard liquid and gas chromatographic methods tuned and applied for environmental organic tracer analysis.
74034	Climate Diplomacy	S	3	2	
74033	Climate Policy and Instruments	S	2	2	

Number	Course Title	Type	ECTS / Credits	Duration	Module Description
74007	Climate Variability and Change: Natural and Man-Made	S	3/5	2	Basic principles of the climate system; naturally-occurring climate variability, climate change in the past; reconstruction of past climate; natural forcing-factors, circulation dynamics; human impact on the climate system; global warming; greenhouse effect; land use change; aerosols; ozone depletion; global circulation models; forecasts; scenarios; fundamentals of energy and mass balance; modelling; sensitive parameters of global change
74036	Current Research in Ecosystem Services	S	3	2	The Seminar deepens lecture topics with current examples from research.
20039	Debated Topics in Environmental Geography	Ad. S	5	2	The Seminar should create an awareness that scientific topics could be discussed controversially based on facts compiled by scientific work. Each topic will be prepared by two persons, one presenting a pro and the other a contra position. Afterwards the topic is discussed by the whole group. Topics not presented will be discussed using papers. The discussed topics are: - Should we define a new geological era named "Anthropocene"? - Do organisms form a self-regulating, complex system that maintains Earth as a habitable planet (the GAIA principle)? - Do extreme events increase due to global warming? - Is there such a thing as "climate refugees"? - The limits to growth - outdated or more topical than ever? - Is a certain rate of soil erosion tolerable and sustainable? - Is the valuation of ecosystem services a sound concept for the sustainable use of natural goods? - Globalization of environmental planning and protection. Are global initiatives and conventions "ecological imperialism"? - "Use it or loose it" - The only way to protect the environment? - Is pollution increasing? - Should scientists increase the impact of their work on society?
00848	Designing and presenting a research plan	S	2,5	1	
28913	Development Cooperation / Development Planning	Tu	4	2	
74023	Disturbance Ecology	Le	3/5	2	Theory, methodology and application of disturbance ecology and pulse dynamics as well as the relationship between disturbance, vegetation dynamics and ecosystem functions are taught in the lecture "Disturbance Ecology". Current research frontiers in disturbance ecology, resilience and sustainability science are presented and discussed in the Seminar "Resilience". The significance of understanding disturbance ecology for ecosystem restoration and sustainable land-use planning is also addressed. Temporal variability of ecosystems, their rhythms and recurrent events are discussed with respect to future global changes to assess the dynamics of ecological systems.
20113	Earth, Soil, Surface I (B1/ÖLD2 Process Geomorphology, lecture/S)	Cs	3	2	In this course we will deal with advanced concepts of geomorphology (e.g. systems, equilibrium, thresholds, quantitative aspects). This introduction is followed by an overview of field work techniques like erosion and transport measurements, laser scanning and shallow geophysics. The course is a mixture of lecture by O.S., short presentations of key literature by the students, and short quantitative excercises. There will be a written exam in the end of the semester.
74035	Ecosystem Services	Le	2/5	2	The lecture "Ecosystem Services" gives an overview of ecosystem services in regional and global human-environmental systems. Contents include the definition and classification of ecosystem services, their relationship to biodiversity and the role of global change. Furthermore, the physical quantification and socio-economic evaluation, the supply and demand by social actors as well as the management of the performance of the ecosystem by market-related policy instruments are dealt with.
