

## **UNDERGRADUATE MAJORS IN ENVIRONMENT**

College of Agriculture and Life Sciences, Cornell University

The College of Agriculture and Life Sciences at Cornell University is committed to offering students a full complement of courses and majors devoted to study of the environment, and human interactions with environment. Regardless of your specific interests and talents, the College provides the means to achieve the intellectual and practical competence needed to address environmental issues locally and globally. College environmental programs are distinguished by strengths in life, physical, and social sciences, as well as a commitment to public outreach and service. More than 100 College faculty are devoted to the study of environment, the socio-economic and scientific issues that surround it, the means by which environmental problems are perceived and communicated to the public, and the quantitative tools and technologies needed to understand it. Field and laboratory facilities for undergraduate instruction are excellent. For those up to the challenge, numerous opportunities exist for undergraduate honors research.

### **MAJORS IN ENVIRONMENTAL PROGRAM AREAS**

The College offers **six undergraduate majors in which to pursue an education focused on the environment:**

**Environmental Engineering, and Environmental Engineering Technology (Department of Biological and Environmental Engineering):** Both majors integrate basic mathematics and physical sciences with life sciences, biology, social science, and humanities. In addition, a Bioenvironmental Engineering Concentration is available within the Engineering Major.

**Biological Sciences (Department of Ecology and Evolutionary Biology):** a biology major with a concentration in Ecology and Evolutionary Biology, focusing on the ecological and evolutionary foundations for understanding populations, communities, and ecosystems.

**Natural Resources (Department of Natural Resources):** a biologically-based major that focuses on the interface of nature (populations, communities, and ecosystems) with the human institutions involved in environmental conservation and management. Three concentrations are available: Applied Ecology; Resource Policy and Management; and Environmental Studies.

**Science of Earth Systems (Cross-department major):** a science-based major, with strong preparation in basic sciences (particularly physical sciences) and mathematics, emphasizing the technical and objective study of the Earth system. Three concentrations are available: Biogeochemistry; Geological Sciences; and Ocean Sciences.

**Science of Natural and Environmental Systems (Cross-department major):** a physical- and biological-science based major that addresses the interface of environmental science and human activity using a broad range of disciplines. Five concentrations are available: Agroecosystem Science; Environmental Biology; Environmental Economics; Environmental Information Science; and Sustainable Development.

In addition to these specific majors, several departments offer a wide range of courses pertaining to environmental issues. Consult the course offerings in the departments of Applied

Economics and Management, Animal Sciences, Biological and Environmental Engineering, Communications, Crop and Soil Sciences, Development Sociology, Earth and Atmospheric Sciences, Ecology and Evolutionary Biology, Entomology, Development Sociology, Food Sciences, Microbiology, Natural Resources, Neurobiology and Behavior, and Plant Biology.

### **Are your interests in Environmental Science, Environmental Policy, or Environmental Engineering and Technology?**

- Students interested in the **environmental sciences** may choose from among Biological Sciences/Ecology and Evolutionary Biology (BioSci/EEB), Natural Resources (NTRES), the Science of Earth Systems (SES), and the Science of Natural and Environmental Systems (SNES).
- Study of **environmental policy** may be pursued through two majors, Natural Resources (NTRES) and Science of Natural and Environmental Systems (SNES).
- **Environmental engineering and environmental engineering technology** are pursued through a major or a concentration in Biological and Environmental Engineering (BEE).

### **CHOOSING AMONG THE MAJORS**

Incoming students may choose from among these majors. However, your initial choice need not be considered final because you have the opportunity to change majors within the College after you matriculate. We encourage you to explore options especially during the first few semesters at Cornell.

Many faculty are associated with more than one major and can guide you in your decision-making, as can the College Counseling and Advising Office and the undergraduate advising coordinators in each major. You also may broaden your academic program by pursuing a minor course of study in another area of interest.

#### **Similarities and differences.**

The primary environmental majors are similar in focusing on environmental topics and providing solid foundations for careers or post-graduate work in many environmental fields. They differ in terms of the particular aspects of environmental sciences, policy, or engineering they emphasize, and in their course requirements for graduation. Both the specific courses and the number of required courses differ among majors; some majors have fairly specific requirements while others offer more flexibility. All of the majors require biology and calculus, although the specific course requirements vary. All of the majors except NTRES require physics.

