

# ENVIRONMENTAL SCIENCE, B.S.

## Environmental Science Major

The major leading to the B.S. degree emphasizes the technical and analytical aspects of environmental science with concentrations in earth science and biology. The program is designed for those students intending to work as scientists in laboratory, field, or research positions. Students with this degree may enter graduate programs in geology, biology, and environmental science. Total credits - 126

## Environmental Science with a Concentration in Earth Science B.S. Degree-Required Courses and Recommended Course Sequence

### First Semester Credits

[[BIO-121]] Principles of Modern Biology I	4
[[FYF-101]] First-Year Foundations	3
[[MTH-111]] Calculus I	4
[[CHM-113]] Elements & Compounds Lab	1
[[CHM-115]] Elements & Compounds	3
	<b>15</b>

### Second Semester

[[CHM-114]] The Chemical Reaction Lab	1
[[CHM-116]] The Chemical Reaction	3
[[BIO-122]] Principles of Modern Biology II	4
[[GEO-101]] Introduction to Geology	3
[[GEO-103]] Introduction to Geology Lab	1
[[MTH-114]] Calculus and Modeling for the Biological and Health Sciences	4
	<b>16</b>

### Third Semester

[[EES-251]] Synoptic Meteorology	4
[[MTH-150]] Elementary Statistics	3
[[ENG-101]] Composition	4
[[PHY-171]] Principles of Classical and Modern Physics	4

Distribution Requirement	3
	<b>18</b>

### Fourth Semester

[[EES-210]] Global Climate Change	3
[[EES-213]] Climate Modeling	1
[[EES-240]] Principles of Environmental Engineering & Science	3
[[EES-241]] Principles of Environmental Engineering & Science Lab	1
[[PHY-174]] Applications of Classical & Modern Physics	4
Distribution Requirement	3
	<b>15</b>

### Fifth Semester

[[EES-230]] Ocean Science	4
[[ENV-321]] Hydrology	3
[[ENV-323]] Hydrology Lab	1
[[GIS-271]] Introduction to GPS & GIS	3
[[EES-394]] Field Study	1
Distribution Requirements	6
	<b>18</b>

### Sixth Semester

[[ENV-330]] Water Quality	4
[[GIS-272]] Advanced GIS & Remote Sensing	3
[[EES-302]] Science Research and Communication	1
[[EES-304]] Environmental Data Analysis	2
Program Elective	3
	<b>16</b>

### Seventh Semester

[[EES-201]] Environmental Ethics and Sustainability	1
[[ENV-315]] Soils	3
[[EES-391]] Senior Projects I	1
Program Electives	6
Distribution Requirement	3
	<b>14</b>

### Eighth Semester

[[GEO-370]] Geomorphology	3
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## Environmental Science, B.S.

[[EES-390]] Environmental Science Seminar	3
[[EES-392]] Senior Projects II	2
Distribution Requirements	3
Free Elective	3
	<b>14</b>

### NOTE:

All program electives must be 200 level or higher.

B.S. candidates are encouraged to complete a science minor (e.g., Physics, Chemistry, or Biology); consult the undergraduate bulletin for details. Candidates are also encouraged to have relevant cooperative educational experiences, 6 credits of which may be applied as EES electives.

Courses at the 200-level and above are intended for science and mathematics majors only. Exceptions may be made with permission of the instructor. Election of a 200-level course by a non-science major will preclude registration for the corresponding 100-level course.

