

Environmental Studies

AN INTERDEPARTMENTAL MAJOR
AND MINOR

Professor: *DeSombre (Director)*

Assistant Professor: *Turner*

Advisory Faculty: *Argow (Geosciences), Besancon (Geosciences), Brabander (Geosciences), Coleman (Chemistry), Jones (Biological Sciences), Mattison (Geosciences), Paarlberg (Political Science), Rodenhouse (Biological Sciences), Sequeira (Biological Sciences), Sneeringer (Economics), Thomas (Biological Sciences), Turner*

Affiliated Faculty: *Karakasidou (Anthropology), Moore (Biological Sciences), Stark (Physics), Steady (Africana Studies)*

Environmental Studies is a particular way of thinking, conducting research, and posing questions. We recognize that knowledge of societies, the environment, and the complex and multifaceted relationship they share, emerges from a wide range of disciplines, including the sciences, social sciences, and humanities. An environmental studies major or minor aims to provide students with critical skills that will allow them to engage current environmental issues and prepare to recognize future ones. Central to this goal is helping students develop independent critical thinking, problem framing, and problem solving skills across disciplines and cultures with which they can diagnose and prioritize a wide range of environmental issues, from the local to the international, from the most pressing to the most long-term. Because of the interdisciplinary nature of environmental issues, the program draws upon courses from multiple departments. Each student will choose electives in consultation with her advisor to help focus her studies on an issue or approach that interests her.

Goals for the Major/Minor

The Environmental Studies program seeks to educate students to:

Identify and analyze significant current and past environmental issues using skills that bridge multiple academic disciplines

Recognize emerging environmental trends and evaluate emerging issues

Evaluate multiple political and cultural perspectives on the relationship between human activities and environmental effects

Consider environmental issues politically, economically, scientifically, culturally, and ethically

Conduct laboratory and field work using current analytical techniques

Be confident in oral and written presentation of information to audiences with differing levels of knowledge

Research and devise potential solutions for environmental problems.

ES 101 Introduction to Environmental Studies with Laboratory: Methods and Analysis

Rodenhouse, Thomas (Biological Sciences)

Explore the campus and beyond in an interdisciplinary manner. Topics include the movement of materials through the environment, ecosystem analysis, principles of resource management, and pollution control. Investigate timely environmental problems and work toward solutions using skills such as computer modeling, X-ray fluorescence spectroscopy, and spatial data analysis using GIS. A combination of field and laboratory work will be integrated with discussion and readings. *Either 101 or 102 may be taken first. (ES 101 replaces ES 100 for students fulfilling the old version of the major)*

Prerequisite: Fulfillment of the basic skills component of the Quantitative Reasoning requirement. Open to first years and sophomores; juniors and seniors may only enroll with permission of the instructor. Not open to students who have taken ES [100].

Distribution: Natural and Physical Science. Fulfills the Quantitative Reasoning overlay requirement.

Semester: Fall

Unit: 1.25

ES 102 Introduction to Environmental Studies: Issues and Concepts

Turner

This course offers an interdisciplinary introduction to Environmental Studies, with a focus on climate change. Major concepts that will be examined include: the state of scientific research, the role of science, politics, and economics in environmental decisionmaking, and the importance of history, ethics and justice in approaching climate change. The central aim of the course is to help students develop the interdisciplinary research skills necessary to pose questions, investigate problems, and develop strategies that will help us address our relationship to the environment. *Either 101 or 102 may be taken first.*

Prerequisite: Fulfillment of the basic skills component of the Quantitative Reasoning requirement.

Distribution: Social and Behavioral Analysis

Semester: Fall, Spring

Unit: 1.0

ES 111/GEOS 111 The Yucca Mountain Problem: Where Should We Put Nuclear Waste?

Besancon (Geosciences)

Choices about disposal of radioactive materials will affect countless future generations. Focusing on the proposed storage facility at Yucca Mountain, Nevada, we will examine the important scientific questions that must be answered for long-term safety of a nuclear repository. Students will learn the scientific principles governing risk assessment, groundwater movement, volcanism, earthquakes, and the groundwater properties of the repository rocks, and how each affects the safety of the proposed containment facility. We will also examine the

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evidence and methods used to predict how the waste and the containers designed to hold it will behave for long periods. Students will identify key issues and produce small group projects examining some of the scientific issues raised by this controversial proposal. *Students may register for either ES 111 or GEOS 111 and credit will be granted accordingly.*

Prerequisite: Open only to first year students.

