EFEKTY UCZENIA SIĘ I TREŚCI PROGRAMOWE ZAJĘĆ

Kierunek: **Environmental Protection**
Poziom studiów: **studia drugiego stopnia**

Course name: **Ecological state of the lake during restoration - biological parameters and ecological state**
On successful completion of this course, a student
in terms of knowledge:
1. Performs microscopic analyzes of the qualitative composition and abundance of phytoplankton and microbial diatoms.
2. Determines the composition of benthic invertebrates and macrophytes.
in terms of skills:
1. Makes a map of plant communities of the examined lake.
2. Analyzes the obtained data and calculate the biological indicators of the ecological state of the lake according to European Water Frame Directive.
3. Prepares a research report and PowerPoint presentation of achieved research results and present it to a wide audience.
in terms of social competences:
1. acts as a promoter of biodiversity protection, presenting and discussing data on environmental studies.
Course learning content:
Identification of phytoplankton (quality, quantity, biomass) and periphytic diatoms (quality, quantity).
Macrophytes as an indicators for environmental changes - data analysis based on mapping the macrophytes community in the program ArcGIS.
Assessment of macroinvertebrates community - species identification, assessment of abundance and biomass.
Analysis and interpretation of research results of various groups of organisms to assess the ecological state of the lake. Examples of indicators: mixed index, Jaccard index, Shannon-Weaver diversity index, diatom index, ESMI, MIR, PMPL, BMWP-PL.
Prepare a PowerPoint presentation of achieved research results and conclusions from analyzes and discussions, and present it to a wide audience.
Prepare a research report of individual thematic groups and a final report.

Course name: **Journal Club**
On successful completion of this course, a student
in terms of knowledge:
1. can indicate current trends and topics in environmental protection/ecology biology.
2. knows and can properly use scientific vocabulary related to environmental protection/ecology.
in terms of skills:
1. provides a critical presentation of a selected scientific paper based on the understanding of the structure of different types of scientific papers and the functions of the paper sections.
in terms of social competences:
1. can participate in a scientific discussion.
Course learning content:
Current trends and topics in research in environmental protection and ecology based on experimental and review papers.
Presentation of experimental and review paper.
Basic elements of scientific publications: defining hypotheses/aims, description of methods, presentation of results, and main conclusions.
Training in scientific communication.

Course name: **Birds monitoring methods**
On successful completion of this course, a student
in terms of knowledge:
1. knows common bird species in Poland and is able to find information how to recognise them
2. knows biology and ecology of selected bird species and is able to connect population trends with environmental change
3. knows assumptions of different bird monitoring methods

in terms of skills:
1. is able to plan and conduct bird monitoring in practice, including analysing obtained data and interpretation of results
2. is able to apply bioacoustical and statistical software to analyse data
3. is able to present obtained results and spots weak and strong sides of applied method
in terms of social competences:
1. spots dependencies between bird population trends and human activity, and is able to explain them
Course learning content:
Identification of bird species
Assumptions of different bird monitoring methods
Biology and ecology of birds
Planning birds monitoring
Applying various bird monitoring methods in practice

Course name: **Mammals monitoring methods**
On successful completion of this course, a student
in terms of knowledge:
1. recognizes mammals belonging to main systematic groups (orders) and ecomorphotypes, can indicate their characteristic features in physiology and behaviour as well as typical habitats.
2. selects and applies methods and equipment optimally suited to the purposes of planned / conducted study on mammals.
in terms of skills:
1. selects and applies methods and equipment optimally suited to the purposes of planned / conducted study on mammals.
2. selects and applies methods and equipment optimally suited to the physiology, ecomorphology and behaviour of the mammals studied, so as to ensure effective data collection while eliminating or reducing mortality, suffering and stress in animals.
3. is able to design and conduct research, experiments and monitoring of mammals, as well as analyse collected data and present in a synthetic way and interpret the results of research and monitoring.
4. finds useful information from scientific literature and online sources.
in terms of social competences:
1. is able to design and conduct research, experiments and monitoring of mammals, as well as analyse collected data and present in a synthetic way and interpret the results of research and monitoring.
Course learning content:
Survey of extant subclasses and orders of mammals in terms of the diversity of their morphology, physiology and eco-morphological types.
Presentation of different types of traps and methods of catching mammals, adapted to their size, ecomorphology and behaviour.
Presentation of different ways of short-term and long-term marking of live mammals as well as measuring, weighing, determining sex and condition, collecting tissues for testing.
Acquaintance with methods of estimating and monitoring changes in species diversity, population size and space use.
Acquaintance with methods of direct and remote observation and detection of various mammals (using shelters, binoculars, night vision, radio-telemetry and satellite telemetry, video-recording, photo-traps, ultrasound detection).
Presentation of methods of detection and estimation of the number of mammals based on traces they left in the environment (tracks, droppings, foraging traces, burrows and nests).
Acquainting with basic methods of data analysis (from trapping, monitoring, experiments, video-recording) as well as of elaborating and presenting results.
Classification of methods in terms of the degree of invasiveness (arduousness), presentation of ways to eliminate or reduce mortality, suffering and stress in studied mammals of different species. Presentation of the principles of ethical conduct in research (including the "3R" principles: refining, reducing, replacing).

Course name: **Ecological economics**
On successful completion of this course, a student
in terms of knowledge:
1. discusses the different approaches to the analysis of human economic behavior
2. describes the role and place of biological resources and processes in the modern economy and its importance for socio-economic development

3. explains socio-economic phenomena from the perspective of ecological economics
4. discusses the concept of sustainable development in the scope of its roots, goals, main documents and tools

in terms of skills:

1. conducts a critical analysis of information on sustainable development
2. conducts disputes and prepares oral presentations using specialized terminology on human economic behaviour in relation to environmental issues

in terms of social competences:

1. discusses contemporary challenges of socioeconomic development

Course learning content:

Economics - the study of the production and consumption of goods
Economy and environment - the role of environment and natural resources in socioeconomic development from the perspective of different economics theories, ecological economics approach
Market system - classical and ecological economics perspective
National incomes accounting - classical and ecological economics perspective.
The concept of sustainable development

Course name: **Molecular ecology**

On successful completion of this course, a student

in terms of knowledge:

1. knows and understands the importance of molecular ecology for the assessment of genetic variability and distribution of populations across the species range.
2. knows the basic research tools and techniques used in molecular ecology.

in terms of skills:

1. can explain the importance of research in the field of molecular ecology in terms of environmental protection and the management of genetic resources of living organisms.
2. can explain the basic methodology and their application in molecular ecology research.
3. can explain the processes affecting the level of genetic variation of species in time and space.
4. can explain the methods and importance of genetic analysis of adaptive and quantitative traits variation of living organisms following environmental changes and distribution of species.
5. can critically evaluate published research in the field of the discussed subject.

in terms of social competences:

1. can use knowledge and skills in the field of molecular ecology in environmental protection.

Course learning content:

Application of molecular ecology in biodiversity and nature conservation research.
Analysis of demographic and evolutionary processes in molecular ecology.
The use of laboratory methods and analysis of genetic data in ecology.
Molecular and adaptive variability in time and space.
Practical applications of research results in the field of molecular ecology.

