NATURE CONSERVATION, MASTER STUDY PROGRAMME, SECOND BOLOGNA CYCLE
COURSE DESCRIPTIONS

COMPULSORY COURSES

Course name**:** **THE HUMAN DIMENSION IN CONSERVATION SCIENCES**
Number of ECTS credits: **6**

Content:

1. Introduction and the challenge
   - Defining human dimensions
   - Exploring human motivation
   - Human behaviour
2. Human dimension of protected areas
   - History informing the present
   - The protected area paradigm shift
   - Protected area management techniques
3. Human-wildlife conflict at species level
   - Understanding stakeholder tolerance
   - Species hierarchies
   - Managing increasing conflict
4. Mapping social processes
   - Identifying stakeholders
   - Defining and planning research
   - Collating results and analysis
5. The application of human dimensions research
   - The policy process
   - Decision processes and problem orientation
   - Government or governance
6. Legal requirements for human dimensions
   - International requirements for human dimensions in conservation
   - Regional policies
   - European policies
7. Emerging issues and case studies
   - Emerging issues
   - Species case studies
   - Protected areas case studies

Course name**:** **ECOLOGY OF TERRESTRIAL ECOSYSTEMS**
Number of ECTS credits: **6**

Content:

1. Basic concepts (ecosystem, biocenosis, biotope, habitat, ecosystem biodiversity, etc.).
2. Basics of vegetation ecology (basic terminology, sinmorphology,sinecology, sindinamics, sinchronology, sinchorology, sinsystematics)
3. Biogeography of ecosystems (zoning of vegetation, biomes, eco-regions, phytogeographic regions in Slovenia, biogeographic regions, principles of island biogeography and metapopulation ecology)
   - Natural bridges between land ecosystems (bird migrations, types of bird migrations and types of global connections between land ecosystems)
4. Review and comparison of ecosystems;
   - Forest Ecosystems (characteristics, structure and function)
   - Non-forest ecosystems (characteristics, structure and function)

- Agrarian ecosystems (characteristics, structure and function)
- Urban Ecosystems (characteristics, structure and function)

5. Ecosystem Biodiversity (basic concepts, factors that influence biodiversity, review of the diversity of ecosystems and global biodiversity, hot spots of biodiversity, threats to biodiversity)
   - Fundamentals of biodiversity monitoring in terrestrial ecosystems
6. Selected topics in Ecology of terrestrial ecosystems;
   - Interaction complexes (interactions of higher-orders in ecosystem)
   - Invasion ecology (invasion process, ecology of non-native species, exampes of the most invasive alien species in terrestrial ecosystems in Slovenia)
   - The importance of key species in ecosystem functioning (the principle of key species, differences in the effects of different types of ecosystem, ecological engineers, examples of key species)

Course name**:** **MARINE ECOLOGY**
Number of ECTS credits: **6**

Content:

Processes in Marine Ecosystems
- Patterns and processes in physical and chemical oceanography; movements of water masses and oceanic currents
- Biological oceanography: environmental gradients and division of marine ecosystems; patterns of marine biodiversity; marine biogeography
- Primary production: limiting factors, spatial and temporal variability; ecology of phytoplankton
- Microbial ecology and microbial food web
- Secondary production and marine food webs; dynamics and control mechanisms of food webs
- Quantification of trophic dynamics, energetic and food web modeling

Ecology of Oceanic Environments
- Ecology of pelagic ecosystems; pelagic zones and communities; ecological adaptations of pelagic organisms
- Ecology of littoral zone and benthic ecosystems: structure and energetic of communities, biodiversity patterns, adaptations of benthic organisms (ecology of supralittoral, eulittoral and sublittoral zones)
- Ecology of mangroves, coral reefs and estuaries: biology, productivity, adaptations and ecology of organisms
- The deep-sea ecosystems: environmental characteristics, patterns of abundance and diversity; structure and energetic of communities
- Polar seas: diversity, adaptations and biological processes

Marine Ecology Research Methods
- Research methods in oceanography
- Plankton sampling, abundance and biomass estimates
- Data collection and quantitative sampling in benthic studies
- Methods for studying dispersal, movements and migrations of marine organisms
- Remote sensing methods in marine research
- Methods in feeding ecology and marine food webs studies

Course name**:** **SEMINAR**
Number of ECTS credits: **6**

Content:
In this course the students will be through seminars and lectures of visiting scientists from Slovenia and abroad get familiar with different topics on nature protection. The Seminars is going listen by students of first, and second-year. The topics are going to be focusing on the specific research lecturers, covering the protection of ecosystems, land or sea. A detailed list of lectures will be published at the beginning of each academic year.

Students in this course will also prepare a paper that will cover one of the areas of student interest in linking to one (or more) of the presented themes in the lectures.

Course name**:** **PRACTICAL TRAINING**
Number of ECTS credits: **6**

Content:
In their 1st year of study, students must undertake a 3-weeks-long practical training. The purpose of the training is to transfer theoretical knowledge into practice.

At the beginning of the academic year, after an initial meeting with the coordinator of the practical training at the Faculty, students choose the organization in which they would like to undertake their practical training. Students should contact their preferred organization and arrange the practical training themselves.

Before the beginning of the practical training students should know all procedures defined in the instructions for students about the practical training.

Course name**:** **ADVANCED TOPICS IN CONSERVATION BIOLOGY**
Number of ECTS credits: **6**

Content:

Contemporary topics in Conservation Ecology
- Modern approaches to conservation science: conservation biology *vs*. nature conservation
- Biodiversity science: taxonomic, process and functional biodiversity; ecological services; temporal dynamics of biodiversity and biodiversity crises
- Cumulative assessment of synergistic anthropogenic threats to biodiversity
- Integrating levels of biological organization in conservation biology
- Ecosystem-based approach to conservation: conservation of dynamics of ecological processes
- Evidence-based framework in conservation biology

Contemporary topics in Molecular ecology
- Planetary boundaries and biodiversity index
- Genetic resources and genetic erosion
- Species concept in conservation biology; evolutionary significant units; focal species concept
- Conservation of ecosystem resilience trough genetic variability
- Dynamic of small population, extinction vortex
- Genetic rescue: captive rearing and reintroductions
- Recent case studies of the implementation of molecular ecology in nature conservation (in Slovenia and comparatively also in wider Alpine-Dinaric region)
- Synthetic biology (genome editing, CRISPR)

Course name**:** **POPULATION BIOLOGY**
Number of ECTS credits: **6**

Content:
- Introduction to population biology; sampling in population ecology studies
- Population abundance estimate methods: abundance indices, census methods; distance sampling; CMR methods for closed and open populations
- Fundamentals of population growth; the finite and intrinsic rates of population growth, factors determining the variability in population growth
- Quantitative population trend analysis and application to conservation: density independent and density dependent population growth models
- Stochastic processes in populations, population viability analysis (PVA) and extinction risk analysis
- Dynamics of small populations and extinction vortex

- Age structured populations and population vital rates; methods for estimating survival, growth and reproduction in populations
- Life-history theory and application to conservation ecology
- Population modeling: deterministic age-structured matrix models
- Applications of population models to conservation, elasticity and sensitivity analysis; reproductive value analysis
- Multiple populations and metapopulation ecology: spatial structure of populations and source-sink dynamics

Course name**:** **MARINE CONSERVATION BIOLOGY**
Number of ECTS credits: **6**

Content:

Marine Conservation Biology: Theoretical Backgrounds
- Introduction to Marine Conservation Science; Marine *vs*. terrestrial ecosystems: differences in conservation approaches
- Ecological functions and services of marine systems
- Conservation ecology of marine populations: application of larval ecology to marine conservation; Allee effects in marine populations;
- Application of population biology and life history theory to marine conservation; extinction risk of marine populations
- Spatial and behavior ecology of marine populations; metapopulation dynamics and connectivity in marine systems

Threats to Biodiversity in Marine Systems
- Synergistic effects of anthropogenic stressors in marine ecosystems
- Impact of climate changes in marine systems and future of the oceans; marine bioinvasions
- Marine fisheries: history and commercial fishing gears; status of marine stocks and global fishery crisis; impact of fishing in marine ecosystems; small fisheries and the issue of bycatch
- Degradation of marine habitats: impact of nutrient over-enrichment; persistent toxic substances and marine pollution
- Bioacoustics and noise pollution in marine systems

Managing Marine Ecosystems
- Ecosystem-based approach to marine conservation
- Placed-base conservation and marine protected areas
- Ecosystem approach to fisheries and sustainable use of marine resources
- Cumulative risk assessment and integrated dynamic ocean management
- Human dimension of marine conservation

Course name**:** **CONSERVATION OF TERRESTRIAL ECOSYSTEMS**
Number of ECTS credits: **6**

Content:
Content of the course is divided into five interlinked topics, allowing successive achievement of the most important goals: getting to know the basic characteristics of terrestrial ecosystems - learning about the most important risk factors - principles and measures for the protection of terrestrial ecosystems - methods of monitoring the succesfulness of protective measures - examples of good practice in Slovenia and broader European area.

