

# Studieplan 2015/2016

## Master in Sustainable Agriculture

**Studiepoeng: 120**

### Studiets varighet, omfang og nivå

#### Study length and academic level

The master in sustainable agriculture is a full time study over 2 years, consisting of 120 ECTS credits.

### Innledning

#### Introduction

In its report 'Our common future' from 1987 the World Commission on Environment and Development (the Brundtland commission) defined sustainable development as 'development that meets the needs of the present without compromising the ability of future generations to meet their needs'. Considerable efforts have been made after the Brundtland report within research, education and agricultural extension to apply the concept of sustainable development to agriculture. The master programme in sustainable agriculture at Hedmark University College is based on these efforts in its ambition to provide the knowledge and skills that its graduates will need in order to contribute to sustainable agricultural production systems in the future.

We consider sustainable agriculture to be an aspect of applied ecology. The main focus of applied ecology when it was defined as a discipline of its own was to increase agricultural productivity. Applied ecology focuses on the application of ecological concepts, theories, models and methods to address current real-world problems, with the ultimate aim to develop improved management practices of biological resources such as fish, wildlife, plants and their derivatives, as well as products from forestry, crops and livestock.

Sustainable agriculture therefore has to be based on a proper understanding of general ecology. Thus, the master program in Sustainable Agriculture will be implemented in close partnership with the program in Applied Ecology which is already a

well-established master degree program at the Faculty of Applied Ecology and Agricultural Sciences.

The Sustainable Agriculture Education Association (SAEA) defines sustainable agriculture as ‘food and agricultural systems that are environmentally sound, economically viable, socially responsible, non-exploitative, humane, and that serve as a foundation for future generations’. This fairly flexible definition does not confine the concept of sustainable agriculture to specific approaches like organic farming or conservation agriculture, but it does also not exclude such approaches. Examples of institutions of higher learning that offer master degree programs in sustainable agriculture include Iowa State University (USA), University of Minnesota (USA), Charles Sturt University (Australia) and Mediterranean Agronomic Institute of Chania (Greece). Within Scandinavia, the programs in agro-environmental management and agrobiolology at Aarhus University (Denmark), agroecology at the Swedish University of Agricultural Sciences and agroecology at the Norwegian University of Life Sciences are examples of close relatives to master degree programs in sustainable agriculture.

In the Norwegian context, the food production has slightly declined over the past few years, while the Government’s ambition is to increase food production by a rate similar to the Norwegian population growth rate. In order to improve this situation, there is a need for increased competency on all levels of the agricultural sector. A recent assessment of the need for professionals compared to the number of graduates within agricultural sciences shows that Norway will face an increasing shortage of staff with degrees within agriculture.

In general terms, the challenges that Norwegian agriculture has to face are the same as the global agricultural challenges:

- Increasing the food production over time to feed a growing human population
- Maintaining and improving sufficient areas of productive land
- Avoiding environmental pollution from agriculture
- Contributing positively in the struggle against global warming
- Producing high quality food that will improve the health of the consumers
- Securing the primary producers good income and recognition in the society

In order to respond effectively to the above-mentioned challenges and expectations, society has a need for professionals who have a broad training in various aspects of sustainable agricultural production.

## Læringsutbytte

**By completing the Master study in Sustainable Agriculture the candidate:**

*Knowledge:*

- has advanced knowledge on important theories and issues relating to sustainability within agriculture and specialised insights into farm level technologies that can contribute to making agricultural production more sustainable
- has thorough knowledge on efforts to improve agricultural sustainability within different paradigms and theories, such as conventional agriculture, conservation agriculture, organic agriculture and integrated pest management
- can apply knowledge to scientific and practical challenges within widely different contexts, ranging from industrialised commercial farming to subsistence agriculture
- can analyse academic problems based on an interdisciplinary understanding of the interaction between agriculture, natural environments and human societies