Course name: **Environmental impact assessment**

On successful completion of this course, a student

in terms of knowledge:

1. Understands that EIA is a tool supporting the informed decision making to avoid environmental damage.
2. Understands how EIA procedures are reflected in national legal documents and what are the international legal obligations in the given country or region.

in terms of skills:

1. Estimates whether the scope, criteria and conditions of EIA are adequately defined.
2. Determines the need and scope for sampling programs including environmental indicators, using adequate methodologies for collection and analysis of qualitative and quantitative data.
3. Develops a scheme for mitigation plans and of monitors their effectiveness.

in terms of social competences:

1. is ready to continuously develop their knowledge on the subject of the EIA.

Course learning content:

Scope and importance of EIA (Environmental Impact Assessment) for informed decision making.
Legal context of EIA in different countries.
Type, nature and scope of the EIA set of procedures.
Difficulties and constraints in application of EIA in the context of particular countries or regions.

Importance of EIA and SEA (Strategic Environmental Assessment) in reversing the loss of environmental resources and helping achieve sustainability objectives.

Course name: **Waste management - selected issues**
On successful completion of this course, a student
in terms of knowledge:
1. knows the classification of waste and the basic methods of municipal waste disposal.
in terms of skills:
1. develops skills in using literary and electronic sources.
2. prepares and delivers presentations on a designated waste management topic.
in terms of social competences:
1. popularizes the need for waste recycling and the zero waste philosophy.
Course learning content:
Waste classification (types and their characteristics)
Waste treatment (biological and thermal methods); recycling; landfilling of municipal waste
Zero waste philosophy

Course name: **Anthropogenic pollution: identification, threat assessment and recovery**
On successful completion of this course, a student
in terms of knowledge:
1. has in-depth knowledge about the soil-water environment of catchment basin and understand the impact of varied catchments on the functioning of wetlands, and on water quality in different types of water bodies especially in the light of permanent or incidental exposure for the contamination.
2. knows remedial actions that can be applied in inland waters and wetlands as well as methodology of proceeding for effective recovery of degraded areas.
3. understands multidimensional intrabiocoenotic feedback mechanisms under influence of specific groups of pollutions, interpret their significance for health of wetlands and land areas, and appreciated the importance of multidisciplinary environmental study.
in terms of skills:
1. provides professional assistance in understanding the impact of anthropogenic pressure and various catchments on the functioning of wetlands, water quality and fields, especially in case of the contamination.
2. proposes a comprehensive methodology for implementing remedial actions that can be applied in inland waters, wetlands and fields as well as methods of proceeding for effective recovery of degraded areas.
3. proposes methods for restoring natural environment conditions adequately to the type and scale of pollution and field conditions.
4. proposes safe methods for the restoration of terrestrial and aquatic environments with the least possible interference with biocoenosis and biotope functioning.
in terms of social competences:
1. proposes methods for restoring the natural conditions of environment adequately to the type and scale of pollution and field conditions.
2. understands multidimensional intrabiocoenotic feedback mechanisms under influence of specific groups of pollutions, interpret their significance for the health of wetlands and appreciate the importance of multidisciplinary environmental study.
Course learning content:
Review of methods to reduce / eliminate the negative effects of environmental disturbances and restore the good ecological state of terrestrial and aquatic ecosystems with examples from lakes, rivers, wetlands and interactions between ecosystems.
Introduction to the practice of conducting research to assess the spatial scale of the threat following anthropogenic pollution.
Implementation of rapid methods of pollution identification and analytical techniques used in natural sciences.
Methods of field study in the area of biotic and abiotic features of the environment (in situ measurements, sampling, initial diagnosis of threats).

Course name: **Environmental impact of crop protection**

On successful completion of this course, a student
in terms of knowledge:
1. knows major crops and describes their geographical distribution, approximate yields and market shares.
2. understands the growing demand for food (plant) production and its influence on shaping the environment.
3. lists and characterizes main crop pests and explains the necessity to provide crop protection.
4. lists the crop protection methods and products and explains their mechanisms of action and market share. Distinguishes between biological and non-biological pesticides, and is able to point their advantages and weaknesses. Is aware of the crop protection impact on the environment and human health. Explains the concept of Integrated Pest Management.
5. explains the threat of pest resistance development and points the possible methods to manage it.
in terms of skills:
1. has skills necessary to design, perform and interpret the results of insecticide toxicity bioassays
2. is able to safely and efficiently work in microbiological laboratory.
in terms of social competences:
1. is prepared to critically discuss and provide rationale for certain strategies in pest management.
Course learning content:
Worldwide crop production - major crops, market share, geographical distribution and impact on the environment.
Major threats to crop production - characterization of economically important pests.
Plant protection methods and products used in agriculture, horticulture and forestry - historical view and current approaches. Synthetic and biological pesticides - effectiveness and impact on environment and human health. Integrated Pest Management.
Pest resistance and resistance management.
Insecticide toxicity bioassays.

Course name: **The use of plankton in water quality**
On successful completion of this course, a student
in terms of knowledge:
1. recognises the need and requirements for assessing the condition of the aquatic ecosystem using the abiotic elements of the environment and the structure of aquatic communities, including plankton organisms
in terms of skills:
1. is able to indicate all specific characteristics for extracting a good indicator species that will be useful to assess a variety of environmental parameters in an aquatic ecosystem; and divide biocoenotic features
2. identifies various abiotic features of water and analyze the response of plankton organisms to physical-chemical parameters of water
3. identifies various biotic features in water bodies and analyze response of plankton organisms to biotic parameters referring to the occurrence of other organisms and the level of habitat complexity in the aquatic ecosystem
4. describes and applies methods for the evaluation of trophic state of water with the use of plankton community indices (biocoenotic structure of plankton community and functional groups)
in terms of social competences:
1. is ready to conduct an assessment of the environmental conditions of freshwater ecosystems based on the biotic structure of the organisms present
Course learning content:
Specific features that favour certain species to be aa appropriate indicator that can be used in the assessment of the quality of the aquatic environment. Establishment of characteristics referring to e.g. to geographical range of the species, abundance of the population or ease of identification. Division of biocoenotic features into relative, absolute and structural in terms of their usage in aquatic quality evaluation.
Classification of abiotic characteristics of water in various types of water bodies. Designating the usefulness of certain plankton species and groups (biocoenotic structure of plankton community and functional groups) for the evaluation of abiotic parameters of water
Identification of biotic forces in an aquatic environment. An analysis of responses of plankton organisms to biotic factors. Designating the usefulness of certain plankton species and groups (biocoenotic structure of plankton community and functional groups) for the assessment of biotic relationships and aquatic habitat complexity

Determination of the trophic state of water as an important aspect of water quality assessment. Methods for the evaluation of the trophic state of water with the use of the plankton community indices (biocoenotic structure of plankton community and functional groups)

