

Master's Degree Programmes in Environmental Science

There are two master's degree programmes under the main subject of Environmental Science in Kuopio campus: Environmental Health and Technology (ENHET) and Biology of Environmental Change (BEC). The curriculum of both programmes consists of 120 credit points (Cp, ECTS), including language and communication skills studies, methodological studies, advanced level studies (including master's thesis (40 Cp), as well as alternative studies. The major subject studies are complemented with alternative studies in environmental science, biology or in other disciplines e.g., forestry, environmental law and policy, statistics, or sustainable development.

If a minimum of 20 ECTS is completed in one discipline, it will be marked as a minor subject in the degree certificate. All teaching is given in English.

The curriculum consists of lectures, exercises, book exams and hands-on training in research groups. Students will achieve comprehensive knowledge in at least one specialised subject, generic core competencies for scientific research, and skills to apply field-specific methods in the laboratory. If needed, teaching can be organised remotely.

The Master's thesis includes an experimental element. The aim is to improve the student's skills in data collection, data analysis and to evaluate the student's ability to report and discuss the observed results scientifically in relation to existing data and knowledge.

In the beginning of the studies, a personal study plan (PSP) shall be prepared for each student with the assistance of the teacher tutor. In order to facilitate the preparation of the PSP, the courses are organised in modules based on their subject and level (basic/advanced).

Practical training in research institutes or other relevant workplaces (max 10 Cp) can be included in the degree.

Master's Degree Programme in Biology of Environmental Change (BEC, main subject environmental science in Kuopio campus) is a research-oriented programme that aims to increase student's knowledge of biological and biogeochemical aspects of the state of the environment. It is designed to give the higher university degree (MSc) to students who already have accomplished the lower university degree (BSc) in an appropriate field of science (environmental or biological science).

Studies in biology of environmental change will provide the students with advanced knowledge on the effects of environmental change on ecosystems and their bioprocesses, especially the interactions between atmosphere and ecosystems. The studies are divided into study modules of which the *environmental ecology study module* focuses on understanding the interactions in ecosystems and the importance of environmental changes in ecosystem interaction situations. The *biogeochemistry study module* focuses on the underlying processes of climate change and human-induced changes in ecosystems. Advanced studies provide a good understanding of the research activities on biological impacts of environmental change at universities and research institutes and to act as a leading expert in environmental monitoring.

Master's Degree Programme in Environmental Health and Technology (ENHET, main subject environmental science in Kuopio campus) is a highly multidisciplinary and research-oriented programme, aiming at combining comprehensive understanding of human exposure and health

effects with technological solutions to reduce the effects. Focus is on environmental agents such as air pollutants, ionizing and non-ionizing radiation and chemicals as well as methods needed to produce meaningful risk assessment from such information. Students may specifically focus on e.g., air pollutants, sustainable water quality, occupational hygiene, or radiation protection. Environmental informatics provides a basis for analysing big data typical of environmental health and technology research. Master's Degree Programme in Environmental Health and Technology gives superb competence to work in research positions in universities and research institutions, in environmental health control and occupational hygiene related jobs in companies and administrative agencies both nationally and internationally.

General Courses on Environmental Health and Technology cover core courses on a wide range of environmental health related topics including exposure assessment, environmental risk assessment, and advanced occupational hygiene. In addition to the general courses, we offer several study modules for advanced knowledge on the following topics:

Air Pollutants, Aerosols and Health module provides advanced knowledge in indoor and outdoor air pollutants, especially fine and nanoparticles, their sources, emission control technologies, health outcomes and risk assessment. This module is ideal if you wish to pursue a career in environmental administration, environmental regulatory agencies, private sector or research.

The radiation module includes courses on biological effects and health risks of radiation, including both ionising and non-ionising radiation. All approaches of environmental health research are used, including in vitro studies, animal studies, epidemiology and exposure assessment. This kind of combination of courses and research provides a unique possibility to become a radiation biology specialist.

Water module specializes in water quality and technology topics including water hygiene and microbial risk assessment, conventional and most up-to-date purification technologies, and prevention of water pollution. The study environment includes a unique water laboratory which offers excellent facilities for the simulation of even pilot-scale purification processes. This study package is suitable for students who wish to pursue a career in water monitoring, regulatory agencies and companies dealing with water treatment or research.