## Environmental Science with a Concentration in Biology B.S. Degree - Required Courses and Recommended Course Sequence

### First Semester Credits

[[BIO-121]] Principles of Modern Biology I	4
[[FYF-101]] First-Year Foundations	3
[[MTH-111]] Calculus I	4
[[CHM-113]] Elements & Compounds Lab	1
[[CHM-115]] Elements & Compounds	3
	<b>15</b>

### Second Semester Credits

[[CHM-114]] The Chemical Reaction Lab	1
[[CHM-116]] The Chemical Reaction	3
[[BIO-122]] Principles of Modern Biology II	4
[[GEO-101]] Introduction to Geology	3
[[GEO-103]] Introduction to Geology Lab	1
[[MTH-114]] Calculus and Modeling for the Biological & Health Sciences	4

	<b>16</b>
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### Third Semester Credits

[[EES-251]] Synoptic Meteorology	4
[[MTH-150]] Elementary Statistics	3
[[ENG-101]] Composition	4
[[PHY-171]] Principles of Classical and Modern Physics	4
Distribution Requirement	3
	<b>18</b>

### Fourth Semester Credits

[[EES-210]] Global Climate Change	3
[[EES-213]] Climate Modeling	1
[[EES-240]] Principles of Environmental Engineering & Science	3
[[EES-241]] Principles of Environmental Engineering & Science Lab	1
[[PHY-174]] Applications of Classical & Modern Physics	4
Distribution Requirement	3
	<b>15</b>

### Fifth Semester Credits

[[BIO-225]] Population and Evolutionary Biology	4
[[BIO-347]] Biostats and Experimental Design	4
[[GIS-271]] Introduction to GPS & GIS	3
[[CHM-231]] Organic Chemistry I	3
[[CHM-233]] Organic Chemistry I Lab	1
Distribution Requirement	3
	<b>18</b>

### Sixth Semester Credits

[[GIS-272]] Advanced GIS & Remote Sensing	3
[[EES-302]] Science Research and Communication	1
EES/BIO Electives	6
Distribution Requirement	3
Free Elective	3
	<b>16</b>

**Seventh Semester Credits**

[[EES-201]] Environmental Ethics and Sustainability	1
[[ENV-315]] Soils	3
[[EES-341]] Freshwater Ecosystems	3
[[ENV-391]] Senior Projects I	1
EES/BIO Electives	6
	<b>14</b>

**Eight Semester Credits**

[[EES-390]] Environmental Science Seminar	3
[[EES-392]] Senior Projects II	2
Distribution Requirements	6
Free Elective	3
	<b>14</b>

**NOTE:**

All program electives must be 200 level or higher.

B.S. candidates are encouraged to complete a science minor (e.g., Physics, Chemistry, or Biology); consult the undergraduate bulletin for details. Candidates are also encouraged to have relevant cooperative educational experiences, 6 credits of which may be applied as EES electives.

Courses at the 200-level and above are intended for science and mathematics majors only. Exceptions may be made with permission of the instructor. Election of a 200-level course by a non-science major will preclude registration for the corresponding 100-level course.

**EES. EARTH AND ENVIRONMENTAL SCIENCES****EES-198/298/398. TOPICS IN EES**

**Credits:** Varies with topic

Departmental courses on topics of special interest, not extensively treated in regularly scheduled offerings, will be presented under this course number on an occasional basis. May be repeated for credit.

[Click here for fee for courses with a lab.](#)

**Pre-Requisites**

Varies with topic studied.

**EES-105. PLANET EARTH**

**Credits:** 3

The nature of our planet and how it works are examined in the context of Earth as a constantly changing dynamic system. An emphasis on global scale processes and the interaction of humans and their physical environment is coupled with in-depth coverage of how science is done and the scientific principles that influence our planet, its rocks, mountains, rivers, atmosphere, and oceans. Major sub-topical areas in the Planet Earth series may include geology (Forces of Geologic Change), oceanography (The Restless Ocean), astronomy (The Cosmic Perspective), geography (Global Regions and Geography), and the relationship between people and their physical surroundings (The Global Environment). Intended for students who are not majoring in science, engineering, pre-pharmacy, nursing, or B.S. programs in mathematics or computer science. Two hours of lecture and two hours of lab per week.

[Click here for course fees.](#)

**Pre-Requisites**

No previous background in science or college-level mathematics is required.