Distribution: Natural and Physical Science

Semester: Spring

Unit: 1.0

ES 201/GEOS 201 Methods and Problems in Environmental Science with Laboratory

Brabander (Geosciences)

Problems in environmental science are inherently multidisciplinary and often require a diverse skill set to analyze and solve. This course will focus on developing a toolbox of skills including field methods, geochemical analysis (natural waters, soils and other environmental materials), and modeling with a goal of being able to frame and solve environmental problems. Students will conduct semester-long research projects and will present their results in a final poster session. *Students may register for either ES 201 or GEOS 201 and credit will be granted accordingly.*

Prerequisite: One of the following: [100], 101, GEOS 101, 102 or permission of the instructor.

Distribution: Natural and Physical Science

Semester: Spring

Unit: 1.25

ES 203 Cultures of Environmentalism

Turner

What is environmentalism? This course explores how different communities of people have answered that question in the United States and abroad. It focuses on the mainstream environmental movement and other formulations of environmentalism, such as environmental justice, deep ecology, animal rights, and indigenous peoples' concerns for the environment. This course takes an interdisciplinary approach to examining the role of culture in shaping how people have valued the environment and organized to protect it. What role do the arts, popular culture, and literature play in environmental activism? What are the ethical and philosophical foundations of modern environmental movements? How is environmental activism historically specific and shaped by particular constructions of race, gender, religion, and nature? The goal of this course is to consider how environmental activism and decisionmaking can and must be sensitive to cultural context.

Prerequisite: 101, 102, or permission of instructor

Distribution: Religion, Ethics, and Moral Philosophy

Semester: Fall

Unit: 1.0

ES 210/GEOS 210 Hydrogeology—Water and Pollutants with Laboratory

NOT OFFERED IN 2009-10. OFFERED IN 2010-11. Investigation of water supply and use. Principles of surface and groundwater movement and water chemistry are applied to the hydrologic cycle to understand sources of water for human use. Mathematical groundwater models are used to understand groundwater movement and pollutant plumes. Quantity and quality of water and the limitations they impose are considered. Normally offered in alternate years. *Students may register for either ES 210 or GEOS 210 and credit will be granted accordingly.*

Prerequisite: GEOS 101 or 102 or permission of instructor

Distribution: Natural and Physical Science or Mathematical Modeling

Semester: N/O. Offered in 2010-11.

Unit: 1.25

ES 212/RAST 212 Lake Baikal: The Soul of Siberia

NOT OFFERED IN 2009-10. OFFERED IN 2010-11. The ecological and cultural values of Lake Baikal—the oldest, deepest, and most biotically rich lake on the planet—are examined. Lectures and discussion in spring prepare students for the three-week field laboratory taught at Lake Baikal in eastern Siberia in August. Lectures address the fundamentals of aquatic ecology and the role of Lake Baikal in Russian literature, history, art, music, and the country's environmental movement. Laboratory work is conducted primarily out-of-doors and includes introductions to the flora and fauna, field tests of student-generated hypotheses, meetings with the lake's stakeholders, and tours of ecological and cultural sites surrounding the lake. *Students may register for either ES 212 or RAST 212 and credit will be granted accordingly. Not offered every year. Subject to Dean's Office approval.*

Prerequisite: ES 101 or BISC 111, RUSS 101, and permission of the instructors. Preference will be given to students who have also taken HIST 211. Application required.

Distribution: Natural and Physical Science

Semester: N/O. Offered in 2010-11.