*Skills:*

- can analyse and deal critically with sources of information ranging from peer reviewed scientific articles and own primary research data to statements by farmers and environmental activists in order to structure and formulate scholarly arguments
- can work independently on practical and theoretical problems in the interface between biology and technology as well as between profitable production and environmental concerns
- can use relevant methods including various data collection techniques and statistical modelling for research and scholarly development in an independent manner
- can carry out an independent research or development project that will address agricultural theories or practices from a sustainability perspective

*General competency:*

- can analyse relevant academic, professional and research ethical problems, specifically those problems that concern appropriate agricultural technology and environmental impacts of agricultural production
- can apply knowledge and skills within sustainable agriculture to address climate change issues as well as other new challenges that the agricultural sector will face in the future
- can communicate own independent work on sustainable agriculture as well as other academic work within the subject area to researchers and other specialists as well as to the general public
- is able to contribute to new thinking and innovation processes within agriculture based on technological and biological knowledge and skills as well as a general understanding of the role of agriculture in the society

## Målgruppe

### Target group

The program targets students who are dedicated to agriculture and who want to have an in-depth knowledge of issues in the interface between agronomy, technology and the environment.

## Kompetanse

### Qualification attained

### Careers

The master degree graduate in sustainable agriculture will be qualified for:

- Research and advisory services in agriculture
- Public service relating to agriculture at municipal, county and central government levels
- Teaching in various educational institutions. Additional training in pedagogy may be needed.
- Entering a PhD program within agricultural sciences or applied ecology.

## Opptakskrav

To enter the program, the students are required to have a bachelor's degree within agricultural or related sciences (e.g. agronomy, soil science, crop science, animal science, agricultural engineering, agricultural economics, forestry or wildlife management) and to confirm the achievement of either:

A Norwegian bachelor degree, or an education recognized as being equivalent to a Norwegian bachelor degree

An education recognized as three years of higher education in Norway

Education approved as equivalent to the above-mentioned degrees according to University law § 3-4

Note that bachelor degrees (3 years of study) from a number of countries are recognized only as 2 years of higher education in Norway. Among these are most South American countries, USA, Russia and a number of Asian and African countries like India and Nigeria. For more information on recognition criteria visit NOKUT.

Your degree from higher education has to include the equivalent of at least 80 ECTS credits of the following subjects:

Minimum 7,5 ECTS-credit equivalents in statistics or similar topics;

Minimum 72,5 ECTS-credit equivalents in agricultural or related topics, e.g. agronomy, soil science, crop science, agricultural engineering, agricultural economics, forestry or wildlife management.

The study may be limited to a certain number of students decided yearly. In this case the ranking of students will follow the average weighted (ECTS credits) marks from your degree in higher education.

English language requirement

All non-native English speakers must provide official documentation of English language proficiency at the level of Norwegian upper secondary school/high school. English must have been the primary foreign language in at least seven years in primary, secondary and upper secondary school, alternatively an A-level exam in English. Applicants who do not fill these requirements, or are not sure that they do must take one of the following tests:

- TOEFL with a score of 500 (written), 170 (computer based), 60 (internet based)
- IELTS with a score of 5.0

## Undervisnings- og læringsformer

### The assessment methods:

The assessment methods are described under each of the courses within the program.

## Vurderingsformer

### Assessment methods

Throughout the study the assessment of the achievement of objectives will be provided in various ways. Most of the courses require students to give oral presentations and include assessment of portfolios with written reports. The different types of evaluation will prepare the student for working with the master thesis and the oral presentation of this work. 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.

The teaching- and learning methods are described under each of the courses within the program.

## Internasjonalisering

### Internationalisation

The master program in sustainable agriculture will be taught in English language and in close cooperation with the faculty's study program in applied ecology, which is already advanced in internationalisation. We expect to recruit international students into the program and students will be able to do elective courses or data collection abroad within the second year of the study program. This will create an international student environment that will improve the quality of the study. 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.

The international network will include institutions of higher learning that offer similar programs. Specifically, cooperation will be sought from Aarhus University, with which the Faculty of Applied Ecology and Agricultural Sciences already has an active cooperation within other disciplines. Quota program partners in low income countries and Eastern Europe will be actively involved in supervision of international students with quota stipends, who will be expected to do the data collection for their master thesis at their home university.

