

# EARTH & ENVIRONMENTAL SCIENCES DEPARTMENT

---

## FACULTY

Dan Ressler, Ph.D., Associate Professor of Earth & Environmental Sciences, interim department head

Katherine Straub, Ph.D., Professor of Earth & Environmental Sciences, [department head](#)

Jennifer Mary Elick, Ph.D., Associate Professor of Earth & Environmental Sciences

Ahmed Lachhab, Ph.D., Associate Professor of Earth & Environmental Sciences

Derek J. Straub, Ph.D., Associate Professor of Earth & Environmental Sciences

## LEARNING GOALS:

- Understand the scientific method and how it is applied in the context of a discipline.
- Understand the earth system, the connections between abiotic and biotic systems, and the effect of the human society on the natural system. Understand the historical context of environmental awareness.
- Application of classification systems: vocabulary, observation and categorization.
- Scale interaction within space and time on earth science processes and outcomes.
- Geographic relationships of Earth, science processes, landforms and materials and comprehension of methods to relate these relationships.
- Data, plot and map interpretation and construction.
- Discipline-appropriate methods for observation, classification, characterization and description using relevant technologies and telemetries.
- Development of discipline-appropriate synthesis of readings, laboratory work and course material to produce original scientific understanding.

**Double-counting restriction:** students in the Earth and Environmental Sciences department may double-count a maximum of 16 semester hours toward another major or minor.

**Requirements for the Major in Earth and Environmental Sciences.** All majors must complete the department foundation courses, a choice of distribution courses, and the corollary science and mathematics courses listed below. To satisfy degree requirements, courses in the Department of Earth and Environmental Sciences must be completed with grades of C- or higher. Students who change majors after completing EENV-102, EENV-103, EENV-104, EENV-105 or EENV-213 may substitute that course in place of EENV-101 in the introductory sequence.

### 16 Department Introductory Sequence

- 4 EENV-101 Environmental Science
- 4 EENV-113 Geology and the Environment
- 4 EENV-220 Water Resources
- 4 EENV-240 Introduction to Meteorology

### 12 Distribution Requirements (one course each from 3 of the following 4 categories)

#### Water Distribution

[EENV-380 Wetlands Analysis](#)

[EENV-420 Groundwater Hydrology](#)

#### Geology Distribution

[EENV-283 Sedimentology/Stratigraphy](#)

[EENV-313 The Susquehanna River](#)

#### Surface Distribution

[EENV-370 Environmental Geophysics](#)

[EENV-383 Soil Science](#)

**Climate/Energy Distribution**  
**EENV-242 Climate and Global Change**  
**EENV-332 Sustainable Energy Resources**

8 Electives (8 SH from additional courses in the distribution list above or the following elective courses:)

- 4 ECOL-201 Ecosystems
- 4 EENV-250 Topics in Earth and Environmental Sciences
- 4 EENV-360 Geographic Information Systems
- 4 EENV-373 Air Quality
- 4 EENV-430 Chemistry of Natural Waters
- 4 CHEM-221 Organic Chemistry I
- 4 BIOL-408 Aquatic Ecology and BIOL-409 Aquatic Ecology Laboratory

20 Corollary Courses

Two of the following four courses for 8 SH: (MATH-108 Introduction to Statistics, MATH-111 Calculus I, MATH-112 Calculus II or MATH-201 Linear Algebra)

- 4 General Chemistry I (Choose from: CHEM-101, CHEM-103 or CHEM-111)
- 4 General Chemistry II (Choose from: CHEM-102, CHEM-104 or CHEM-232)
- 4 Introductory Physics I (Choose from: PHYS-202, PHYS-203 or PHYS-204)

4 Senior Research: EENV-510 Senior Project I

4 Capstone Experience: EENV-511 Senior Project II or 4 SH from an approved Capstone experience in another department

For the purposes of calculating the required 2.00 minimum GPA in the major, the Earth and Environmental Sciences Department uses all of the major courses with the EENV prefix.

**Minor in Earth and Environmental Sciences.** The minor requires 20 semester hours, with grades of C- or better, from among the courses in the major. No more than 8 SH in 100-level EENV courses may be applied toward the minor.

