Environmental science

Environmental science is the discipline of detecting and solving environmental problems. Human impacts on the natural world span geology, chemistry, and the mathematical and natural sciences. The program in environmental science is oriented towards teaching analytical and problem-solving skills that take advantage of a student's major science discipline. The subjects that lead to a co-major, or major, in environmental science provide the necessary training to make the graduate effective at finding solutions to a variety of environmental problems. This will provide graduates with the opportunity to make valuable contributions to industry, regulatory authorities and education.

Students enrolled in a Bachelor of Science, Bachelor of Arts and Sciences or a BSc combined course with law, commerce or arts can follow a course of study which results in the award of a Bachelor of Science with a co-major in environmental science. Students enrolled in a BSc combined course with engineering, geomatics or forestry can follow a course of study which results in the award of a BSc with a major in environmental science. Students complete core environmental science subjects and a specialisation in a selected scientific discipline such as animal behaviour, chemistry, conservation and wildlife, earth sciences, ecology, genetics, geography, marine biology, mathematics and statistics, microbiology, pharmacology, and plant sciences. Students may also complete some management, economics, politics and law subjects. This course of study in environmental science provides training in scientific skills and disciplines that may be used to identify and solve environmental problems. It teaches students how to make efficient use of scarce resources available for management and conservation of the environment. In particular, the skills developed by studying environmental science will enable graduates to:

- evaluate physical, chemical and ecological components of the environment;
- identify environmental problems;
- construct models of ecological processes;
- undertake risk analyses;
- assess environmental impacts;
- design experiments and monitoring programs;
- undertake quantitative analysis of environmental data; and
- provide solutions for environmental problems.

Career opportunities

Studying environmental science provides an opportunity for laboratory, outdoor and indoor careers dealing with environmental issues. Graduates work in areas such as:

- consulting in environmental impact assessment;
- the mining, agriculture, land development and forestry sectors;
- science and management of soil, water and air pollution;
- environmental education;
- parks and wildlife research and management;
- natural resource development and management.

Potential employers include local, State and Federal Government, environmental and regulatory agencies, environmental groups, and resource and development departments at the State and Federal level, environmental, natural resource and engineering consulting companies and a number of major chemical and mining companies.

Suggested subjects

To complete an environmental science co-major or major (the latter is only available to students in BSc combined courses with engineering, geomatics and forest science), students should complete the appropriate subject sequence outlined on page 16 (co-major) or page 12 (major). Some alternatives to these subjects will be accepted. These are listed in Table 1.

It is suggested that students also complete social and applied science subjects to the value of at least 25 points. Examples are given in Table 2

Table 1: Alternatives for the environmental science co-major or major

Subjects	Sem	Acceptable alternatives
100-level subjects		
610-141 Chemistry *(p.2)*	1	610-161
610-142 Chemistry *(p.2)*	2	610-162

Table 1: Alternatives for the environmental science co-major or major

Subjects	Sem	Acceptable alternatives
620-160 Experimental Design & Data Analysis *(p.6)*	1 or 2	620-131. Some other statistics subjects may be suitable prerequisites for 620-270.
625-101 Earth Sciences - The Global Environment *(p.1)*	1	121-012
200-level subjects		
600-201 Physical Environment *(p.1)*	1	212-201, 121-018
610-280 Environmental Chemistry *(p.5)*	2	Any 200 level chemistry subject, or 521-211 and 521-212
300-level subjects		
451-312 GIS & Remote Sensing for Enviro Science *(p.7)*	2	121-024

Table 2: Social and applied science subjects for the environmental science co-major or major

121-021 Environmental Politics and Management *(p.4)*
121-022 Development and Urban Environments *(p.4)*
121-028 Sustainable Development *(p.5)*
121-432 Environmental Field Class *(p.7)*
121-435 Environmental Management Systems *(p.7)*
136-040 Science, Technology and Society
136-031 Science, Philosophy and History
136-033 Science, Reason and Reality *(p.3)*
316-101 Introductory Macroeconomics *(p.1)*[1]
316-208 Economics of the Environment *(p.2)*[1]

1. Non-science subject, see *Science and non-science subjects (p.7)*

Honours

There is no special honours program in environmental science. Students are encouraged to pursue an environmental science honours project as part of the normal honours program in a science department. For further information, contact the environmental science coordinator.

Subject descriptions

600-201 Physical Environment

Credit points: 12.5 **HECS-band:** 2

Coordinator: Dr R Brown

Prerequisites: Earth sciences 625-101; biology 600-142; chemistry 610-122 (before 1998), 610-142 or 610-162; or 121-012 Environmental Change (121-171 before 1999).