Hedmark University College has several international agreements of collaboration. Specific to the Faculty 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

### Content, structure and organisation

#### First semester

The students will read Concepts in ecology (6EV310), Study design and statistical modelling (6EV311) and Human impacts on ecological systems (6EV320). These courses are given by the Department of forestry and wildlife management at the study site Evenstad, but will be partly or fully given by video transmission at Blæstad.

#### Second semester

The second semester will comprise a 15 credits course in Agroecology (6JB310) and a 15 credits course on Technologies for sustainable agricultural systems (6JB320). These courses will be offered by Department of Agricultural Sciences, Blæstad.

#### Third and fourth semester

The students will have a choice whether to do a 60 ECTS credits or a 30 ECTS credits master degree thesis. In choosing a 30 ECTS credits thesis the student will select 30

ECTS credits of relevant elective courses in an another department within Hedmark University College or within another recognised institution of higher learning, either within Norway or abroad.

The elective courses have to be approved by the department, with a deadline of three months in advance of the start of the courses.

### Courses

Emnekode	Emnets navn	S.poeng	O/V *)	Studiepoeng pr. semester	
				S1(H)	S2(V)
1st year of study					
6EV310	<u>Concepts in ecology</u>	7,5	O	7,5	
6EV311	<u>Study design and statistical modelling</u>	7,5	O	7,5	
6EV320	<u>Human impacts on ecological systems</u>	15	O	15	
6JB320	<u>Technologies for sustainable agricultural systems</u>	15	O		15
6JB310	<u>Agroecology</u>	15	O		15
2nd year of study					
6JB391	<u>Master Thesis in Sustainable Agriculture (60 ECTS)</u>	60	O	30	30
Sum:				0	0

\*) O - Obligatorisk emne, V - Valgbare emne

### Courses

Emnekode	Emnets navn	S.poeng	O/V *)	Studiepoeng pr. semester	
				S1(H)	S2(V)
1st year of study					
6EV310	<u>Concepts in ecology</u>	7,5	O	7,5	
6EV311	<u>Study design and statistical modelling</u>	7,5	O	7,5	
6EV320	<u>Human impacts on ecological systems</u>	15	O	15	
6JB320	<u>Technologies for sustainable agricultural systems</u>	15	O		15
6JB310	<u>Agroecology</u>	15	O		15
2nd year of study					
6JB390	<u>Master Thesis in Sustainable Agriculture (30 ECTS)</u>	30	O		30
Sum:				0	0

\*) O - Obligatorisk emne, V - Valgbare emne



# Emneoversikt

## 6EV310 Concepts in ecology

**Emnekode:** 6EV310

**Studiepoeng:** 7,5

### Semester

Høst

### Språk

English

### Forkunnskaper

None

### Læringsutbytte

A candidate with fulfilled qualifications will have the following learning outcome:

Knowledge:

A broad understanding of central concepts in ecological theory, with emphasis on evolution, behavioural ecology, population biology and community ecology.

Skills:

Become familiar with the process of reading, understanding and writing scientific literature.

General competence:

Acquire the ability to evaluate ecological research, and learn to communicate and participate in discussions on the application of ecological theory in practical conservation and management.

## Innhold

Central topics in ecological theory, with focus on evolution, behavioural ecology, population biology and community ecology. Extensive training in analyzing research publications and reports, and critically reviewing the aim, methods and conclusions. Thereby learning the process of scientific writing. The students will be introduced to study design and learn how to analyse and discuss data from ecological studies by producing two shared reports with the course in Study design and statistical modelling. This course establishes the basis needed for the subsequent course Human impacts on ecological systems.

## Organisering og arbeidsformer

Lectures, seminars and exercises. Some exercises will be given in combination with the course Study design and statistical modelling. The introduction and discussion part of these reports from these exercises counts for the course Concepts in ecology. The methods and results counts for the course Study design and statistical modelling. Seminars will include presentations and discussions by student groups.

