

# ENVIRONMENTAL SCIENCE

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The Environmental Science program houses one academic major and two related minors: Earth Science and Geography & Environmental Studies.

The environmental science major provides students with a comprehensive background in the physical and life sciences as well as applications in the social and management dimensions of environmental issues that are central to the quality of human life on earth as well as to the conservation and protection of the planet's natural resources.

Environmental Science as a career includes such professions as: water, soil, or air quality analyst, natural resource manager, environmental protection agent, environmental planner, soil scientist, hydrologist, park ranger, conservation warden, resource mapping specialist, government researcher, environmental educator and private environmental consultant.

The program manages the 65-acre Greene Scientific Field Station located in the Kettle Moraine region just west of Waukesha. This site features a pristine trout stream, several surface springs, and associated wetland vegetative communities. The site provides students with opportunities for outdoor laboratory and research activities, and also provides work experience for students interested in hands-on management of private resource conservancy sites.

Last, a student can earn a Master of Science in Environmental Science via a partnership with Alaska Pacific University (APU). Students who enroll at Carroll for three years and then transfer to APU for two years can earn both a Bachelor of Science degree from Carroll University and a Master of Science degree from APU.

## Objectives of the Environmental Science Major

To provide students with an integrated awareness and understanding of the biological, physical, chemical, and social components of the global natural resource base. Students should be able to apply this knowledge to the management of resources, the measurement of environmental quality, and the assessment of related societal impacts and implications. To provide students with an academic experience that facilitates advanced graduate study and career work in environmentally related fields.

### **Key Elements of the Major**

Several required core courses that provide students not only with a broad introduction to the field of environmental science, but also with upper-level research or internship experiences in environmental analysis and assessment. Upon completion of the major students will:

- Recognize the interrelated biophysical components and processes (i.e., structure and function) of the natural environment.
- Understand how physical/chemical processes dynamically shape the earth's surface and how such phenomena are distributed globally.
- Correlate a broad understanding of environmental science with a specific/correlative understanding of related scientific fields.
- Cultivate a set of personal values and attitudes concerning the environment, which will then prepare oneself to actively address environmental problems and participate in their solutions.
- Understand how human activities and physical systems affect one another, and how to assess the impacts and implications of these interrelationships.
- Apply appropriate scientific methods and techniques to the acquisition, analysis, and evaluation of environmental data.
- Analyze environmental variables in measurable (quantitative/objective) and perceptual (qualitative/subjective) ways using modern equipment and instrumentation.
- Acquire and analyze environmental samples and variables in outdoor settings using field equipment and instrumentation.
- Utilize computers for acquiring, organizing, analyzing, and displaying valid environmental information and research results.
- Demonstrate competency in written and oral communication by preparing effective written reports and oral presentations for peer and professional audiences.
- Work cooperatively and purposefully with others in research and problem-solving situations.

### **Fees**

Specific courses that require use of equipment and disposable supplies are assigned a course fee.

## **Environmental Science Major Bachelor of Science**

### **Core Courses**

Environmental Science 105, Earth Science  
Environmental Science 201, Problem Solving in Environmental Systems  
Environmental Science 220, Weather and Climate  
Environmental Science 230, Chemistry of the Environment  
Environmental Science 253, Mapping and Remote Sensing  
Environmental Science 267, Geographic Information Systems  
Environmental Science 292, Environmental Ethics and Applications  
Environmental Science 325, Soils and Hydrology

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Environmental Science 349, Environmental Policy and Planning

Environmental Science 455, Watershed Management

Environmental Science 499, Capstone Seminar in Environmental Assessment (2 credits)

### **Required Supporting Courses**

Biology 120, General Biology I

Chemistry 109, Principles of Inorganic Chemistry

Computer Science 107, Problem Solving Using Information Technology, or higher

Mathematics 112, or Mathematics 140 or higher

Politics 101, Introduction to Global Studies

### **Environmental Science Minors**

#### **Earth Science<sup>1</sup>**

Environmental Science 105, Earth Science

Environmental Science 220, Weather and Climate

Environmental Science 223, Geologic Landscapes of North

Environmental Science 253, Mapping and Remote Sensing

Physics 105, Astronomy

In addition, two courses (minimum 6 credits) from the following:

Environmental Science 215, Natural Hazards (2 credits)

Environmental Science 255, Environmental Resources of Wisconsin

Environmental Science 325, Soils and Hydrology

Environmental Science 290/490, Workshop in Environmental Science

#### **Geography & Environmental Studies<sup>1</sup>**

Environmental Science 105, Earth Science

Environmental Science 120, Conservation and Environmental Improvement

Environmental Science 138, Cultural Geography

Environmental Science 160, World Regional Geography

Environmental Science 292, Environmental Ethics and Applications

In addition, two or three courses (minimum 8 credits) from the following offerings:

Environmental Science 215, Natural Hazards (2 credits)

Environmental Science 220, Weather and Climate

Environmental Science 223, Geologic Landscapes of North America

Environmental Science 253, Mapping and Remote Sensing

Environmental Science 252, Contemporary Issues in Geography and  
The Environment (2 credits)

Environmental Science 255, Environmental Resources of Wisconsin

Environmental Science 267, Geographic Information Systems

Environmental Science 290/490, Workshop in Environmental Science

Environmental Science 349, Environmental Policy and Planning

Environmental Science 455, Watershed Management

Sociology 202, Society and Ecology

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<sup>1</sup> Meets DPI certification requirements as an approved minor for secondary education.

### **Graduate Degree in Environmental Science in Alaska**

Three years of undergraduate coursework are completed at Carroll University followed by two years of graduate study at Alaska Pacific University (APU). The first year of APU courses transfer back to Carroll to complete the Bachelor of Science degree in Environmental Science with a minor in biology or chemistry. The agreement with APU specifies that students should be able to complete the Master of Science degree after two years of study in Alaska.

In preparation for this graduate program, students must complete a minimum of 104 credits at Carroll, all LSP courses, plus the following math and science courses during their first three years at Carroll:

Biology 120, General Biology I  
Biology 125, General Biology II  
Chemistry 109, Principles of Inorganic Chemistry  
Chemistry 110, Principles of Analytic Chemistry  
Computer Science 107, Problem Solving Using Information Technology (2 credits)  
Environmental Science 105, Earth Science  
Environmental Science 201, Problem Solving in Environmental Systems  
Environmental Science 220, Weather and Climate  
Environmental Science 223, Geologic Landscapes of North America  
Environmental Science 230, Chemistry of the Environment  
Environmental Science 253, Mapping and Remote Sensing  
Environmental Science 267, Geographic Information Systems  
Environmental Science 292, Environmental Ethics and Applications  
Environmental Science 325, Soils and Hydrology  
Environmental Science 349, Environmental Policy and Planning  
Environmental Science 455, Watershed Management  
Environmental Science 499, Capstone Seminar in Environmental Assessment (2 credits)  
Mathematics 112, Introduction to Statistics  
Mathematics 140, Calculus and its Applications

#### **105. Earth Science**

**NI**

**4 credits**

Introduction to the basic concepts in physical geography and earth science, including the description, analysis, and interpretation of the major components of the earth's natural environment. The first part of the course focuses on the structure and processes of the atmosphere, along with resulting global patterns of climate. The second part of the course introduces map use and earth material identification and emphasizes the formation and distribution of the earth's landforms. Four hours of lecture/discussion and one three-hour laboratory. (Required course fee) (*Fa, Sp*)

#### **120. Conservation and Environmental Improvement**

**NI**

**4 credits**

A study of global natural resources and methods used in their conservation. The course includes the basic concepts of ecological biology including interactions between the living and the non-living elements of the environment, concepts of energy transformation in physical and biological systems, the nature of the Earth's ecosystems, and the implications



ences of climate on surface vegetation, soils, water resources, health and human comfort, and economic activity. Historic climate change theories and contemporary global issues are both addressed. Laboratory exercises supplement lecture topics and emphasize local atmospheric observations and forecasts as well as regional climate data analyses. (Required course fee) (*Sp*) Prerequisite: ENV 105 or consent of the instructor.

**223. Geologic Landscapes of North America****4 credits**

The major landform regions of the U.S. and Canada are examined with respect to their geologic structures, origins, stages of development, and defined spatial patterns. Course exercises supplement lecture topics through the use of topographic maps, geologic maps, aerial photographs and related local field trips. (*Fa, odd years*) Prerequisite: ENV 105 or consent of the instructor.

**230. Chemistry of the Environment****4 credits**

This course introduces the basic concepts regarding the chemistry of the Earth's three major environmental components: air, water, and soil. The environmental chemistry of elements and compounds will be presented in terms of the natural biogeochemical cycles and in terms of human-caused pollutant transport and reactivity within and between environmental components. Laboratory experiments and field trips are designed to illustrate the chemical processes discussed in class and introduce various principles regarding environmental monitoring and sample analysis. Four hours of lecture/discussion and one three-hour laboratory. (Required course fee) (*Sp*) Prerequisites: ENV 105 and CHE 109.