74057	Ecosystem Services Assessment of Landscapes	Tu	2	2	Land use and land cover change (LUCC) can cause dramatic shifts in biodiversity and ecosystem services of landscapes. This technical course will give an introduction into spatial optimization methods that can be used to analyse trade-offs between ecosystem services/biodiversity (e.g. between agricultural production, water quality and biodiversity) and to identify 'optimal' land-use allocations that enhance the provisioning of ecosystem services in the landscape. Requirements: Basic skills in R and GIS, own computer
28151	Introduction to Soil Physics	Le	3	2	This course provides an introduction to the most important physical properties and processes of soil. Participants will learn which are the most important soil particles and how we can quantify them in the quantify them in the laboratory (theory only), soils as three-phase systems, the main forces acting on soil water soil water, how water is stored and moves in soils and much more. The course is organised as a series of lectures and exercises. The most important parts are: 1. introduction to soil physics 2. physical properties of soil 3. water properties and capillary rise 4. relationships between volume and mass 5. energy status of soil water 6. water retention in soils 7. water flow in saturated and unsaturated soils 8. water flow under transient conditions 9. introduction to solute transport

Number	Course Title	Type	ECTS / Credits	Duration	Module Description
20139	Emerging Topics in Rhizosphere Research	S	2/2,5	2	
28131	Environmental Analytical Chemistry II - Advanced Methods	Cs	5	4	The lecture Introduction to Environmental Analytical Chemistry II will continue where module C2 ended. It will focus on advanced laboratory methods, getting into more details, mainly of chromatographic and spectroscopic methods. The tutorial will focus on selected topics of current research interest and include both practical laboratory work, e.g. development of a chromatographic separation method for trace elements by IC-ICPMS, but also detailed digital data interpretation, e.g. of results from optical measurements of natural organic matter or of XAS spectra from trace element binding to solid mineral phases. The tutorial will also include visits to other laboratories at the University of Bayreuth to get an overview of available techniques as well as one visit to an analytical facility outside the university, such as e.g. the environmental research centre Leipzig-Halle. The visits will be scientifically prepared by studying and discussing research papers of the respective groups.
28061	Environmental Forensics (C3)	S		2	The lecture on inorganic pollutants 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 this Seminar 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.
74004	Excursion	Exc	3	1	Excursion to Bamberg
25875	Exercise - Ecology and Evolution of Trait Plasticity	Tu	5	3	
00030	Exercises to Introduction to Micrometeorology" (Numerical lab to Introduction to micrometeorology)	Tu	5	1	
74090	Field Quantification of Biodiversity	Tu	2	2	
20356	Fundamentals of Ecotoxicology	Tu	2,5	3	The module consists of two parts: 1) In the block course "Fundamentals of Ecotoxicology", basic principles of ecotoxicology are introduced and methods of toxicity bioassays and chemical residue analysis are tried out in practice. 2) In the Seminar "Advanced Ecotoxicology" which takes place during the lecture period, the acquired basic knowledge is used to critically reflect on, discuss and summarize current scientific research.
28009	Geographical Colloquium	Cq	3	2	
20085	Global Change and Agroecosystems	S	5	2	
74001	Global Change Ecology (Oa)	Le	1	1	First, an overview of the information about current and expected global development is given. Not only climate change but also land-use changes and the loss of biodiversity is included. In the advanced Seminar, current research results are presented and analysed.
28135	Global Urban Health	S	5	2	
74012	Hydrological Concepts	Le	3	2	
28051	Inorganic Pollutants and Nutrients (C3)	Le	5	2	The lecture on inorganic pollutants 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.
28416	Introduction to Aquatic Geochemistry	Le	3	2	
74003	Jour Fixe	S	1	1	First, an overview of the information about current and expected global development is given. Not only climate change but also land-use changes and the loss of biodiversity is included. In the advanced Seminar, current research results are presented and analysed. This module lasts for one semester and must be taken in the first semester as it sets the basis for the entire programme. The course consists of a one-hour lecture and a one-hour Seminar. Additionally, a regularly scheduled weekly meeting is offered to discuss current study issues and for group mentoring. Two daylong excursions about landscape ecology supplement the module.

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24066	Small Group Practical Chemometrics	Lab	4	7	Students learn to create, analyse and critically interpret spectroscopic data for chemometric evaluations. Part of the practical course is a Seminar with a graded presentation (in English).
74046	Land Use Policies, Markets, and Ecosystems	Le	2	2	The lecture addresses the influence of markets and politics on land use change. With global and regional case studies, we will analyse the relationship between those drivers, local land use and management decisions, and the provision of ecosystem services. Additionally, we will get an overview of different methods for the quantification of land use change and affected ecosystem services.