Main topics:

1. The most important characteristics, relationships and importance of selected terrestrial ecosystems:
- Diversity of terrestrial ecosystems;
- Forest ecosystems;
- Agrarian ecosystems;

- Urban ecosystems;
- Specific ecosystems: industrial influenced areas, secondary ecosystems;
- Ecotones (transitional areas).

2. The most important risk factors and their negative impacts on terrestrial ecosystems:
- Destruction and fragmentation of habitats;
- Negative edge effect;
- (Over) use of renewable resources (including potential over-catching);
- Introduction, spread and impacts of non-native (especially invasive) species;
- Negative impacts of road and rail infrastructure (barrier effect, cause of mortality);
- Climate change;
- Pollution.

3. Principles and protection measures of terrestrial ecosystems:
- Review of the relevant Slovenian and European legislation;
- Basics of forest-economic planning;
- Basics of hunter-management planning and management of populations;
- Basics of planning and infrastructure placement;
- Actions of linking populations (underpasses, overpasses) and to reduce wildlife road and rail mortality;
- Measures to reduce emissions of toxic substances;
- Ecoremediation.

4. Monitoring methods:
- Monitoring target (indicator) species in terrestrial systems and freshwater aquatic bodies;
- The impact of road infrastructure on wildlife;
- Control method as a tool for adaptive (cognitive) management of wildlife populations;
- Bioindication and biomonitoring (the concept, purpose, principles, ranking according to the statutory monitoring of inorganic media).

5. Examples of good practice:
- Solving the problems of vehicle collisions with wild ungulates in Slovenia and some other European countries;
- Monitoring of ekoducts usefulness for animals crossing over motorways in Slovenia;
- Retrospective biomonitoring effectiveness of different measures to reduce emissions of toxic substances in Slovenia and Europe;
- Butterflies (and othere selected invertebrates) as biondicators in agro-ecosystems, urban environments, human-influenced systems.

Course name**:** **MASTER'S THESIS**
Number of ECTS credits: **30**

Content:
The master's thesis is based on independent research work in the field of nature conservation, which the student carries out in agreement with the mentor. The student first chooses a topic, defines the problem and poses research questions or hypotheses. This is followed by a literature review, on the basis of which the research is planned and appropriate work methods are selected. The work may include field, laboratory or office data collection (or a combination of the above), their analysis and interpretation. The student places the results in the broader context of nature conservation and draws conclusions and possible recommendations from them. The task is concluded with the preparation of a master's thesis in accordance with the instructions of the faculty and with a public presentation and defense.

ELECTIVE COURSES

Course name: **AGROECOLOGY**
Number of ECTS credits: **6**

Content:
Course contents of the subject Agroecology are divided into three sections: the first part includes definitions, principles, objectives and importance of agroecology. The second part is aimed at studying and understanding agroecosystems, the third part is about the importance of biodiversity in agroecosystems.

1. Agroecology.
   - Definitions, principles, objectives.
   - Agroecology in the context of intensive and sustainable agriculture.
   - The importance and potentials of agroecolgy in different agricultural systems.
   - Agroecology and related sciences: biotechnology, phytopharmacy, bioeconomy and rural sociology.
2. Agroecosystems.
   - Knowledge of different agroecosystems and to study their characteristics, differences, advantages and disadvantages.
   - Comparisons of nitrogen cycle, nutrient cycle, energy flow, species, genes.
   - Comparison of ecosystem structure, functions, biodiversity.
   - Agroecosystems and adjacent ecosystems - interactions.
   - Ecological and environmental problems in agroecosystems.
   - The importance of social and economic stability in agroecosystems.
   - Sustainable agroecosystems.
   - The preservation, maintenance and management of sustainable agroecosystems.
3. Biodiversity in agroecosystems.
   - Identifying biodiversity in agroecosystems.
   - The importance of biodiversity in agroecosystems functions.
   - Consequences of biodiversity erosion in agroecosystems.
   - Valuation of biodiversity in agroecosystems.
   - Methods of conservation and strategies to improve the status of biodiversity in agroecosystems.

Beside frontal lectures, work in small groups is intended within Agroecology. Groups will be field handled with various causes related to agroecological themes. Results of field observations and analysis will be presented in the form of seminar papers.

With regard to selected topics of seminars additional lectures are provided by visiting academic staff or researchers.

Course name: **FLORAL BIOLOGY AND POLLINATION ECOLOGY**
Number of ECTS credits: **6**

Content:
This interdisciplinary course will survey the science of pollination biology, including the discovery of plant pollination in the late seventeenth century, plant adaptations to animal pollination and how they evolve, the diversity of mating systems, floral traits in connection to pollinating animals, the many ways that plants manipulate animals to achieve pollination via general and/or specific plant-pollinator interactions, and the importance of pollination to human society.

Contents:

1. Essentials of flower design and function
   - Why pollination matters?
   - Floral design and function
   - Pollination, matting and reproduction in plants
   - Evolution of flowers, pollination and plant diversity
2. Floral advertisments and floral rewards
   - Visual signals and floral color

- Olfactory signals
- The biology of pollen
- The biology of nectar
- Other floral rewards
- The environmental economics of pollination

3. Pollination syndromes
    - Types of flower visitors: syndromes, constancy and effectivenes
    - Generalist flowers and generalist visitors
    - Biotic and abiotic pollination
    - The timing and patterning of flowering
    - Competition and pollination ecology
    - Pollination in different habitats
    - Pollination of crops
    - The global pollination crisis

Course name: **ECOLOGY OF MEDITERRANEAN FOREST ECOSYSTEMS**
Number of ECTS credits: **6**

Content:

- The definition of discipline and its role, purpose (study of relationships, structure and functioning of Mediterranean forest ecosystems), identification of the specific position of the other ecosystems in our country and the world.
- History of the emergence and development, the role and nature of Mediterranean forests in the past and today.
- Key components and basic relations in the Mediterranean forest ecosystems, defining principles of multi-purpose sustainability and sustainability.
- Organic frameworks, performance and sheer key tree species.
- Basics of forestry by defining the basic concepts and laws (Liebig, Lundegardh, Mitscherlitsch), entropy and energy flow.
- Habitat and ecological framework, the detailed effects of site specific factors (heat, light, water, air and wind), air conditioning as a whole, edaphic factors.
- Structure and function of the stands.
- Growth and increment, and ecopsychological and incremental baselines.
- Specificity of treatment and of forest management and forest resources, their functions in the Mediterranean.
- Virgin Mediterranean forests and their legality in the development, comparison with other Mediterranean forests.
- Special features and factors of Mediterranean forest restoration.
- Stability of forest biodiversity and the Mediterranean.
- Selected chapters: Light and water - ecological factors of Mediterranean forest.
- Selected Topics: stress and reaction ability of Mediterranean forests.

Course name: **ECOLOGY OF HIGH MOUNTAIN ECOSYSTEMS**
Number of ECTS credits: **6**

Content:
Students will learn and be familiar with the basic concepts of ecology and biodiversity, ecology study techniques, extreme nature conservation habitats and their evaluation in theory and practice, changes in biodiversity patterns in space and time in conjunction with habitat diversity and specific environmental factors, human impact on mountain ecosystems and biodiversity. Particular emphasis will be given the ecology of high mountains that surround the Mediterranean (oromediteran). Substance, the subject of well-connected to other academic subjects: Systematic Zoology, Systematic Botany, Biodiversity and Biogeography and ecology of
the Mediterranean.

