

ENVIRONMENTAL SCIENCES

[The Regulations for the Degree of Philosophiae Doctor \(PhD\) at the Norwegian University of Life Sciences](#) apply for the PhD education. The regulations concern the objectives of, responsibility for, admission to, and implementation and completion of the PhD education, including collaboration on PhD education with another degree-conferring institution. For all references in the text, these Regulations apply.

PROGRAMME OF STUDY

The PhD programme in Environmental Sciences at the Department of Environmental Sciences (IMV), Norwegian University of Life Sciences (NMBU) consists of the following programme options:

- Environmental and Natural Resources
- Soil Science and Agronomy (biogeochemistry, plant nutrition and soil physics in natural and cultivated ecosystems)
- Radiation Ecology

MAIN OBJECTIVES

The PhD programme in Environmental Sciences shall qualify students for research of international standard and for other work in society where there are high demands on scientific insight and analytical thinking, in accordance with recognised scientific principles and standards in research ethics. The PhD programme in Environmental Sciences is a doctoral programme that will educate independent researchers of international calibre in conjunction with national and international research communities.

PLACE IN THE NORWEGIAN QUALIFICATIONS FRAMEWORK

Level 8, philosophiae doctor (PhD)

DEGREE ON COMPLETION OF THE PROGRAMME OF STUDY

PhD

SCOPE

The PhD programme has a nominal duration of three years' full-time study, divided into a minimum of 30 credits for the PhD education and 2.5 years for research work and completion of the dissertation.

OWNER AND CONTACT DETAILS

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COLLABORATION WITH OTHER INSTITUTIONS

There is extensive national and international collaboration among the research communities at IMV. PhD candidates are brought into such networks and collaboration along the same lines as other academic staff. Supervisors are responsible for ensuring that candidates are invited to relevant meetings and networks, and collaborate with research communities outside the department and NMBU.

SOCIETAL RELEVANCE

The PhD programme in Environmental Sciences offered at IMV shall qualify students for research of international standard and for other work in society where there are high demands on scientific insight and analytical thinking. Environmental Sciences builds on different disciplines that are combined and developed, often as a response to the emerging impact of environmental problems on society. The PhD programme in Environmental Sciences encompasses the subject areas of geology, soil (biogeochemistry and plant nutrition), water (limnology and hydrology) and environmental chemistry, ecotoxicology and radiation protection.

Geological PhD research is relevant to society through its contributions to a better understanding of geological processes and abiotic nature (geosystem services). This covers the interaction between the climate and the natural environment over time, the shaping and use of the landscape, and sustainable and environmentally adapted use of geological resources, including groundwater.

The relevance to society of biogeochemistry and plant nutrition is linked to the management of soil as a resource, related to improved and safe environmentally-friendly food production, handling contaminants, carbon storage and regulation of greenhouse gas emissions. Soil is important to the entire ecosystem in order to regulate the effects of a changed climate and land use. PhD research will cover the interaction between soil and other elements, and how knowledge about soil is important in order to understand processes in the ecosystem that affect society globally; e.g. drinking water quality and soil quality in relation to food production.

Water-related research within the PhD programme will be of great relevance to ecosystem-based water management, and a cohesive approach to national and international challenges associated with water resources and water contamination. Freshwater is a limited resource that is affected by changes in weather and climate conditions. The interaction between water balance and water quality is crucial in this respect. Implementation of the EU's Water Framework Directive has recently brought this issue to the fore, and the reference state and pollution levels are central issues.

Environmental chemistry and ecotoxicology require exposure (chemistry) to a biological response (biology). This subject area is therefore of direct scientific relevance to management of the Pollution Control Act, the Radiation Protection Act, the EU's Water Framework Directive, etc. The Pollution Control Regulations were amended in 2012, and the term environmental contaminant now covers metals, organic compounds and radioactive substances. Research related to the discharge of environmental contaminants from different sources, transport and dispersal in different ecosystems, biological uptake and early effects on the level of individual, the population and the ecosystem, and assessment of consequences and risks are thus highly relevant to society.