25873	Ecology and Evolution of Trait Plasticity	Le	2,5	2	
24004	Advanced Polymers (Biofabrication)	Le	3	2	
74058	Life Cycle Assessment of Products	Tu	2	2	
28128	Mass Spectrometry	Cs		4	Students will learn the theoretical basis of mass spectrometry based on a textbook. Each chapter will be read prior to a Seminar by each participant, then discussed in the group and completed by the lecturer in the Seminar. In the accompanying tutorials, students are introduced to tuning, analysis and data interpretation as well as to trouble shooting and instrument maintenance. As an applied example, students then receive real samples in a difficult matrix (e.g., sewage sludge or sea water) and must independently carry out sample preparation, analysis and data interpretation including quality control and error calculations and they must evaluate their results in an environmental chemistry context.
28417	Methods in Aquatic Geochemistry	Tu	2,5	2	This tutorial can only be attended together with the lecture "Introduction to Aquatic Geochemistry". Please refer to the course page for the "Introduction to Aquatic Geochemistry" lecture for further information.
28301	Micrometeorology Basics (Introduction to Micrometeorology)	Le	3	2	
28004	Micrometeorological and atmospheric chemistry S	S	5	2	
28440	Modelling Land Use Policies, Markets, and Ecosystems	Tu	2	2	In this tutorial, we will model land use decisions based on market development, agricultural and environmental policy in different case study regions. Using agent-based modeling (in NetLogo), existing models will be adjusted and parameterized. This modelling approach allows the identification of probable land use decisions by individuals. Changes in ecosystem services through land-use decisions can be integrated into the decision-making process. Subsequently, consequences for the design of policy measures and the provision of ecosystem services are analysed and evaluated.
74026	Modelling of Spatial Ecological Processes	Tu	3	2	
20659	Modelling Soil-Plant-Atmosphere Systems	Le & Tu	6	4	The content of this course is the simulation of water flow and solute transport in soils and in plant roots. First, the principles of water flow and solute transport in permeable media will be introduced. Then flow equations at the continuous scale will be derived (i.e. Richards' equation, the advection-dispersion equation, water flow across the roots). Some analytical solutions will be derived (capillary rise, radial flow), while for more general cases the finite difference and finite elements method will be explained. In the second part of the lectures, the students will work in teams to solve selected numerical problems, such as: 1) a three-dimensional water uptake by root architecture and the identification of optimal root traits for water acquisition from drying soils, 2) determination of the soil water retention curve and the unsaturated conductivity by inverse modelling of an evaporation experiment performed in the class, and 3) the application of a pore-scale percolation model to describe water infiltration in water repellent soils.
28668	Multivariate Statistics (Introduction to (Spatial) Data Science: Critical Statistical Work with R)	Tu	3	2	In this course we will deal with the basics and selected applications of the programming language R for the purpose of data analysis in human geography research. No previous knowledge of programming or similar is required, but basic knowledge of statistical methods is an advantage and will only be touched on as necessary during the sessions. In the sessions we will work together on the different steps of data analysis and deepen these through practical exercises and discussions. These steps include reading, writing or transforming (geo)data, evaluating it using descriptive and inferential statistics, visualisation and documenting the work steps for exchange with third parties. The aim is to enable students to work independently with R and to prepare them for advanced applications. For easier participation, it is recommended that students install R and the RStudio development environment on their own computer (see https://posit.co/download/rstudio-desktop/). The required performance includes regular and active participation in the sessions as well as their preparation and follow-up and a final data evaluation in the form of a short project report.
74006	Natural Climate and Human Impacts on Climate	Le	2	2	Learning Objectives: The aim of this module is to teach fundamental knowledge about current climate development. Course Content: Basic principles of the climate system; naturally-occurring climate variability, climate change in the past; reconstruction of past climate; natural forcing-factors, circulation dynamics; human impact on the climate system; global warming; greenhouse effect; land use change; aerosols; ozone depletion; global circulation models; forecasts; scenarios; fundamentals of energy and mass balance; modelling; sensitive parameters of global change

Number	Course Title	Type	ECTS / Credits	Duration	Module Description
74010	Natural Risks and Hazards	Le & Tu	2/2,5	2	Aim of this module is to teach about occurrence and impact of natural risks and extreme events in ecology. Reoccurring events are included as well as single disasters; those with stabilizing effects and those with catastrophic consequences and regime shifts. The impact of climatic, biotic and geomorphological events on biodiversity, ecology, provision of services, and cultural landscapes is covered. The learning objective is the ability to deal with in-depth theories and methods of Disturbance Ecology and to research extreme events. Fundamentals for a scientific study of interdisciplinary disaster research and risk management will be developed. There is no ecozone, no ecosystem, no part of our natural enviroment without disturbances. The variety of potential disturbance events and disturbance regimes on our globe range from such extreme events as volcanic eruptions and tsunamis to small-scale events such as insect herbivory or the invation of neophytes and neozoos. In this Seminar, we will walk through the Earth's ecozones in different thematic blocks and introduce the typical disturbance regimes. There will always be a short keynote presentation by the two course instructors at the beginning of each block topic. Afterwards, students will have the opportunity to give their presentations and discuss them. The presentations should not exceed 15 minutes. There will be 5 minutes for discussion. Attentive and active participation in the discussions is required from all participants, as this will be included in the overall grade. There will be a list of topics (see below), where you can choose "your" disturbance type for your presentation.