Course name: **Lab of biomonitoring**
On successful completion of this course, a student
in terms of knowledge:
1. Knows the animal, algae, aquatic and terrestrial based bioindication methods and is able to find appropriate indication groups and to put it into practice.
2. Correctly interprets the state of the aquatic environment based on the species and communities of phytoplankton, zooplankton and aquatic plants.
3. Knows the ecological diatom scale and phytoplankton functional groups -based bioindication methods as well as limits of their use.
4. Possess general knowledge necessary for understanding hierarchical and dynamical structure of soil fauna influenced by both direct and indirect, abiotic and biotic (including anthropogenic) conditions.
in terms of skills:
1. Is capable of planning field investigations aimed at sampling geobotanical and water data, as well as its further interpretation in order to evaluate and even to predict ecosystem properties.
2. Correctly interprets results of carried out research analyses both qualitative and quantitative and is able to present results of bioindication and biomonitoring set on basic and transformed (applied) floristic and faunistic.
3. Can work in a group using the principles of safety and respect for the work of other team members.
in terms of social competences:
1. Critically evaluates information on the application of bioindicators and biomonitoring.
Course learning content:
Biomonitoring, bioindicators – terminology: quality indicators within plants and animals (eury- and stenotopic forms, cosmopolitan).
The plankton assemblages structure and lakes and rivers eutrophication with regard to cyanobacterial monitoring and the indicator role of diatoms.
Green algae as indicators of water quality: Reynolds functional groups for phytoplankton, macroscopic green algae.
The bioindication toolset for estimating the human impact in urban terrestrial environment using micro- and macrofauna.
Planning application of faunal bioindicator system for specific task - methodological limits an practical aspects.

Course name: **Practice in assessment and restoration of aquatic ecosystems**
On successful completion of this course, a student
in terms of knowledge:
1. identifies the type and source of pollution of the water body to evaluate their importance to the proper functioning of the ecosystem.
2. assesses the impact of catchment (natural and human related pressure) on lake eutrophication
3. establishes a hierarchical plan of conservation measures for the water ecosystem.
4. discusses the various methods of lake restoration with the possibilities of their application in specific waterbodies.
5. evaluates the effectiveness of protection and restoration measures.
6. explains the reasons of restoration success/failures based on case studies.
in terms of skills:
1. uses literature sources in term of their proper selection and citation.
2. evaluates the potential results of a particular restoration method for the future functioning of the lake ecosystem.
3. presents a project for lake restoration based on collected data using specialized terminology.
in terms of social competences:
1. is ready to play the role of sa cience popularizer for aquatic ecosystems management.
2. demonstrates the ability to critically analyze source data and express own opinions regarding lake management.
Course learning content:
Methods of aquatic ecosystem assessment in the aspect of eutrophication and the impact of catchment.
Protective treatment methods/techniques required prior to the lake restoration.
Lake restoration methods.

The adjustment of appropriate restoration method to individual lake/catchment conditions as well as human pressure.
Worldwide restoration case studies, with special emphasis to reasons of restoration success/failure.

Course name: **Financing of Environmental Protection**
On successful completion of this course, a student
in terms of knowledge:
1. can actively and successfully seek a funding for funding sources for environmental protection.
2. knows how to use a variety of sources during the application writing process (knows how to handle different types of literature databases).
in terms of skills:
1. can prepare particular parts of a grant proposal in accordance with general and specific guidelines.
2. can prepare a complete project entirely by her/himself.
3. can properly construct her/his own project team and knows how to work within a research team.
in terms of social competences:
1. can prepare a specific list of gains and losses from the environmental protection actions.
Course learning content:
The formulation of environmental protection projects and how to seek sources of their funding.
Different grant types.
Project team construction and proper communication within it.
Using databases and other sources of information necessary for writing grant applications.
Preparation of all parts of a proposal: CV, introduction, background, methodology, cost estimate, characteristics of expected results.
Characteristics of gains and losses of the environmental protection actions.

Course name: **Ecological state of the lake during restoration - hydromorphology and quality of water**
On successful completion of this course, a student
in terms of knowledge:
1. Performs spectrophotometric chemical analyzes, e.g. nitrogen and total phosphorus concentrations.
2. Performs spectrophotometric analysis of photosynthetic pigment concentrations - chlorophyll a.
in terms of skills:
1. Prepares surveys carried out in the field and analyze data on the use and development of the zone near lake.
2. Analyzes the obtained data and calculate the physical and chemical indicators of the ecological state of the lake.
3. Prepares a research report and PowerPoint presentation of achieved research results and present it to a wide audience.
in terms of social competences:
1. Acts as a promoter of water protection.
Course learning content:
Acquaintance with methods for determining of nutrients concentration in water and interpreting chemical results for the purposes of water quality assessment (EWFD).
Acquaintance with methods for determining of chlorophyll-a concentration in water and methods of interpretation of results.
Catchment characteristics including hydromorphological conditions and its role in shaping the water quality of the lake / river under study.
Determine the state of the ecosystem and changes in recent years under the influence of the restoration process.
Prepare a PowerPoint presentation of achieved research results and conclusions from analyzes and discussions, and present it to a wide audience.
Prepare a research report of individual thematic groups and a final report.

Course name: **Aquatic Community Ecology**
On successful completion of this course, a student
in terms of knowledge:
1. knows community properties and simple mathematical models describing them
2. characterises inter- and intraspecific interactions in aquatic community

3. describes and explains the influence of biotic and abiotic factors on the structure and dynamics of aquatic communities
4. describes types of succession and structural changes of aquatic communities
5. names and explains causes and consequences of diversity
6. points possibilities of applying the knowledge about community functioning and structure in environment protection

in terms of social competences:

1. is aware of the importance of scientific approach to environmental protection and biodiversity restoration.
2. is capable of critical thinking and identifyng scientific problems linked to protection of aquatic ecosystems

Course learning content:

Concept of communities
Interactions between organisms. prey, predator, parasites, diseases
Inter- and intraspecific competition. The role of resources
Organisms and their environment. The characteristics of physical and chemical factors in aquatic environment influencing individuals and communities
Succession in aquatic ecosystems
Sources of species diversity within and among natural communities. Equilibrium and nonequilibrium community concepts
'Top-down' and 'Bottom-up' regulation of communities, stability and keystone species. How to use community ecology in applied sciences

Course name: **Urban aquatic biodiversity: 'pondscape'**

On successful completion of this course, a student

in terms of knowledge:

1. knows how to assess biodiversity metrics in respect to varying levels of habitat complexity and human pressure in the urban aquatic environment of different anthropogenic-transformation gradients

in terms of skills:

1. recognizes the importance of aquatic biodiversity, focusing on macrophytes and plankton, and their role in ecosystem health and functioning
2. classifies various levels of urban impact on aquatic ecosystems, ranging from strongly impacted urban centers to weak urban outskirts
3. has a comprehensive understanding of the relationship between aquatic ecosystems and human impact in urban environments
4. analyzes the contributions of various origin types of water bodies to overall urban biodiversity

in terms of social competences:

1. is aware of the implications of managing and conserving water bodies for biodiversity and community well-being in the urban landscape

Course learning content:

Understanding the concept of urban impact on aquatic ecosystems. Extracting gradients of human pressure in the surroundings of a water body. Effects of urbanization on water quality, habitat complexity, and biodiversity.
Introduction to hydrobiota: macrophytes and plankton. Biodiversity assessment techniques. Threats to aquatic systems and causes of changes in biodiversity.
Contribution of various levels of habitat complexity to urban biodiversity.
Ecological value of various origin types of small water bodies in enhancing urban biodiversity.