ADMISSION REQUIREMENTS

See sections 5 and 6.

The general requirement for admission to the PhD programme of study in Environmental Sciences is a relevant master's degree. Other formal requirements are stipulated in NMBU's PhD Regulations. Candidates are thoroughly assessed in terms of academic qualifications and communication skills in English. Foreign applicants must document approved competence in written and oral English (see section 5.2). Admission as a PhD student is contingent on the documentation of full funding of salary for at least three years, and necessary funds to run the project in accordance with the project budget and for the required coursework.

LEARNING OUTCOMES

The PhD programme in Environmental Sciences is a doctoral programme that will educate independent researchers of international calibre in conjunction with national and international research communities. The PhD programme will qualify students for research work and for other work where there are high demands on scientific insight. The PhD programme seeks to meet the current and future needs for competence in order to conduct research, development and dissemination at universities, other public and private institutions, enterprises and organisations.

KNOWLEDGE

On completion of the PhD programme in Environmental Sciences, new doctors are expected to:

- Have in-depth knowledge within their subject area in environmental sciences, and to be at the forefront of knowledge within their specific area of research.
- Have in-depth knowledge about scientific theories and methods associated with the field.
- Be able to assess and analyse different theories, methods and processes in research and scientific development projects – also from an international perspective.
- Contribute to the development of new knowledge, new theories and methods in the field.

SKILLS

On completion of the PhD programme in Environmental Sciences, new doctors are expected to:

- Be able to formulate problems and hypotheses, plan and conduct research and scientific development work of high international calibre within their field.
- Know how to use the scientific equipment, instruments and analysis tools of their field of specialisation.
- Master relevant statistical methods and be able to assess the utility and limitations of different statistical methods.
- Have conducted original research that has led to new knowledge that can be published in international peer-reviewed journals.
- Be able to handle complexity, create an overview, and synthesise scientific information.
- Be able to perform critical assessments and give constructive criticism on scientific work in their field.
- Be able to handle criticism constructively, and address it.
- Be able to disseminate research results orally and in writing, in both scientific and popular scientific forums.

GENERAL COMPETENCE

On completion of the PhD programme in Environmental Sciences, new doctors are expected to:

- Be able to conduct their research with professional and ethical integrity, and be able to identify and evaluate relevant environmental and ethical issues.
- Be able to manage interdisciplinary tasks and projects.
- Be able to disseminate research and development work through recognised national and international channels, and participate in scientific debates within the subject area.
- Be able to disseminate the results of their research work to the business sector, the authorities and public administration, and to the general public through contact with the media.
- Be able to place own research in larger scientific and societal contexts.
- Be able to assess the need for and, if required, stimulate innovation in the field.
- Have some experience with teaching students within their subject area or area of specialisation when this is possible.

LEARNING ACTIVITIES

MEANS OF ACQUIRING THE KNOWLEDGE

- Required coursework of a minimum of 30 credits that consists of a combination of compulsory and elective courses in the subject area, providing comprehensive in-depth competence. The required coursework will be adapted to the PhD student's individual specialisation in the subject area, based on his/her master's degree.
- Reading and keeping updated on literature within his/her field of specialisation.
- Work on the synthesis (i.e., the introductory chapter) of the thesis, where the candidate has independently written an introduction that provides a theoretical and practical background for the

research work, discusses and justifies the choice and use of research methods and puts the results as a whole in an international perspective.

- Participation in national and international meetings and conferences.

MEANS OF ACQUIRING THE SKILLS

- Participating in planning and shaping the PhD project in detail and, if applicable, participating in the planning of new project applications.
- Supervision and own research, where the PhD student actively benefits from the competence of the supervisory team.
- Developing his/her own academic network outside the supervisory team.
- Attending courses and conferences when relevant.
- Working on publications, submissions to journals, handling remarks from referees, and working on the thesis.
- Participating in peer review of scientific manuscripts, giving feedback on colleagues' manuscripts, and attending seminars where the ideas and results of other PhD students and researchers are discussed.