00110	Orientation Week Environmental Chemistry	Cs		2	
00995	Paper Seminar "hot topics"	S	2,5	2	
21008	Population ecology advanced S for B.Sc. and M.Sc. students, state examination candidates and doctoral students	S		2	
20834	Practical course - RNA - structure and function	Lab	2,7	5	The practical course aims to demonstrate the difficulties involved in RNA research and how these can be overcome. First, RNA is produced, biophysically examined and structurally characterised. In addition, protein-RNA interactions are analysed biophysically and structurally.
74021	Progress in Biogeography	S	2,5/5	2	In the Seminar "Progress in Biogeography", current developments in Biogeography will be dealt with. Students gain practice in working with literature data banks and online-journals. Putting together and presenting a presentation trains students in the production of survey articles based on current scientific primary literature.
74002	Progress in Global Change Research	S	2	1	
00187	Python programming in the life sciences	S	4,5	2	This module provides an introduction to the Python programming language. The aim is to teach students how to programme in Python using problems from biochemistry and bioinformatics. Basic algorithms from bioinformatics are taught in order to process, analyse and present scientific data.
00188	Python programming in the life sciences	Tu	4,5	2	This module provides an introduction to the Python programming language. The aim is to teach students how to programme in Python using problems from biochemistry and bioinformatics. Basic algorithms from bioinformatics are taught in order to process, analyse and present scientific data. Programming tasks are worked on in class.
00189	Python Programming in the Life Sciences	Lab	4,5	7	This module provides an introduction to the Python programming language. The aim is to teach students how to programme in Python using problems from biochemistry and bioinformatics. Basic algorithms from bioinformatics are taught in order to process, analyse and present scientific data. A programming project is worked on independently.
20523	Radioisotopes and Tracer Experiments	Le		1	
28511	Regional Geography: Africa/Asia/Latin America	S	5	2	How do globalization processes intersect with and remake regional geographies in Africa, Asia, and Latin America? What specific socio-economic and socio-ecological landscapes emerge from this, and how is this shaped by the ecology, politics, power, and history of particular places? How does globalizing capitalism exactly play out in diverse geographical contexts, and what can the context-based knowledge production that geography has traditionally cultivated contribute to our larger understanding of the world? Based on concrete regional examples and by way of empirical case studies, the trends and patterns of uneven spatial development, as well as the place-based and trans-local factors contributing to it are analyzed and situated within a global context.

