# Studieplan 2008/2009

## Master i anvendt økologi

### Studiepoeng: Arbeidsmengde i studiepoeng er: 120.

### Studiets varighet, omfang og nivå

The master of science in applied ecology is a full time study over 2 years, consisting of 120 ECTS credits according to § 3 in 'The regulation of requirement to a master of science degree appointed by the Ministry of Education and Research July 2nd, 2002 ("Forskrift om krav til mastergrad" fastsatt av Utdannings- og Forskningsdepartementet den 2. juli 2002). Half of the study (60 credits) consists of a master thesis in applied ecology.

### Innledning

### *1.1 Background*

Through evolutionary time species have gone extinct, sometimes in the form of mass extinctions. The background or 'natural' extinction rate is, however, negligible compared to the impact of man on species survival. The extinction of species today is estimated to be 100-1 000 times higher than the background extinction rate, estimated as the average extinction rate over the last 100 million years. There is good evidence that we are now approaching another mass extinction which would be solely due to human activity and surpass in extent any previous mass extinction.

Of the 13 million species assumed to be present in the world today, only 1.8 million have been scientifically described and named. The eradication of species, even before they have ever been described, is one of the major environmental threats today. In Norway alone, ca 15 000 species have been assessed as threatened, and as many as 3 000 species exist in the national 'red list' of species most vulnerable to extinction. Among the larger, most conspicuous species in Norway, 30 and 25 % of all mammals and birds, respectively, belong to the red list.

Extinction of species reduces biodiversity and its inherent value. More concretely the instrumental, or utilitarian, value of biodiversity is reduced by decreasing humans' possibilities to acquire goods (e.g. food, fuel, fibre and medicines), services (e.g. pollination, recycling, nitrogen fixation, homeostatic regulation), information (e.g. genetic engineering, pure science) and psycho-spiritual values (aesthetic beauty, religious awe, scientific knowledge).

The extinction of species also contravenes human intentions for sustainable development as agreed in international conventions. Even though the understanding of extinction of species is highly dependent

on evolutionary and ecological processes, there is a need today to incorporate such knowledge with an understanding of human impacts on ecosystems. In the present program we will focus on the biological processes and the scientific tools needed to understand and acquire knowledge about sustainable development of ecosystems, aiming to provide the competence needed among the many practitioners in the professional areas of education, management and research who will influence the sustainable development of our future.

## *1.2 Applied ecology*

Ecology is the scientific study of the interactions that determine the distribution and abundance of organisms. The 'applied' perspective often refers to how ecological knowledge can be used to achieve specific aims. The aims may be associated with the exploitation of natural resources, for instance as a sustainable harvest, or equally with the protection of the biodiversity of ecosystems. Human impacts such as habitat destruction and fragmentation, harvesting, biological control, the introduction of alien species, and discharge of environmental poisons or climatic gasses all contribute to changes in the environment. Today these changes are occuring at a much faster rate and to a greater extent than species are able to adapt to. However, ecological knowledge may be used to reduce the detrimental effects. For instance, remedial actions such as specific harvesting strategies or a landscape approach to areas of expansion may allow sustainable development between man and the environment. Sustainable development does, however, demand specific methods for monitoring the natural environment to identify deviations from the aims of management. Hence, in the present master program in applied ecology we focus on:

1) The ecological effects of human impact in nature;

2) The ecological effects of remedial actions;

3) Sustainable utilisation of natural resources; and

4) Wildlife- and habitat monitoring.

'Applied' in the present sudy program also refers to the ability to carry to completion a substantial piece of original research. We aim to train students to be able to plan, conduct, analyse and present results from ecological studies with management applications. Besides a strong foundation in the discipline of ecology, this requires knowledge of novel technology, mathematical and statistical skills, as well as a good command of English which is the scientific language. We will attach importance to the students' ability to acquire information and be critical of the sources refered to. Seminars and discussions will enhance students' ablities to evaluate 'accepted truths in ecology', and results and interpretations from other studies.

Despite the discipline of ecology being neutral in value, several topics in ecology touch on areas of conflicting values. Knowledge of the development of human ethical principles and attitudes is important to be able to communicate with various social groups that need ecological results. Hence, to complete the 'applied' perspective, a knowledge of social sciences as well as the development of communication skills, will run like a connecting thread throughout the study.

### *1.3 Why a master in applied ecology*

International conventions require a continuously higher level of consciousness regarding the use of natural resources and wildlife- and habitat monitoring. Norway, and the Nordic countries in general, hold a unique position in this context with large, relatively intact, wildlife areas which we have a special responsibility to utilise sustainable. As far as we know, we are the first educational institution in Norway, and among the Nordic countries, to prepare a master of science degree in applied ecology. Except for the University of Stavanger, all the universities in Norway either offer a master of science in ecology, or offer ecology as a major area of study within a master of science in biology. Characteristic of the master of science in ecology offered in Norway, is the focus on ecology as a basic science.

