

# EARTH SCIENCES MAJOR (B.S.)

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

## Description

The Bachelor of Science degree in the Department of Earth Sciences has four tracks designed for students interested in focusing on Earth's climate, geology, geophysics or oceanography. The program provides a strong concentration in geoscience, built upon a solid foundation in mathematics and the physical sciences. The B.S. degree is especially well-suited for students who wish to work in the environmental and geoscience industries, energy sector and climate technologies, teaching at the secondary level, state and federal environmental agencies, or to pursue graduate studies in the Earth sciences, oceanography, and related fields of study. The degree requires a central core of courses and a required specialization in one of climate, geology, geophysics, or oceanography to develop depth in a particular area of the Earth sciences. Students are encouraged to participate in research, field, lab, or internship opportunities to round out their experiences in the degree program.

## 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

Code	Title	Credits
<b>Required Courses</b>		
MATH 425	Calculus I <sup>1</sup>	4
MATH 426	Calculus II	4
CHEM 403	General Chemistry I <sup>1,2</sup>	4
CHEM 404	General Chemistry II <sup>1,2</sup>	4
PHYS 407	General Physics I <sup>1</sup>	4
PHYS 408	General Physics II <sup>1</sup>	4
<b>Core Curriculum</b>		
ESCI 401	Dynamic Earth	4
or ESCI 409	Geology and the Environment	
ESCI 402	Earth History	4
ESCI 501	Introduction to Oceanography	4
ESCI 512	Principles of Mineralogy	4
ESCI 530	Geological Field Methods <sup>3</sup>	4
or ESCI 534	Techniques in Environmental Sciences	
Select one of the following:		
ESCI 654	Fate and Transport in the Environment	4
ESCI 701	Quantitative Methods in Earth Sciences <sup>4</sup>	4
<b>Specializations</b>		
Select one of the following approved specializations:		
Climate		

Geology	
Geophysics	
Oceanography	
<b>Science/Math Electives</b>	
Complete three additional approved science/math electives <sup>5</sup>	
<b>Capstone</b>	
Complete the capstone requirement	
<b>Total Credits</b>	<b>48</b>

- <sup>1</sup> Some of these courses may also satisfy Discovery Program requirements.
- <sup>2</sup> Or CHEM 405 Chemical Principles for Engineers if applicable
- <sup>3</sup> ESCI 530 Geological Field Methods is required for the geology and geophysics specializations
- <sup>4</sup> Geophysics track must select ESCI 701 Quantitative Methods in Earth Sciences
- <sup>5</sup> The following should be considered: additional 700-level Earth sciences courses; additional chemistry, mathematics, and physics courses; courses in computer science, engineering, and the biological sciences; and an off-campus field camp.

## Specialization Requirements

Code	Title	Credits
<b>Climate Specialization</b>		
ESCI 514	Introduction to Climate	3
ESCI 561	Landscape Evolution	4
Select at least two of the following:		6-7
ESCI 758	Introductory Physical Oceanography	
ESCI 760	Paleoceanography	
ESCI #762	Glacial Geology	
ESCI 765	Paleoclimatology	
Select three advanced-level approved electives		9-12
<b>Total Credits</b>		<b>22-26</b>

Code	Title	Credits
<b>Geology Specialization</b>		
ESCI 561	Landscape Evolution	4
ESCI 614	Introduction to Petrology	4
ESCI 631	Structural Geology	4
BIOL 412	Introductory Biology: Evolution, Biodiversity and Ecology	4
Three approved electives, two of which are at the 700 level		6-8
<b>Total Credits</b>		<b>22-24</b>

Code	Title	Credits
<b>Geophysics Specialization</b>		
MATH 527	Differential Equations with Linear Algebra	4
MATH 528	Multidimensional Calculus	4
ESCI 561	Landscape Evolution	4
or ESCI 614	Introduction to Petrology	
ESCI 631	Structural Geology	4
Select at least two of the following:		8
ESCI 734	Global Geophysics	
ESCI 756	Geotectonics	
ESCI 759	Geological Oceanography	
One approved 700-level elective		3-4
<b>Total Credits</b>		<b>27-28</b>

Code	Title	Credits
<b>Oceanography Specialization</b>		
BIOL 411	Introductory Biology: Molecular and Cellular	4
ESCI 514	Introduction to Climate	3
Select at least three of the following:		10-11
ESCI 752	Chemical Oceanography	
ESCI 758	Introductory Physical Oceanography	
ESCI 759	Geological Oceanography	