Major topics:

1. Ecology of animals and plants at high altitude
    - The concept of limiting

- Regional and global overview of research

2. Alpine zone
   - Altitude zonation
   - Global distribution
   - The origin of the fauna and flora
   - Alpine life forms
3. Alpine climate
   - Alpine zone restrictions
   - Regional specialties
4. The life under snow
   - Temperature
   - Solar radiation
   - Gas concentration
   - The response of plants and animals
5. Soil conditions
6. Forest and tree borders
   - Real and potential border
   - Regional specialties
7. Plant physiology and functional ecology
   - Regional specialties
   - Stress
   - Water conditions
   - Nutrient
   - Circulation of materials
8. Reproductive strategy
9. Global warming and the situation in the highland zone
10. Oromediteran
11. Patterns of biodiversity along altitudinal gradients
    - The diversity of flora and fauna
    - The diversity of habitats
    - Regional specialties

Course name: **ENTOMOLOGY**
Number of ECTS credits: **3**

Content:

- Introduction in entomology –its importance, insect diversity
- Insect communication
- Evolution ecology of insects (life strategies, reproductive biology, coevolution, insect-plant interactions)
- Life cycles (onthogeny, generations shift, diapause, migration, environmental influences)
- Ecology of insects (population biology, limitations, climate influence, population effects of predation)
- Ground insects (edaphic fauna, saproxylic insects, coprophags, scavengers, fungivory, cave fauna)
- Water insects (adaptions to water ecosystems, problem of respiration, feeding guilds, marine habitats)
- Social insects
- Predators and parasites (types with examples, prey/host selection, parasitoids)
- Indirect interactions and ecosystem role of insects
- Population effects of predation (insect predators, defense mechanisms, population dynamics)
- Importance of insects for human (medicine, economy, agriculture, forestry, population management, alien species, urban entomology)
- Insect conservation (extinctions, threats, population conservation, conservationst documents, Natura 2000)
- Survey and monitoring of insect populations and assemblages (bioindicators, biological monitoring, population monitoring of endangered species, freshwater monitoring, fundamental problems in development of insect monitoring)
- Entomological methods – field survey methods, material analysis, ecological methods

Course name**: PLANT PHISIOLOGY II**
Number of ECTS credits: **6**

Content:

1. Water balance of plants
   - Admission, transportat and transmit of water.
   - Water balance of plants. Poikilohydric and homoiohydric Plants.
   - Water balance of plant communities.
   - Life forms and ecological groups of plants.
2. Mineral nutrition of plants
   - Soil as a source of elements, the circulation of elements in ecosystems and major cycles.
   - Processes in the rhizosphere.
   - Overview of the functions of certain macro-and microelements, the emergence in the soil, availability, concentration and diffusion of minerals in the rhizosphere.
   - Uptake in roots, ion uptake mechanisms in plant cells (transport through the cell membrane).
   - Transport at short distances.
   - Transportation of mineral nutrients in xylem and phloem and its regulation.
   - Mineral nutrition and plant growth and development, its physiological role in the plant, disruptions in supply.
   - Microorganisms of the rhyzosphere, the ecological significance of mycorrhiza and plant symbiosis with N2-fixing microorganisms.
   - Mineral nutrition of the plant communities.
   - Environmental impact on the metabolism of minerals, life forms and ecological groups of plants.
3. Carbon Metabolism
   - Effects of environmental factors on photosynthesis (light and light-independent reactions of photosynthesis, energy efficiency of photosynthesis, daily and seasonal course of photosynthesis, measurements of photosynthesis).
   - The types of carbon metabolism (C3, C4 and CAM plants).
   - Photorespiration.
   - Breathing.
   - Circulation and consumption of carbohydrates in the plant.
   - Life forms.
   - Primary production of plant communities, yield of biomass, consumption of net production income.
   - Energy conservation in the plant communities.
4. Stress physiology of plants
   - Natural stress factors (lack and excess of light, UV radiation, extreme temperatures, lack and excess of water, scarcity and the problem of excessive salt concentrations, mechanical damage, the interaction with plants, microorganisms and animals).
   - Anthropogenic stress factors (pollution with atmospheric oxidants, heavy metals, xenobiotics; fire, radioactivity in the environmen;, ionic radiation, electromagnetic fields).
   - Responses of plants to stress factors (functional disorders of cell metabolism, symptoms of injury at the level of cell and whole organism, defense and repair mechanisms, detoxification of free oxygen radicals with antioxidants and enzymes).
   - Anatomical and physiological adaptations of Mediterranean plants to extreme areas (skills and strategies of survival).
   - The use of biotechnology in the development of stress tolerance in plants.
5. Pollution bioindication
   - Reaction and storage indicators, test organisms, biomonitoring methods.

Course name**: HERPETOLOGY**
Number of ECTS credits: **3**

Content:
In the theoretical part of the subject herpetology - the science that studies amphibians and reptiles - will first be briefly defined. The historical and biological reasons for treating these two groups together will be explained. The basics of evolution, anatomy, physiology and ecology of amphibians and reptiles will be presented, followed by particularities of the life cycle and how these affect the conservation status. The chapter on systematics and species diversity will cover the major part of the course. All groups of recent amphibians and reptiles will be presented, with an emphasis on fauna of southeastern Europe. In this context, students will be acquainted with endemic species.

During practical work (laboratory or fieldwork) students will learn how to determine the studied species. Part of the this will address relevant recent research in this field. During field work students will be included in ongoing studies of amphibians and reptiles becoming familiar with the methods of monitoring and protection measures.

The main topics will be:

1. Evolution:
   - Amphibians as the first land vertebrates
   - Reptiles - first amniotes
2. Special features of the anatomy and physiology of amphibians and reptiles:
   - poikilothermy – advantages/disadvantages
   - water balance
   - physical support and movement
3. Reproduction and life cycle:
   - diverse life cycles of amphibians
   - pedomorphosys
   - reptile reproduction
4. Ecology:
   - suitable habitats
   - the importance of amphibians and reptiles in terrestrial and freshwater ecosystems
5. Threats and conservation:
   - global amphibian decline and its causes
   - threats to reptiles
   - conservation on national and international level
6. Diversity:
   - at the global level
   - in Europe, emphasis on the Balkans and Mediterranean
   - endemism
   - species determination
7. Current research topics on amphibians and reptiles:
   - review of relevant contemporary research
8. Methods of fieldwork and practical measures of protection:
   - monitoring

Involvement in ongoing herpetological research.

Course name**: SELECTED TOPICS IN TERRESTRIAL ZOOLOGY**
Number of ECTS credits: **6**

Content:
1. Introduction to Zoology of terrestrial animals
   - Diversity and evolution of terrestrial life
   - Systematic of terrestrial animals and evolutionary relationships
   - Principles of animal ecology: physical support, motion, energy, reproduction

- terrestrial environments and adaptations: terrestrial environments including aquatic ones

2. Structure and functional biology of terrestrial life and its environment
   - Overview of phyla with charactzeristics important for life in terrestrial ecosystems
   - Adaptations to environment
   - Population
   - Interspecific and intraspecific relations
   - Ecosystem: structure and diversity
   - Ecosystem: matter cycles and energy flow
   - Ecosystem: succession vs. equilibrium
   - Diversity of planetary ecosystems
   - Ecosystem: exploitation problems
3. Methods in terrestrial zoology research
   - Field study design in terrestrial zoology research
   - Observing, recording and sampling terrestrial animals
   - Data analysis in terrestrial zoology studies
   - Methods in taxonomy and systematics

Lab techniques for behavioral and ecological research in captive animals.

Course name**:** **ENVIRONMENTAL MICROBIOLOGY**
Number of ECTS credits: **6**

Content:
The students become acquainted with microbiology as a scientific discipline and a profession of science. At the same time students learn the basic principles of scientific thinking, and identification and evaluation of new knowledge.

