Ecology for non-ecologists

Subject: Ecology

Part of research school: ECOS, Ecology and society

Education cycle: Third

Marking scale: Passed / Failed

Prerequisites: Admitted to a postgraduate program. The course is suitable for all graduate students who do not specialize in ecology.

Pedagogical form: The course consists of lectures, interactive workshops, and self-study as the course aims at providing theoretical understanding of the concept of ecology. This will be tested with a written essay and presentation at the end symposium.

Literature: Townsend, C.R., M. Begon & J.L. Harper (2008) Essentials of Ecology. 3rd edition. (or later editions)

Additional information: The Department reserves the right to cancel the course if there are not more than 5 students who have applied for the course. There is no tuition fee. The student is responsible for any housing and travel costs. Students belonging to the ECOS research school have priority to the course.

Responsible department: Department of wildlife, fish and ecosystem studies

Location: Umeå

Populations, communities and ecosystems

Number of credits: 1.5 ECTS

Scope: Basic course, aimed at students with non-ecology background

Purpose: The aim of the course is to introduce basic ecology, particularly theory on populations, communities and ecosystems.

Learning outcomes: Upon completion of the course the student should be able to:

- Explain the concepts of population, community and ecosystem
- Describe how natural selection shapes individuals and populations
- Explain how births, deaths, and movement shape populations
- Apply theory on life tables to estimate changes in population size
- Summarize key processes in population ecology
- Apply theory on meta-population dynamics to study populations
- Apply theory on island biogeography to study communities
- Understand that communities are intimately linked with the abiotic environment by fluxes of energy and matter
- Understand the meanings of species richness and diversity indices

- Understand richness gradients with latitude, altitude and during community succession, and the difficulties of explaining them
- Give examples of bottom-up versus top-down control of ecosystems.

Content: The course starts with an introduction to ecology and the fundamental understanding of evolution to understand processes at the population, community and ecosystem scale. The course then continues with the concept of populations, discussing how the concepts of birth, death and movement shape populations over time. We will also highlight some of the key concepts of population ecology, such as r versus K species, density dependence processes and dispersal. We will then scale up from populations to communities, including meta-population dynamics and island biogeography. Last, we will elaborate on how biotic and abiotic aspects jointly shape ecosystems and discuss key aspects of ecosystem theory such as energy fluxes, and bottom-up versus top-down control of ecosystems.

Resources, competition and predation

Number of credits: 1.5 ECTS

Scope: Basic course, aimed at students with non-ecology background

Purpose: The aim of the course is to give the student an introduction to the main biotic interactions such as the different type of species interactions and consumer-resource interactions.

Learning outcomes: Upon completion of the course the student should be able to:

- Describe the variety of ways through which organisms may interact
- Explain the nature of, and contrast between, conditions and resources
- Describe how organisms deal with the consumption of different resources
- Describe the different ways through which organisms may interact over resources, such as intra- and interspecific competition and facilitation, and the effects of these interactions
- Understand the importance of direct and indirect effects and distinguish between bottom-up and top-down control of food webs
- Distinguish the similarities and differences among ‘true predators’, grazers and parasites
- Apply theory on optimal foraging to analyse foraging decisions made by animals
- Apply theory on trophic cascades to analyse interactions between carnivores, herbivores and plants

Content: The course starts with introducing the variety of ways through which organisms interact, including: mutualism, competition, facilitation, predation, etc. We will then continue with the concept of consumer-resource interactions within a food web, working on the concepts of resources, competition and predation. The course continues with the concepts of resources and conditions focussing on how organisms deal with variation in both. We will then continue with both intra- and interspecific competition for resources, including some evolutionary effects on competition. We will then continue to look at predators and parasites to complete the

food web. We will explore bottom-up and top-down control in food webs and discuss the concept of trophic cascades.

Conservation ecology

Number of credits: 2 ECTS

Scope: Basic course, aimed at students with non-ecology background

Purpose: The aim of the course is to give the student an introduction to conservation ecology.

Learning outcomes: Upon completion of the course the student should be able to:

- Be able to describe a variety of mechanisms through which humans affect the environment
- Describe several conservation ecological paradigms, such as strict protection, conservation through sustainable use, and rewilding, and the similarities and differences among these paradigms
- Describe the biological basics of sustainable harvesting
- Explain what causes species to be endangered
- Understand the population genetics of small populations and inbreeding
- Apply theory on ecosystem services to quantify the loss caused by degraded habitats
- Apply theory on communities, food webs and ecosystem functioning to construct conservation plans for species, communities and ecosystems
- Explain the concept of trophic downgrading and its possible consequences

Content: We will start with introducing how humans have influenced the environment, physically as well as chemically (pollution, climate change). We will continue with showing how the field of conservation ecology aims to provide the science to mitigate these negative anthropogenic effects by developing conservation measures based on theoretical understanding of populations, communities and ecosystems. This includes, among other things, use of knowledge of food webs and species interactions to sustainably manage pests and pollutants, and knowledge on population and community ecology to protect and conserve species and their habitats. We will show how conservation ecology has gone through several paradigm shifts and changing approaches towards conservation; strict protection during the early days of conservation, conservation based on sustainable use of resources, including the concept of ecosystem services, and more recently, conservation focused on restoring ecosystems and their functioning such as the concept of rewilding.