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28911	Regional Geography: Africa/Asia/Latin America	S	5	2	This module exposes students to basic concepts, methods and disciplinary perspectives of geography with a particular focus on the physical geography, demographic patterns, human and economic resources, socio-political systems and the relationships between these in the three ``regions'' namely Africa, Asia and Latin America/Caribbean. The central focus on these issues will help students interrogate the relation between cultural and physical attributes of regions and the implications for regional development patterns. The course structure is designed to be comprehensible to students who may not have strong geography backgrounds. Throughout the course, students will ask the following refreshing questions: How and why are places defined and delineated as `regions'? What are the conundrums in the categorisation and delineation of ``regions''? How do history and globalisation processes intersect with and remake regional geographies of Africa, Asia and Latin America? What specific socio-economic and socio-ecological landscapes emerge from globalisation processes, and how does it in turn (re-) structure and re-orient the conduct of politics in particular places? How does globalising capitalism play out in diverse geographical contexts, and what can context-based knowledge production contribute to our more extensive understanding of the world? OR which theoretical perspectives offer a more nuanced understanding of these three regions in the context of global change and increasing regional interconnectedness or interrelations? A `region` is the basic unit of analysis in geography and constitutes an important concept in any geography module. The fundamental idea of delineating places as `regions` is based on the idea of `homogeneity' of features, including 'natural' features (e.g., forests/desert landscapes and water bodies) and `man-made' versions (e.g., the built environment, language, ideologies, system of government, history, religion and cultural artefacts). A collection of places can be considered a `region` according to certain definable `homogenous' features. The framing of regions as unique, homogenous, and isolated spaces provides the basis for studying and analysing spatial variations in poverty, economic development, religion, political systems, and human-environment interrelations, as well as the drivers of the observed spatial variations/inequalities over time. That said, `regions' are neither entirely static entities since certain unifying characteristics are mutable nor stay in isolation owing to increasing regional interdependencies/interrelations in varying degrees. The mutability of features characterising `Regions' and the emerging understanding of regions as relational and temporary entities challenge or expose the limits of the mainstream geographical categorisations: The Developed, Developing, and Underdeveloped World. The term `Global South' has emerged as a more appropriate concept to describe development patterns in Africa, Asia, and Latin America/Caribbean due to the increasing global interconnectedness. However, the indicators employed in such characterisations are not unproblematic either. This Regional Geography module addresses the changing relationships between and within places, economies, people, 2 cultures, and physical environments in Africa, Asia and Latin America (and in relation to the advanced `global north' too) and how the interrelations shape each region in many unique ways.
74052	Remote Sensing	Tu	3	2	Theoretical basics of Remote Sensing; Optical, Thermal, and Microwave Sensing; Sensor Systems and Properties of Remote Sensing Data; Image Processing and Classification using Open Source software and coding approaches
74043	Research at the Natural and Social Science Interface	S	1	1	This course teaches theory and practice of inter- and transdisciplinary research.
20554	Rhizosphere Biogeochemistry and Biophysics	Le	3	2	
74069	Science and Communication	Le & Tu	3	2	Science communication skills are needed to get support for scientific research, to inform decision making, or to engage stake-holder. A major component of this course will be to provide students with the chance to apply knowledge acquired in previous modules to defend their envisaged solution to typical climate change or conservation challenges or discussions.
68026	Scientific workshop for Environmental Geography	Pro	5	5	
74059	Scientific writing in biogeography and disturbance ecology (Scientific working)	S	1	1	Different trans-disciplinary manuscripts, both in content and methods, are offered, reviewed and discussed in small groups.
00750	Biodiversity in the Tropics	S	1,8	2	The module begins with an introductory overview of tropical ecology. Using tropical forests, one of the most species-rich systems on earth, the theories and the current state of knowledge on the mechanisms of the formation and maintenance of diversity, on the processes that determine the spatial and temporal distribution of diversity, on the function of diversity, on the influences of climate change and land use, and on conservation strategies will then be taught. Genetic, chemical, functional and species diversity as well as various taxonomic groups are included.
20958	Microplastics in the environment	S	2	1	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.
22431	Genetic engineering	S	2	2	This course is compulsory for students of the BSc Biochemistry programme (usually in the 5th semester). BSc Biology students can also apply for the module as a specialisation module.

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20833	Seminar RNA - Structure and Function	S	2	2	In the Seminar, current and relevant works from the literature that are related to the lecture are presented by the students and discussed in the group. Attention is paid to a scientifically critical approach to the results.