The course is divided into the following sections:

1) Introduction to microbiology and historical overview of the development of environmental microbiology as a science.
2) Basic principles of microbiology (phylogenetic groups of microorganisms and their basic features, evolution, physiology, microorganisms).
3) Basic principles of microbial ecology and microbial diversity.
4) Microorganisms and the environment (soil, water, atmosphere, extreme environments).
5) Microbial interactions and interactions with other organisms.
6) Biogeochemical cycles and ecosystem services.
7) Methodological approaches in environmental microbiology (introduction of conventional and molecular approaches in microbiology, bioinformatics and data processing).
8) Applications in environmental microbiology.

Course name**:** **ENVIRONMENTAL TECHNOLOGY**
Number of ECTS credits: **6**

Content:
In the first part of the course students will be presented with a brief summary of the Slovenian and European legislation on environmental protection, followed by a review of industrial immission and emission into the environment.

Contamination of the atmosphere will be presented with a special emphasis on the general problem of global and local contamination of the atmosphere. The distribution of individual sources of pollution and contamination. The effects of impurities on the most important air quality will be analysed and an overview of the basic systems and equipment for the extraction of particles and gases from contaminated air will be provided.

The topic of waste management will include an overview of basic features, types and sources of solid waste. Featured will be the waste treatment, recycling, reuse of raw materials and utilization of waste energy potential.

Major topics:

1. SLO and EU legislation on environment protection
2. Environmental Protection Act with implemented regulations for the individual components of the environment
3. Emission and immission in the environment
4. Environmental Contaminants
5. Waste management technologies
   - Origin, classification and structure of waste
   - Waste Management Strategy
   - Procedures to conduct a comprehensive industrial and municipal waste in the SLO and the EU
   - Municipal landfills
   - Incinerators
   - Feature recycling processes
   - Waste Problems in SLO
6. Technologies to reduce air emissions and soil
   - Ways of limiting emissions of air pollution
   - Efficiency, usability and choice of air-cleaning systems
   - Control of industrial air pollution
   - Methods of reducing and control emissions in land
7. Environmental impact assessment
   - Standards, methodologies and certifications in the field of environmental impacts assessment and their use for ethical and socially responsible design, planning and evaluation of strategic development opportunities of organizations
   - Schemes for environmental labelling (Labeling) of the carbon footprint of products
   - Life Cycle Analysis (LCA)
   - Assessment of environmental impacts
   - Determination of the scenarios at the end of the product life cycle in the direction of sustainable use, namely, analysis and assessment of acceptability in terms of actual and potential environmental impact and for all foreseeable short-term or long-term, direct or indirect impact on the environment as a whole and its individual components.
   - The concept of Cradle to Cradle (C2C)

Course name**:** **ORNITHOLOGY**
Number of ECTS credits: **3**

Content:

- Introduction to Ornithology – importance, research fields, social research aspects (e.g. citizen science), influence of ornithological knowledge on society and science development
- History of ornithology and historical ornithological themes
- Bird flight
- Migration and circadian and annual cycles
- Bioacoustics of birds and territoriality
- Mating strategies and breeding systems
- Breeding biology (egg, types of bird nestlings, breeding strategies, reproductive success, habitat selection)
- Population dynamics – natality, mortality, limitations
- Biogeography of birds – distribution patterns, endemism, hybird zones, structure and dynamics of bird assemblages
- Ecology of birds – ecological guilds, interspecific interactions, ecosystem role of birds, bioindicators
- Avian conservation – threats, population trends, extinctions, documents of nature conservation related to birds, ornithologically important areas (EBA, IBA) and Natura 2000, examples from Slovenia

- Ornithological methodology – methods of bird study, fundamentals of field and laboratory work, museum techniques, bird trapping and individual marking of birds (ringing, telemetry), population survey and population estrimations, calculating population trends

Course name**:** **PALEOECOLOGY**
Number of ECTS credits: **3**

Content:

1. INTRODUCTION: Introduction to the basic disciplines of paleoecology: paleobotany (palynology, archaeobotany and phytoliths analysis), archaeozoology, determining the age of paleoecologic records, paleoclimatology.
2. PALINOLOGY, ARCHAEOBOTANY / PALEOBOTANY and PHYTOLITHS ANALYSIS: Presentation of research methods, interpretive possibilities and limitations of the diciplines, history of development of vegetation in the late Quaternary (with the emphasis on late Glacial and Holocene) in Europe and Slovenia, the impact of humans and climatic variation on vegetation development.
3. ARCHAEOZOOLOGY and PALEONTOLOGY: Former fauna - an indicator of environmental conditions and human impact on the environment, presentation of research methods, interpretive opportunities and constraints of dicsiplines.
4. AGE DETERMINATION OF PALEOECOLOGIC RECORDS: Presentation of chronological methods and the importance of accurate dating, temporal and spatial framework for environmental changes (start, progress and coexistence of events, local / regional / global change)
5. PALOCLIMATOLOGY: Climate fluctuations in the late Quaternary
6. PALEOEKOLOGIJA and NATURE CONSERVATION: Why is paleoecologic research of long-term environmental processes relevant to nature conservation, understanding of biodiversity and ecological renaturation, some examples
7. MULTIDISCIPLINARY PALEOECOLOGIC RESEARCH: Some examples of how the multi-disciplinary, multi-proxy research approaches can attain a higher level of information on former environment, discussion

Course name**:** **SYSTEMATICS AND PROTECTION OF LOWER PLANTS AND FUNGI**
Number of ECTS credits: **6**

Content:
The content of the course is divided into general topics, referring to the basic concepts and principles of the systematics and conservation, and the specific topics, referring to each group of treated organisms (algae, lichens, mosses, fungi).

Overview of treatment groups:

1. Algae
   - Characteristics of algae and cyanobacteria, morphological, cytological and physiological characteristics of individual groups and their propagation.
   - Taxonomy of algae: classic, molecular, origin, phylogeny and evolution
   - Ecology: terrestrial algae, marine algae, freshwater algae, lakes (phytoplankton, periphyton), river (periphyton)
   - Algae and pollution: toxic cyanobacteria and algae, eutrophication and ecosystem protection, algae as indicator organisms and the ecological assessment of rivers and lakes (water directive of the EU)
   - The economic importance of algae
   - Biotechnology and algae
   - Laboratory and mass cultivation of algae: food and pharmaceutical products, biofuels
   - Algae and paleolimnology
2. Lichens
   - Characteristics of lichens as a compound organisms, forms and methods of reproduction
   - Taxonomy of lichens: The basics of identification, Morphological and chemical signs
   - The importance of lichens in terrestrial ecosystems and their use

- The main ecological groups: epiphytes, ground, rock, wood,lichenic
- Protection and use of lichens in bioindication: Mapping of species, Mapping of the growth types, Accumulation indicators, Red Lists

3. Mosses
   - The main features of bryophytes and comparison with other embriophytes
   - Metagenesys, gametophyte and sporophyte structure
   - Taxonomy: The main groups (hornworts, liverworts and leafy mosses)
   - The importance of bryophytes in terrestrial and aquatic ecosystems
   - The main ecological groups: epiphytes, soil lichens, rocky lichens, water lichens
   - Protection and use of mosses in bioindication: Mosses as indicators of phytocenology, - Mosses as indicators of air pollution accumulation, Red Lists
4. Fungi
   - The main characteristics of the group, reproduction, life forms
   - Taxonomy of fungi: Classical, Molecular and comparability
   - Functional groups (which, performance, importance to the environment and humans): Saprophytes, Symbionts, Parasites / pathogens
   - Protection against fungi and fungi: Legal basis (Slo, EU), Ecosystem protection, Protection against fungi

Course name**:** **VEGETATION AND PLANT ECOLOGY**
Number of ECTS credits: **6**

Content:

1. Introduction:
   - Phytocenology-science of vegetation,
   - discipline in phytocenology,
   - history, vegetation surveys,
   - basic concepts, ecosystem, habitat, habitat, biocenosis, fitocenoza, plant communities, vegetation, biomedicine
2. Sinmorphology:
   - Fitocenological enumeration,
   - quantitative characteristics of plant communities,
   - qualitative characteristics of plant communities
3. Sinecology:
   - General on sinecology (= plant communities reflect the interaction of ecological factors inanimate and living nature),
   - classification and description of sinecological factors (climate, soil, geomorphology, biotic factors),
   - competition and coexistence of plant species
   - sinecological and autocecological amplitude,
   - survival strategies of plants (r / K concept, C / S / R concept)
4. Sindinamics:
   - Temporal changes in vegetation, cyclical changes (annual phenological change, vegetation fluctuations-fluctuations), non-cyclical change (succession, the characteristics and mechanisms of succession, types of succession,the importance of knowing succession stages)
5. Sinchronology:
   - The history of vegetation development
6. Sinchorology:
   - Boundaries between vegetation types (Continuum,discontinuum),
   - horizontal layout of vegetation (zonal, extraconal and azonal vegetation)
   - vertical layout of vegetation,
   - vegetation zones,
   - biomes,
   - vegetation maps
7. Sinsystematics:
   - Nomenclature rules
   - systematic units,
   - comparison of vegetation surveys (analytical tables, synthetic table),

- the importance of plant species in phytocoenological tables.
- methods of analyzing vegetation in sinsystematic (classification and ordination)

8. Review of vegetation in Slovenia:
   - Slovenia's fitogeographical areas,
   - an overview of vegetation types in Slovenia (the prevalence and characteristics).