- BioSci/EEB emphasizes the basic biological and ecological foundations of environments and ecosystems.
- Other majors (BEE, SES, SNES) emphasize the mathematical, physical, and chemical foundations of environmental sciences, with both BEE and SNES including a strong biological focus.
- One major (NTRES) emphasizes the biology and ecology of natural systems and their conservation and management.
- Environmental Engineering (and the Bioenvironmental Engineering Concentration) requires a core of courses common to all engineering majors, and encourages students to seek electives in both CALS and Engineering.
- Two majors (NTRES, SNES) include attention to the social science/human aspects of environmental management and conservation.

- Engineering majors in BEE place strong emphasis on professional engineering practices.

#### After the major...

- Some of the environmental majors in CALS, such as Biological and Environmental Engineering (BEE), stress teamwork and prepare students for careers in consulting and engineering design, and also prepare you to pursue a graduate degree or for entry-level positions in technical fields. These majors prepare students for professional careers involving technical problem solving and graduate study.
- Majors in the Science of Natural and Environmental Systems (SNES), Natural Resources (NTRES), and Biological Sciences (BioSci-EEB) have the flexibility to prepare you for graduate school or an entry-level position in environmental and/or resource management agencies at local, state, federal, and international levels or for jobs in the private for-profit (e.g., environmental consulting firms) or non-profit sectors.
- The Science of Earth Systems (SES) major prepares students for a graduate degree program in any of the Earth sciences, and provides the science background needed for careers in Earth science teaching, environmental consulting, and other environmental fields.

#### MORE ABOUT THE MAJORS...

**BIOLOGICAL AND ENVIRONMENTAL ENGINEERING (BEE).** Students in BEE may major in Environmental Engineering or Environmental Engineering Technology, or pursue the Bioenvironmental Engineering Concentration in the Biological Engineering major. Environmental Engineering is a structured program of study that integrates basic mathematics and engineering with physical sciences, life sciences, and biology. The curriculum contains the core of courses common to all engineering disciplines, and Environmental Engineering majors may complete engineering minors which are noted on their transcripts. The undergraduate Engineering Program is administered jointly by the College of Agriculture and Life Sciences and the College of Engineering; students spend their final year enrolled in the engineering college and their diplomas are signed by both deans.

**Environmental Engineering** is a quantitative discipline. It involves the application of mathematics, physics and engineering fundamentals to analyze and describe the environmental system along with the associated biological processes that take place in the landscape. Environmental engineers are responsible for sustainable stewardship of our land and water resources. At the Bachelor's degree level they often work on interdisciplinary teams that design environmentally sustainable food production systems, provide safe drinking water, develop bioremediation technologies for pollution abatement, treat and recycle waste, and invent and implement management strategies which protect the quality of our air, land and water for future generations. Engineers are problem solvers; they work in interdisciplinary teams and design systems that work in harmony with the natural environment, including the people who live there. They pursue careers in consulting, industry, and international development, and with a graduate degree they work in government and university research, and even law and medicine.

**Environmental Engineering Technology** students complete the college distribution requirements along with basic courses in calculus, physics, chemistry and computing. Electives include 15 credits of environmental sciences, 15 credits of technology, and roughly 30 credits in the students' area of interest. The curriculum is flexible and emphasizes biological and

environmental sciences, and subjects like hydrology, natural resources and ecology. Graduates of the technology major often work on the applied aspects of environmental protection and management, incorporating the social and political factors involved in the process. They work with engineers and scientists in consulting firms, government agencies and private industry to creatively solve environmental problems. They have an excellent track record of success in graduate school, (including engineering) and in business and professional programs.

For more information see: [www.bee.cornell.edu](http://www.bee.cornell.edu)

**BIOLOGICAL SCIENCES IN ECOLOGY AND EVOLUTIONARY BIOLOGY (BioSci/EEB).** Ecology and Evolutionary Biology is a field of study that seeks to understand the causes of variation in nature at scales ranging from genes to ecosystems. Students major in the Biological Sciences with a concentration in Ecology and Evolutionary Biology. As biology majors, students take courses in introductory biology, ecology, evolution, genetics, chemistry, physics, and mathematics. Through the EEB concentration, students learn the fundamentals of species, population, community, and ecosystem biology. Students also choose from courses on a broad array of taxonomic groups (bacteria to animals) and environments (terrestrial, freshwater, and marine). All taxon and ecology courses deal with the basic biology of systems and their responses to human impacts. Students are also encouraged to take courses at biological field stations.

The goals of the concentration are to prepare students rigorously for careers in environmental biology in academic, governmental, and non-governmental institutions, and to prepare students to go on to graduate studies in ecology and evolution.