Curriculum of Environmental Science 2021-2022

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|---|---------------|
| MSc degree | 120 Cp |
| Language and communication studies | min. 2 Cp* |
| Methodological studies | min. 8 Cp* |
| Advanced level studies** | min. 80 Cp* |
| MSc thesis | (40 Cp*) |
| including Maturity test | (0 Cp*) |
| Alternative studies | min. 25 Cp |
| Select studies so that the overall amount of credit points is 120 Cp | |
| * Compulsory studies | |

General skills studies for international students

| Code | Course | Cp | Timing |
|---------|---|----|--------------|
| 1131003 | Orientation for International students | 1 | Every autumn |
| 8031003 | University Study Skills | 1 | Every autumn |
| 8031006 | University Computing Skills | 2 | Every autumn |
| 8020280 | Information skills and Sources in Science for Int. Students | 1 | Every autumn |
| 8014301 | Finnish 1 | 4 | Every autumn |
| 3622111 | Basic Statistics in English | 5 | Every autumn |
| 3710453 | Environmental Health for International Students | 5 | Every autumn |
| 3710236 | Applied Water Chemistry | 2 | Every autumn |
| 3710707 | General Microbiological Methods | 2 | Every autumn |
| 3710463 | Home Exam on Basics of Non-ionizing Radiation | 4 | Every autumn |

**Advanced level studies in Environmental Science (min. 80 Cp), study years 2021–2023

Compulsory advanced level studies (43 Cp)

| Code | Course | Cp |
|---------|---|----|
| 3710001 | MSc Thesis/Pro Gradu | 40 |
| 3710004 | Maturity test in MSc | 0 |
| 3710036 | MSc Thesis Seminar in Environmental Science and Biology | 3 |

Methodological studies (8 Cp)

| Code | Course | Cp |
|---------|--|-----|
| 3710418 | Design of Ecological and Environmental Experiments* | 4 |
| 3710557 | Environment and Health - Research Seminars | 1 |
| 3710028 | Personal Study Plan to MSc Degree (PSP MSc)* | 1 |
| 3123101 | Philosophy and History of Biology* | 3 |
| 3710487 | Implementation of Teaching or Scientific Events in Environmental Science | 1-3 |

*compulsory study

Advanced level studies, Environmental Health and Technology, 3710 978

General courses on Environmental Health and Technology

| Code | Course | Cp | Timing |
|---------|-------------------------------------|----|--------------|
| 3710465 | Environmental Risk Assessment | 5 | Every autumn |
| 3710435 | Exposure Assessment | 3 | Every autumn |
| 3710477 | Exposure Measurements and Modelling | 6 | Spring 2022 |
| 3710475 | Chemicals, Environment and Health | 5 | Every spring |
| 3710402 | Advanced Occupational Hygiene | 3 | Autumn, 2022 |
| 4455703 | Environmental Epidemiology | 3 | Spring, 2023 |

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|----------------|---|------|--------------|
| 3710441 | Sisä- ja työymp. mittaukset ja riskien arviointi (SMR) (in Finnish) | 5 | Spring, 2023 |
| 3710458 | Environmental Data Mining | 5 | Every autumn |
| 3710459 | Advanced Course on Environmental Data | 5 | Every spring |
| 3513028 | Advanced Geographical Information Systems | 5 | Spring 2022 |
| 3710713 | Practical Training, advanced studies | 3-10 | Continuously |
| 3710712 | Project Work in a Research Group | 3-10 | Continuously |
| 3710302 | Specific Book Exams | 3-10 | Continuously |

Courses on aerosols and air pollutants

| Code | Course | Cp | Timing |
|----------------|---|-----------|---------------|
| 3710481 | Health Effects of Air Pollutants and Nanomaterials | 6 | Autumn 2021 |
| 3710472 | Air Pollution Practicals | 5 | Spring, 2023 |
| 3352703 | Climate Change | 5 | Autumn 2022 |
| 3352707 | Aerosol Physics I | 5 | Spring 2023 |
| 3352708 | Aerosol physics II | 5 | Spring 2023 |
| 3352710 | Atmospheric Physics and Meteorology | 5 | Autumn 2021 |
| 3352709 | Atmospheric Chemistry | 5 | Spring 2022 |
| 3710482 | Combustion, Emissions, and Control Technologies | 5 | Spring 2022 |
| 3710443 | Sisäilman epäpuhtauksien hallinta ja ilmanvaihto (in Finnish) | 5 | Autumn 2021 |