Course name**:** **BIOTIC GLOBALISATION IN OCEANS**
Number of ECTS credits: **3**

Content:
- Terminology in biotic globalisation
- Bioinvasion processes in the marine environment
- Spreading of non-indigenous species and phases of introduction
- Impacts of bioinvasion
- Management of bioinvasion
- Tropicalisation – northward spreading of southern species
- Methods to study biotic globalisation

Course name**:** **ECOPHYSIOLOGY OF MARINE ANIMALS**
Number of ECTS credits: **6**

Content:
- Introduction to Ecophysiology.
  The sea environment. Marine ecophysiology.
- Environmental factors.
  Abiotic factors-temperature, salinity, nutrients, gases in the sea, pH, pressure, light and motion of the sea.
- Responses of organisms to changing environmental factors- regulatory, acclimatisation and adaptation. Acclimation. Extreme responses. Stress factors and stress response. Hypoxia and anoxia. Physiological adaptation to hypoxia conditions. Tolerance to anoxic conditions.
- Transport mechanisms.
  Cell membrane - transport of substances through the membrane. Gradient. Membrane potential. Passive and active transport through the membrane. Ion-exchange systems. Ion channels.
- Osmoregulation.
  Osmoregulation mechanisms in crustaceans and fish. The role of the enzyme carbonic anhydrase in marine organisms. Gills. Antennal gland. Kidneys.
- Biomineralization.
  Changes in the process of biomineralization of marine organisms as indicators of environmental change in the environment.
- Biomonitoring.
- Monitoring and changes in the environment by marine organisms.

Course name**:** **GEOGRAPHY OF THE MEDITERRANEAN SEA**
Number of ECTS credits: **6**

Content:
The course acquaints the students with the characteristics of the Mediterranean Sea and its catchment. In addition to basic oceanographic characteristics (morphology of the sea basins, water features, water movement, life in the sea) students will learn about the other geographical and landscape characteristics of the Mediterranean area (climate, geological structure, geomorphological processes, runoff water, etc.) , which are associated with the sea. A special emphasis will be made on understanding of the interactions between sea and land and sea and human. Special attention will be given to the contact between sea and land, and restricted as well as the wider coastal area.

Course name**:** **SELECTED TOPICS IN MARINE ZOOLOGY**
Number of ECTS credits: **6**

Content:

1. Introduction to Marine Zoology
   - Diversity and evolution of marine life
   - Systematic of marine animals and evolutionary relationships: promorphology, body cavities, diploblastic and triploblastic animals
   - Principles of animal ecology: physical support, motion, energy, reproduction
   - Marine environments and adaptations: pelagic, benthic and nektonic animals
2. Structure and functional biology of marine life
   - Marine protozoan
   - Phylum Porifera
   - Phylum Cnidaria
   - Phylum Mollusca
   - Phylum Annelida
   - Phylum Arthropoda
   - Phylum Bryozoa
   - Phylum Echinodermata
   - Phyllum Hemichordata
   - Phyllum Chordata: marine fishes, marine reptiles, seabirds and marine mammals
3. Methods in marine zoology research
   - Field study design in marine zoology research
   - Observing, recording and sampling marine animals
   - Data analysis in marine zoology studies
   - Methods in marine taxonomy and systematics
   - Lab techniques for behavioral and ecological research in captive seawater settings.

Course name**:** **MARINE BOTANY**
Number of ECTS credits: **6**

Content:

Introduction to marine botany

- Why study the course Marine Botany?
- Which organisms and communities are studied?
- Systematics of marine photoautotrophs
- Levels of diversity among marine photoautotrophs

Diversity of Algae

- Algae: definition, life forms, biochemistry
- Evolution of algae: the endosymbiotic theory
- Main characteristics (systematics, morphology, anatomy, reproduction, ecology) of selected algal taxa, with emphasis on Mediterranean Sea taxa

Classification and biogeography of seagrasses

- Main characteristics of seagrass families and genera, with emphasis on Mediterranean taxa
- Vegetative and reproductive morphology and anatomy of seagrasses
- Biogeography of extant seagrasses
- Ecosystem services

Special aspects of photoautotrophic communities in the northern Adriatic Sea and anthropogenic pressures on them

- Harmful algal blooms
- Non-indigenous and invasive species
- Threatened habitats and restoration measures

Biotechnological and environmental applications of marine photoautotrophs

- Food and other products (pharmaceuticals, biofuels, aquaculture)
- Environmental monitoring

Course name**:** **MARINE ICHTHYOLOGY**
Number of ECTS credits: **6**

Content:
Ichthyology and principles of fisheries biology
- Terminology
- Fish evolution
- Basic anatomy & physiology of fishes
- Zoogeography
- Reproductive strategies
- Why so many fish species?
- Ecological groups of fish
- Fish as ecological indicators
- Threats to fish populations
- Methods and techniques in ichthyology
- Principles of fisheres biology
- Fish resources
- Fish mariculture

Course name**:** **MARINE PROTECTED AREAS: SOCIAL ASPECTS**
Number of ECTS credits: **3**

Content:
1. Introduction
   - What is an MPA?
   - The MPA paradigm
   - The first MPAs
2. Attributes of the marine environment
   - Ecological differences
   - Management differences
   - Psychological differences
3. Maritime law
   - The development of customary international law
   - The United Nations Conventions on the Law of the Sea
   - Applying international law to MPA definition
4. Marine Policy
   - What causes policy change
   - Decision taking and policy making
   - The role of the organisations and institutions
5. Regional policy and the European Union
   - Regional policy
   - EU policy
   - Transboundary MPAs
6. Future issues
   - New technologies
   - New frontiers: the role of the international seabed authority
   - Climate change, sea level rise, ocean warming and acidification
7. Case study and role play
   - Introduction to the Lošinj MPA
   - MPA workshop
   - Review of the workshop and lessons learnt

Course name: **MARINE ECOTOXICOLOGY**
Number of ECTS credits: **3**

Content:
- Introduction to Marine ecotoxicology (history, definitions and aim).
- Major Classes of Pollutants (physical, chemical, biological)

- Contamination identification (nature, concentration, distribution, sources).
- Direct chemical methods for the identification, quantification and speciation of in/organic pollutants
- Determination and dynamics of the pollutants (fate of contaminants in abiotic compartments of the ecosystem).
- Dynamics of contaminants in living organisms: uptake and accumulation, elimination-detoxification, biomagnification.
- Acute responses and chronic effects (LC50, LD50, LOEC, NOEC, geno-toxic disease sindrome)
- Effects of pollutants on individuals, populations, and communities
- Toxicity and genotoxicity bioassays
- Biomarkers
- Impact on human health and activities (food resources, commercial interests, nature conservation, national/EU legislation)
- Monitoring of a marine pollution – Biomonitoring (case study Adriatic Sea Slovenia/Croatia).

Course name: **CONSERVATION ECOLOGY OF MARINE MAMMALS**
Number of ECTS credits: **3**

Content:
- Evolution of marine mammals
- Taxonomy, diversity and biogeography of marine mammals
- Life history and adaptations to a marine environment, physiological ecology and energetics
- Ecology, reproductive biology, communication, navigation and movements of marine mammals.
- Status of marine mammals
- Impact of fisheries and bycatch on marine mammals
- Impact of habitat loss and habitat degradation
- Marine mammals and tourism issues
- Population health and diseases, impact of biomagnifying contaminants
- Management, conservation and legislation
- Methods in marine mammal research: experimental design and field surveys, population abundance estimates, sampling methods and analysis in feeding ecology studies, research methods in fishery interactions studies.