MEANS OF ACHIEVING GENERAL COMPETENCE

- Taking a course on research ethics with a recommended scope of at least 5 credits.
- Supervision and own research.
- Working on publications and the thesis.
- The trial lecture, by familiarising him/herself with a specified topic quickly, time management, searching for / selecting / evaluating / processing information, giving an oral presentation.
- Presenting own research findings at national and international scientific conferences.
- Giving lectures to students and/or being a teaching assistant within his/her area of competence when this is possible.

EVALUATION OF LEARNING OUTCOMES

The objectives and input to learning outcomes will be evaluated in the final instance by means of a trial lecture and public defence of the thesis. The required coursework is evaluated using different forms of evaluation, such as an oral or written examination, submitting assignments or a term paper. The content of the doctoral work and the required coursework is approved by the research committee, and the progress is monitored by means of annual progress reports and the compulsory seminars (introductory seminar, midway assessment seminar and final seminar). Other input to learning outcomes does not need to be evaluated, but the principal supervisor is responsible for ensuring that the objectives are met through relevant measures, scientific discussions and steps towards dissemination work within the time frame of the doctoral work.

The degree of philosophiae doctor (PhD) is conferred on the basis of:

- approved completion of the required coursework
- an approved doctoral thesis
- an approved trial lecture on a specified topic
- an approved public defence of the doctoral thesis (disputation)

See section 12.

ACADEMIC CONTENT AND STRUCTURE

Based on a relevant master's degree, the PhD candidate will carry out an independent work of research that will lead to a scientific thesis of high academic quality. The candidate must learn critical thinking skills, how to disseminate knowledge, and academic collaboration. The PhD education will be provided in close interaction with a team of at least two supervisors who will assist the candidate in the process with issues related to theory, experiments and concepts, and the rest of the research community around the PhD student.

Geology

The programme will offer a broad scientific approach on complex geological processes in the landscape and the interaction between the natural environment and the climate over time, better exploitation of groundwater and mineral resources and flood reduction measures. The key words are paleoenvironment, paleoclimate, hydrogeology and agrogeology. The programme will offer a scientific focus on the paleoenvironment, the paleoclimate and geological resources.

Soil (biogeochemistry and plant nutrition)

The programme will provide a broad scientific approach and in-depth expertise on complex biogeochemical processes in soil in the fields of soil chemistry, soil physics and soil biology in both cultivated and natural systems.

Limnology and hydrology

The programme offers a broad scientific approach to key limnological and hydrological issues, especially processes linking watershed and freshwater systems. Key words: limnology, hydrology, freshwater biology, water chemistry, run-off. Scientific focus on biological, chemical and physical processes in freshwater systems within topics like eutrophication, primary production, natural organic material (humus), and lake dynamics, based on lake and sediment samples, and modelling tools. Limnology and hydrology are subjects that synthesise knowledge from a number of basic subject areas in biology, chemistry, mathematics, physics, geology, pedology, etc.

Environmental chemistry

Environmental chemistry linked to ecotoxicology covers substances (e.g. metals, salts, organic compounds, radionuclides) in different ecosystems and processes that affect transport, biological uptake and effects on organisms in the environment in the short and long term. The programme links exposure (chemistry) to response (biology), and represents a broad scientific approach to the areas of environmental contaminants – sources – transport – biological uptake – early effects – consequences and risk assessments. The programme will provide scientific specialisation in subjects that focus on environmental contaminants: sources, consequences and risk assessments, with emphasis on mechanisms, processes and kinetics. To reduce uncertainties associated with risk assessments, the focus will be on key factors that cause the greatest uncertainties. Research related to radioactivity in collaboration with other stressors is also a topic at the Centre for Environmental Radioactivity (CERAD), NMBU's only Centre of Excellence, which has been established at IMV, and is financed by the Research Council of Norway (2013–2022).