Unit: 1.25

ES 214/POL2 214 Social Causes and Consequences of Environmental Problems

DeSombre

This course focuses on the social science explanations for why environmental problems are created, the impacts they have, the difficulties of addressing them, and the regulatory and other actions that succeed in mitigating them. Topics include: externalities and the politics of unpriced costs and benefits, collective action problems and interest-group theory, time horizons in decision-making, the politics of science, risk and uncertainty, comparative political structures, and cooperation theory. Also addressed are different strategies for changing environmental behavior, including command and control measures, taxes, fees, and other market instruments, and voluntary approaches. These will all be examined across multiple countries and levels of governance. *Students may register for either ES 214 or POL2 214 and credit will be granted accordingly.*

Prerequisite: ES 102, or one course in political science, or permission of the instructor.

Distribution: Social and Behavioral Analysis

Semester: Fall

Unit: 1.0

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ES 217/BISC 217 Field Botany with Laboratory

Griffith (Botany Fellow)

Field Botany is a combination of "What's that wildflower?" and "Why does it grow over there and not here?" The course merges aspects of plant systematics and identification (with an emphasis on learning the local flora and important plant families) and plant ecology (with an emphasis on ecological interactions and phenomena unique to plants). Laboratories will primarily be taught in the field and greenhouses and will include using dichotomous and Web-based keys to identify plants, observational and experimental studies, and long-term study of forest patches on the Wellesley campus. Laboratories will also include experimental design and data analysis. The goal of Field Botany is not only to train students of botany and plant ecology, but to engage them in botany every time they step outside. *Students may register for either ES 217 or BISC 217 and credit will be granted accordingly.*

Prerequisite: ES 101 or BISC 108 or BISC 111

Distribution: Natural and Physical Science

Semester: Fall Unit: 1.25

ES 222 Dynamic Modeling of Environmental Issues

Coleman (Chemistry)

A hands-on introduction to the application of systems dynamics to developing computer-based models for complex problems, with an emphasis on the environment. Starting with simple closed systems, students will develop models of increasing sophistication and complexity for issues such as population dynamics, air and water pollution, energy production and usage, waste management and sustainable development. Emphasis will be placed on the principles of problem solving and systems dynamics and on developing models that reflect, as closely as possible, real-world situations and the interrelatedness of various environmental concerns.

Prerequisite: 101 and successful completion of the Quantitative Reasoning requirement, or permission of the instructor.

Distribution: Natural and Physical Science or Mathematical Modeling

Semester: Spring Unit: 1.0

ES 234/ANTH 234 Cultural Ecology

NOT OFFERED IN 2009-10. This course explores theoretical and methodological issues in the study of human culture and social activity in relation to ecological systems and the environment. Readings include both classic studies as well as contemporary research, with particular emphasis placed on the various dimensions and scales of social organization and activity, and on the role of cultural, religious, and political institutions in shaping ecological relationships as well as economic behavior. *Students may register for either ES 234 or ANTH 234 and credit will be granted accordingly.*

Prerequisite: None

Distribution: Social and Behavioral Analysis

Semester: N/O Unit: 1.0

ES 299/HIST 299 U.S. Environmental History

Turner

This course examines the relationship between nature and society in American history. The course will consider topics such as the decimation of the bison, the rise of Chicago, the history of natural disasters, and the environmental consequences of war. There are three goals for this course: First, we will examine how humans have interacted with nature over time and how nature, in turn, has shaped human society. Second, we will examine how attitudes toward nature have differed among peoples, places, and times and we will consider how the meanings people give to nature inform their cultural and political activities. Third, we will study how these historical forces have combined to shape the American landscape and the human and natural communities to which it is home. While this course focuses on the past, an important goal is to understand the ways in which history shapes how we understand and value the environment as we do today. *Students may register for either ES 299 or HIST 299 and credit will be granted accordingly.*

Prerequisites: 101, or 102, or an American history course, or permission of the instructor.

Distribution: Historical Studies

Semester: Spring Unit: 1.0

ES 300 Environmental Decisionmaking

DeSombre

An interdisciplinary seminar in which students work together in small groups to understand and develop solutions for current environmental problems. Each year, we focus on a given environmental issue of concern to our community, e.g., environmental implications of building design, energy use, or water quality. In particular, we work to understand its scientific background, the political processes that lead to potential solutions, and the ethical and environmental justice implications. Student-led research provides the bulk of the information about the issue and its role in our local environment; lectures and readings provide supplementary information about the local situation and the global context.