**Double-counting restriction:** students may double-count a maximum of 8 semester hours toward another major or minor.

**Honors in Earth and Environmental Sciences.** The departmental honors program encourages and recognizes superior academic performance in earth and environmental sciences. To graduate with departmental honors, earth and environmental sciences majors must:

- Maintain a cumulative GPA of 3.25 and a GPA of 3.50 in Earth and Environmental Science courses;
- Earn a score of 75% or higher on the department comprehensive exam;
- Earn an A- or higher in both EENV-510 and EENV-511; and
- Pass an oral comprehensive examination of their thesis in their final semester.

## **EARTH AND ENVIRONMENTAL SCIENCES COURSES**

### **EENV-101 Environmental Science**

Modern society functions with incredible resources and conveniences. Some of this progress has come at a great environmental price. This course investigates the scientific principles of the geosphere, hydrosphere, biosphere and atmosphere, and examines the environmental issues that our society faces. Topics include sustainability, ecology, resources, energy, pollution, wastes and approaches to living in a more sustainable way. 4 SH. 3 lecture hours, 3 laboratory/field hours. CC: Scientific Explanations.

### **EENV-102 Environmental Hazards**

Investigation of selected natural hazards, including volcanic eruptions, earthquakes, severe weather and landslides that affect and may be affected by humans. Topics are interrelated by case studies, discussion of current issues, and laboratory and field exercises. 4 SH. 3 lecture hours, 3 laboratory/field hours. CC: Scientific Explanations.

### **EENV-103 Earth System History**

This course focuses on life from its origin on this planet to its present diversity of species. Students learn about the fundamental physical and biological changes that have shaped and influenced the Earth system since its formation 4.6 billion years ago. Topics addressed include physical concepts that deal with geologic time and stratigraphic relationships, plate tectonics and nutrient cycling. Discussions cover such topics as the origin of life, evolutionary processes, the expansion of biodiversity, the radiation of organisms in the oceans, the conquest of land, mass extinctions, dinosaurs and the rise of humans. 4 SH. 3 lecture hours, 3 laboratory/field hours. CC: Scientific Explanations.

### **EENV-104 Weather and Climate**

Introduction to basic concepts in meteorology, including temperature, pressure, precipitation, winds, fronts, severe weather, forecasting and atmospheric measurements. The focus is on observing the atmosphere and explaining our observations. Labs include weather map analysis, lab experiments and field trips. 4 SH. 3 lecture hours, 3 laboratory/field hours. CC: Scientific Explanations.

### **EENV-105 Energy and the Environment**

Modern society relies on cheap and abundant energy for almost every aspect of daily life, from transportation to entertainment. Where does this energy come from? How much do we consume? How will we meet our future energy needs? What are the consequences of our energy use? These questions will be addressed as energy use and its impact on the environment is explored. Topics include the scientific principles that define energy and its transformation, society's current reliance on fossil fuels, climate change, and alternative and sustainable energy sources. 4 SH. 3 lecture hours, 3 laboratory/field hours. CC: Scientific Explanations.

### **EENV-113 Geology and the Environment**

Fundamental concepts and principles of geology and the processes and materials that interact at the surface of the Earth. The course includes rocks and minerals, plate tectonic interactions, weathering and erosion, the cycling of materials through different environments, and how we use these resources. Same as ECOL-113. 4 SH. 3 lecture hours, 3 laboratory/field hours.

### **EENV-213 Oceanography**

Introduction to oceanography. The processes that control the formation and function of the oceans. The course focuses on food, mineral and energy resources associated with the ocean and societies' influence on those resources. 4 SH. 3 lecture hours, 3 laboratory/field hours. CC: Diversity Intensive, Ethics Intensive, Scientific Explanations.

### **EENV-220 Water Resources**

Introduction to watersheds and water resources. Students study the distribution and variation in water resources (lakes, rivers, groundwater) and the historical impact of water resources on societies past and present. Topics include surface water hydrology, fluvial geomorphology, hill slope processes, water budgets, stream flow, water allocation law, water conflicts, and surface water and groundwater interactions. Prerequisite: EENV-101 or ECOL-100 or EENV-113. 4 SH. 3 lecture hours, 3 laboratory/field hours.