For more information see: [www.bio.cornell.edu](http://www.bio.cornell.edu)

**NATURAL RESOURCES (NTRES).** Natural Resources is a field of study at the interface of environmental science and policy. The major in Natural Resources emphasizes the study of species, populations, and communities of plants and animals; the ecosystems and landscapes in which they occur; and the institutions and policies that humans use to conserve and manage them. Natural resources are those elements of the world around us with which we, as humans, interact, either 'directly' as users, or indirectly through our activities. The major's focus is on biological resources (e.g., fisheries, wildlife, forests, wetlands) and includes issues of conservation and restoration of scarce species and their habitats, sustainable harvest of species of economic importance, management of invasive species and over-abundant species, population dynamics in aquatic and terrestrial systems, ecosystem and watershed management, and mitigating the effects of human-induced changes on the environment.

**Concentrations** include: (1) Applied Ecology, which provides students with advanced study of species and population biology, and community and ecosystem ecology as applied to the conservation and management of organisms and their habitats; (2) Resource Policy and Management, which provides students with advanced study in the institutions and policies that humans apply to resource management, and in improving understanding of the relationship of human attitudes and values to environmentally-related behaviors; and (3) Environmental Studies, which is intended for students who want a rigorous but broad program of study regarding the interactions of humans and their environment and that emphasizes the ability to think critically about those interactions.

The mission of the Department of Natural Resources, home of the major, is "to develop knowledge and facilitate learning to improve society's stewardship of natural resources and the environment." A commitment to undergraduate education is a vital component of that

mission.

For more information see <http://www.dnr.cornell.edu>

**SCIENCE OF EARTH SYSTEMS (SES).** The SES major emphasizes the basic science of the Earth system. Under the increasing pressure of public concerns about air and water pollution, nuclear waste disposal, the ozone hole, and global warming, the scientific community has realized how inter-related are the components that were once viewed as separate parts of the Earth system. While the critical parts - processes in the biosphere, hydrosphere, atmosphere, and lithosphere - are studied in detail within the boundaries of traditional disciplines, how the parts combine and interact is the key to understanding how our home planet works, its past history, and its likely future.

The Science of Earth Systems (SES) Major at Cornell offers an interdisciplinary approach to understanding and managing the Earth. The major is administered by the Department of Earth and Atmospheric Sciences, and includes collaborations with Ecology and Evolutionary Biology, Natural Resources, and Astronomy.

The major offers three defined **concentrations**, including biogeochemistry, geological sciences, and ocean sciences. Specially designed concentrations in planetary sciences, ecological systems, soil science and hydrological science are also possible. All concentrations require students to take at least two courses in calculus, physics, chemistry, and biology, an introduction to science of earth systems, three of four core courses emphasizing the interconnectedness of the Earth system (Climate Dynamics, Evolution of the Earth System, Biogeochemistry, and Interior of the Earth), and four courses in one of the areas of concentration.

For more information see: <http://www.eas.cornell.edu>

**SCIENCE OF NATURAL AND ENVIRONMENTAL SYSTEMS (SNES).** The College of Agriculture and Life Sciences recently created this new environmental major. Its mission is to provide integrated rigorous instruction in four major areas of environmental science: biological (Ecology and the Environment), economic (Environmental and Resource Economics), physical (Environmental Chemistry: Soil, Air, Water), and social (Environment and Society). All students take a set of ten foundation courses in the sciences, including biology, calculus, chemistry, physics, and statistics, and a set of four environmental core courses covering Earth, biotic, social, and economic systems. They then select six courses in one of several **concentrations**: agroecosystem science, environmental biology, environmental economics, environmental information science, and sustainable development.

The SNES major is supported through advising and course offerings in several departments, including Animal Sciences, Applied Economics and Management, Biological and Environmental Engineering, City and Regional Planning, Crop and Soil Sciences, Design and Environmental Analysis, Development Sociology, Earth and Atmospheric Sciences, Ecology and Evolutionary Biology, Entomology, Horticulture, Microbiology, Natural Resources, Plant Breeding, and Plant Sciences.

For more information, see <http://snes.eas.cornell.edu>

### **Want to know more about studying "environment" in CALS?**

For more information on being admitted to any of the undergraduate programs offered in the College of Agriculture and Life Sciences, consult CALS Admissions at:

[ALS\\_Admissions@cornell.edu](mailto:ALS_Admissions@cornell.edu)

or

<http://www.cals.cornell.edu/cals/prospective/admissions/index.cfm>