Course name: **Ecosystem dynamics and functions**

On successful completion of this course, a student

in terms of knowledge:

1. has an overview of inter-specific interactions that are recognized in ecology: not only competition and trophic interactions such as predation, but also e.g. the ecology of fear, and reproductive interference.
2. understands the role that inter-specific interactions play in shaping biological communities together with neutral processes.
3. understands how biological communities function in ecosystems and provide ecosystem services.
4. has insight into how ecosystems can change state and as a result reduce the services that they provide, and the difficulties associated with reversing these processes.
5. understands how ecological interactions shape the evolution of species' traits.

6. has a comprehensive understanding of the principles and concepts related to the ecology of aquatic ecosystems: aquatic biodiversity vs. habitat heterogeneity; aquatic adaptations of organisms.

in terms of skills:

1. is able to design experiments on inter-specific interactions including: formulate questions, hypotheses, predictions, and methods to test predictions.
2. is able to rapidly extract key information from peer-reviewed scientific articles in ecology.

in terms of social competences:

1. gains experience of working in small groups.
2. gains experience with presenting ideas using various techniques.

Course learning content:

Overview of ecology from global energy and nutrient flows to the autecology of individual species.
Overview of inter-specific interactions based on costs and benefits. and trophic versus non-trophic interactions.
Dispersal and neutral processes in community assembly.
Ecological niches and deterministic community assembly. How do neutral processes and deterministic processes together determine the assembly of biological communities?
The ecosystem functions of biological communities: the roles of species diversity and functional diversity, and redundancy.
How ecosystem functions lead to ecosystem services. How to appreciate and quantify these services and incorporate this knowledge into economic and political decisions?
State change in ecosystems: hysteresis and its consequences for restoration at the scale of small habitats (e.g. eutrophication of small lakes), and globally (e.g. CO2 emission and global warming).
Aquatic ecology: habitat heterogeneity; interactions; adaptations of organisms.
Field conversatory class: introduction of problems (habitat heterogeneity, succession, antagonistic and non-antagonistic interactions; adaptations).
Laboratory conversatory class: summarizing results from field practice - analysis of habitat heterogeneity and adaptations, comparisons, presentations.

Course name: **Invertebrate monitoring methods**

On successful completion of this course, a student

in terms of knowledge:

1. can argue the function of invertebrate monitoring.
2. can identify the main groups of invertebrates used in monitoring.
3. can describe sampling methods used in invertebrate monitoring.

in terms of skills:

1. can select appropriate sampling method.
2. can design and implement a monitoring plan.
3. can evaluate results of monitoring using basic statistical methods.
4. can present results of monitoring.

in terms of social competences:

1. is ready to expand knowledge on the methods used in invertebrate monitoring.

Course learning content:

The importance of invertebrates in ecosystems and environmental monitoring. Overview of the invertebrates used in environmental monitoring.
Sampling methods used in invertebrate monitoring.
Designing of terrestrial invertebrate monitoring programmes.
Overview of statistical methods for invertebrate monitoring data.
Statistical analysis, interpretation and reporting of monitoring data.

Course name: **Conservation and restoration of peatland**

On successful completion of this course, a student

in terms of knowledge:

1. Knows the biogeography and typology of peatlands
2. Knows the biodiversity of peatlands in the various spatial scales
3. Understands the relationships between climate, hydrology and carbon storage in peatlands
4. Knows the influence of agriculture, urbanization and pollution on peatland ecosystems
5. Understands the significance of wetlands for the reconstruction of the past environment, and human impact

in terms of skills:

1. Explains the loss of diversity and carbon through human-induced disturbance, e.g. agriculture & forestry
2. Assesses healthy and disturbed peatlands and provides solution for the restoration

in terms of social competences:

1. Works for the better future of peatlands in the restoration and rewetting context
2. Engages in teaching and scientific communication about peatlands

Course learning content:

Biogeography and typology of wetlands with the special focus on peatlands
Biodiversity of wetlands: from macro to micro scale
Carbon in peatlands - sequestration and disturbances
Peatlands and climate change
Palaeoecology, peatland archive and archaeology
Conservation and restoration of peatlands
Peatlands of W Pommerania and Wielkopolska - the field trip

Course name: **Environmental monitoring in practice (Study Tour Jeziory)**

On successful completion of this course, a student

in terms of knowledge:

1. has extended knowledge of the significance of environmental monitoring and its application in the scientific multidisciplinary study on the example of the relationships between geomorphological and biological diversity of the Wielkopolski National Park

in terms of skills:

1. applies methods of field monitoring studies of abiotic conditions
2. applies methods of field monitoring studies of biodiversity

in terms of social competences:

1. proposes monitoring methods adequately to the subject of research, field conditions, and use or protection status

Course learning content:

Monitoring in practice: Assumptions of environmental monitoring versus scientific study, including the specificity of the study in protected areas subject to human impact
The need for a multidisciplinary approach to the monitoring and scientific study of geo- and biodiversity of the Wielkopolski National Park
Methods of field monitoring study of abiotic conditions
Methods of field monitoring study of varied groups of organisms and species diversity

Course name: **Environmental microbiology**

On successful completion of this course, a student

in terms of knowledge:

1. knows metabolic processes in microorganisms and their genetic background.
2. describes and differentiates microorganisms in various conditions and environments.
3. is aware of the impact that microbes have on the biosphere and humans.
4. describes the relevance of applied environmental microbiology.

in terms of skills:

1. can isolate, enumerate and identify bacteria sampled from the environment.
2. can apply phenotypic and molecular methods for studying environmental microorganisms.

in terms of social competences:

1. critically evaluates received information in the matter of applied environmental microbiology.

Course learning content:

Bacterial cell structure, energy release and conservation, and genetics.
Diversity, classification and evolution of microorganisms.
Microorganisms in marine, freshwater, terrestrial, and air ecosystems.
Pathogenic and antibiotic-resistant bacteria as biotic contamination of the environment.
The role of bacteria in biogeochemical cycling.
Applied environmental microbiology.

Course name: **Environmental policies**

On successful completion of this course, a student

in terms of knowledge:

1. justifies the significance of documents establishing strategies and policies of environmental protection at global, regional and national level.

2. discusses the concept of sustainable development from the perspective of global, regional and national strategies and policies.
3. lists and discusses the main important documents specifying policy and tools of its implementation in the field of air pollution and climate change at global, regional and national levels.
4. lists and discusses the main important documents specifying policy and tools of its implementation in the field of water protection and management at global, regional and national levels.
5. lists and discusses the main important documents specifying policy and tools of its implementation in the field of protection of biodiversity at global, regional and national levels.
6. lists and discusses the main important documents specifying policy and tools of its implementation in the field of waste management at global, regional and national levels.

in terms of skills:
1. conducts a critical analysis of information on environmental policies.
2. prepares oral presentation using specialized terminology in the field on environmental policy.

in terms of social competences:
1. undertakes a public discussion and evaluates activities in the field of environmental protection carried out by various entities of public life.