Course name**: BIOLOGY AND CONSERVATION OF LARGE VERTEBRATES**
Number of ECTS credits: **6**

Content:

Part I: Introduction
- Large vertebrates: life histories, evolutionary strategies, and common ecological traits
- Ecological roles of large vertebrates in marine and terrestrial ecosystems
- General human-induced threats to large vertebrates

Part II: Conservation Biology of Large Marine Vertebrates
- Convergent evolution, life histories, adaptations and comparative physiological ecology
- Evolution, diversity and conservation ecology of elasmobranches, sea turtles, marine birds and marine mammals
- Status of large marine vertebrates and human-induced threats
- Impact of fisheries on large marine vertebrates
- Impact of habitat loss, degradation and pollution
- large marine vertebrates and environmental tourism
- Ecosystem-approach to conservation of large marine vertebrates, and dynamic population management in the light of climate changes
- Research methods in large marine vertebrates studies

Part III: Conservation Biology of Large Terrestrial Vertebrates
- Biology and diversity of large terrestrial vertebrates
- Population and conservation ecology of large European carnivores: brown bear, wolf, lynx

- Population and conservation ecology of large European herbivores: ungulates
- Intraspecific and interspecific interactions of large terrestrial vertebrates
- Anthropogenic threats and interactions of large terrestrial vertebrates with humans: values, hunting management, feeding, breeding, damages, introductions, reintroductions
- Habitat capacity and “social” carrying capacity
- Population management, conservation and legislation
- Research methods in large terrestrial vertebrates studies

Course name**: BIOLOGICAL MONITORING**
Number of ECTS credits: **6**

Content:
- The definition and concept of bioindication and biomonitoring.
- The purpose, strategy, principles, strengths and weaknesses.
- Environmental stress, environmental pollution and bioindication.
- Bioindication importance of environmental legislation.
- Means, methods and levels of bioindication / biomonitoring.
- Reservoirs and response (reaction) bioindication.
- Active and passive bioindication.
- Retrospective (historical) bioindication.
- Features and options of using different bioindication organisms and examples of good practice in Slovenia.
- Lichens and mosses as bioindicators of air pollution.
- Fungi as bioindicators of soil contamination.
- Higher plants as bioindicators of environmental pollution.
- Vertebrates (birds, mammals) as bioindicators.

Course name**: EPIZOOTIOLOGY AND PARASITOLOGY**
Number of ECTS credits: **6**

Content:
- Principles of disease and epidemiology
- Fundamentals of Microbiology and Bacteriology
- Basics on viruses, viroids, prions and fungi
- Review of parasites important for human and animal health; ecological role of parasites
- Medical and veterinary entomology
- Examination and bionomy of medically important insect vectors (sand flies, mosquitoes and others)
- Diagnostics in epidemiology and epizootiology.
- Diseases at the population level, the role of the disease as a mechanism for controlling population size.

Field and laboratory work (15 hours): Visit to the field study area and a captive holding center (game farm).

Specific topics:
- methods of determining the pathogens (field and laboratory techniques)
- methods for sampling the pathogens and their vectors
- interactions between host species and pathogens
- introduced species as disease factors
- examination of various parasites and vectors in the laboratory

In addition to lectures and tutorials, students will have the opportunity to be engaged in current research in epizootiology and parasitology.

Course name**: GENOMICS AND BIOTECHNOLOGY**
Number of ECTS credits: **6**

Content:
Genomics, a global analysis of the structure of genomes of organisms: sequencing and whole genome genotyping, global genetic maps, physical mapping, cytogenomics, expressed sequences mapping, positional cloning, identification of gene-based sequences. Genomic bioinformatics.

Transcriptomics, global analysis of expressed genes of the organism: mRNA and cDNA transcriptome subtraction hybridization, differential gene expression, global RNA expression analysis using microarrays (oligonukleotidni and cDNA chips). Data analysis and interpretation of biological

Proteomics, the global analysis of protein organism: proteins, protein modifications, protein-protein interactions and protein-DNA, tissue-specific proteome, proteomics methodology (electrophoresis, liquid chromatography, mass spectrometry), databases and data analysis. Global protein analysis using microarrays (protein chips).
Model genome sequencing projects and the use of genomic information of Arabidopsis and rice for horticultural crops.

Genomics applications in plant biotechnology: isolation of genes, the search for new active ingredients, the use of genomic diversity of plant pathogen diagnostics. Environmental genomics, metabolomics, and pharmacogenomics.

A basic understanding of ethical aspects associated with modern genomics (data protection, legal and ethical aspects of patenting).

Course name**: BUILT ENVIRONMENT AND SUSTAINABLE DEVELOPMENT**
Number of ECTS credits: **6**

Content:
1. GENERAL INTRODUCTION
   - The aims and role of the course
   - Review of the content of lectures
   - Review of the content of practical work
   - A review of exam
2. BUILT ENVIRONMENT AND SUSTAINABLE DEVELOPMENT
   - The built environment
   - Sustainable development
   - Restrictions of the enviroment capacity
   - Air quality in urban areas and built structures
   - Sound environment
   - Light environment
   - Renewable and non-renewable energy sources
   - RES renewable energy sources
   - Wind power
   - Energy from the sun
   - Geothermal energy
   - Biomass
3. SUSTAINABLE DEVELOPMENT AND BUILDING AN URBAN ENVIRONMENT
   - Urban development in relation to the cultural landscape
   - The structure and functioning of cities through time
   - Creation of a modern city
   - The modern city and sustainable development
   - Cities and strategies for rational management of space
   - Cities and the strategies of rational use of substances
   - Cities and waste management strategies
   - Cities and strategies of the rational management of water
   - Cities and energy management strategies
4. BUILT ENVIRONMENT AND GLOBAL CLIMATE CHANGE

5. SUSTAINABLE DEVELOPMENT AND ARCHITECTURE
   - Development of architecture in relation to the environment
   - Contemporary architecture and sustainable development
   - Rational use of materials in architecture; examples of good practice
   - Rational use of energy in architecture; examples of good practice
   - Natural lighting and architecture; examples of good practice
   - Integrated systems and environmentally friendly architectural design

Course name**: MATHEMATICAL BIOLOGY**
Number of ECTS credits: **6**

Content:

1. INTRODUCTION
   - Basic principles of mathematical modeling.
   - Introductory examples from ecology, evolution and epidemiology.
   - Classes of mathematical models (discrete-time and continuous-time, deterministic and stochastic).
2. DISCRETE-TIME MODELS
   - Motivating examples (cell division, propagation of annual plants, predator-prey dynamics). Metods of analysis: graphical methods (cobwebbing), linearization, fixed points, stability. Single species models.
   - Models for two interacting species.
   - Examples: host-parasitoid models (Nicholson-Bailey), population genetics (Hardy-Weinberg) etc.

3. CONTINUOUS-TIME MODELS
   - Introductory examples (growth of microorganisms, bacterial growth in a chemostat etc.).
   - Linearization, local stability analysis, qualitative methods (phase portraits).
   - Single species models (the Malthus model, logistic growth, Allee effect).
   - Models of two interacting populations: predator-prey dynamics (Lotka-Volterra, Rosenzweig-MacArthur), competition and symbiosis.
   - Infectious disease models: SI, SIR, SIS, etc. (when do we have an epidemic, final size of an epidemic, effects of vaccination).

Course name**: MULTIVARIATE STATISTICS IN ECOLOGY AND NATURE CONSERVATION**
Number of ECTS credits: **6**

Content:
In lectures and tutorials students will be theoretically and practically acquainted with the following regression and multivariate statistical techniques and ordinate techniques:

- R - a tool for statistical analysis
- Multiple regression
- Principal components analysis (PCA)
- Correspondent
- Canonical correspondences analysis
- Discriminative analysis
- Hierarchical classification
- Classification of the estimated number of clusters in advance

Course name**: ENVIRONMENTAL EDUCATION**
Number of ECTS credits: **6**

Content:
The course covers all major content, which derive from the development role of environment in space and environmental issues, such as water, air and soil pollution, waste management, the impact on the environment, environmental impact assessment, nature protection, communications with public, new

eco-technology to protect and restore the environment, as well as environmental economics and environmental sociology, law and environmental management including application and project management. The course is designed for obtaining a comprehensive insight into the environment. By identifying and exploring all the environmental elements an interdisciplinary attitude to the environment is created, and only as such, allow the inclusion of educational content.

