

# ENVIRONMENTAL SCIENCES MAJOR: GEOSYSTEMS OPTION (B.S.)

<https://ceps.unh.edu/earth-sciences/program/bs/environmental-sciences-major-geosystems-option>

## Description

The College of Engineering and Physical Sciences (CEPS) and the College of Life Science and Agriculture (COLSA) jointly offer a bachelor of science degree in environmental sciences. Environmental sciences, an interdisciplinary field, focuses on the interaction of biological, chemical, and physical processes that shape our natural environment. Students graduating with a degree in environmental sciences will have an understanding of these interacting processes, the ability to communicate effectively with both scientific and lay audiences, competency in field methods appropriate for entry-level environmental science positions, competency in the use and application of Geographic Information Systems (GIS), a basic understanding of environmental policy, and the ability to contribute to multidisciplinary teams. The University of New Hampshire is a recognized leader in environmental sciences research, and the environmental sciences program capitalizes on faculty expertise in this area. The full-time faculty members comprising this program have major teaching and research emphases in the areas of biogeochemical cycling, environmental chemistry, ecosystem science, geospatial science, global change, hydrology, plant ecology, soil science, and water resource management.

Employment opportunities include environmental consulting firms, educational facilities (e.g., science centers), environmental monitoring laboratories (e.g., water treatment plants; the Environmental Protection Agency), government agencies (e.g., the U.S. Geological Survey, Bureau of Land Management, Natural Resource Conservation Service), university and government research laboratories, and nongovernment environmental organizations. The environmental sciences program also constitutes an excellent preparation for graduate programs in several areas relating to the environment. Students should consult with their adviser early if their goals include further study.

The Program has four options, and specific course requirements for the major vary by option. The geosystems and hydrology options are both managed by the Department of Earth Sciences in CEPS, and the ecosystems and soils and watersheds options are both managed by the Department of Natural Resources and the Environment in the COLSA. The geosystems option provides students with a solid grounding in quantitative reasoning, with an emphasis on geochemical and geospatial systems.

## Requirements

### Degree Requirements

**Minimum Credit Requirement:** 128 credits

**Minimum Residency Requirement:** 32 credits must be taken at UNH

**Minimum GPA:** 2.0 required for conferral\*

**Core Curriculum Required:** Discovery & Writing Program Requirements

**Foreign Language Requirement:** No

All Major, Option and Elective Requirements as indicated.

\*Major GPA requirements as indicated.

## Major Requirements

In addition to the Discovery Program and University writing requirements, all students complete introductory courses, and foundation courses that include introductions to biology, physics, chemistry, geology, calculus, and statistics. Students must complete additional courses for the geosystems option to total 88 credits in the major.

### Required Courses:

#### Introductory

Code	Title	Credits
NR 400	Professional Perspectives in Natural Resources	1
NR 403	Introduction to Environmental Science	4
Select one additional elective introductory environmental science course		4
<b>Total Credits</b>		<b>9</b>

#### FOUNDATION

Code	Title	Credits
<b>Biology</b>		
BIOL 411 or BIOL 412	Introductory Biology: Molecular and Cellular Introductory Biology: Evolution, Biodiversity and Ecology	4
<b>Chemistry</b>		
Select one of the following:		4-8
CHEM 403 & CHEM 404 or CHEM 405	General Chemistry I and General Chemistry II Chemical Principles for Engineers	
<b>Physics</b>		
PHYS 407 & PHYS 408	General Physics I and General Physics II	8
<b>Calculus</b>		
MATH 425 & MATH 426	Calculus I and Calculus II	8
<b>Statistics</b>		
MATH 644 or BIOL 528	Statistics for Engineers and Scientists Applied Biostatistics I	4
<b>Geology</b>		
Select one of the following:		4
ESCI 401	Dynamic Earth	
ESCI 402	Earth History	
ESCI 409	Geology and the Environment	
<b>Total Credits</b>		<b>32-36</b>

#### CORE COURSES

Code	Title	Credits
ESCI 534	Techniques in Environmental Sciences	3
ESCI 654	Fate and Transport in the Environment	4
ESCI 690	Capstone & Professional Development	1
ESCI 777 or NR 658	GIS for Earth & Environmental Sciences Introduction to Geographic Information Systems	4
NR 602	Natural Resources and Environmental Policy	4
Capstone Experience (see below)		4
<b>Total Credits</b>		<b>20</b>

#### Geosystems Option

Code	Title	Credits
<b>Mineralogy</b>		
ESCI 512	Principles of Mineralogy	4
<b>Geomorphology</b>		
ESCI 561	Landscape Evolution	4
<b>Biogeosciences</b>		

ESCI 642	Biogeosciences in the Earth System	3
<b>Geochemistry</b>		
Select one course from the following:		4
ESCI 741	Geochemistry	
ESCI 745	Isotope Geochemistry	
ESCI 747	Aqueous Geochemistry	
ESCI 796	Topics (Biogeochemistry)	
or NR 744	Biogeochemistry	
<b>Quantitative/Spatial Analysis</b>		
Select one course		4
<b>Electives</b>		
Select two or three approved electives <sup>1</sup>		8-12
<b>Total Credits</b>		27-31

<sup>1</sup> For a list of approved elective courses and for further information about the geosystems option, students may contact [earth.sciences@unh.edu](mailto:earth.sciences@unh.edu). ([earth.sciences@unh.edu](mailto:earth.sciences@unh.edu))

Some students enroll in the EcoQuest program (a study abroad opportunity in New Zealand), which satisfies the policy requirement, and capstone requirement if taken senior year.