The master of science in applied ecology is also unique in Norway because it is proposed to be taught in English to give it an international perspective, and because theory and practice will follow each other continuously during the study.. The emphasis of the research program will be on empirical research addressing questions relevant to regional wildlife management.

## Læringsutbytte

The Faculty of Forestry and Wildlife Management aims to offer studies related to the sustainable utilisation of forest and unenclosed hinterland within an institutional area of commitment called ‘Green values’. With Green values we highlight the significance of nature, not only as an economic resource, but also for the well-being of humanity and the inherent value of biodiversity. It is the faculty’s objective to be actively involved in research programs addressing the application of ecological science and to increase internationalisation through student exchange programs, an increased number and improved level of courses taught in English and cooperative research programs with international institutions.

The Master of science in applied ecology aims to provide the opportunity for students to:

- Learn to conceive, plan and carry to completion a substantial piece of original research under the supervision of a professional in the field;
- Become familiar with contemporary knowledge and thinking in the field of applied ecology;
- Learn to communicate and participate in discussions on current controversial issues in ecology and the application of the science .
- Acquire in depth knowledge of:
    - Ecological topics at scales from individuals to global systems.
    - Human impacts due to harvesting, introduction of alien species, habitat destruction and fragmentation, population control, pollution and climatic changes.
    - The application of ecological methodology such as study design, statistical modelling, ecological technologies and analysis of wildlife and habitat monitoring.

## Målgruppe

Our aim is to target students and professionals who have a dedicated interest in wildlife, and the interaction between man and the environment. Herein we target professionals within wildlife

management who want to extend their competence in the field of ecology above the level of a bachelor.

Primarily we target students with a bachelor in ecology, (wildlife) biology, evolution, environmental sciences or such like. However, we encourage applicants with other bachelor degrees, or who can show an interdisciplinary bachelor degree, as long as they fulfil the entrance requirements (see chapter

## Kompetanse

The masters of science degree in applied ecology qualifies the student to:

1) Work as a research assistant, for instance with environmental impact assessment or wildlife- and habitat monitoring;

2) Work in decision making in private and public wildlife management at all levels from licensees, local authorities and ministries.

3) Work at educational institutions. Additional pedagogic background may be needed dependent on institutional requirements.

4) Enter a PhD-program in biology or likewise for a further career in research.

## Opptakskrav fritekst

To enter the program, a student is required to confirm they have achieved:

## Undervisnings- og læringsformer

Lectures followed by practical exercises both in the field and in the computer-lab. There will also be extensive use of seminars by student presentations and discussions as well as presentations by invited external professionals. See chapter 12 for a detailed description.

## Vurderingsformer

Se de enkelte emner

## Internasjonalisering

We propose the master of science in applied ecology to be taught in English. This to allow for international applicants, and to create an international student environment that will improve the quality of the study, not least through discussions of various ‘schools’ in ecology and human attitudes. We will encourage and make allowances for students who wish to study abroad for part of their degree. Such an international stay is recommended to take place during the second and/or third semester of the study depending on the courses the student may achieve abroad. In addition, we will accept qualified external supervisors of the master thesis from international universities and university colleges. Hence, an international stay may be used to carry out part of the master thesis.

Hedmark University College has several international agreements of collaboration. Specific to the Faculty of Forestry and Wildlife Management there are active student exchange programs with:

- University of Applied Sciences, Eberswalde, Germany
- Arnt-Moritz-University Greifswald, Germany
- University of Applied Sciences, Weihenstephan, Germany
- University of Freiburg, Germany
- School of Forestry, Basna Stiavnica, Slovakia
- Zvolen University, Slovakia
- Pacific Lutheran University, USA
- North Dakota State University, USA

The faculty also has student- and staff exchanges with the University of Fairbanks, Alaska, and African Wildlife Management College, Tanzania, and an agreement of intention with 12 Nordic institutions to cooperate on joint degrees in 'Nordic Ecosystem Management'.

## Studiets innhold, oppbygging og organisering

First semester: The basics of applied ecology and ecological scientific methodology, including the ability to gain knowledge from information technology.

Second semester: Discussing current topics in applied ecology, achieving competence in advanced monitoring technology and methodology, and deriving the question and plan for the master thesis.

Third semester: Same as the second semester, but with more emphasis on data collection for the master thesis.

Fourth semester: Analysing and completing the master thesis.

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## Emner

*Studiepoeng* År 1 År 2

- **Study design and statistical modelling**

  10 studiepoeng

- **Human impact in ecology and evolution**

  20 studiepoeng

- **Valgemne 10 Sp**

  10 studiepoeng

- **Current topics in applied ecology**

  10 studiepoeng

- **Human dimension in ecosystem management**

  10 studiepoeng

- **Master thesis in applied ecology**

  60 studiepoeng

# Emneoversikt

## 6SU321 Study design and statistical modelling

### Emnekode: 6SU321

### Studiepoeng: 10

### Språk

Engelsk

### Forkunnskaper

### Læringsutbytte

To learn the relationship between the scientific question, choice of study design, analyses and the presentation and interpretation of results.