### **EENV-240 Introduction to Meteorology**

A comprehensive overview of the atmospheric processes responsible for observed weather patterns. This course provides students with an understanding of radiation and energy budgets, cloud formation, precipitation processes, surface and upper-level winds, the global circulation, and the development of midlatitude cyclones and severe weather. 4 SH. 3 lecture hours, 3 laboratory/field hours.

### **EENV-242 Climate and Global Change**

An overview of the Earth's past, present and future climate. Topics include climate forcing, response and feedbacks; observed climate change; climate data; anthropogenic climate change; and climate change treaties. Prerequisite: sophomore standing. 4 SH. CC: Interdisciplinary, Writing Intensive.

### **EENV-250 Topics in Earth and Environmental Sciences**

Selected topics vary depending on instructor, student interest and new advances in environmental science. Topics might include watershed modeling, geology of Pennsylvania, meteorology or the natural history of the Susquehanna River basin. Prerequisites: Earth and environmental sciences major or minor, environmental studies major or minor, or ecology major or minor. 1-4 SH.

### **EENV-283 Sedimentology/Stratigraphy**

An introduction to the properties, classification and nomenclature of soils, sediments and sedimentary rocks. Discusses processes that create, transport, deposit and lithify sediments. Students examine depositional environments where sediments form and accumulate, the properties of sedimentary rocks and the stratigraphic framework of sedimentary successions. Prerequisite: EENV-113. 4 SH. 3 lecture hours, 3 laboratory/field hours. CC: Writing Intensive.

### **EENV-313 The Susquehanna River**

This course will examine the Susquehanna River drainage basin from multiple perspectives including its geologic history, ecologic relationships and influences throughout the basin, the historical colonization and use of resources within the basin, and our recent response to the environmental issues that currently plague the system. Through a multidisciplinary approach, we will begin to better understand this complex environment and its future outcome. Prerequisites: sophomore standing, EENV-101 or ECOL-100, and EENV-113 (same as ECOL-113). 4 SH. 3 lecture hours, 3 laboratory/field hours. CC: Ethics Intensive, Interdisciplinary.

### **EENV-332 Sustainable Energy Resources**

An overview of energy use, its effect on the environment and the potential for sustainable energy solutions. Traditional, non-sustainable energy production from fossil fuels is first described in terms of energy efficiency, environmental impact and available reserves. This is followed by a description of individual sustainable energy technologies with a focus on the underlying science, energy production rates, viability and potential limitations. Specific technologies that are discussed include: wind turbines, solar thermal systems, solar photovoltaics, hydropower, wave and tidal energy capture, and geothermal heating. Prerequisites: Sophomore standing. 3 lecture hours, 3 laboratory/field hours. 4 SH. CC: Interdisciplinary.

### **EENV-360 Geographic Information Systems**

An introduction to geographic information systems (GIS) theory, software and practical application. Students will use GIS software to organize, edit, analyze and display geographic data to develop new understanding and interpretation of both natural and human landscapes and resources. Mapping exercises and student projects will be used to develop skills in data management, spatial analysis and estimation (geostatistics), terrain analysis, and spatial modeling. Prerequisite: Sophomore standing. 4 SH. 3 lecture hours, 3 laboratory hours. CC: Interdisciplinary.

### **EENV-370 Environmental Geophysics**

Methods of near-surface geophysical explorations with emphasis on solving environmental and geotechnical problems. Students learn the basic physical variation in Earth and non-Earth materials and how these variations may be used to discern what lies beneath the Earth's surface. Examples of near-surface geophysical applications include detection of contaminant plumes, buried metallic objects, variations in geological materials, aggregates and mining, forensics, archaeology, and hydrogeology. Prerequisites: EENV-113 and MATH-111. 4 SH. 3 lecture hours, 3 laboratory/field hours.

### **EENV-373 Air Quality**

An introduction to air quality and air pollution issues from the regional scale to the global scale. This course examines the various types and sources of air pollutants and the effects of air pollution on health, welfare and the environment. Specific topics include acid deposition, tropospheric and stratospheric ozone, visibility degradation, air pollution meteorology, and regulatory aspects of air quality. Laboratory experiments focus on air-quality measurement strategies. Prerequisites: EENV-240, General Chemistry I, (CHEM-101, -103, or -111), General Chemistry II (CHEM-102, -104 or -112) or instructor's permission. 4 SH. 3 lecture hours, 3 laboratory/field hours.