Prerequisite: A declared major or minor in environmental studies, 101 or 102 and completion of the three breadth distribution requirements, or permission of the instructor. This course is only open to juniors and seniors.

Distribution: None

Semester: Spring Unit: 1.0

ES 306 Seminar. Green Chemistry

NOT OFFERED IN 2009-10. OFFERED IN 2010-11. A study of the impact of chemicals and the chemical industry, broadly defined, on the global environment, and on emerging approaches to reducing that impact. The major focus will be on the fundamentals of designing chemical processes that produce smaller amounts of harmful by-products, reduce the use of toxic solvents, exploit catalysis, and maximize the

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conversion of reactants to the desired product. We will also examine the economic and political issues that surround green chemistry.

Prerequisite: CHEM 205 and CHEM 211, or CHEM 120 and CHEM 211, or permission of the instructor.

Distribution: Natural and Physical Science

Semester: N/O. Offered in 2010-11. Unit: 1.0

ES 307/BISC 307 Advanced Topics in Ecology with Laboratory

Rodenhouse (Biological Sciences)

Topic for 2009-10: Global Change Biology. Environmental conditions for nearly all life forms on Earth are changing at unprecedented rates largely due to human activities: agriculture, deforestation, urbanization, pollution, climate change, translocation of species, hunting and harvesting. These causes of change and their consequences are not confined by national boundaries or even historical ecological boundaries. This course will examine critically the causes of change, how complex biological systems are studied, and the observed and projected biological consequences of environmental change. Labs will explore how relevant data are gathered and structured for analysis and modeling. Each student will complete an independent project of her choosing on a relevant topic. *Students may register for either ES 307 or BISC 307 and credit will be granted accordingly.*

Prerequisite: Two units in Biological Sciences at the 200-level or above, or permission of the instructor

Distribution: Natural and Physical Science

Semester: Spring Unit: 1.25

ES 312/POL2 312S Seminar:

Environmental Policy

DeSombre

Focuses both on how to make and how to study environmental policy. Examines issues essential in understanding how environmental policy works and explores these topics in depth through case studies of current environmental policy issues. Students will also undertake an original research project and work in groups on influencing or creating local environmental policy. *Students may register for either ES 312S or POL2 312S and credit will be granted accordingly.*

Prerequisite: One 200-level unit in political science and permission of instructor. Enrollment limited; interested students must fill out a seminar application available in the political science department office or on the department Web site.

Distribution: Social and Behavioral Analysis

Semester: Fall Unit: 1.0

ES 315/GEOS 315 Environmental Geochemistry with Laboratory

Brabander (Geosciences)

Accurately predicting the fate and transport of naturally occurring toxic elements and anthropogenic compounds in the environment requires a broad set of multidisciplinary skills. This course introduces geochemical approaches including mass balance, residence time, isotope fractionation, and thermodynamic and kinetic modeling necessary to fingerprint sources of pollutants and track them in water, soil, and plants. These fundamentals will be explored in several classic case studies and in semester-long geochemical research projects conducted by small groups. *Normally offered in alternate years. Students may register for either ES 315 or GEOS 315 and credit will be granted accordingly.*

Prerequisite: One course above the 100 level in two of the following disciplines: Geosciences, Chemistry, Biological Sciences or Environmental Studies; or permission of the instructor.

Distribution: Natural and Physical Science or Mathematical Modeling

Semester: Fall Unit: 1.25

ES 325/POL3 325 International

Environmental Law

NOT OFFERED IN 2009-10. OFFERED IN 2010-11. Examines the basic legal instruments and their historical development in addressing international environmental issues. Under what conditions have states been able to cooperate to improve the global environment? Negotiation of, compliance with, and effectiveness of international environmental law, and specific environmental issue areas in which international environmental law operates will be addressed. *Students may register for either ES 325 or POL3 325 and credit will be granted accordingly.*

Prerequisite: POL3 321 or ES 214/POL2 214 or permission of instructor.