Course learning content:
Types and structure of documents establishing strategies and policies of environmental protection at global, regional and national levels
Strategies and policies of sustainable development
Policies, documents, goals and tools of air and climate protection
Policies, documents, goals and tools of water protection and management
Policies, documents, goals and tools of biodiversity protection
Policies, documents, goals and tools of waste management

Course name: **Ecological state of the lake during restoration (Study Tour Wągrowiec)**
On successful completion of this course, a student
in terms of knowledge:
1. designates study sites and phytoplankton and periphytic diatoms (microbenthos) sampling points in the lake,
2. identifies species and assemblages of hydromacrophytes, takes a phytosociological releves, measures the depth range and size of patches of individual communities
3. assesses the condition of the direct catchment area and ecotone zone

in terms of skills:
1. is able to collect and preserve representative samples in vertical and horizontal transects
2. is able to measure in situ water quality indicators important for assessing the ecological status of lakes
3. is capable of taking quantitative samples of benthic invertebrates and selecting and sorting macroinvertebrates from different taxonomic groups
4. is able to prepare databases covering the results collected during field work

in terms of social competences:
1. critically analyzes available information in the field of environmental protection in order to solve practical problems related to water monitoring

Course learning content:
Methodology for determining sites and collections of plankton samples in a vertical and horizontal profile in the lake. Methodology for periphyton collections.
Methods and equipment for measuring in situ water quality parameters in a vertical and horizontal profile.
Species and assemblages of hydromacrophytes identification including taking a phytosociological releves, measuring the depth range and size of patches of individual communities.
Methodology for determining sites and collecting macroinvertebrate samples in a vertical and horizontal profile in the lake.
Total and direct catchment of the lake and its management. Assessment of the current state and possible threats. The nature of the catchment and the quality of lake waters including the role of the river.

Course name: **Sustainable development**
On successful completion of this course, a student
in terms of knowledge:
1. Defines the past and present ecological threats as consequences of human activities.

2. Knows the principle elements of sustainable development.
3. Can present examples of sustainable management in different environments.
4. Defines the human-wildlife conflict, methods of reduction and the impact on local communities.
5. Understands the meaning of "ecosystem services", and their role in biodiversity conservation.

in terms of skills:

1. Formulates the main ecological footprints that affect the environment in global, continental and regional scale.
2. Presents the principal elements of sustainable development.
3. Indicates the role of ecosystem services in biodiversity conservation.
4. Discusses the human-wildlife conflicts in the light of the sustainable development.
5. Presents the main concerns of human-wildlife conflicts globally and locally.

in terms of social competences:

1. is able to discuss, with respect for the opponent and their values.
2. is able to take criticism.
3. is able to conduct dialogue and cooperate.

Course learning content:

Past and present ecological threats as consequences of human activities.
Principle elements of sustainable development.
Examples of sustainable management in different environments: un/protected areas, forest fragments, park borders.
Human-wildlife conflict, methods of conflict's reduction and the impact on local communities.
Ecosystem services and their role in biodiversity conservation.

Course name: **MSc Seminar**

On successful completion of this course, a student

in terms of knowledge:

1. has in-depth knowledge of research problems in the field of environmental protection related to the subject of the master's thesis being prepared.

in terms of skills:

1. presents the current stages of the master's thesis in the form of an oral or multimedia presentation and skillfully answers the questions.
2. skillfully uses literature sources and data from non-scientific Internet sources with respect to intellectual property rights.

in terms of social competences:

1. is ready for continuous critical deepening of knowledge in the field of environmental protection and professional self-improvement.

Course learning content:

A review of world literature on current issues, taking into account the research interests of particular students.
Presentation of the results and research problems from particular stages of the master's thesis preparation.
Discussion in the group on the presented issues of water and land environment protection and air quality.

Course name: **Basic molecular methods**

On successful completion of this course, a student

in terms of knowledge:

1. Presents the basic information on the structure, function of nucleic acids and proteins and their importance in use in the environmental studies.
2. Characterizes the basic methods of molecular biology for the study of nucleic acids and proteins for environmental purpose.

in terms of skills:

1. Plans experiment based on nucleic acids for environmental studies.
2. Cooperates in group to perform an experiment based on the basic methods of molecular biology, critically analyzes the results and formulate conclusions regarding them.

in terms of social competences:

1. critically evaluates the results of environmental studies based on molecular biology methods

Course learning content:

Basic information regarding the structure, function and importance of nucleic acids in environmental research.

Basic information regarding the structure, function and importance of proteins in environmental research.
The use of nucleic acids in environmental research and the methods used for this purpose: cloning, PCR; microarrays, genotyping (SNP and RLFP); Sanger and NGS sequencing.
The use of proteins in environmental research and the methods used for this purpose: protein isolation and purification, electrophoresis, immunodetection and Elisa test, microscopy, mass spectrometry, protein expression in model organisms.

Course name: **Environmental toxicology**
On successful completion of this course, a student
in terms of knowledge:
1. knows how to test, show and classify toxicity.
in terms of skills:
1. presents methods of intoxication, methods of detoxification, and fates of toxic substances on single organisms and ecosystems.
2. lists and characterizes elements and compounds which are toxic; describes the toxic effects of xenobiotics on selected species and the whole environment.
3. can anticipate the toxic effects of xenobiotics on selected organisms and the whole environment on the basis of theoretical knowledge.
4. conducts appropriate laboratory tests, and uses appropriate statistical methods to obtain, analyze and describe data in environmental toxicology.
5. successfully collaborates within a group; can plan, work and process laboratory data within a group of students.
6. skillfully and safely works with toxic compounds.
in terms of social competences:
1. is able to analyze, evaluate and present the resulting toxicological threats to organisms and ecosystems.
Course learning content:
Safety precautions during laboratory and field work in environmental toxicology.
Estimation of toxicity. Analytical methods in ecotoxicology.
Classification of toxicity.
Mechanisms of intoxication and detoxification.
Effect of toxins and toxicants on single organisms, populations, species and ecosystems. Anthropogenic sources of toxic substances.
Bioaccumulation, biomagnification, retention, and biotransformation of toxins in the environment.
Toxicity of selected elements and compounds.