Radiation

| Code | Course | Cp | Timing |
|----------------|--|-----------|---------------|
| 3710404 | Radiation Biology | 5 | Spring 2021 |
| 3710470 | Radiation Biology Practicals | 5 | Spring 2022 |
| 3710410 | Dosimetry of Ionising Radiation | 3 | Spring 2023 |
| 3710446 | Radioecology and toxicology | 5 | Autumn 2021 |
| 3710483 | Measurements and Dosimetry of Non-ionising Radiation | 6 | Autumn 2022 |
| 3710464 | Radiation Biology Journal Club | 2 | Continuously |

Sustainable Water Quality and Technology

| Code | Course | Cp | Timing |
|----------------|---|-----------|--|
| 3710460 | Advanced Water Hygiene | 5 | Spring, 2022 |
| 3710401 | Health-related Environmental Microbiology | 4 | Autumn 2022 |
| 3710223 | Water Chemistry and Treatment Practicals | 3 | Every autumn, continues to spring semester |
| 3123195 | Sustainable Water Management | 5 | Spring, 2022 |

Advanced level studies, *Biology of Environmental Change*, 3710979

General courses on Biology of Environmental Change

| Code | Course | Cp | Timing |
|----------------|---|-----------|---------------|
| 3710475 | Chemicals, Environment and Health | 5 | Every spring |
| 3710458 | Environmental Data Mining | 5 | Every autumn |
| 3710459 | Advanced Course on Environmental Data | 5 | Every spring |
| 3513028 | Advanced Geographical Information Systems | 5 | Every spring |
| 3710713 | Practical Training, advanced studies | 3-10 | Continuously |
| 3710712 | Project Work in a Research Group | 3-10 | Continuously |
| 3710302 | Specific Book Exams | 3-10 | Continuously |
| 3123196 | Genetic Modification of Organisms | 5 | Spring 2022 |
| 3123186 | Optical Methods in Plant Biology and Environmental Research | 5 | Every autumn |

Environmental ecology

| Code | Course | Cp | Timing |
|-----------------|---|-----------|---------------|
| 3123172 | Advanced Taxonomic Collection | 2-6 | Continuously |
| 3710486 | Chemical Ecology | 5 | Autumn 2021 |
| 3123190 | Community Ecology | 4 | Autumn 2022 |
| 3123175 | Current Issues in Aquatic Ecotoxicology | 2 | Autumn 2021 |
| 3710462 | Ecological Risk Assessment | 5 | Every spring |
| 3123198 | Function of Plants in Changing Environment | 8 | Spring 2023 |
| 3710485 | Entomology | 4 | Autumn 2022 |
| 23123194 | Global Peatland Ecology | 3 | Autumn 2021 |
| 3123169 | Literature Report in Hydrobiology, Advanced studies | 3 | Continuously |
| 3123247 | Environmental Adaptation of Animals | 6 | Spring 2023 |

Biogeochemistry

| Code | Course | Cp | Timing |
|-----------------|---|-----------|---------------|
| 3710419 | Biogeochemistry | 6 | Spring 2023 |
| 3710451 | Bioprocesses in Removal of Environmental Pollutants | 3 | Autumn 2021 |
| 3710469 | Journal Club in Biosphere-Atmosphere Interactions | 2-4 | Continuously |
| 3710473 | Methods in Soil Ecology | 5 | Spring 2022 |
| 3710474 | Soil Ecology | 6 | Spring 2022 |
| 3710455 | Stable Isotopes in Environmental Research | 5 | Autumn 2021 |
| 3710468 | Methods in Microbial Biogeochemistry | 5 | Spring 2023 |
| 3513125A | Carbon Dynamics in Forest Soils | 3 | Autumn 2021 |
| 3513125B | Carbon Dynamics of Forest Soils, Book Examination | 2-4 | |

Kieli- ja viestintäopinnot (min. 2 Cp)

| Code | Course | Cp | Timing |
|----------------|---|-----------|---------------|
| 8313300 | Advanced English Academic and Professional Communication for Applied Physics, Computer Science and Environmental Science | 2 | Every spring |
| 8015017 | Advanced English Academic and Professional Communication for the International Master's Degree Programmes of Science and Forestry | 2 | Every spring |