

ECOLOGY

FACULTY COORDINATOR

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Ecology is an interdisciplinary program that draws on the strengths of the Biology Department and the Earth and Environmental Sciences Department and provides students the possibility of earning either a major or a minor in ecology.

LEARNING GOALS:

- Ecology majors will learn to identify and describe the basic principles and theories of ecology and the related sciences (biology, environmental science and geology).
- Using these principles and theories, students will learn to construct and critique logical scientific arguments.
- Students will learn to use appropriate skills and techniques to acquire and evaluate scientific evidence.
- Students will recognize how basic ecological principles and theories are relevant to the broader university curriculum, as well as to their daily lives.

Requirements for the Major in Ecology. The Bachelor of Science degree in ecology requires 56 semester hours in biology, earth and environmental sciences and chemistry with grades of C- or better in ecology, biology, and earth and environmental sciences courses. The Bachelor of Science in ecology includes a four-course introductory sequence and a year or more of student research. In addition, the 56 semester hours include 24 semester hours of elective courses with at least 12 drawn from each of Category 1 and Category 2. In cases where the lecture and laboratory components of courses are listed separately, students in the ecology program must take both lecture and laboratory.

16 Introductory Sequence (16 semester hours)

- 4 ECOL-100 Introduction to the Science of Ecology
(BIOL-101 Ecology and Evolution, EENV-101 Environmental Science, or EENV-103 Earth System History may substitute as an initial course in the introductory sequence)
- 4 ECOL-110 Biogeodiversity
- 4 ECOL-201 Community and Ecosystems Ecology
- 4 BIOL-220 Biostatistics

24 Elective Courses

(24 semester hours chosen from the following, with at least 12 semester hours taken in Category 1 and 12 semester hours taken in category 2)

Category 1: Biology Electives (12 credits must be chosen from the following. The course must be accompanied with the laboratory when offered and at least two courses of the 12 credits must be lab-based)

- 4 BIOL-312-313 Microbiology
- 4 BIOL-324-325 Animal Behavior
- 4 BIOL-326-327 Invertebrate Zoology
- 4 BIOL-328-329 Natural History of Early Vertebrates
- 4 BIOL-332-333 Population Biology
- 4 BIOL-340-341 Marine Ecology
- 4 BIOL-404-405 Plant Physiology
- 4 BIOL-408-409 Aquatic Ecology
- 4 BIOL-460-461 Winter Ecology of Vertebrates
- 2 ECOL-560 Explorations in Ecology (e.g. Sustainable Food Systems, Biology of Invasive Species, Amphibian Population Declines, Vertebrate Ecology of Costa Rica, Human Evolution and Behavior, etc.)

Category 2: Environmental Science Electives (12 credits must be chosen from the following:)

- 4 EENV-113 Geology and the Environment
- 4 EENV-213 Oceanography
- 4 EENV-220 Water Resources
- 4 EENV-240 Introduction to Meteorology
- 4 EENV-242 Climate and Global Change
- 4 EENV-283 Sedimentology/Stratigraphy
- 4 EENV-313 The Susquehanna River
- 4 EENV-360 Geographic Information Systems
- 4 EENV-380 Wetlands Analysis
- 4 EENV-383 Soil Science
- 4 EENV-420 Groundwater Hydrology
- 4 EENV-430 Chemistry of Natural Waters

8 Student Research

ECOL-509 Student Research I may be taken during the third year for students that require more than one field season of research.

ECOL-510 Student Research I may be taken as either 2 or 4 semester hours senior year.

Students who have completed ECOL-509 must take no more than 2 semester hours of ECOL- 510.

- 2 ECOL-509 Student Research I
- 2 or 4 ECOL-510 Student Research I
- 4 ECOL-511 Student Research II

8 Required Corollary Courses

Students must complete the following corollary chemistry courses:

- 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

Note: Additional corollary courses are strongly recommended for those intending to pursue graduate training. These recommended courses include CHEM-221 Organic Chemistry I, CHEM-222 Organic Chemistry II, CHEM-242 Methods of Chemical Analysis, Introductory Physics I (PHYS-202, PHYS-203 or PHYS-204), and Introductory Physics II (PHYS-205 or PHYS-206).