All PhD students must attend three regular seminars at the department, in accordance with section 9.1: an *introductory* seminar before submitting the application for approval of the education plan, a *midterm assessment* seminar about 1.5–2 years into the PhD education, and a *final* seminar before submitting the doctoral thesis. The midterm assessment must be carried out in accordance with section 9.2. The seminars are considered part of the required education plan and the quality assurance of the PhD programme of study, and will give the students useful feedback for the work ahead.

PhD students must submit annual progress reports on a standard [form](#). The first of these must be submitted 6 months after the start date, then every year. Deviations from the plan must be explained. The requirement of a progress report is set out in section 9.1. PhD students and supervisors share responsibility for progress.

INTERNATIONAL PERSPECTIVE

There is extensive national and international collaboration among the research communities in environmental sciences at IMV, and they participate in a number of international research networks (e.g. EU projects). PhD students must be brought into such networks and collaboration along the same lines as other academic staff. Supervisors are responsible for ensuring that candidates are invited to relevant meetings and networks, and collaborate with research communities outside the department and NMBU.

PhD candidates are encouraged to take courses in the Nordic countries and elsewhere abroad, and to spend a period of time at a foreign research institution during their PhD contract.

RESEARCH COMMUNITY LINKED TO THE PROGRAMME OF STUDY

The Department of Environmental Sciences has a broad scientific portfolio that covers geology, soil, biogeochemistry, plant nutrition, limnology, hydrology, environmental chemistry, ecotoxicology and radiation protection. The doctoral work will provide expertise and specialisation in one of these areas of research.

A PhD student's principal supervisor is appointed from among the department's permanent academic staff (professors, associate professors and researchers). Employees in adjunct associate professor or adjunct professor positions may serve as the principal supervisor as long as a member of the academic staff with a permanent contract is the co-supervisor. Other researchers with relevant expertise can be appointed as co-supervisors, also those who come from other national or international institutions.

RESEARCH WORK IN CONNECTION WITH THE PROGRAMME OF STUDY

The research work shall be an independent, scientific work that fulfils international standards and is of high academic quality (see section 10). The work will be planned and carried out in consultation with the supervisors and any external partners. A realistic milestone plan must be drawn up, so that the work can be completed, and the thesis submitted by the end of the contract period. The principal supervisor has general responsibility for ensuring that the plan is realistic.

The progress of the research work must be reported in the annual [progress report](#).

SUPPORT FUNCTIONS AND INFRASTRUCTURE

The PhD students will have office space at IMV. The principal supervisor will arrange for space in the laboratory when this is required.

IMV's IT staff will buy computers for the PhD students, offer support, and provide access to software, printers and the Internet.

The research committee at IMV reviews applications for admission, education plans, proposals for evaluation committees, and monitors the quality and progress of each candidate's PhD education. The research committee's secretary carries out the day-to-day administrative and advisory functions in relation to PhD students.

EXCHANGES

IMV facilitates national and international exchanges. PhD candidates are encouraged to take international courses, and to spend a period of time at a foreign research institution during their PhD contract.

ACCESSIBILITY

General information about universal design and special arrangements at NMBU: <http://www.nmbu.no/lmu>.

WORDING OF THE DIPLOMA

PhD programme in Environmental Sciences

The PhD programme in Environmental Sciences is based at the Department of Environmental Sciences at NMBU, and will provide expertise and specialisation in one or more of the department's areas of research within environmental sciences. These areas include geology, soil, biogeochemistry, plant nutrition, limnology, hydrology, environmental chemistry, ecotoxicology and radiation protection. The PhD education shall qualify students for research of international standard and for other work in society where there are high demands on scientific insight and analytical thinking. The PhD candidate will complete an education that offers deeper and broader competence, based on a relevant master's degree, and will carry out an independent work of research leading to a scientific thesis of high academic quality.

The degree of philosophiae doctor (PhD) is conferred on the basis of:

- Approved completion of the required coursework
- An approved doctoral thesis
- An approved trial lecture on a specified topic
- An approved public defence of the doctoral thesis (disputation)

The programme is based on the general description of the *PhD Education at NMBU*, and is regulated by the *Regulations for the Degree of Philosophiae Doctor (PhD) at the Norwegian University of Life Sciences*.