ENVIRONMENTAL SCIENCES MAJOR: HYDROLOGY OPTION (B.S.)

https://ceps.unh.edu/earth-sciences/program/bs/environmental-sciences-major-hydrology-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, geospatial science, ecosystem 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 hydrology option provides students with a solid grounding in fundamental hydrological principles and quantitative reasoning.

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 COURSES

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>ESCI 505</td>
<td>GIS for Earth &amp; Environmental Sciences</td>
<td>4</td>
</tr>
<tr>
<td>or NR 658</td>
<td>Introduction to Geographic Information Systems</td>
<td>4</td>
</tr>
<tr>
<td>NR 662</td>
<td>Natural Resources and Environmental Policy</td>
<td>4</td>
</tr>
<tr>
<td>or NR 662</td>
<td>Environmental Policy, Planning and Sustainability in New Zealand</td>
<td>4</td>
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Capstone Experience

Total Credits 15
NR 791 Preparation for Capstone and an independent study or capstone course taken in the senior year and approved by their adviser and the program coordinator.

**HYDROLOGY**

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>ESCI 561</td>
<td>Landscape Evolution</td>
<td>4</td>
</tr>
<tr>
<td>ESCI 512</td>
<td>Principles of Mineralogy</td>
<td>4</td>
</tr>
<tr>
<td>or NR 501</td>
<td>Studio Soils</td>
<td></td>
</tr>
<tr>
<td>ESCI 705</td>
<td>Principles of Hydrology</td>
<td>4</td>
</tr>
<tr>
<td>or CEE 754</td>
<td>Engineering Hydrology</td>
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Select one Quantitative Analysis course from the following:

- CS 418P Introduction to Scientific Programming/Python
- ESCI 701 Quantitative Methods in Earth Sciences
- ESCI 764 Spectral Analysis of Geophysical Time Series Data
- MATH 525 Linearity I
- 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

Select two or three approved electives from the following:

- CEE 660 Fluid Mechanics
- CEE 721 Environmental Sampling and Analysis
- CEE 723 Environmental Water Chemistry
- CEE 724 Environmental Engineering Microbiology
- CEE 751 Open Channel Flow
- CEE 758 Stormwater Management Designs
- CEE 759 Stream Restoration
- ESCI 642 Biogeoosciences in the Earth System
- ESCI 741 Geochemistry
- ESCI 745 Isotope Geochemistry
- ESCI 747 Aquatic Geochemistry
- ESCI 762 Glacial Geology
- ESCI 778 Remote Sensing Earth & Environmental Sciences
- NR 560 Ecology and Biogeography of New Zealand
- NR 661 Restoration Ecology and Ecosystem Management in New Zealand
- NR 703 Watershed Water Quality Management
- NR 707 Environmental Modeling
- NR 744 Biogeochemistry
- NR 751 Aquatic Ecosystems
- NR 757 Remote Sensing of the Environment
- NR 759 Digital Image Processing for Natural Resources
- NR 761 Environmental Soil Chemistry

**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 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**

### First Year

#### Fall

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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<tbody>
<tr>
<td>NR 400</td>
<td>1</td>
</tr>
<tr>
<td>NR 403</td>
<td>4</td>
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<tr>
<td>MATH 425</td>
<td>4</td>
</tr>
<tr>
<td>CHEM 403</td>
<td>4</td>
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<tr>
<td>ENGL 401</td>
<td>4</td>
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**Credits**

17

### Second Year

#### Fall

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>ESCI 534</td>
<td>3</td>
</tr>
<tr>
<td>ESCI 561</td>
<td>4</td>
</tr>
<tr>
<td>MATH 644</td>
<td>4</td>
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**Credits**

4

### Spring

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<tbody>
<tr>
<td>NR 504</td>
<td>4</td>
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**Credits**

15

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.

Students must complete additional courses for the hydrology option to total 88 credits in the major.

For further information about the hydrology option or to discuss alternative elective courses, students may contact earth.sciences@unh.edu (earth.sciences@unh.edu)
### Student 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.
- Demonstrate knowledge of core concepts in the hydrologic sciences: stream flow, groundwater, water budgets, hydrologic fluxes, and physical factors that affect them, and a basic understanding of the uses and limitations of a hydrologic model.
- 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.

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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).

Three technical electives must be approved in consultation with departmental advisor.

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