Majors must also take a comprehensive ecology examination prior to graduation. Exam content will be drawn from introductory sequence courses. Students have multiple opportunities to take the comprehensive examination; only the highest score is recorded on the transcript. Performance on the comprehensive examination is reported on the transcript as high pass, pass or fail.

Requirements for the Minor in Ecology. The minor in ecology requires 24 semester hours in ecology, biology, and earth and environmental sciences with grades of C- or better. The first course in the minor may be one of the following: ECOL-100, BIOL-101, EENV-101 or EENV-103. That introductory course should be followed by the sequence of ECOL-110/BIOL-204 and ECOL-201. Following the completion of the introductory sequence, the student will take at least four semester hours from Category 1 (biology) and four semester hours from Category 2 (earth and environmental sciences).

Double-counting restriction for interdisciplinary minors: only 8 semester hours of this minor may be double-counted toward the student's major.

Category 1: Biology Electives (must be taken with the laboratory)

- 4 BIOL-312/313 Microbiology
- 4 BIOL-324/325 Animal Behavior
- 4 BIOL-326/327 Invertebrate Zoology
- 4 BIOL-328/329 Natural History of Early Vertebrates
- 4 BIOL-332/333 Population Biology

- 4 BIOL-404/405 Plant Physiology
- 4 BIOL-408/409 Aquatic Ecology
- 4 BIOL-460/461 Winter Ecology of Vertebrates

Category 2: Environmental Science Electives

- 4 EENV-213 Oceanography
- 4 EENV-220 Water Resources
- 4 EENV-240 Introduction to Meteorology
- 4 EENV-242 Climate and Global Change
- 4 EENV-283 Sedimentology/Stratigraphy
- 4 EENV-313 The Susquehanna River
- 4 EENV-360 Geographic Information Systems
- 4 EENV-380 Wetlands Analysis
- 4 EENV-383 Soil Science
- 4 EENV-420 Groundwater Hydrology
- 4 EENV-430 Chemistry of Natural Waters

Honors in Ecology. The ecology program encourages and recognizes superior academic performance in ecology. To graduate with program honors, ecology majors must request entry to the program or be nominated for entry to the program by one or more faculty members who teach required or elective distribution courses within the major. Request for entry or nominations for honors must be initiated by the beginning of the senior year.

Candidates for academic honors must:

- Maintain a cumulative GPA of 3.25 and a GPA of 3.50 in major courses to qualify for academic honors.
- Successfully complete Student Research I and II (ECOL-510 and ECOL-511) and earn a grade of B- or better in these courses.
- Receive a high pass on their highest score on the comprehensive exam. Candidates for research honors must do the following:
- Be nominated by a member of the faculty who teaches within the ecology program by midterm of Student Research II (ECOL-511).
- Submit an acceptable research thesis based upon two semesters of Student Research (ECOL-510 and ECOL-511).
- Pass an oral comprehensive examination of their thesis in their final semester. The oral comprehensive examination is administered by faculty who teach within the ecology major.

Ecology Research Facilities. The Center for Environmental Education and Research (CEER) is an 87-acre tract of land immediately adjacent to campus that serves as a convenient field station for observational and manipulative studies in ecology. The CEER is home to the Freshwater Research Institute, a research laboratory and center for freshwater ecological research. The CEER also includes a research greenhouse, research plots and storage facilities for field equipment. In addition, the department operates the George A. Hepner Ecology Laboratory at Camp Karoondinha. It provides a small research laboratory and a variety of habitats, offering students experience through short- and long-term experiments. The property features more than 600 acres from 600 to 1,800 feet above sea level. It includes both deciduous and mixed coniferous forests, an 8-acre lake, Penns Creek and small streams.