Candidates learn about the natural and social factors of the environment, on the concrete cases they learn about environmental degradation and the individual research work acquire skills to transfer knowledge into teaching practice.

During the course current comprehensions from the environment are given, the course is also oriented into field work, especially learning about new methods of field work, which can be used in schools. Students learn about regional problems of environmental degradation on specific areas in Slovenia and abroad.

Major topics:
- Natural environment (surface water, rocks, soil, vegetation, climate, fauna).
- Social environment (village, population, economic and non-actions).
- Regional geography of selected regions in Slovenia (the Pannonian, Alpine, Karst, Mediterranean).
- Educational environmental projects.
- Methodological approaches to environmental education.

Course name**: LEGAL ASPECTS OF NATURE CONSERVATION**
Number of ECTS credits: **3**

Content:
Given that this Study programme is not primarily intended for law students, they must first be acquainted with Slovenian legislation, with special reference to nature conservation.
In this context, implementation in Slovenian law will be shown.

The course will examine nature conservation in the Slovenian constitution, in international legal acts, in European Union law and other legal sources of national legislation (statutes and statutory sources of law) and the relationship between these.

In the second part the course will examine regulations regarding valuable natural features: the process of their determination, protection of valuable natural features, the legal consequences of the status, the use of natural values etc.

In a similar way the legal regulation of biodiversity will be presented: the protection of plant and animal species in general and the protection of endangered species, as well as legal aspects of ecosystem protection.

The third section will address the regulation of nature protection measures: direct and indirect protection measures and enforcement of nature protection measures.

Course name**: FIELD PRACTICUM**
Number of ECTS credits: **3**

Content:
The course is conducted on the field with the exception of reports, submitted by the students after the completion of field work, and if necessary laboratory work.
Field exercises take place in groups, with the assistance of professor or assistant, as well as individually.

Students must complete at least 10 field days from three topics:
- Mandatory field days (4 days): contents are specified at the beginning of the academic year.

- Optional field days (4 days): students choose them by their choice. Field days are published regularly on the website of the faculty.
- Independent field days (2 days): Students carry out a short self-study.

The students must submit a report for each field work day.

Major topics:
Sampling of animals, plants and other organisms in aquatic and riparian, forest, grassland, subterranean and urban habitats, and sampling of abiotic and biotic parameters in different habitats.

Course name**:** **MANAGEMENT GENETIC RESOURCES**
Number of ECTS credits: **6**

Content:
Content will be presented in the following areas:

- Basic genetic resources: evolution and variability of plant species, taxonomy, presentation gene-centers of crops, and the beginnings of agriculture and the consequences for the development of modern agriculture.
- Types of genetic resources and meaning: the conventional kind: breeding for quality products, increase yields, tolerance to certain factors, unconventional types: food sources, medicinal plants, wild species
- The national programs of conservation of genetic resources: principles and objectives, strategies, initial programs, the international situation, the presentation of international organizations FAO and IPGRI
- Sources of genetic variability, the concept of genetic erosion, genetic resources inventory and collection of samples on the ground for storage in gene banks, the rules of modern collection
- Collection of Genetic Resources: Methods and Techniques collection; differences in feeding generative and vegetative propagated plants
- Gene banks: the presentation of international gene banks and description of gene banks
- Documentation of genetic resources by IPGRI (International Institute for Plant Genetic Resources), a division of descriptors: passport, management descriptors, descriptors of the site evaluation, descriptors of characterization and descriptors of the secondary evaluation
- Example of evaluation of genetic material reproduced generative and vegetative material, such as olives (UPOV descriptors and COI), figs (IPGRI descriptors), hops, buckwheat
- Methods of storage of genetic material in gene banks in situ and in vitro conservation: Proceedings of growth slowed, cooling systems, development of seeds during storage, recovery, storage of tissue culture, cryoconservation, storage cells, tissues and pollen.
- Examples of successful use of genetic resources in the world and in the Slovenian territory, the factors limit the use of genetic resources, prebreeding
- Structure and variability of populations: the study of genetic variability in populations, acquisition, wild and cultivated plants, population genetics, the study of genetic variability by calculating the parameters of genetic variability (expected and observed heterozygosity, alleles and effective alleles, zero alleles, the ability to distinguish or discriminate power of markers, probability of identical genotypes ,...)
- The study of plant genomes with applications (core, mitochondrial and chloroplast DNA)
- Introduction of modern biotechnological methods, the use of markers and their properties, application in the management of genetic resources (RFLP, RAPD, MS, AFLP, STS, SCAR, ramp, EST, SNP ,...)
- Methods of determining the genetic similarity, calculating coefficients of similarity, making a similar tree or dendrogram

Course name**:** **CONSERVATION GENETICS**
Number of ECTS credits: **6**

Content:
The course will focus primarily on **acquiring basic knowledge in the field of evolutionary genetics, which is necessary for understanding the use of information tools in biological sciences, with an emphasis on nature conservation.** The introductory part will show the evolution and molecular evolution; where the emphasis will be placed on the importance of polymorphism at the molecular

level and the neutral theory. The main content of the course will address the importance of **molecular ecology in nature conservation and the possibility of its use for better knowledge and long-term conservation of populations and species, including the presentation of some recent case studies from the Slovenian and wider European area.**

- What is conservation genetics?
- Genetics and extictions
- Evolutionary genetics of natural populations
- Genetic diversity and molecular markers (single locus)
- Characterizing genetic diversity: quantitative variation
- Evolution in large populations. Natural selection and adaptation
- Mutation, migration and their interactions with selection
- Evolution in small populations
- Maintenance of genetic diversity
- Effects of population size reduction
- Inbreeding
- Inbreeding depression
- Genetic viable population
- Resolving taxonomic uncertainties and defining management units
- Genetics and the management of wild and captive populations
- Reintroduction

Course name**:** **PROJECT LEADERSHIP**
Number of ECTS credits: **6**

Content:
The course is defined according to the theoretical definition of the project and teamwork. The aims of the projects, objectives, activities, expected results and effects are presented.
During the course, candidates learn about the next phase of the project:

- Definition of objectives (conception, design, pilot phase ...).
- Planning (study of execution, project structure, the basic phase, the time framework, the framework sources, indicative quote, term project organization at the macro level, documentation, also the possibility for foreign operators ...).
- Drawing up, monitoring (analysis of the results, consequences, prepare alternative solutions ...).
- Completion of the project (measured achievement of the objectives, analysis of deviations, the preparation of a database for the following projects ...).

The students became especially acquainted with the project management, which is very important for the success of the project. The students learn about all phases of the project and features within them. The basis of this course is to know the specifics of the project approach and project management.

Major topics:

- Project identification
- Collections project
- Project breakdown
- Networking
- Time analysis
- Determination of resources
- Cost analysis
- Conversion of the draft plan
- Projects and subprojects
- Projects and common resources
- Pursuing projects
- Administration of projects

Course name**:** **WILDLIFE HEALTH**
Number of ECTS credits: **6**

Content:
Lectures consist of seven key sections, which are complemented and upgraded. Some contenta are more detaily or practically presented at seminars, tutorials and field exercises. Field work present a major share of practical work and replaces the laboratory work.

The main themes are:

LECTURES AND SEMINARS

1. The definition of health or disease in individual animals, an animal population and population in an ecosystem community or ecoregion:
   - Most important and larger numbers of wild species in our country, territory, and migration of animals
   - Assessment of health, some general symptoms of the disease or disability, health, medical disability of individuals, infectious diseases common to several animal species, zoonoses, territorial disease (endemic), epidemic or epizootic and pandemic or panzoonoses, sepsis, death etc.
   - Social structure and its significance for health
   - Animal reproduction as an indicator of health and determination of youngsters and adolescents health.