Course name: **Aquatic management**
On successful completion of this course, a student
in terms of knowledge:
1. explains and describes the structure of global water resources and its management and demonstrates the need of water resources protection
2. describes the role of forest management, agriculture, fishery, land drainage in water management and propose preventive actions in the watershed aiming at water resources protection by means iof its quantity and quality
3. describes methods of sustainable water supply for human needs
4. characterises environmental consequences of water management (anti-flood protection, dam reservoirs, hydropower, river transformations)
5. justifies the need of sustainable water management (water retention) in the aspect of climate changes
in terms of skills:
1. uses literature sources in term of their proper selection and citation
2. assesses the water management projects in the aspect of sustainability and environmental impact
3. provides information on potential consequences of human actions in aquatic ecosystems and discusses it with others
in terms of social competences:
1. is ready to play the role of science popularizer for aquatic ecosystem management
2. demonstrates the ability to critically analyze source data and express own opinion in the aspect of water management
Course learning content:
Global water resources and its management

The role of forestry, agriculture and fishery management in the transformation of water systems
Water quality and quantity in the light of human pressures and climate changes
Transformation of river by means of water damming, hydropower plants, channelization for inland shipping and anti-flood protection
Sustainable water management

Course name: **Scientific English**
On successful completion of this course, a student
in terms of skills:
1. speaks fluent English to communicate effectively on a variety of topics, take part in scientific discourse and be able to form properly structured questions and answers
2. understands spoken English to participate in class activities
3. uses more complex grammatical structures at the advanced and proficiency levels
4. writes properly a variety of texts in academic English
5. uses the enriched vocabulary including formal, academic terminology as well as technical terms and scientific vocabulary used by biologists
6. gives a short and profesional presentation in fluent English and handling discussion

Course learning content:
Listening comprehension practice – exposure to a variety of texts ranging from informal to formal ones including the texts containing academic and scientific biological vocabulary.
Speaking – discussions on the basis of texts given during the classes and the ones given prior to the class; discussions following listening comprehension practice; in-class discussions based on students' presentations.
Vocabulary – enriching students' vocabulary and enforcing its use for everyday situations as well as formal ones such as presentations. Vocabulary tasks will be incorporated in listening, writing, speaking and grammar practice.
Grammar- revision of the grammatical rules and structures learned so far; focus on more complex structures and their effective use in both spoken and written register; grammar will be explained in reference to listening and presentation skill practice as well.
Writing – introduction of elements of a coherent paragraph (topic sentence, body, concluding sentence); various types of paragraphs; exposure to a variety of essays; characteristics of proper academic writing; short forms – emails, abstract.
Presentation – a structure of a coherent presentation; use of proper vocabulary, grammar and speaking skills to deliver a presentation; the presentation will be followed by in-class discussion.

Course name: **MSc Project**
On successful completion of this course, a student
in terms of knowledge:
1. applies the knowledge obtained during the studies to solve a specific research problem.
2. assesses the appropriateness of the methods used in the reviewed literature.
3. finds the literature useful for the analysis of a particular scientific issue/problem.
4. assesses the adequacy of the conclusions with reference to the results of the Master project.

in terms of skills:
1. applies the skills obtained during the studies to solve a specific research problem
2. uses the appropriate research methods for his/her purposes.
3. assesses the appropriateness of the methods used in the reviewed literature.
4. finds the literature useful for the analysis of a particular scientific issue/problem.
5. assesses the adequacy of the conclusions with reference to the results of the Master project.
6. presents the results of a study using various forms of scientific expression.

in terms of social competences:
1. applies the knowledge and skills obtained during the studies to solve a specific research problem.
2. assesses the appropriateness of the methods used in the reviewed literature.
3. finds the literature useful for analysis of a particular scientific issue/problem.
4. assesses the adequacy of the conclusions with reference to the results of the Master project.
5. presents the results of a study using various forms of scientific expression.

Course learning content:
Analyzing the problem or topic.
Conducting extensive research.
Summarizing findings from the research investigation.
Recommending additional research on the topic.

Drawing conclusions and making recommendations.
Documenting the results of the research.

Course name: **Research methods in hydrobiological studies**
On successful completion of this course, a student
in terms of knowledge:
1. knows how to classify aquatic organisms based on a number of ecological criteria and environmental parameters.
2. knows the basic laboratory and field equipment (including optical) used in the hydrobiology.
3. knows the basic methods of environmental sampling, and the principles of obtaining representative samples of various types of aquatic organisms.
4. knows and understands methods for assessing the ecological status and trophic state of aquatic ecosystems based on different aquatic biocoenoses.
in terms of skills:
1. knows how to work safely in the field, collect a variety of environmental samples and perform research on the basic physical characteristics of aquatic ecosystems.
2. knows how to work safely in the laboratory, operate laboratory equipment and anlyze samples collected in the field.
3. can assess the ecological state and trophic condition of aquatic ecosystems, on the basis of the proper methods, collected environmental samples and data
4. knows how to prepare a report on the trophic and ecological status of aquatic ecosystems.
5. can work in a group and manage a research team.
in terms of social competences:
1. can critically and creatively approach the obtained results of research and observations.
2. is ready to take on the role of a person indicating the need for environmental protection, popularizing environmental issues in the context of sustainable functioning of aquatic ecosystems.
Course learning content:
Methods in hydrobiology - historical overview. Sampling of plankton (bacteria, algae), periphyton, macrophytes, benthos and fish. Timing and frequency of sampling. Establishment of sampling stations. Storage of samples. Characteristics of equipment.
Types of microscopes and applying them in hydrobiological examinations for quality and quantitative evaluation of bacterioplankton, phytoplankton, zooplankton, periphyton, benthos, macrophytes.
Parameters defining composition and structure of communities. Feeding and size groups of organisms in aquatic environment. Grouping of organisms in the assessment of water quality. The use of biological parameters in hydrobiological research.
Classification of aquatic plants. Macrophytes in different types of waters. Testing methods for aquatic plants and sedge associations as well as their populations and communities. Assessment of ecological status of standing water bodies (lakes) with use Ecological State Macrophyte Index (ESMI) Assessment of ecological status of river with use the Macrophyte Index for Rivers (MIR)
Methods for investigating of fish communities in aquatic ecosystems. Classification of lakes and rivers based on the fish community. Fish capture methods, determination of fish abundance, age and growth rate, and fish biometric features. Methods of zoobenthos sampling, sieving and taxonomical determination. Benthic invertebrates as indicator of ecological state of freshwater ecosystems

Course name: **Applied Aquatic Ecology**
On successful completion of this course, a student
in terms of knowledge:
1. is equipped with knowledge of ecology and various approaches to protection of aquatic ecosystems
2. knows the role of keystone aquatic organisms and the influence of biotic and abiotic factors on their physiology and behaviour
3. knows the mechanisms influencing the structure and dynamics of aquatic communities
4. recognizes and understands the problem of aquatic invasions in the context of global climate change
in terms of skills:
1. is familiar with molecular techniques, ecotoxicological tests, and various indicators to assess the ecosystem condition.
2. tests and observes known mechanisms influencing the structure and dynamics of aquatic communities used in ecosystem restoration
3. is be able to design, conduct and analyze simple experiments regarding ecological mechanisms applied in restoration and industry.
in terms of social competences:

1. recognizes current problems in environmental protection and introduction of sustainable development.
2. is capable of using scientific approach in solving problems linked to environmental protection and biodiversity restoration.