MEFB 755	Biological Oceanography	9-12
Complete three advanced-level approved electives		9-12
<b>Total Credits</b>		<b>26-30</b>

## 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

### Climate Specialization

#### First Year

Fall		Credits
ESCI 400	Freshman Field Seminar	1
ESCI 401	Dynamic Earth	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 402	Earth History	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		Credits
ESCI 501	Introduction to Oceanography	4

ESCI 530 or ESCI 534	Geological Field Methods or Techniques in Environmental Sciences	4
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PHYS 407	General Physics I	4
Discovery Course <sup>1</sup>		4

**Credits** **16**

#### Spring

ESCI 512	Principles of Mineralogy	4
ESCI 514	Introduction to Climate	3
PHYS 408	General Physics II	4
Discovery Course <sup>1</sup>		4

**Credits** **15**

#### Third Year

##### Fall

ESCI 561	Landscape Evolution	4
ESCI 758 or ESCI 760	Introductory Physical Oceanography (or 6/7__) or Paleoceanography	3

ESCI __ or Free Elective		4
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Discovery Course <sup>1</sup>		4
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Seminar or Research Experience		1
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**Credits** **16**

##### Spring

ESCI 654 or ESCI 701	Fate and Transport in the Environment or Quantitative Methods in Earth Sciences	4
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ESCI #762 or ESCI 765	Glacial Geology (or 6/7__) or Paleoclimatology	4
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Science Elective <sup>2</sup>		4
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Discovery course		4
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**Credits** **16**

#### Fourth Year

##### Fall

ESCI 6/7__		4
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ESCI 758 or ESCI 760	Introductory Physical Oceanography (or 6/7__) or Paleoceanography	3
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Science Elective <sup>2</sup>		4
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Discovery Course <sup>1</sup>		4
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Seminar or Research Experience		1
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**Credits** **16**

##### Spring

ESCI #762 or ESCI 765	Glacial Geology (or 6/7__) or Paleoclimatology	4
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Science Elective <sup>2</sup>		4
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Discovery Course <sup>1</sup>		4
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Senior Capstone		4
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**Credits** **16**

**Total Credits** **128**

## Geology Specialization

First Year			
<b>Fall</b>			
ESCI 400	Freshman Field Seminar		1
ESCI 401	Dynamic Earth		4
MATH 425	Calculus I		4
CHEM 403	General Chemistry I		4
ENGL 401	First-Year Writing (or pass placement test)		4
<b>Credits</b>			<b>17</b>
<b>Spring</b>			
ESCI 402	Earth History		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>
<b>Second Year</b>			
<b>Fall</b>			
ESCI 530	Geological Field Methods		4
ESCI 561	Landscape Evolution		4
PHYS 407	General Physics I		4
Discovery Course <sup>1</sup>			4
<b>Credits</b>			<b>16</b>
<b>Spring</b>			
ESCI 501	Introduction to Oceanography		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>
<b>Third Year</b>			
<b>Fall</b>			
ESCI 614	Introduction to Petrology		4
ESCI 631	Structural Geology		4
BIOL 412	Introductory Biology: Evolution, Biodiversity and Ecology		4
Discovery Course <sup>1</sup>			4
<b>Credits</b>			<b>16</b>
<b>Spring</b>			
ESCI 654	Fate and Transport in the Environment (or		4
or ESCI 701	6__)		
	or Quantitative Methods in Earth Sciences		
Free Elective			4
Science Elective <sup>2</sup>			4
Discovery Course <sup>1</sup>			4
<b>Credits</b>			<b>16</b>
<b>Fourth Year</b>			
<b>Fall</b>			
ESCI 7__			4
Free Elective			4
Science Elective <sup>2</sup>			4
Discovery Course <sup>1</sup>			4
<b>Credits</b>			<b>16</b>

Spring			
ESCI 7__			4
Science Elective <sup>2</sup>			4
Discovery Course <sup>1</sup>			4
Senior Capstone			4
<b>Credits</b>			<b>16</b>
<b>Total Credits</b>			<b>129</b>

