

# ENVIRONMENTAL SCIENCES, MINOR

The environmental sciences minor has been developed to encourage and facilitate studies in environmental sciences by students completing degrees in the other science and engineering disciplines. The environmental sciences (ES) minor requires:

- completion of a set of courses in the core sciences,
- two introductory courses dealing with the environment, and
- three or more upper-level environmental sciences courses, as described.

## Faculty Advising

A faculty advisor is assigned to each student in the environmental sciences minor program to assist in planning their academic program and to approve the choice of courses to satisfy the minor. Faculty advisors are available in the following areas:

- **Biological Processes**  
Faculty advisor: Sarah Preheim
- **Physical Processes**  
Faculty advisor: Ciaran Harman
- **Environmental Chemistry**  
Faculty advisor: Alan Stone
- **Environmental Systems**  
Faculty advisor: Ben Hobbs

## Program Requirements

### Core Sciences (ES Minor)

Because of the interdisciplinary nature of environmental science, it is important that professionals from various areas of expertise acquire a common language and set of core concepts to make discussion and cooperation possible. The following courses represent the minimum set of requirements:

Code	Title	Credits
<b>Mathematics (12 credits)</b>		
AS.110.108	Calculus I (Physical Sciences & Engineering)	4
AS.110.109	Calculus II (For Physical Sciences and Engineering)	4
At least one of these four courses:		
AS.110.201	Linear Algebra	4
AS.110.202	Calculus III	4
AS.110.302	Differential Equations and Applications	4
EN.553.291	Linear Algebra and Differential Equations	4
<b>Biology (3 credits)</b>		
One course is needed, such as: AS.020.151 General Biology I		
<b>Chemistry (8 credits)</b>		
AS.030.101	Introductory Chemistry I	3
AS.030.102	Introductory Chemistry II	3
AS.030.105	Introductory Chemistry Laboratory I	1
AS.030.106	Introductory Chemistry Laboratory II	1
<b>Physics (10 credits)</b>		
AS.171.101	General Physics: Physical Science Major I	4

or AS.171.107	General Physics for Physical Sciences Majors (AL)	
AS.171.102	General Physics: Physical Science Major II	4
or AS.171.108	General Physics for Physical Science Majors (AL)	
AS.173.111	General Physics Laboratory I	1
AS.173.112	General Physics Laboratory II	1

## Environmental Sciences

Students must take two introductory courses dealing with the environment and three or more of the upper-level environmental science courses on the following lists, for a total of 15 credits:

Code	Title	Credits
<b>Introductory Courses (6 credits)</b>		
Select two of the following:		6
AS.270.220	The Dynamic Earth: An Introduction to Geology	
AS.270.221	The Dynamic Earth Laboratory	
EN.570.110	Introduction to Engineering for Sustainable Development	
EN.570.201	Environmental Biology and Ecology	
EN.570.239	Environmental Engineering Chemistry - Current and Emerging Topics	
<b>Upper-Level Courses (9-10 credits)</b>		
Select three of the following:		9-10
AS.270.302	Aqueous Geochemistry	
AS.270.350	Sedimentary Geology	
EN.570.303	Environmental Engineering Principles and Applications	
EN.570.350	Environmental Hazards and Health Risks	
EN.570.353	Hydrology	
EN.570.441	Environmental Inorganic Chemistry	
EN.570.443	Aquatic and Biofluid Chemistry	
EN.570.445	Physical and Chemical Processes I	
EN.570.491	Hazardous Waste Engineering and Management	
EN.575.706	Biological Processes for Water & Wastewater Treatment	
<b>Total Credits</b>		<b>15-16</b>

## Pairing Your Major with the ES Minor

Many of the most creative and productive advances in environmental sciences in recent years have come from scientists trained in traditional disciplines (biology, chemistry, geology, physics, and engineering) who have devoted themselves to the study of environmental problems. Completion of the degree requirements of a traditional discipline provides depth and rigor that, when supplemented with additional academic training in environmental science, can be applied to professional work in a variety of environmental subjects, as the following examples show:

### Biological Processes

Response of ecosystems to change, microbial degradation of pollutants, biogeochemical cycling of greenhouse gases. **Illustrative majors:** Biology, Biomedical Engineering, Biophysics, Biochemical Engineering.

### Physical Processes

Erosion of hillslopes, rivers, and coastlines; sediment production, transport, and fate; groundwater, movement of contaminant plumes; oceanography; atmospheric physics; aerosol formation; global warming.

**Illustrative majors:** Civil Engineering, Chemical and Biomolecular Engineering, Mechanical Engineering, Physics, Earth and Planetary Sciences.

### **Environmental Chemistry**

Environmental fate of pollutants, water and waste water treatment, geochemistry, atmospheric chemistry, ozone depletion, acid rain.

**Illustrative majors:** Chemistry, Chemical and Biomolecular Engineering, Earth and Planetary Sciences, Materials Science and Engineering.

### **Environmental Systems**

Environmental modeling, risk assessment, environmental systems design, pollution control strategies. **Illustrative majors:** Civil Engineering, Applied Mathematics and Statistics.