### **EENV-380 Wetlands Analysis**

Wetlands are complex environments that are controlled by chemical, biological and physical interactions. The course explores the structure, function, management and jurisdictional delineation of non-tidal freshwater wetlands. Lecture material covers the history of wetlands use/abuse; current definitions and analysis of the common indicators of wetland function; and hydrology, soils and vegetation. The laboratory consists of plant identification, techniques for hydric soil analysis and identification of wetland hydrology indicators using current methodologies for delineation of jurisdictional wetlands. Same as ECOL-380. Prerequisites: CHEM-102 or CHEM-104. 4 SH. 3 lecture hours, 3 laboratory/field hours. CC: Writing Intensive.

### **EENV-383 Soil Science**

Soil science is the exploration of the organic and mineral material that forms thin layers where atmospheric, biological and geological interactions occur. Students study the materials that make up soil, their relationship to each other, water and air interactions, and the biological, chemical and physical processes that are at work in soil. The course also explores how various cultures have used and abused this natural resource and how different diversity markers, such as sexual orientation, ethnic background, global residence and socioeconomic status, have affected the science and participation in federal support programs. 4 SH. 3 lecture hours, 3 laboratory/field hours. CC: Diversity Intensive.

### **EENV-420 Groundwater Hydrology**

A comprehensive study of groundwater and the technologies that locate, extract and protect this resource. Emphasizes practical knowledge, developing theoretical principles when applicable. Includes origin and movement of groundwater, exploration techniques and groundwater computer modeling. Prerequisites: EENV-101 or ECOL-100, and EENV-113 and MATH-111. 4 SH. 3 lecture hours, 3 laboratory/field hours.

### **EENV-430 Chemistry of Natural Waters**

Chemical reactions in the atmosphere, the land surface and in the groundwater determine the distribution of both beneficial and toxic materials on earth that may affect resource distribution and human health. Chemistry of Natural Waters examines the elements and reactions that govern the mobility, stability and distribution of nutrients, salts and toxins in freshwater, marine, atmospheric and groundwater systems. Chemical analysis techniques, field methods, computer applications and problem solving are important components of the course. Prerequisites: CHEM-102 or CHEM-104. 4 SH. 3 lecture hours, 3 laboratory/field hours.

### **EENV-510 Senior Project I**

Introduces students to environmental research, reading, and writing in the context of a collaborative or independent research project. Prerequisite: Instructor's permission. 4 SH.

### **EENV-511 Senior Project II**

A continuation of collaborative or independent research with an emphasis on written and oral presentation of data and explanation of results. Prerequisite: EENV-510 or instructor's permission. 4 SH. Capstone. CC: Writing Intensive.

### **EENV-560 Environmental Independent Study**

Individual students select a contemporary environmental topic to investigate in depth and propose their plan of study to the department for approval. Each student is assigned a departmental faculty mentor to oversee the project. Projects require extensive literature searches accompanied by oral and written presentations. Prerequisites: Junior or senior standing and department approval of project. 4 SH.

### **EENV-590 Environmental Internship**

Individual student work in private industry or public agency. Open only when positions are available. The student, employer and the department internship coordinator must complete the Student Learning Contract before the end of the drop/add deadline. Oral and written presentations and employer's written evaluation are required. Prerequisites: Junior or senior standing and department permission. May be repeated for credit. 2-4 SH. Capstone.

### **EENV-595 Research in Earth and Environmental Sciences**

Independent research projects in the earth and environmental sciences. Prerequisites: Junior or senior standing and department permission. 2 SH. Capstone.

### **EENV-597 Field Program**

Participate in another institution's summer field program and transfer the credits to satisfy the capstone experience requirement in earth and environmental sciences. Acceptable programs are those that are three to six weeks in length and include field instruction, independent projects and a final presentation of the completed work. Requirements to be met in residence at Susquehanna include attendance at capstone class meetings and completion of projects assigned therein, to include both written and oral presentation of the work. Prerequisite: Department permission. 2-4 SH. Capstone.