## Geophysics Specialization

First Year			
<b>Fall</b>			
ESCI 400	Freshman Field Seminar		1
ESCI 401	Dynamic Earth		4
MATH 425	Calculus I		4
CHEM 403	General Chemistry I		4
ENGL 401	First-Year Writing (or pass placement test)		4
<b>Credits</b>			<b>17</b>
<b>Spring</b>			
ESCI 402	Earth History		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>
<b>Second Year</b>			
<b>Fall</b>			
ESCI 530	Geological Field Methods		4
ESCI 561	Landscape Evolution (or 6/7__)		4
PHYS 407	General Physics I		4
Discovery Course <sup>1</sup>			4
<b>Credits</b>			<b>16</b>
<b>Spring</b>			
ESCI 501	Introduction to Oceanography		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>
<b>Third Year</b>			
<b>Fall</b>			
ESCI 614	Introduction to Petrology (or 6/7__)		4
ESCI 631	Structural Geology		4
MATH 527	Differential Equations with Linear Algebra		4
Discovery Course <sup>1</sup>			4
<b>Credits</b>			<b>16</b>
<b>Spring</b>			
ESCI 701	Quantitative Methods in Earth Sciences		4
MATH 528	Multidimensional Calculus		4
Science Elective <sup>2</sup>			4
Discovery Course <sup>1</sup>			4
<b>Credits</b>			<b>16</b>
<b>Fourth Year</b>			
<b>Fall</b>			
ESCI 759	Geological Oceanography		4

Free Elective	4
Science Elective <sup>2</sup>	4
Discovery Course <sup>1</sup>	4
<b>Credits</b>	<b>16</b>
<b>Spring</b>	
ESCI 734 Global Geophysics (or ESCI 756)	4
Science Elective <sup>2</sup>	4
Discovery Course <sup>1</sup>	4
Senior Capstone	4
<b>Credits</b>	<b>16</b>
<b>Total Credits</b>	<b>129</b>

## Oceanography Specialization

### First Year

Fall	Credits
ESCI 400 Freshman Field Seminar	1
ESCI 401 Dynamic Earth	4
MATH 425 Calculus I	4
CHEM 403 General Chemistry I	4
ENGL 401 First-Year Writing (or pass placement test)	4
<b>Credits</b>	<b>17</b>

### Spring

ESCI 402 Earth History	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	Credits
ESCI 501 Introduction to Oceanography	4
ESCI 530 Geological Field Methods or ESCI 534 or Techniques in Environmental Sciences	4
PHYS 407 General Physics I	4
Discovery Course <sup>1</sup>	4
<b>Credits</b>	<b>16</b>

### Spring

ESCI 512 Principles of Mineralogy	4
ESCI 514 Introduction to Climate	3
PHYS 408 General Physics II	4
Discovery Course <sup>1</sup>	4
<b>Credits</b>	<b>15</b>

### Third Year

Fall	Credits
ESCI 758 Introductory Physical Oceanography (or 6/7__)	3
ESCI 6/7__ or Free Elective	4
Science Elective <sup>2</sup>	4
Discovery Course <sup>1</sup>	4
Seminar or Research Experience	1
<b>Credits</b>	<b>16</b>

### Spring

ESCI 654 Fate and Transport in the Environment (or or ESCI 710 6/7__) or Groundwater Hydrology	4
ESCI 6/7__ or Free Elective	4
MEFB 755 Biological Oceanography	4
Discovery Course	4
<b>Credits</b>	<b>16</b>

### Fourth Year

#### Fall

ESCI 6/7__	4
ESCI 759 Geological Oceanography (or 6/7__)	4
Science Elective <sup>2</sup>	4
Discovery Course <sup>1</sup>	4
<b>Credits</b>	<b>16</b>

#### Spring

ESCI 752 Chemical Oceanography (or 6/7__)	3
Science Elective <sup>2</sup>	4
Discovery Course <sup>1</sup>	4
Senior Capstone	4
Seminar or Research Experience	1.0
<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 (Biological Sciences; Environment Technology & Society; Historical Perspectives; World Culture; Fine & Performing Arts; Social Science; Humanities).

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

## Student Learning Outcomes

Students will be able to:

- Recognize common Earth materials and structures.
- Describe how Earth scientists construct the geological time scale and apply geochronologic dating techniques.
- Describe the broad attributes of and interactions within the Earth System, as well as its geological history, how and why it is changing today, and how those changes impact society.
- Understanding Earth processes and cycles.
- Perform simple calculations to process and evaluate quantitative Earth science data..
- Collect, interpret, and synthesize basic field observations and measurements to develop and test multiple working hypotheses to explain them.
- Become proficient in basic geological and Earth science laboratory skills.
- Successfully apply basic calculus and chemistry to Earth science problems.
- Summarize, analyze, and evaluate student-generated scientific data and the primary Earth sciences literature.

- Effectively communicate results of scientific inquiries orally, visually, and in writing.