**252. Contemporary Issues in Geography and the Environment****2 credits**

This course highlights various contemporary issues relating to the global environment with a focus on the distributional patterns of environmental problems such as natural resource depletion, food production, overpopulation, energy use, water pollution, and global climate change. This course may be used with a prior university biology laboratory course to satisfy the environmental science requirement for teachers. (*Wn, Su*)

**253. Mapping and Remote Sensing****4 credits**

This course explores a number of tools and techniques used by environmental geographers to assess the patterns, distributions, and characteristics of various earth surface features, such as aerial photo and satellite image interpretation, geologic and topographic map interpretation, spatial data acquisition and analysis, and field mapping. It also introduces students to modern methods of remote sensing, including the applied use of color infrared, thermal infrared, microwave, radar and multispectral imagery in the study of landforms, agriculture, forestry, water resources, weather and urban planning. (Required course fee) (*Fa*)

**255. Environmental Resources of Wisconsin****4 credits**

This course investigates the spatial patterns of Wisconsin's varied physical and cultural landscapes, including such topics as climate, natural vegetation, geologic landforms, water resources, agriculture, and historic settlement patterns. (*Su, even years*)

### 267. Geographic Information Systems

4 credits

Students are introduced to various computer overlay mapping techniques for analyzing spatial data and investigating geographic, demographic, and environmental problems. Lectures provide a conceptual background on geographic information systems. Hands-on computer laboratory exercises enable students to map terrain surfaces, conduct site suitability, feasibility, and desirability studies, investigate environmental impacts of human activity, and assess demographic and land-use patterns using ArcGIS software and available databases. (Required course fee) (*Sp*)

### 290/490. Workshop in Environmental Science

2-4 credits

Topical workshops, field studies, or short courses are established in various areas of interest as recognized/needed by the program. For example, under this listing, the program offers a “Cultural and Environmental Geography of Alaska” field study during May term (*odd years*), which is also offered for NCEP credit.

### 292. Environmental Ethics and Applications

4 credits

This course addresses historic philosophical and religious perspectives concerning the natural environment, including contemporary ethical responses to such global concerns as resource stewardship and management, technological change and impact, ecological diversity and sustainability, environmental politics and economics, energy use, population growth, and overconsumption. An emphasis will be placed on global resource challenges and social issues related to resource utilization. (*Sp*)

### 325. Soils and Hydrology

4 credits

This course addresses various technical aspects of global soil and water resources, how we utilize and impact the quality and quantity of these vital resources, and how we manage and conserve them for future generations. Topics include soil classification, soil physics, soil chemistry, soil fertility, water chemistry, hydrology, and sediment and contaminant transport. (*Fa, even years*) Prerequisites: CHE 109.

### 349. Environmental Policy and Planning

4 credits

An introduction to the nature of environmental planning, including various laws and policies designed to guide regional growth. The course examines the basic concepts and problems underlying the design and planning of environmentally desirable and appropriate land uses. Students will become familiar with federal, state, and municipal policies that influence and regulate environmental planning. Special emphasis is placed on assessing growth and development within watersheds, mapping and inventorying regional land-use changes, and identifying critical environmental impacts. (*Fa*) Prerequisite: ENV 105.

### 380/480. Work-Oriented Internship

2-4 credits

Prerequisite: Junior or senior standing and consent of major adviser.

### 391/491. Special Topics in Environmental Science

1-4 credits

This course is a study of a selected topic not covered in regular course offerings. Lecture and discussion. Offered as needed. The topic will be announced prior to registration. A course fee may apply.

**396/496. Research in Environmental Science****2-4 credits**

Prerequisite: Junior or senior standing and consent of major adviser.

**398/498. Independent Study in Environmental Science****1-4 credits**

Prerequisite: Junior or senior standing, approval of the divisional dean and consent of the instructor.

**455. Watershed Management****4 credits**

This course examines the interaction of abiotic, biotic, and social components in the management of a drainage basin's terrestrial and aquatic resources. Through the examination of global watershed management literature and related case studies, students will actively engage in the development of a watershed management plan. Class projects will focus on selected Wisconsin, upper Midwest, and Great Lakes watersheds. (*Fa*) Prerequisites: ENV 201, plus junior or senior standing. ENV 267 recommended.

**499. Capstone Seminar in Environmental Assessment****2 credits**

Examines some of the key tools and techniques used to effectively analyze and assess the impact of various human activities on environmental quality, and provides a capstone research/field experience in environmental science. Individual projects involve an environmental impact assessment or resource management plan. Contemporary issues and career opportunities in environmental management and monitoring are also addressed. (Required course fee) (*Sp*) Prerequisites: Environmental major status and senior standing.