## Capstone Experience

A capstone experience is required of all undergraduate Earth sciences majors during their senior year. All capstone experiences at UNH must meet one or more of the following criteria:

1. The capstone synthesizes and applies disciplinary knowledge and skills.
2. The capstone fosters reflection on undergraduate learning and experience.
3. The capstone demonstrates emerging professional competencies.
4. The capstone applies, analyzes, and/or interprets research or data or artistic expression.
5. The capstone explores areas of interest based on the integration of prior learning.

Suggested ways of meeting the capstone requirement in the Department of Earth Sciences include approved INCO 790 Advanced Research Experience, ESCI 795 Topics, ESCI 796 Topics, ESCI 799 Senior Thesis, URA/SURF/IROP projects, internships, environmental/geologic field camps, REU programs, or Earth Sciences education and outreach activities designed according to the above criteria. Capstone experiences must be equivalent to a minimum of 2 academic credits. Students should work closely with their faculty advisors to define the most appropriate capstone experience for their Earth Sciences degree program, although the capstone mentor can be someone other than their primary faculty advisor. All capstone experiences must be approved and certified by the faculty advisor and the capstone mentor. Presentation of projects or experiences developed for the capstone is encouraged at the annual UNH Undergraduate Research Conference or other appropriate venue.

## Degree Plan

### Sample Degree Plan

*This sample degree plan serves as a general guide; students collaborate with their academic advisor to develop a personalized degree plan to meet their academic goals and program requirements.*

#### First Year

Fall		Credits
NR 400 or ESCI 400	Professional Perspectives in Natural Resources or Freshman Field Seminar	1
NR 403	Introduction to Environmental Science	4
MATH 425	Calculus I	4
CHEM 403	General Chemistry I	4
ENGL 401	First-Year Writing	4
<b>Credits</b>		<b>17</b>

#### Spring

ESCI 409	Geology and the Environment	4
MATH 426	Calculus II	4
CHEM 404	General Chemistry II	4
Inquiry Discovery Course <sup>1</sup>		4
<b>Credits</b>		<b>16</b>

#### Second Year

Fall		
BIOL 411 or BIOL 412	Introductory Biology: Molecular and Cellular or Introductory Biology: Evolution, Biodiversity and Ecology	4
ESCI 534	Techniques in Environmental Sciences	3
PHYS 407	General Physics I	4
Discovery Course <sup>1</sup>		4
<b>Credits</b>		<b>15</b>

#### Spring

ESCI 501 or ESCI 514	Introduction to Oceanography or Introduction to Climate	4
ESCI 512	Principles of Mineralogy	4
PHYS 408	General Physics II	4
Discovery Course <sup>1</sup>		4
<b>Credits</b>		<b>16</b>

#### Third Year

Fall		
ESCI 561	Landscape Evolution	4
ESCI 741 or ESCI 747	Geochemistry or Aqueous Geochemistry	4
ESCI 777	GIS for Earth & Environmental Sciences	4
Discovery Course <sup>1</sup>		4
<b>Credits</b>		<b>16</b>

#### Spring

ESCI 654	Fate and Transport in the Environment	4
ESCI 690	Capstone & Professional Development	1
MATH 644 or BIOL 528	Statistics for Engineers and Scientists or Applied Biostatistics I	4
ESCI 642	Biogeosciences in the Earth System	3
NR 602	Natural Resources and Environmental Policy	4
<b>Credits</b>		<b>16</b>

#### Fourth Year

Fall		
Elective		4

Approved Technical Elective <sup>2</sup>	4
Quantitative/Spatial Analysis Elective <sup>2</sup>	4
Discovery Course <sup>1</sup>	4
<b>Credits</b>	<b>16</b>
<b>Spring</b>	
Discovery Course <sup>1</sup>	4
Senior Capstone (ESCI 799, INCO 790) or elective if capstone is satisfied	4
Approved Technical Elective <sup>2</sup>	4
Elective	4
<b>Credits</b>	<b>16</b>
<b>Total Credits</b>	<b>128</b>

<sup>1</sup> One course must be taken in each of the remaining Disciplinary Groups of the University Discovery Program (Environment Technology & Society; Historical Perspectives; World Culture; Fine & Performing Arts; Social Science; Humanities).

<sup>2</sup> Three technical electives must be approved in consultation with departmental advisor.

All students must take four writing intensive courses, including ENGL 401 First-Year Writing, a course in the major, and a course at the 600/700 level.

## Student Learning Outcomes

### Program Learning Outcomes Students will be able to:

- Recognize common Earth and environmental materials.
- Understand the Earth as a system and be able to describe the broad attributes of and interactions within the Earth System and the environment through both short- and long-term perspectives, evaluate how and why it is changing today, and assess coupled human and natural system interactions.
- Understand Earth processes and cycles.
- Perform field measurements and simple calculations to collect, evaluate and interpret quantitative environmental or geological data. Understand the role that spatially explicit data and time series play in understanding environmental and hydrological sciences.
- Collect, interpret, and synthesize basic field observations and measurements to develop and test multiple working hypotheses to explain them. Additionally, become comfortable with the use of technology and computational methods in processing a range of scientific data.
- Analyze, summarize, evaluate, and explain/present their own scientific data and the primary Earth and environmental sciences literature.
- Communicate results of scientific inquiries orally, visually, and in writing.