Contact: Twenty-four lectures (two per week), 24 hours practical (two hours per week) *(Semester 1)*.

Description: Topics covered include fundamental controls on the large-scale physical environment, including external factors, geological factors, and internal processes; Milankovitch cycles; use of proxy data in studying environmental change including signals in ice cores, tree rings, corals, sediments; soil descriptions and soil formation processes; the hydrological cycle; the roles of water in the environment, including soil moisture, surface hydrology, flow behaviour and erodibility of streams, ground-water occurrence and processes, forms of recharge and discharge; the oceanic circulation, tide and wave behaviour and the evolution of coastal environments; the climate story told by the western Victorian lakes; and greenhouse effect and the global atmospheric carbon budget.

Students completing this subject should understand the underlying scientific principles and processes of climate, water and landforms that have a major influence on the structure of the past, present and future environments, and of the rates of change of these processes.

Assessment: A 2-hour written examination (60%); a 2-hour practical examination (40%).

600-203 Environmental Measurement

Credit points: 12.5 **HECS-band:** 2

Coordinator: Prof M Burgman

Prerequisites: Experimental Design and Data Analysis (620-160) or Scientific Programming and Simulation (620-131), or Statistics for Engineers (620-001) or Quantitative Methods 1 (316-130) or equivalent; it would be an advantage to have Applied Statistics (620-270) and Biology (600-141 and 600-142).

Contact: Twenty-four lectures (two per week), 24 hours tutorials/practicals and a one-day field excursion *(Semester 2).*

Description: Students completing this subject should understand measurement processes, measurement techniques, and the principles of numerical sampling, data collection, description and reporting. They should be familiar with field procedures for measuring physical parameters, and sampling of fauna and flora, and freshwater and marine environments. They should be able to apply strategies for efficient and effective estimation and be able to design routine environmental monitoring and assessment programs. The subject includes sampling theory for environmental problems, stratification, and ratio and regression estimation.

Assessment: A 3-hour written examination at the end of the semester, and continuous assessment and practical reports. Both the examination and the continuous assessment must be completed satisfactorily before credit can be granted for the subject.

600-301 Problem Solving in Environmental Science

Credit points: 12.5 **HECS-band:** 2

Coordinator: Assoc Prof M Keough

Prerequisites: 600-303 Environmental Risk Assessment; a statistics subject is strongly recommended.

Contact: Twenty-four lectures (two per week), 18 hours practicals/tutorials *(Semester 2).*

Description: Students completing this subject should have an appreciation of environmental decision-making and the role of scientists in that process, and should understand the methodologies used for the assessment of human impacts on the natural environment. They should be familiar with the statistical principles underlying the design of environmental impact assessment and monitoring, and have experience in conducting and presenting the results of a multidisciplinary research project in environmental impact assessment. The subject includes methods of hypothesis development, experimental design and testing in environmental impact assessment, design and analysis of sampling and monitoring programs and their subsequent analysis, and evaluating proposed solutions for their technical feasibility and risk.

Assessment: A 3-hour end-of-semester written examination; up to 3000 words of essay work, and a short oral presentation before an audience of staff and students.

600-303 Environmental Risk Assessment

Credit points: 12.5 **HECS-band:** 2

Coordinator: Dr J Carey

Prerequisites: 600-203 Environmental Measurement or equivalent.

Contact: Twenty-four lectures (two per week), 24 hrs of practical/tutorials *(Semester 1).*

Description: Students completing this subject should be familiar with the concept of exposure pathways, understand the ecological processes associated with contamination in aquatic and terrestrial ecosystems, be able to develop empirical models and estimate exposures and responses in ecological systems. The course includes an outline of the framework for applying the concepts of risk assessment to achieve management goals. Students will learn how to perform fundamental exposure, hazard and ecological risk assessment procedures. The subject content includes the psychology and history of risk perception, exposure pathways, models for environmental toxicology, Australian standards for risk assessment, response surfaces, indicator species and exemplars, test endpoints, assessment endpoints and management goals, extrapolations among taxa, interval, arithmetic, empirical modelling, parameter estimation, and risk assessment.

Assessment: A 3-hour written examination at the end of semester, and continuous assessment from tutorial and practical sessions. Both continuous assessment and the examination must be completed satisfactorily before credit can be granted for the subject.

640-261 Energy and Environment

See full subject details on page 6.