Course learning content:
Overview of Methods used in Protection and Restoration of Aquatic Ecosystems
Ecology of Keystone Organisms in Aquatic Ecosystems - Influence of Environmental Factors
Indirect Effects in Restoration of Aquatic Ecosystems
Aquatic Invasions in the Light of Global Climate Change
Indicators and Biotests Assessing the Ecosystem Condition
Using Molecular Tools to Assess Ecosystem Biodiversity
Ecology of Harmful Algal Blooms
The Influence of Environmental Factors on Plankton
Interspecific Interactions
Thermal Tolerance of Autotrophs and Poikilothermic Animals
Effectiveness of Biomanipulation
Aquatic Organisms As Alternative Fertilizers

Course name: **Air quality monitoring**
On successful completion of this course, a student
in terms of knowledge:
1. will know how to characterize the most hazardous anthropogenic (chemical) and natural (biological) air pollutants
2. will be able to describe the sources and processes related to atmospheric transport of air pollutants
3. will be able to indicate the impact of air pollutants on human health and environment as a whole

in terms of skills:
1. will know how to use the appropriate methods of air quality monitoring (analytical, GIS, dispersion modelling), and retrieve, analyse and interpret collected data, and make conclusions
2. will know how to use the most important web sources, local and regional databases and air quality models

in terms of social competences:
1. will show readiness to promote a healthy lifestyle in the context of air quality

Course learning content:
Detailed characteristics of the most hazardous anthropogenic (chemical) and natural (biological) air pollutants.
Description of the sources and processes related to atmospheric life cycles of air pollutants.
Review of the impact of air pollutants on human health and environment as a whole.
Laboratory methods used in air quality monitoring, GIS analysis, dispersion modelling, summary and interpretation of obtained data.
Introduction to the most important web sources related to air quality monitoring, local and regional databases and air quality models.

Course name: **Principles of Geographical Information Systems**
On successful completion of this course, a student
in terms of knowledge:
1. knows how to define the concept of Geographical Information Systems, lists their key features and describes briefly the history of geographic information and geoinformation systems as well as the most important directions of their further development.
2. knows how to use spatial data assets of various types and formats, including on line resources and creates own spatial data sets and indicate the differences between different data models.

in terms of skills:
1. knows how to indentify the main similarities and differences between selected commonly used GIS software and navigates the basic functions of the ArcGIS menu and one selected open-source software.
2. knows how to interpret spatial biotic/abiotic data and understand relations between them through spatial analysis and visualizes the results of spatial analysis using cartographic symbolization.

in terms of social competences:
1. is able to critically assess the results of spatial analysis and visualization.

Course learning content:
Methodological assumptions of geographic information systems.

History, development and future of geographic information systems. Basic definitions, concepts, functions and components of geographic information systems.
Quantum GIS and ArcGIS software interface.
Sources of spatial data. Preparation of input data for analysis. Methods of acquiring spatial data, creating and editing objects.
Analysis of biotic/abiotic vector and raster data. Examples of simple spatial analyzes in the field of environmental protection. Visualization of spatial analysis results.

Course name: **Environmental global change**
On successful completion of this course, a student
in terms of knowledge:
1. Knows about the impact of humans on global changes on our planet, since the same beginning of civilization.
2. Understands the consequences of ice caps shrinking on biodiversity and habitat loss in polar and tropical regions.
3. Indicates benchmark sites for observing of global changes.
4. Understands socioeconomic consequences of global changes and biodiversity loss and philosophical and economic approach.
in terms of skills:
1. Recognizes of in-situ and ex-situ conservation opportunities and what actions can be taken to prevent species extinction.
2. is proficcient in searching scientific data in search engines and discuss with opponents the relationships between: (1) human health - environment, (2) the distribution of biological and chemical pollutants and the environment, and (3) anthropogenic factors - changes of the natural environment.
in terms of social competences:
1. is able to prepare a scientific talk and discuss in a group (using empirical data) selected issues concerning consequences of climate change and other anthropogenic factors affecting the natural environment and public health.
Course learning content:
Effects of the current changes of the cryosphere on biodiversity, ecosystems, human health, and selected economic aspects.
Biotic and abiotic pollutants (heavy metals, radionuclides, microplastics, pesticides andantibiotics) in terrestrial and marine ecosystems.Processes of bioaccumulation of pollutants and their releaseto marine and terrestrial ecosystems.
The role of marine, freshwater, and glacial ecosystems in maintaining of Earth's equilibrium

Course name: **Chemical lab of water monitoring**
On successful completion of this course, a student
in terms of knowledge:
1. knows the principles of sampling for the chemical monitoring of water
2. knows the chemical parameters used for the assessment of aquatic trophic state and water monitoring
3. describes relations between parameters of water quality as well as between these parameters and biotic and abiotic elements of the environment
in terms of skills:
1. operates field equipment and conducts field measurements obligatory in water monitoring
2. conducts the chemical analyses of selected chemical elements and substances key in water monitoring
3. understands and interprets the obtained results, and is able to assess trophic state and water quality
4. works in group
5. follows the principles of occupational safety during field and laboratory activity
in terms of social competences:
1. demonstrates the ability to critically analyze source data
Course learning content:
Field surveys and sampling in different types of water ecosystems, principles in field measurements necessary in water monitoring
Trophic status indexes and principles of chemical water monitoring
Determination of different forms of phosphorus and nitrogen in water as nutrients determining aquatic ecosystem productivity
Determination of water colour, odour and acidity in water monitoring

Determination of detergents and heavy metals in waters

Course name: **Remote sensing data**
On successful completion of this course, a student
in terms of knowledge:
1. is able to search remote sensing data (satellite and aerial images, data from laser scanning), knows the possibilities of their use and their limitations. Student knows the advantages and limitations of image acquisition using unmanned aerial vehicles (UAVs).
2. knows the limitations resulting from differences in the methodological approach to data analysis in the form of reference databases (including BDOT, MPHP, VMap) and thematic databases (including CLC), and data obtained independently - based on the analysis of remote sensing materials.
in terms of skills:
1. can process LiDAR data, i.e. filter point clouds, change recording formats, create DEM, DSM, nDSM, CHM models.
2. can process remote sensing data in the form of aerial and satellite images using specialized software. Student can calculate the NDVI vegetation index.
3. can analyze and interpret data obtained from processing of raw materials (satellite images, aerial images and point clouds).
4. is capable of visualizing the effects of work in the GIS system, creating thematic maps, summarizing of the key finding and presenting them in an accessible and understandable way.
in terms of social competences:
1. is able to critically assess the results of studies that are based on remote sensing data, knowing the limitations of the method.
Course learning content:
Satellite and aerial photos as sources of remotely obtained environmental data - basic features, data acquisition possibilities, advantages and limitations. The use of unmanned aerial vehicles (UAVs) in the acquisition of remote sensing materials.
Preparation of images for classification, atmospheric and noise correction.
Supervised and unsupervised classification of satellite images.
Visualization of remote sensing analysis results, creation of habitat maps, land cover, hypsometry, slope exposure, slopes, solar radiation potential.
Laser scanning (LIDAR) as a source of information about the terrain and the spatial structure of its coverage. Mode of action, possibilities, advantages and limitations.
Analysis of LIDAR data (data filtration, model creation - Digital Elevation Model (DEM), Digital Surface Model (DSM), normalised Digital Surface Model (nDSM) and Tree Crown Model (CHM). 3D modeling of spatial information obtained on the basis of point clouds from aerial scanning.