### Innhold

The course will start with basic statistics, but quickly progress to advanced statistical modelling and the association between statistical modelling and study design. Example of topics: Basic statistical terminology such as population, sample, independence, various types of variables, statistical and biological significance, degrees of freedom, and statistical distributions; Basic descriptive and exploratory statistics; The applicability of statistical modelling with topics such as: Selection of the most parsimonious model through various procedures, AIC, Cp, average modelling, Bayesian modelling, and common sense; Generalised linear mixed models with various link functions and error distributions; Multivariate analysis; From statistical to predictive mathematical models.

### Organisering og arbeidsformer

Lectures and exercises in the computer-lab. Exercises in combination with 6SU 321 that result in individual written reports.

### Vurderingsordning

45 %: Statistics, structure and presentation of result in the three reports (15% each);
55 %: Oral exam

### Ansvarlig avdeling

Avdeling for skog- og utmarksfag

# 6SU311 Human impact in ecology and evolution

## Emnekode: 6SU311

## Studiepoeng: 20

## Språk

Engelsk

## Forkunnskaper

## Læringsutbytte

Acquire in depth knowledge in population biology and human impacts on ecosystems and in evolution.

## Innhold

Main emphasis will be given to the theory of population biology and the human impact on populations through habitat destruction and fragmentation, harvesting, introduction of alien species, population control and pollution. The course will also integrate topics on man’s impact on individuals through animal behaviour (e.g. mating systems, dispersal and migrations, habitat selection and colonisation) and community dynamics (e.g. biodiversity and global issues such as climatic changes).

## Organisering og arbeidsformer

Lectures, seminars and exercises. Exercises will be given in combination with 6SU 321 and result in written reports. Seminars will include presentations and discussions by student groups.

## Vurderingsordning

45 %: The scientific content of the three reports (15% each);
55 %: Oral exam.

## Ansvarlig avdeling

Avdeling for skog- og utmarksfag

# Valgemne 10 Sp

## Emnekode:

## Studiepoeng: 10

## Språk

Norsk

## Forkunnskaper

Se det enkelte emnet

## Læringsutbytte

Se det enkelte emnet

## Innhold

Se det enkelte emnet

## Organisering og arbeidsformer

Se det enkelte emnet

## Vurderingsordning

Se det enkelte emnet

## Ansvarlig avdeling

Avdeling for skog- og utmarksfag

# 6SU312 Current topics in applied ecology

## Emnekode: 6SU312

## Studiepoeng: 10

## Språk

Engelsk

## Forkunnskaper

6SU311

## Læringsutbytte

Getting updated in current topics in applied ecology.

## Innhold

Recent international publications in applied ecology:

## Organisering og arbeidsformer

One group of students present a recent publication in applied ecology, and another group of students function as referees in seminars.

## Vurderingsordning

An evaluation of the presentations and participation in the seminars.

## Ansvarlig avdeling

Avdeling for skog- og utmarksfag

# 6SU360 Human dimension in ecosystem management

## Emnekode: 6SU360

## Studiepoeng: 10

## Språk

Engelsk

## Forkunnskaper

## Læringsutbytte

Introduce the student to general theories and methods of social sciences applicable in wildlife management.

## Innhold

A basis for understanding the human dimension of natural resource management, and provide:

• An overall understanding of the multidisciplinary aspects of applied ecology in general, and the social scientific aspects of ecosystem management in particular;

• Appreciation of social, cultural and economic values of ecosystems;

• Insights into the conflicts in ecosystem management: their source and solutions;

• Insight of major social scientific disciplines and their approach to ecosystem management;

• Case studies and examples of the use of HD research and approaches to ecosystem management.

## Organisering og arbeidsformer

Lectures, seminars, readings and discussions.

## Vurderingsordning

Oral examination

## Ansvarlig avdeling

Avdeling for skog- og utmarksfag

# 6SU399 Master thesis in applied ecology

## Emnekode: 6SU399

## Studiepoeng: 60

## Språk

Engelsk

## Forkunnskaper

6SU 311, 6SU 312, 6SU 321, 6SU 322.

## Læringsutbytte

Acquire the competence of completing a substantial piece of scientific work in applied ecology.

## Innhold

An independent research project, where the student will plan, design and collect data from an empirical study connected to applied ecology, and analyse and present the results in the master thesis. The thesis will be in the form and structure of a manuscript intended to be submitted to an international scientific journal, but may be written in Norwegian.

## Organisering og arbeidsformer

work by the student under the supervision of a professional in the field.

## Vurderingsordning

Oral exam discussing the dissertation.

## Ansvarlig avdeling

Avdeling for skog- og utmarksfag