74083	Socio-Economic and Political Dimensions of Global Change	S	5	2	We live in a world of change. The change is ubiquitous and hardly controllable, predictable and solvable by adherence to any tried-and-tested governance mechanism or a one-directional silver bullet solution. The observed change entails dramatic alterations in the impacts, geographical scope and complexity of societal and political adaptations to the environment. It is also accompanied by the reconfiguration of the risk-reward ratio of investments in particular geographies over time (e.g., recent geographic shifts in extractivism) and the emergence of new affordances of hitherto less-valued resources and technologies (e.g., the Zoom tech and PPEs use craze linked to the COVID-19 outbreak). Examples of global change include the following: climate change, resource depletion (or even threats of extinction), spatial spread of deadly diseases and their containment measures (e.g., COVID-19 and Ebola pandemics) and transitions in systems (e.g., energy agrarian, ecological transitions, political and technological transitions). Since adaptation and mitigation measures embody the making of (purportedly) `desirable futures' for everyone everywhere, global change is inextricably linked to the production of hegemonic discourses by powerful interest groups that set and make the agenda worthwhile and appealing. Furthermore, certain forms of global change are not new. Yet their novelty lies in how they are being represented, contested and justified in new ways regarding causality, the prescribed remedies and circumstances that precede their occurrence in specific regions. Unequal adaptative capacities of individuals, social groups, communities and countries to change and power asymmetries in the control of hegemonic discourses suggest that global change produces opportunities/privileges interlaced with marginalisation, uncertainties, resource access struggles and other socio-political tensions across the world. Framing these changes with the prefix `global' foregrounds a systemic approach. That is, global change is caused by the combined effect of activities about a system rather than isolated parts, thus requiring concerted efforts from all - including even victims of global change. This GCE employs a political ecology approach, multi-level perspective and development theories to examine the drivers, patterns, and impact of global environmental, political and socio-economic changes.
28910	Socio-economic Development Processes	Ad. S	3	2	
20668	Soil and Plant Hydrology	Le	3	2	The module goal is to learn how soil management and various (a)biotic drivers affect the structure of soils and herewith multiple soil functions at different temporal scales. Agroecosystem management alters soil structure and thus various soil functions. In addition, bioturbation and climatic conditions induce seasonal dynamics in the pore network and thus in the architecture of the soil. Quantifying these changes provides critical information about soil as a habitat and water as a key resource for plant production. In addition, soil structure plays a crucial role for water and matter fluxes in agroecosystems. In this module, we learn about soil structure as a dynamic soil state, methods to quantify structural indicators and how these structural changes modify soil functions. We will further discuss how management systems can be adapted in prospect of future scenarios. The course provides a general overview of soil structure, how it is changing by various drivers (tillage, freezing/thawing, wetting/drying, bioturbation), as well as the feedback mechanisms for soil functions and implications for resource management in agroecosystems.
74025	Spatial Ecology	S	2	2	The Seminar works with examples of ecological spatial phenomena (e.g. source-sink dynamics, metapopulations, invasions, coexistence).
74024	Stability, Resilience and Inertia	S	5	3	Theory, methodology and application of disturbance ecology and pulse dynamics as well as the relationship between disturbance, vegetation dynamics and ecosystem functions are taught in the lecture 'Disturbance Ecology'. Current research frontiers in disturbance ecology, resilience and sustainability science are presented and discussed in the Seminar 'Resilience'. The significance of understanding disturbance ecology for ecosystem restoration and sustainable land-use planning is also addressed. Temporal variability of ecosystems, their rhythms and recurrent events are discussed with respect to future global changes to assess the dynamics of ecological systems.
28556	Statistical analysis of geoscientific data	Tu	3	2	The course deals with the acquisition, processing, statistical evaluation and utilisation of geoscientific raster datasets (NetCDF, multi-layer GeoTIFFs) and thematic point information (station values, field data). Climate data is the main focus (e.g. GPCC, ERA5). Time series, simple trends and applied facts are analysed and various data sets are evaluated. In addition, climate and environmental information is clearly visualised. The basis for this is the software R/R Studio. QGIS is also used for visualisation.
21521	Symposium Global Environmental Challenges	S	2,5	1	
25180	Trends in Biogeography	S	1/2,5	1	Different trans-disciplinary publications, both in content and methods, are offered and discussed in small groups.
20817	Trends in quantitative ecosystem research	S	2	2	Ecological publications with a focus on methodological advancements. WV39
20959	Exercise - Microplastics in the environment	Tu	3	7	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.
00730	Exercise Field Methods for Plant Ecology	Tu		6	Learn to design experiments for ecological studies. Describe frequency, architecture and functional characteristics of plants. Comply with the requirements of open science. Understand the ecological effects of fire, herbivory, nutrients, soil and climate on plants.