2. Factors that affect health:
   - Environmental factors (infections with pathogens and toxic chemicals, especially heavy metals, pesticides and herbicides)
   - Environmental parameters that may influence the onset of disease in water systems, water pollution and animal diseases, especially fish and crustaceans,
   - Population density and size of living areas and urbanization interventions in the wild habitat of wildlife
   - Nutrition and diets (food chain) as a source of nutritious food, medicinal and toxic ingredients, seasonal features of diets
   - Pathogens and modes of their effect on the host, their propagation, resistance or sensitivity and pathogenicity and vectors
   - Natural disasters, particularly oil spills.

3. Major infectious diseases:
   - Common disesases for different animal species
   - Specific to individual species (mammals: carnivores, ungulates, hare, rodents, bats, marine mammals; birds; reptiles; amphibians; fish and crustaceans; bees)

4. Organ systems and interference in their functioning and specific diseases:
   - Skin
   - Locomotor apparatus
   - Nervous system and sense organs
   - Endocrine system
   - Digestive system (alimentary canal, digestion glands, digestion and metabolism)
   - Respiratory system
   - Circulatory and lymphatic system (including the heart)
   - Blood, haematopoietic and lymphatic organs and immune system,
   - Secretory organs
   - Reproductive organs,
   - Gestation and incubation and health or sickness of embryo.

5. Wild animals in captivity:
   - Refuge or rehabilitation center, ZOO, terrarium, aquarium, etc.
   - Injuries and other health problems that are the reason for referral and treatment of wild animals in a rehabilitation center,
   - Problems of handling animals (translocation) and return to nature,

- Treatment of animals in captivity (immobilization, the approach and examination, sampling, marking of animals, etc.)
- Regulations of the Slovenian Republic and EU, that cover this topic, including normatives,
- Legal and ethical definition of euthanasia,
- Health and frequent disease of wild animals in captivity
- Feeding the animals in captivity
- Hygiene and DDD (disinfection, disinfestation and rodent extermination).

6. Criteria for the assessment of change in health (bioindicators):
   - Animal behaviour and method for survey the change in health
   - Dead animals and assesment of causes of deadth as a indicator of health conditions in the environment.

7. Action:
   - Cooperation with the departments working in the field of nature protection and animal health, the relevant regulations, CITES documents,
   - The process of finding the affected wild animals (cubs, injured or otherwise disabled and infirm animals)
   - Sampling of the material of dead animals, live animals residuals etc.
   - Supervision, documentation of animals
   - Reports and proposals.

TUTORIALS:
- Documentation of the animals,
- Regulations and normatives (national and EU),
- Photos,
- Preparations (histological, anatomical),
- Reading and interpretation of diagnostic findings (parasitology, microbiology, hematology, biochemistry, toxicology) and animal health or the environmental burden.

FIELD WORK:
Exercises are performed in the organization with the relevant permission of the Ministry of Environment and Spatial Planning and the Veterinary Administration of the Ministry of Agriculture, Forestry and Food. The theme of exercises:
- Handling of animals and disinfection (hands, tools, space, germicidal barrier, etc.).
- Sampling of material for laboratory tests and some material testing.
- Preparation of rehabilitated animals to return to nature and the return process.
- Observation of animals in captivity (cages, terrarium, etc.) anf the assessment of their health.
- A survey of fauna in a natural resesrve (in arrangement with the appropriate hunting or other organization).

Comment: During the fieldwork students must have appropriate footwear, clothing and protective equipment (rubber gloves, gown, apron).

Course name**:** **LABORATORY PRACTICUM**
Number of ECTS credits: **3**

Content:
The course of laboratory practicum trains students in laboratory work and molecular techniques. Students are acquainted with the rules of laboratory work and the methods of handling hazardous, noxious and corrosive substances in the molecular genetics laboratory. Students will learn different techniques of isolation of DNA and RNA, and apparatus that is used to achieve best results; they learn principles of polymerase chain reaction (PCR) and optimisation options and they learn to assess the quality and quantity of the PCR product obtained. Students also learn to obtain the final results in the form of nucleotide sequences and / or DNA loci on the basis of selected methods (eg. microsatellites, AFLP, RAPD, NGS etc.). Additionally, the student will learn some ecotoxicological tests such as determination of chromosomal aberrations and influence of allopathy on seed germination.

Laboratory work is conceptually organised. Students will be presented with work plan in order to understand the procedures in detail before each exercise. Learned theory will be then transferred into practice. Student will produce a report for each exercise and organise their laboratory notebooks.

Course represents detailed training for research in practice. It enables students to transfer the theoretical knowledge into practice and at the same time encourage them to develop their research interests through researching and seeking information and finally shape learned facts into complete background for survey basis. Through the course students will gain insight into the results produced by molecular techniques and learn analysing the results and writing reports.

Course name**:** **PROTECTED AREA SYSTEMS**
Number of ECTS credits: **6**

Content:
System of protected and conserved areas: definitions; components of the system: protected areas, conserved areas, ecological networks, other effective area-based conservation measures, ecological corridors; international/national policies supporting effective systems of protected areas

Governance models: balance between economic development and biodiversity conservation; governance by government; shared governance; governance by private actors; governance by local communities

Management of threats to protected areas: identification and management of threats; Addressing the threats

Capacity development: capacity development approaches; capacity development at individual, organisational and system levels

Management planning: management plans

Business planning: business plans

Management effectiveness standards: the IUCN management effectiveness framework; standards for effective management; management effectiveness evaluation methodologies

Course name**:** **RESTORATION ECOLOGY**
Number of ECTS credits: **6**

Content:
Degradation of ecosystems and the decline of biodiversity are global challenges for humanity. The decline of ecosystem services in combination with global climate change also has a dramatic impact on human society - especially on the quality of life and the economy. The restoration of nature is therefore becoming a global political issue.
The United Nations has declared a Decade on restoration (2021-2030), and the leading role in the world with restoration ambitions is taken by the EU. According to the EU Biodiversity Strategy, 25,000 km of rivers should be restored by 2030, and according to the Nature Restoration Law, 30% of Europe's land and marine degraded habitats should be restored by 2030, 60% by 2040 and 90% by 2050. It is clear that new knowledge and retraining will be necessary to realize this goal, especially in the field of restoration ecology. The course therefore addresses a key development need in the coming decades.

Restoration ecology provides the science essential to the practice of ecologicl restoration. It is the process of assisting the recovery of an ecosystem that has been degraded, damaged or destroyed (SER 2004). Ecological theory informs the practice of restoration but the converse is also true: restoration science and practice can contribute to basic ecological theory (Palmer *et al.* 2016). The following main content areas will be covered.

1. Introduction to restoration ecology

Definition of restoration ecology, history and development of restoration ecology, importance of restoration ecology in the modern world.
2. Ecosystem processes and ecological theories
Ecological concepts and theories necessary for the restoration of ecosystems, natural processes of ecosystem recovery, establishment of balance in affected ecosystems, interactions between organisms in restored ecosystems.
3. Methods and approaches of ecosystem restoration
Basic steps in ecological restoration, restoration planning, definition of restoration goals, necessary knowledge and data, analysis of restoration methods, implementation of restoration activities, evaluation and adaptation. Importance and methods of management after restoration, ensuring sustainability. Restoration methods will be discussed in more detail for the following ecosystems:
freshwater - rivers, eutrophic lakes, reedbeds, marine estuaries, terrestrial - agricultural, forest.
4. Examples of successful restoration projects and practical challenges of ecosystem restoration
Case studies of restoration ecological projects from Slovenia and around the world, analysis of approaches that have led to successful restoration of ecosystems, measurement of success and sustainability of restoration projects.
5. The role of society in restoring ecosystems
Nature restoration as a platform for civil society involvement and awareness of the importance of nature protection. Policy implications and legislative challenges for realizing nature restoration ambitions. Future challenges and perspectives of restorative ecology.

SER. 2004. The SER International Primer on Ecological Restoration. www.ser.org
Palmer M.A., Zedler J.B., Falk D.A. (2016): Ecological theory and Restoration ecology. In Palmer M.A., Zedler J.B., Falk D.A. (eds.): Foundations of Restoration ecology. Island Press, Washington.