**EES-201. ENVIRONMENTAL ETHICS AND SUSTAINABILITY**

**Credits:** 1

This course entails an examination of the central topics of environmental ethics and sustainability as viewed from the perspectives of science. Ethical and sustainability paradigms that all environmental scientists should be aware of will be studied. Course is delivered online.

**Pre-Requisites**

[[EES-240]] and [[EES-241]], or permission of the instructor.

**EES-210. GLOBAL CLIMATE CHANGE**

**Credits:** 3

The nature and function of earth's global climate are examined from a unified system perspective. Major questions focus on scientific versus public understanding of trends in global temperature, precipitation, and sea level. The course emphasizes negative and positive feedback processes that force key changes in the earth's climate system: past, present, and future. Topics include fundamentals of global and regional heat and water balance, the role of elemental cycles in controlling climate (e.g., the carbon cycle), descriptive climate classification, long-term, short-term, and catastrophic climatic change (e.g., ice ages and bolide impacts), and human effects on climate (e.g., enhanced greenhouse, rising sea level). This course integrates a scientific understanding of climatic change and explores contemporary social and economic policy responses to change scenarios. Three hours of lecture per week.

## Environmental Science, B.S.

### EES-213. CLIMATE MODELING

**Credits:** 1

Students will utilize software to construct basic models of Earth Systems. No prior knowledge of the software is assumed or required. Weekly assignments will consist of computer-based modeling exercises, each progressively building upon previous assignments. Specifically, students will utilize software to construct relatively simple models of world population growth, fossil fuel consumption, the global carbon cycle, and the Earth's energy balance. The final modeling exercise couples the population growth, carbon cycle, and Earth energy balance assignments in an effort to explore the effect of future population growth and carbon dioxide emissions on global mean temperature. Two hours of lab per week.

**Co-Requisites**

[[EES-210]]

### EES-218. ENVIRONMENTAL ETHICS

**Credits:** 3

An examination of the central problems of environmental ethics as viewed from the perspectives of science and of philosophy. The value of nature and 'natural objects,' differing attitudes toward wildlife and the land itself, implications of anthropocentrism, individualism, ecocentrism, and ecofeminism, bases for land and water conservation, and other topics will be examined within a framework of moral and scientific argument. Cross-listed with [[PHL-218]].

**Pre-Requisites**

[[PHL-101]] or [[EES-240]] and [[EES-241]], or permission of the instructor.

### EES-230. OCEAN SCIENCE

**Credits:** 4

An interdisciplinary approach to the study of the fundamentals of oceanography emphasizing physical, chemical, and biological interrelationships. Three hours of lecture and three hours of lab. Requirements: For CS, Engineering, Math, and Science majors only

[Click here for course fees.](#)

### EES-240. PRINCIPLES OF ENVIRONMENTAL ENGINEERING & SCIENCE

**Credits:** 3

A study of physical, chemical, and biological components of environmental systems and a discussion of processes involved in water quality management, air quality management, waste management, and sustainability. Three hours of lecture per week.

**Pre-Requisites**

[[MTH-111]] or permission of the instructor. Requirements: for CS, Engineering, Math, and Science majors only.

### EES-241. PRINCIPLES OF ENVIRONMENTAL ENGINEERING & SCIENCE LAB

**Credits:** 1

Experiments with and analysis of the physical, chemical, and biological components of environmental systems.

[Click here for course fees.](#)

**Co-Requisites**

[[EES-240]] concurrent or prior.

### EES-242. ENVIRONMENTAL HEALTH

**Credits:** 3

To provide students with an understanding of man's impact on the environment and how those impacts can be controlled or mitigated. Students completing this course should be able to recognize environmental problems and understand control and preventative measures. Three hours of lecture.

**Pre-Requisites**

Introductory physics and chemistry. Students who have taken [[EES-240]] will be admitted only with the consent of the instructor.