## Obligatoriske krav som må være godkjent før man kan avlegge eksamen

## Vurderingsordning

- two written reports (count 20% each)
- individual written exam (60%).

Grading according to ECTS-system on scale A-E for passed and F for failed.

## Ansvarlig avdeling

Avdeling for anvendt økologi og landbruksfag

# 6EV311 Study design and statistical modelling

Emnekode: 6EV311

Studiepoeng: 7,5

## Semester

Høst

## Språk

English

## Forkunnskaper

None

## Læringsutbytte

A candidate with fulfilled qualifications will have the following learning outcome:

Knowledge:

The student has a good understanding of basic statistical terminology.

Skills:

The student can apply statistical models in ecology and interpret model outcomes and predictions. The student is able to present statistical results in scientific reports.

General competence:

The student is familiar with the use and limitations of statistics in ecology.

## Innhold

The course will start with basic statistics, but quickly progress to advanced statistical modelling and the association between statistical modelling and study design.

Basic statistical terminology: population, sample, independence, various types of variables, statistical and biological significance, degrees of freedom, and statistical

distributions; Basic descriptive and exploratory statistics.

Application of statistical modelling: Connection between sampling and statistics; Selection of the most parsimonious model through various procedures, AIC, Cp, average modelling and common sense; Generalised linear mixed models with various link functions and error distributions; Multivariate analysis; From statistical to predictive mathematical models.

Presentation of statistical results, and the writing of the 'scientific story'

## Organisering og arbeidsformer

Lectures, seminars and exercises. Some exercises will be given in combination with the course Concepts in ecology. The introduction and discussion part of these reports from these exercises counts for the course Concepts in ecology. The methods and results counts for the course Study design and statistical modelling. Seminars will include presentations and discussions by student groups.

## Obligatoriske krav som må være godkjent før man kan avlegge eksamen

### Vurderingsordning

- Assessment of a portfolio including two written reports and one exercise (45%).
- Oral exam (55%).

Grading according to ECTS-system on scale A-E for passed and F for failed.

### Ansvarlig avdeling

Avdeling for anvendt økologi og landbruksfag

# 6EV320 Human impacts on ecological systems

Emnekode: 6EV320

Studiepoeng: 15

## Semester

Høst

## Språk

English

## Forkunnskaper

The following courses of the master in applied ecology or equivalent courses from other universities: Concepts in ecology; Study design and statistical modelling

## Læringsutbytte

A candidate with fulfilled qualifications will have the following learning outcome:

Knowledge:

A broad understanding of how humans modify ecological systems including impacts on animal populations, communities, ecosystems, and landscapes. Students will also gain an understanding of global change and how it may impact ecological systems.

Skills:

Present and discuss current issues of applied ecology.

General competence:

An in-depth understanding of the role of humans in ecosystem dynamics. Being familiar with key terms of conservation biology and natural resource management.

## Innhold

Applying basic theory to the conservation and management of ecological systems. Students will gain additional exposure to reading and understanding scientific articles and scientific writing. The students will gain additional exposure to study design, data analysis and interpretation with a focus on applied ecology.

## **Organisering og arbeidsformer**

Lectures, seminars, and computer exercises. Seminars will include presentations and discussions by student groups and outside speakers.

## **Obligatoriske krav som må være godkjent før man kan avlegge eksamen**

Portfolio including oral presentation and written reports

## **Vurderingsordning**

Written exam - 4 hours. Grading according to ECTS-system on scale A-E for passed and F for failed.

## **Ansvarlig avdeling**

Avdeling for anvendt økologi og landbruksfag

# 6JB320 Technologies for sustainable agricultural systems

Emnekode: 6JB320

Studiepoeng: 15

## Semester

Vår  
3

## Språk

English

## Forkunnskaper

None

## Læringsutbytte

**By completing the course in technologies for sustainable agricultural systems the candidate:**

*Knowledge:*

- has advanced knowledge within the theory and practice of environmentally friendly technology and specialised insights into sustainable farm mechanisation.
- has through knowledge of the scholarly theories and methods within field mechanisation as well as farm buildings.
- can apply knowledge on sustainable technology to various conditions with respect to soil, climate, production system and farm size.
- can analyse real life problems within agriculture on the basis of knowledge on sustainable technologies.