Number	Course Title	Type	ECTS / Credits	Duration	Module Description
21636	Exercise for Earth, Soil, Surface I (B1/ÖLD2 Exercise Earth, Soil Surface I/Process Geomorphology)	Tu	2	2	The basic concepts of geomorphology are presented, followed by qualitative and quantitative investigation approaches in process geomorphology (e.g. mapping, mass flux measurements, surface models, shallow geophysics). In the practical part of the module students learn to apply a selection of the presented techniques to geomorphological problems and to assess their possibilities and limitations. The exercise is complementary for MSc students of Environmental Geography that participates at "B1 Earth, Soil Surface I" and MSc students of Geoecology participating at "ÖLD2 Process Geomorphology". The practical part will take place from 20.02.2024 to 23.02.2024 as a 1-week block exercise.
00563	Exercise for the lecture "Experimental Ecology"	Tu		4	Designing, setting up, and running a small greenhouse experiment measuring plant traits Data analyses
20480	Exercises on simulation in soil physics with Hydrus-1D	Le & Tu	3	2	This course provides an introduction to water flow simulations with Hydrus -1D. The course targets two important spatial scales in soil physics/soil hydrology: the laboratory scale (small laboratory columns, 5-100 cm) and the field scale (pedon 1-10 m). Participants will learn the basic terminology of water flow simulations, the basic assumptions behind simulations using Hydrus -1D, how to set up and run their own simulations, how to work with the output files, how to plot data, and how to draw conclusions from their simulation results. The course consists of a series of short lectures followed by computer exercises. The main parts are: 1. introduction to the course and to the theory of simulating water flux with Richards equation, basics on numerical solutions and terminology; 2. introduction to Hydrus -1D and first simulations; 3. laboratory scale: simulation of the laboratory method for measuring water retention curves (how much time do our samples need to reach equilibrium conditions, what is the spatial distribution of the matrix potential in the soil column); 4. from laboratory data to simulations. How are WRC data converted into mathematical models of the water retention curve (RETC software)?; 5. laboratory scale: simulation of the laboratory method for the estimation of Ksat and K(h) (Darcy equation). 6. from laboratory data to simulations. Conversion of laboratory data into mathematical models of soil hydraulic properties (RETC); 7. laboratory scale: simulation of infiltration experiments of water in soil columns, (effect of boundary conditions); 8. field scale: Drainage of a soil profile due to gravity, evaporation and water uptake by roots, discussion of the following concepts: Field capacity, permanent wilting point, available water content and storage. 9. field scale: simulation of steady-state water profiles above a water table (effect of precipitation and/or evaporation); 10. field scale: simulation of perennial water dynamics under realistic BCs. How do the main water balance components differ between a wet and a dry year for different soil types? 11th field scale: Heat transport in soils. How fast do different soil profiles warm up on a given day, but also in a given season?
28404	Preparation for the Master's thesis	S	5	4	
00441	Biodiversity in the Tropics	Le	3,1	2	The module begins with an introductory overview of tropical ecology. Using tropical forests, one of the most species-rich systems on earth, the theories and the current state of knowledge on the mechanisms of the formation and maintenance of diversity, on the processes that determine the spatial and temporal distribution of diversity, on the function of diversity, on the influences of climate change and land use, and on conservation strategies will then be taught. Genetic, chemical, functional and species diversity as well as various taxonomic groups are included.
20956	Microplastics in the environment	Le	4	1	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.
24065	Chemometrics	Le	3	2	Overview of chemometrics - from the beginnings to AI. Special features of the application to spectroscopic data (e.g.: IR, MS, NMR, isotope ratios, trace elements, etc.). Experimental basics: from sample preparation to the finished model. Overview of classification and regression methods and associated data pre-treatment. Introduction to the development of non-directional analytical methods and corresponding validation concepts. Application examples: from inorganic chemistry to food analysis (authenticity analysis) and diagnostics. Topic-related exercises supplement the lecture (part of the VL).
24000	Polymer Synthesis	Le	4,2	2	
20832	RNA - Structure and Function	Le	3	2	

Key/Abbreviations:

Ad.S	Advanced seminar
Cs	Course
Cq	Colloquium
Exc	Excursion
ECTS	Credit Points
Lab	Lab course
Le	Lecture
Pro	Project
PT	Practical Training
S	Seminar
Tu	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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