Course name: **Seasonality of biological events**
On successful completion of this course, a student
in terms of knowledge:
1. is able to define seasonality and phenology and indicates examples of phenological, seasonal processes in the environment.
2. is able to recognize current environmental problems connected with seasonality and phenology of biosphere.
3. is able to give examples and explain how the weather phenomena affect biological and ecological processes.
in terms of skills:
1. is able to distinguish phenological stages in plants and animals.
2. is able to plan and perform phenological observations.
3. is able to establish and maintain simple phenological network.
4. is able to forecast the timing of selected phenological stages based on meteorological data and is able to obtain meteorological data on their own.
5. is able to handle different spatial and non-spatial data related to phenology and seasonality in different spatial and temporal scales.
in terms of social competences:
1. is able to discuss and promote phenology as important in environmental management.
Course learning content:
Descriptions and definitions of seasonality and phenology as well as discussing and explaining the examples of phenology in biology and ecology.
Phenological observations in the field.

Forecasting the timing of selected phenophases using meteorological and satellite data. Satellite data processing. Investigating phenological changes in vegetation at a biome scale using satellite data.
Planning and establishing a simple phenological network.
Primary and secondary phenological stages - phenological classification systems, standards.
Satellite-based and ground-based phenology - which is right? Panel discussion.

Course name: **Basic R programming for scientists**
On successful completion of this course, a student
in terms of knowledge:
1. knows and is able to apply basic R syntax
2. is able to plan how to solve simple calculations tasks in R and how to use R to test biological and ecological hypotheses
in terms of skills:
1. recognizes different data types in R such as vectors, matrices, lists, data frames, and also knows object classes such as numeric, logical, characters, factors; is able to import and export different data in R, for example excel file or files with different extensions (i.e. .csv, .txt, png, tif)
2. processes the data at basic level, is able to effectively clean the data, change formats, add and remove columns, do selections, joining tables and other activities connected with data processing; downloads data from Internet databases through R
3. is able to visualize the results using boxplots, barplots, scatterplots with custom modifications and explains how they work
4. is able to write simple functions shortening the code and automatically repeat simple calculations using loops
in terms of social competences:
1. is able to search for the information in the Internet, critically assess its reliability and correctness and to use the existing code to extend and modify their own code needed to resolve the problem
Course learning content:
Learning of the basics of R syntax
Import, export and data processing
Performing simple calculations on data frames (among others); downloading the data from the Internet, from servers through R
Writing simple functions and automation of tasks using loops
Using the existing open code and information from the Internet for modification of their own code and for their own purposes
Visualization of the results and their interpretation, presenting the results in front of the group and discussion

Course name: **Ecohydrology**
On successful completion of this course, a student
in terms of knowledge:
1. has extensive knowledge about the assumptions of ecohydrology as an interdisciplinary, holistic approach to the management and protection of water resources
in terms of skills:
1. understands the significance of the alimentation basin for water quality and presents the impact of varied catchments on the functioning of standing water ecosystems
2. understands the concept of the river continuum and, according to its assumptions, interprets the influence of the natural and anthropogenic catchment on the quality of riverine water
3. understands multidimensional intrabiocoenotic feedback mechanisms and applies the knowledge about their significance in water quality management
in terms of social competences:
1. is ready to apply the principles of sustainable development in the use of water resources
2. is ready to continuously develop their knowledge on the subject of the current water management and protection issues
Course learning content:
Basic assumptions of ecohydrology
Biogeochemical cycle and pollution transport
Dual regulation and other principles for ecohydrology activities
Types of aquatic ecosystems, their biodiversity, and matter circulation
Catchment features and typology, human-made changes to the catchments, and the water quality in lakes and rivers

The river continuum concept
Sample groups of aquatic organisms and relationships between them in the ecosystem; bioindicators
Phytotechnologies - examples of nature-based ecohydrological solutions
Ecotones as buffer zones for nutrient run-off: the significance of abiotic processes and biotic influences
Socio-economic determinants of the use of water resources and their protection

Course name: **Mediation and social conflicts in environmental protection**
On successful completion of this course, a student
in terms of knowledge:
1. knows processes and phenomena related to environmental protection with the special emphasis on mediation and social conflicts
2. knows theoretical and practical aspects of social conflicts with regard to air quality and pollution prevention
3. knows social conditions related to information strategies and educational activities in the field of environmental protection
in terms of skills:
1. uses his/her knowledge to search for reliable sources of information and conducts their critical analysis
2. conducts various professional activities related to environmental protection, e.g. prepare comprehensive information for local communities or institutions
3. systematically updates knowledge related to new information strategies and techniques in order to avoid social conflicts with regard to environmental protection
in terms of social competences:
1. formulates his/her judgments on various environmental issues and puts them into practice
2. correctly identifies and resolves various dilemmas related to information policy in the field of environmental protection
Course learning content:
The premise of environmental conflict
The purpose of environmental conflict
Persuasions of environmental conflict
Managing environmental conflicts
Approaches to mediation
Biopsychical principles of sustainability
Social principles of sustainability
Communication: the interpersonal element
Practicing the mediation of conscience
Case studies: environmental degradation as a source of conflict

Course name: **Bioclimatology**
On successful completion of this course, a student
in terms of knowledge:
1. Explains and defines terminology and methods of introduced in the course.
2. Is introduced to the basic concept of energy flux and matter circulation in the environment (soil-plant-atmosphere system).
3. Is aware of methods and field techniques of the estimation of heat and mass exchange between the ecosystems and the atmosphere.
4. Learns the application for calculation methods for estimating climate-ecosystem interactions.
5. Analyzes the climate-ecosystems processes by using of heat and mass balance estimation methods.
6. Understands and interprets the impact of meteorological processes on ecosystems.
in terms of skills:
1. Introduces methods and field techniques for estimating heat and mass exchange between ecosystems and the atmosphere.
2. Learns the application of calculation methods for climate-ecosystem interactions estimations.
3. Analyzes the climate-ecosystems processes by using of heat and mass balance estimation methods.
4. Understands and interprets the impact of meteorological processes on ecosystems.
5. Learns the communications and cooperation skills within the working group.
in terms of social competences:
1. Explains and defines terminology and methods of introduced in the course.
2. Is introduced to basic concept of energy flux and matter circulation in the environment (soil-plant-atmosphere system).

3. Learns the understanding and interpretation of meteorological processes impact on the ecosystems.
4. Learns the communications and cooperation skills within the working group.

Course learning content:

Energy transfer and mass circulation in the ecosystem-atmosphere system.
Heat and mass (e.g. water vapor, CO2) balances and exchange between the plants and the atmosphere.
Techniques of the estimations of heat and mass exchange between the ecosystems and the atmosphere.
Methods of estimation of heat and mass exchange between the ecosystems and the atmosphere.
The examples of interactions between the ecosystems and climate.