ECOLOGY COURSES

ECOL-100 Introduction to the Science of Ecology

An introduction to ecology and its relationships with other disciplines of science. Emphasizes analysis of current problems in the ecological sciences, particularly as they relate to discussions that students will have to make as citizens of a scientific/technological society. 4 SH. 3 lecture hours, 3 laboratory hours. CC: Scientific Explanations.

ECOL-110 Biogeodiversity

Explores the influences of geology (abiotic factors), environment (including climate), and place on the evolution and diversity of life. Students investigate multiple issues posed by the science and technology of the diversity of life on this planet. Particular issues include changing views of systematic relationships of living things, how many species occur on earth, and how to establish effective public policy guidelines for protection of life's diversity. Prerequisite: BIOL-101, or EENV-101, or ECOL-101, or BIOL-205. 4 SH. 3 lecture hours, 3 laboratory hours. CC: Writing Intensive.

ECOL-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 EENV-113. 4 SH. 3 lecture hours, 3 laboratory/field hours.

ECOL-201 Community and Ecosystems Ecology

Ecosystem ecology addresses the interactions between organisms and their environment as an integrated system. The physical setting for an ecosystem, the climate, geology and soils interact with water, nutrients and energy to control the organisms that thrive there. Prerequisite: BIOL-101, ECOL-100 or EENV-101. 4 SH. 3 lecture hours, 3 laboratory/field hours.

ECOL-220 Biostatistics

Biostatistics will focus on the collection and analysis of biological data. The course is designed to introduce students to the fundamental concepts of experimental and sampling design, as well as quantitative hypothesis testing. Some equations will be covered in the course; however, the emphasis will be on interpretation and presentation of statistical results. These concepts will be reinforced in upper-level biology/ecology/neuroscience courses taken by students to fulfill distribution requirements during their junior and senior years. Same as BIOL-220. Prerequisites: Sophomore standing and either BIOL-101, BIOL-102, or ECOL-100. 4 SH. 4 lecture hours. CC: Analytical Thought.

ECOL-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 nontidal 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 EENV-380. Prerequisites: CHEM-102 or CHEM-104. 4 SH. 3 lecture hours, 3 laboratory/field hours. CC: Writing Intensive.

ECOL-408 Aquatic Ecology

The ecology of freshwater ecosystems. Emphasizes biota of freshwater and their relationships with physical and chemical components of lakes, streams and reservoirs. Same as BIOL-408. Prerequisite: BIOL-101 or ECOL-100 or ECOL-201. 3 SH.

ECOL-409 Aquatic Ecology Laboratory

Field laboratory in aquatic ecology techniques. Topics include physical and chemical measurements and the identification and enumeration of phytoplankton, zooplankton, aquatic plants and benthic organisms. Same as BIOL-409. Prerequisite: BIOL-101 or ECOL-100 or ECOL-201. 1 SH. 4 laboratory hours.

ECOL-501 Independent Study

Individual work on selected topics for qualified students under faculty direction. Requires approval of supervising professor and department head. 1-4 SH.

ECOL-509 Student Research I

Introduces students to methods and techniques of ecological research in the context of a collaborative research project. Prerequisite: Instructor's permission. 2 SH. 8 contact hours.

ECOL-510 Student Research I

Introduces students to methods and techniques of ecological research in the context of a collaborative research project. Prerequisite: Instructor's permission. 2 or 4 SH. 16 contact hours.

ECOL-511 Student Research II

Collaborative research with an emphasis on presentation of data and explanation of results. Prerequisite: Instructor's permission. 4 SH. 16 contact hours. Capstone. CC: Writing Intensive.

ECOL-560 Interdisciplinary Explorations

Explores salient issues in the biological sciences from an interdisciplinary perspective. Prerequisite: Sophomore standing and BIOL-101, or BIOL-102, or ECOL-100. CC: Interdisciplinary. 2-4 SH.