

ENVIRONMENTAL SCIENCES MAJOR: EARTH SYSTEMS OPTION (B.S.)

<https://www.unh.edu/program/bachelor-science/environmental-sciences-geosystems>

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 3 options, and specific course requirements for the major vary by option. The Earth Systems option is 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 COLSA. The Earth Systems option provides students with a solid grounding in quantitative reasoning, with an emphasis on geochemical, hydrologic, 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 Earth Systems option, including at least four courses at the 700-level.

Code	Title	Credits
Required Courses		
<i>Foundation</i>		
MATH 425	Calculus I	4
MATH 426	Calculus II	4
CHEM 403 & CHEM 404	General Chemistry I and General Chemistry II	4-8
or CHEM 405	Chemical Principles for Engineers	
PHYS 407	General Physics I	4
PHYS 408	General Physics II	4
MATH 644	Statistics for Engineers and Scientists	4
or BIOL 528	Applied Biostatistics I	
BIOL 411	Introductory Biology: Molecular and Cellular	4
or BIOL 412	Introductory Biology: Evolution, Biodiversity and Ecology	
<i>Intro</i>		
ESCI 400	First-year Experience	1
or NR 400	Professional Perspectives in Natural Resources	
NR 403	Introduction to Environmental Science	4
Select one introductory level elective from the following:		
ESCI 405	Global Environmental Change	
ESCI 420	Our Solar System	
ESCI 501	Introduction to Oceanography	
ESCI 514	Introduction to Climate	
NR 504	Freshwater Resources	
CEE 520	Environmental Pollution and Protection: A Global Context	
GEOG 473	Elements of Weather	
<i>Earth Systems</i>		
ESCI 401	Dynamic Earth	4
or ESCI 402	Earth History	
or ESCI 409	Geology and the Environment	
ESCI 561	Landscape Evolution	4
ESCI 512	Principles of Mineralogy	4
or NR 501	Studio Soils	
ESCI 642	Biogeosciences in the Earth System	3-4
or ESCI 654	Fate and Transport in the Environment	
NR 602	Natural Resources and Environmental Policy	4
or NR 507	Introduction to our Energy System and Sustainable Energy	
<i>Hydrology Elective</i>		
ESCI 705	Principles of Hydrology	4
or ESCI 710	Groundwater Hydrology	
<i>Geochemistry Elective</i>		
ESCI 741	Geochemistry	4
or ESCI 745	Isotope Geochemistry	
or ESCI 747	Aqueous Geochemistry	
<i>Methods</i>		
ESCI 534	Techniques in Environmental Sciences	3
NR 658	Introduction to Geographic Information Systems	4
or ESCI 777	GIS for Earth & Environmental Sciences	
Select one quantitative methods elective from the following:		
ESCI 633	Sea Level Rise and Fall	
ESCI 654	Fate and Transport in the Environment	
ESCI 701	Quantitative Methods in Earth Sciences	
ESCI 734	Global Geophysics	

ESCI 764	Spectral Analysis of Geophysical Time Series Data	
CS 410P	Introduction to Scientific Programming/Python	
CS 457	Introduction to Data Science and Analytics	
MATH 527	Differential Equations with Linear Algebra	
MATH 528	Multidimensional Calculus	
MATH 645	Linear Algebra for Applications	
MATH 739	Applied Regression Analysis	
MATH 740	Design of Experiments I	
<i>Math/Science Electives</i>		
Select two approved science electives determined in consultation with departmental advisor.		8
The following should be considered: additional courses in Earth Sciences, Mathematics, Chemistry, and Physics; Computer Science, Engineering, the Biological Sciences, or Natural Resources and the Environment.		
<i>Professional Development</i>		
ESCI 690	Capstone & Professional Development	1
<i>Capstone Experience*</i>		
Total Credits		84-89

For further information about the Earth systems option, students may contact earth.sciences@unh.edu. (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
ESCI 400 or NR 400	First-year Experience or Professional Perspectives in Natural Resources	1
NR 403	Introduction to Environmental Science	4
MATH 425	Calculus I	4
CHEM 403	General Chemistry I	4
ENGL 401	First-Year Writing (or pass placement test)	4
Credits		17

Spring

ESCI 409 or ESCI 402	Geology and the Environment or Earth History	4
MATH 426	Calculus II	4
CHEM 404	General Chemistry II	4
Inquiry Discovery Course ¹		4
Credits		16

Second Year

Fall		Credits
ESCI 534	Techniques in Environmental Sciences	3
PHYS 407	General Physics I	4
Intro-level Environmental Science elective		4
Discovery Course ¹		4
Credits		15

Spring

BIOL 411 or BIOL 412	Introductory Biology: Molecular and Cellular or Introductory Biology: Evolution, Biodiversity and Ecology	4
ESCI 512	Principles of Mineralogy	4
PHYS 408	General Physics II	4
Discovery Course ¹		4
Credits		16

Third Year

Fall		Credits
ESCI 777	GIS for Earth & Environmental Sciences	4
NR 602	Natural Resources and Environmental Policy	4
ESCI 561	Landscape Evolution	4
Discovery Course ¹		4
Credits		16

Spring

BIOL 528 or MATH 644	Applied Biostatistics I or Statistics for Engineers and Scientists	4
ESCI 654 or ESCI 642	Fate and Transport in the Environment or Biogeosciences in the Earth System	4

ESCI 690	Capstone & Professional Development	1
Science Elective ²		4
Discovery Course ¹		4
Credits		17
Fourth Year		
Fall		
ESCI 705 or ESCI 741	Principles of Hydrology or Geochemistry	4
Quantative Methods Elective		4
Free Elective ²		4
Discovery Course ¹		4
Credits		16
Spring		
ESCI 710 or ESCI 745	Groundwater Hydrology or Isotope Geochemistry	4
Science Elective ²		4
Free Elective		4
Senior Capstone		4
Credits		16
Total Credits		129

¹ 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).

² 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 and understand common Earth and environmental materials, processes, dynamics, and cycles.
- Demonstrate a broad understanding of Earth-ocean-atmosphere systems, with an emphasis on interactions among physical, chemical, and biological processes that shape our natural environment and impact society.
- Perform calculations and apply computational methods to process and evaluate a range of quantitative Earth, environmental, geochemical, and hydrologic data.
- Become proficient in basic Earth and the environmental science laboratory and field techniques.
- Summarize, analyze, evaluate, and explain/present student-generated scientific data and the primary Earth and environmental sciences literature.
- Effectively communicate results of scientific inquiries orally, visually, and in writing.