### EES-251. SYNOPTIC METEOROLOGY

**Credits:** 4

Topics include surface and upper air weather systems, weather phenomena, climate, and local weather influences. Synoptic map analysis and interpretation are emphasized. Three hours of lecture and three hours of lab per week. Requirements: For CS, Engineering, Math, and Science majors only

[Click here for course fees.](#)

### EES-261. REGIONAL GEOGRAPHY

**Credits:** 3

Topics covered include maps and charts and basic elements of physical, cultural, historical, and economic geography as applied to specific geographic regions. Three hours of lecture per week.

### EES-280. PRINCIPLES OF ASTRONOMY

**Credits:** 4

Topics include orbital mechanics, results of planetary probes, spectra and stellar evolution, and cosmology. Three hours of lecture and three hours of lab per week. Requirements: For Science majors only

[Click here for course fees.](#)

**EES-302. SCIENCE RESEARCH AND COMMUNICATION****Credits:** 1

The aim for this course is to provide students with the necessary foundation to think critically about scientific research and communication. The course introduces students to the (1) philosophy of science, (2) design, execution, and evolution of scientific projects, (3) exploration, evaluation, and management of scientific literature, (4) methods and ethics of scientific communication, and (5) proposal design for a project to be continued into Senior Project (EES/GEO 391/392) that includes a literature review, definition of research questions, objectives, or testable hypotheses, and the methods used to carry out the project. The broader social and political context in which scientific research is situated and must respond to and interact with is also explored. More than that, this course explores the important connections between research design and communication by having students focus on the application of learned theory and skills to projects with Senior Project advisor.

**Pre-Requisites**

Junior standing.

**EES-304. ENVIRONMENTAL DATA ANALYSIS****Credits:** 2

To acquaint students majoring in earth and environmental sciences with the techniques and methods of data acquisition and analysis, including environmental sampling methodology and data management. Emphasis will be placed on examination of real data sets from various areas of the earth and environmental sciences with particular emphasis placed on using and applying graphical and statistical procedures used in [[EES-391]]-392 (Senior Projects). Two hours of lecture per week.

**Pre-Requisites**

[[MTH-150]] and Junior standing or permission of the instructor.

**EES-340. CONSERVATION BIOLOGY****Credits:** 3

This course covers the major topics of conservation biology including an introduction to biodiversity, threats to biodiversity, and solutions to diminish extinctions and population declines. Lecture: three hours per week. Offered each year. Cross-listed with [[BIO-340]].

**Pre-Requisites**

[[BIO-225]] - [[BIO-226]] or permission of the instructor.

**EES-341. FRESHWATER ECOSYSTEMS****Credits:** 3

A study of the biological and ecological aspects of streams, lakes, and wetlands from a watershed perspective. An initial introduction to physical, chemical, and geological principles of limnology is followed by a focus on freshwater biology. Laboratories include field-based watershed investigations and lake management assessments using geographic information systems techniques. Cross-listed with [[BIO-341]]. Two hours of lecture and three hours of lab per week. Offered in alternate years.

[Click here for course fees.](#)**Pre-Requisites**

[[GEO-101]] - [[GEO-103]], or [[EES-240]] - [[EES-241]], or [[BIO-121]] - [[BIO-122]] or permission of the instructor.

**EES-343. MARINE ECOLOGY****Credits:** 3

An examination of the biology of marine life within the context of modern ecological principles. The structure and physiology of marine organisms will be studied from the perspectives of adaptation to the ocean as habitat, biological productivity, and interspecific relationships. Emphasis will be placed on life in intertidal zones, estuaries, surface waters, and the deep sea. Two hours of lecture and three hours of lab per week. Cross-listed with [[BIO-343]]. Offered in alternate years.

[Click here for course fees.](#)**Pre-Requisites**

[[EES-230]] and [[BIO-121]] - [[BIO-122]] or permission of the instructor. Students must have formal course experiences in oceanography and biology at the science major level or have completed their sophomore year as a biology major.