*Skills:*

- can analyse and discuss critically various sources of information within sustainable

agricultural technologies and use them to structure and formulate scholarly arguments.

- can analyse existing theories, methods and interpretations within agricultural engineering and use such theories, methods and interpretations to work independently on practical and theoretical problems.

*General competency:*

- can analyse relevant academic, professional and research ethical problems relating to agricultural technologies.
- can communicate about academic issues, analyses and conclusions within environmentally friendly technologies, both with specialists and the general public.
- can use knowledge and skills within sustainable technological systems to contribute to new thinking and innovation processes.

## **Innhold**

### **Content:**

- Alternative mechanisation in bioproduction systems
- Efficiency in mechanisation systems
- Precision farming systems
- Precision tools in animal husbandry
- Smart buildings
- Management and information systems in agricultural production
- Man-machine systems in bioproduction
- Innovation and product development
  - Logistics of farm products
- Consequences of climatic changes for farm mechanisation
- Methods for increased farm production and in farm product management
  - Choice of level of farm mechanisation and labour intensity

## **Organisering og arbeidsformer**

### **Organization and work forms:**

Lectures, seminars, excursions and exercises. Seminars will include presentations and discussions by student groups.

## **Obligatoriske krav som må være godkjent før man kan avlegge eksamen**

**Mandatory requirements that must be approved before you can take the exam:**



None

## Vurderingsordning

### Valuation scheme:

Assessment of an individual portfolio that includes two written reports (30% each) and an individual oral exam (40%). Grading according to ECTS-system on scale A-E for passed and F for failed.

It is required that all exams are passed for the subject to be evaluated as passed.

## Ansvarlig avdeling

Avdeling for anvendt økologi og landbruksfag

# 6JB310 Agroecology

**Emnekode: 6JB310**

**Studiepoeng: 15**

## **Semester**

Vår  
4

## **Språk**

English

## **Forkunnskaper**

None

## **Læringsutbytte**

**By completing the course in agroecology the candidate:**

*Knowledge:*

- has advanced knowledge within the theory and practice of agroecology and specialised insights into production systems that enhance sustainability including ecological management of pests and diseases.
- has thorough knowledge of the scholarly theories and methods within agroecology including various competing interpretations of the concept.
- can apply knowledge on agroecology to various conditions with respect to soil, climate and production systems.
- can analyse real life problems within agriculture on the basis of knowledge within agroecology.

*Skills:*

- can analyse and discuss critically various sources of information within agroecology and use them to structure and formulate scholarly arguments.
- can analyse existing theories, methods and interpretations within agroecology and use

such theories, methods and interpretations to work independently on practical and theoretical problems.

*General competency:*

- can analyse relevant academic, professional and research ethical problems within agroecology.
- can communicate about academic issues, analyses and conclusions within agroecology, both with specialists and the general public.
- can use knowledge and skills in agroecology to contribute to new thinking and innovation processes.

## **Innhold**

**Content:**

- The concepts and history of agroecology and sustainability
- Description and analysis of agroecosystems
- Production systems that enhance sustainability: Polyculture, cover crops, mulching, crop rotation, minimum tillage, agroforestry
- Ecological management of insect pests, pathogens and weeds
- Toward sustainable agriculture – designing alternative agricultural systems

## **Organisering og arbeidsformer**

**Organization and work forms:**

Lectures, group discussions, study visits, laboratory exercises, project work.

## **Obligatoriske krav som må være godkjent før man kan avlegge eksamen**

None

## **Vurderingsordning**

**Valuation scheme:**

Assessment of an individual portfolio that includes two written reports (30% each) and an individual oral exam (40%). Grading according to ECTS-system on scale A-E for passed and F for failed.