**EES-344. ECOLOGY****Credits:** 4

Ecology examines contemporary ecological thinking as it pertains to the interrelationships of organisms and their environments. Interactions at the populations and community level are emphasized. Two hours of lecture and three hours of lab per week. Cross-listed with [[BIO-344]]. Offered in alternate years.

[Click here for course fees.](#)**Pre-Requisites**

[[BIO-121]] - [[BIO-122]] or permission of the instructor.

**EES-366. FIELD BOTANY****Credits:** 3

This is a specialized summertime field course, which emphasizes a taxonomic, phylogenetic, and ecological survey of higher plants indigenous to Northeastern Pennsylvania. Due to the extensive field work, enrollment is somewhat more restricted than in other courses; therefore, written permission from the instructor is the primary prerequisite for those upperclassmen who wish to register for the course. Cross-listed with [[BIO-366]]. Offered in alternate years.

[Click here for course fees.](#)**Pre-Requisites**

[[BIO-121]] - [[BIO-122]] or permission of the instructor.

## Environmental Science, B.S.

### **EES-390. ENVIRONMENTAL SCIENCE SEMINAR**

**Credits:** 3

This course is presented seminar-style, focusing on Environmental Science topics relevant to current problems, trends, and news. The course serves as an open and constructive venue where students will have an opportunity to delve into themed topics and more holistically discuss environmental science issues. The theme of the course will change each term, but will remain within the Environmental Sciences: ecology, environmental chemistry, sustainability, climate change, hazardous waste, etc. Students are required to read and actively discuss scientific literature, assemble and analyze relevant data, formulate and criticize quantitative/qualitative theories, and explore case studies. Three hours of seminar per week. Requirement: students with senior standing only.

### **EES-391. SENIOR PROJECTS I**

**Credits:** 1

Design and development of selected projects in earth and environmental sciences and other related fields under the direction of a staff member. Technical as well as economical factors will be considered in the design. A professional paper and detailed progress report are required.

[Click here for course fees.](#)

#### **Pre-Requisites**

Department permission

### **EES-392. SENIOR PROJECTS II**

**Credits:** 2

Design and development of selected projects in earth and environmental sciences and other related fields under the direction of a staff member. Technical as well as economical factors will be considered in the design. A professional paper to be presented and discussed in an open forum is required.

[Click here for course fees.](#)

#### **Pre-Requisites**

[[EES-391]] or department permission. (See the department for more details about the department permission.)

### **EES-394. FIELD STUDY**

**Credits:** 1-3

On-site study of an earth or environmental problem or situation incorporating field documentation and investigative techniques. May be repeated for credit when no duplication of experience results. One hour of lecture, plus field trips.

[Click here for course fees.](#)

#### **Pre-Requisites**

[[EES-240]], [[EES-241]], [[GEO-101]] and [[GEO-103]].

### **EES-395. AND 396. INDEPENDENT RESEARCH**

**Credits:** Varies with topic 1-3 credits.

Independent study or research of specific earth or environmental science topic at an advanced level under the direction of a departmental faculty member.

[Click here for course fees.](#)

#### **Pre-Requisites**

Upper class standing and approval of academic advisor, research advisor, and department chairperson.

### **EES-399. COOPERATIVE EDUCATION**

**Credits:** 1-6

Professional cooperative education placement in a private or public organization related to the student's academic objectives and career goals. In addition to their work experience, students are required to submit weekly reaction papers and an academic project to a Faculty Coordinator in the student's discipline. See the Cooperative Education section of this bulletin for placement procedures.

#### **Pre-Requisites**

Sophomore standing; minimum 2.0 cumulative GPA; consent of the academic advisor; and approval of placement by the department chairperson.

### **EES-498. TOPICS**

**Credits:** Varies with topic

Departmental courses on advanced topics of special interest, not extensively treated in regularly scheduled offerings, will be presented under this course number on an occasional basis. Available for either undergraduate or graduate credit. May be repeated for credit.

[Click here for fee for courses with a lab.](#)

#### **Pre-Requisites**

Senior or graduate standing