It is required that all exams are passed for the subject to be evaluated as passed.

## **Ansvarlig avdeling**

Avdeling for anvendt økologi og landbruksfag

# 6JB391 Master Thesis in Sustainable Agriculture (60 ECTS)

Emnekode: 6JB391

Studiepoeng: 60

## Semester

Høst / Vår  
1-4

## Språk

English

## Forkunnskaper

Prerequisites: 6EV310 Concepts in Ecology, 6EV311 Study Design and Statistical Modelling, 6EV320 Human Impacts on Ecological Systems, 6JB310 Agroecology and 6JB320 Technologies for Sustainable Agricultural Systems, or similar courses.

## Læringsutbytte

Teaching methods:

**After completing the master thesis the student:**

*Knowledge:*

- has advanced knowledge on the tradition, theories, methods and research as well as extensive knowledge on the most updated scientific literature within a specific agricultural topic that the student has chosen.

*Skills:*

- can plan and design scientific activities, collect and analyze data for scientific research.
- can analyze and deal critically with various sources of information and use them to

structure and formulate arguments.

- can carry out an independent research or development project of considerable size.
- can present the results from the research project in the master thesis.

*General competency:*

- can communicate own scientific research as well as other important research findings based on scientific literature to researchers as well as to students, farmers and the general public, both in written and oral form.
- can analyze relevant research ethical problems.

## Innhold

### Course contents:

The thesis will be an independent scientific investigation into a topic within the broad concept of sustainable agriculture. 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 either in English or a Scandinavian language.

## Organisering og arbeidsformer

### Organization and work forms:

Independent work under individual supervision by one of the department's scientific staff.

## Obligatoriske krav som må være godkjent før man kan avlegge eksamen

### Mandatory requirements that must be approved before you can take the exam:

The student will have to submit a research proposal for approval by the supervisor and the department, and will also have to give an oral presentation of the proposal.

## Vurderingsordning

### Assessment methods:

Individual written thesis with oral presentation and discussion. Grading according to ECTS-system on scale A-E for passed and F for failed.

## Ansvarlig avdeling

Avdeling for anvendt økologi og landbruksfag

# 6JB390 Master Thesis in Sustainable Agriculture (30 ECTS)

Emnekode: 6JB390

Studiepoeng: 30

## Semester

Vår  
3 and 4

## Språk

English

## Forkunnskaper

Prerequisites: 6EV310 Concepts in Ecology, 6EV311 Study Design and Statistical Modelling, 6EV320 Human Impacts on Ecological Systems, 6JB310 Agroecology and 6JB320 Technologies for Sustainable Agricultural Systems, or similar courses

## Læringsutbytte

**After completing the master thesis the student:**

*Knowledge:*

- has advanced knowledge on the tradition, theories, methods and research within a specific agricultural topic that the student has chosen.

*Skills:*

- can plan and design scientific activities, collect and analyze data for scientific research.
- can analyze and deal critically with various sources of information and use them to structure and formulate arguments.
- can carry out an independent, limited research or development project.
- can present the results from the research project in the master thesis.



*General competency:*

- can communicate scientific research to researchers as well as to students, farmers and the general public, both in written and oral form.
- can analyze relevant research ethical problems.

## **Innhold**

### **Course contents:**

The thesis will be an independent scientific investigation into a topic within the broad concept of sustainable agriculture. 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 either in English or in a Scandinavian language.

## **Organisering og arbeidsformer**

### **Organization and work forms:**

Independent work under individual supervision by one of the department's scientific staff

## **Obligatoriske krav som må være godkjent før man kan avlegge eksamen**

### **Mandatory requirements that must be approved before you can take the exam:**

The student will have to submit a research proposal for approval by the supervisor and the department, and will also have to give an oral presentation of the proposal.

## **Vurderingsordning**

### **Assessment methods:**

Individual written thesis with oral presentation and discussion. Grading according to ECTS-system on scale A-E for passed and F for failed.

## **Ansvarlig avdeling**

Avdeling for anvendt økologi og landbruksfag