Distribution: Social and Behavioral Analysis

Semester: N/O. Offered in 2010-11. Unit: 1.0

ES 327/BISC 327 Biodiversity Topics

Jones (Biological Sciences)

Topic for 2009-10: Biological Diversity in Context. Biodiversity, like sustainability, is a much-used term with a broad range of meanings. This seminar will examine what biodiversity means at a range of scales, from genetic variation within a single species, to the microbial community surrounding a single plant's roots, through suburban backyards, cities and nature preserves, to whole continents and finally the planet. We will focus primarily on the biological implications of biodiversity loss for the relevant ecological community and ecosystem function, and how those implications affect humans. Students will interpret primary scientific literature and analyze data to test hypotheses generated by the class. *Students may register for either ES 327 or BISC 327 and credit will be granted accordingly.*

Prerequisite: ES 201/GEOS 201 or BISC 201 or BISC 207 or permission of instructor

Distribution: Natural and Physical Sciences

Semester: Fall Unit: 1.0

ES 381/POL1 381 United States Environmental Politics

NOT OFFERED IN 2009-10. OFFERED IN 2010-11. This course examines the politics of environmental issues in the United States. The course has two primary goals: First, to introduce students to the institutions, stakeholders, and political processes important to debates over environmental policy at the federal level. Second, to develop and practice skills of analyzing and making decisions relevant to environmental politics and policy. Drawing on the literature of environmental politics and policy, this course will consider how environmental issues are framed in political discourse, various approaches to environmental advocacy and reform, and the contested role of science in environmental politics. The course will be organized around environmental case studies, including endangered species conservation, public lands management, air and water pollution, and toxics regulation. *Students may register for either ES 381 or POL1 381 and credit will be granted accordingly.*

Prerequisites: 102, 214, POL1 200, or permission of the instructor.

Distribution: Social and Behavioral Analysis

Semester: N/O. Offered in 2010-11. Unit: 1.0

Individual Study

ES 250 or 350 (Research or Individual Study) can be advised by any member of the advisory faculty in environmental studies. They may count towards the area of concentration. A half-unit course may only count as credit towards the major when combined with another half-unit course. Only two units of independent study may be counted towards the major. ES 350 courses may not be used to fulfill the minimum requirement that two electives be at the 300 level.

ES 250 Research or Individual Study

Prerequisite: Permission of the instructor, ordinarily limited to students who have completed at least three units toward their major.

Distribution: None

Semester: Fall, Spring Unit: 1.0

ES 250H Research or Individual Study

Prerequisite: Permission of the instructor, ordinarily limited to students who have completed at least three units toward their major.

Distribution: None

Semester: Fall, Spring Unit: 0.5

ES 350 Research or Individual Study

Prerequisite: Permission of the instructor, ordinarily limited to students who have completed at least five units toward their major.

Distribution: None

Semester: Fall, Spring Unit: 1.0

ES 350H Research or Individual Study

Prerequisite: Permission of the instructor, ordinarily limited to students who have completed at least five units toward their major.

Distribution: None

Semester: Fall, Spring Unit: 0.5

ES 360 Senior Thesis Research

Prerequisite: By permission of the advisory faculty. See Honors in Environmental Studies.

Distribution: None

Semester: Fall, Spring Unit: 1.0

ES 370 Senior Thesis

Prerequisite: 360 and permission of department.

Distribution: None

Semester: Fall, Spring Unit: 1.0

Related Courses

The following courses may be used as electives. No more than one 100-level course may be used as an elective for the major and 100-level electives may not be used for the minor. Courses not listed may be accepted by petition. (Note that some 200- and 300-level courses have prerequisites outside of required Environmental Studies courses.)

AFR 226 Environmental Justice, "Race," and Sustainable Development

BISC 108 Environmental Horticulture with Laboratory

BISC 201 Ecology with Laboratory

BISC 202 Evolution with Laboratory

BISC 210 Marine Biology with Laboratory

BISC 308 Tropical Ecology with Wintersession Laboratory

BISC 319 Population Genetics and Systematics: Evolution on Islands with Laboratory

ECON 228 Environmental and Resource Economics

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GEOS 101 Earth Processes and the Environment with Laboratory
GEOS 102 The Dynamic Earth with Laboratory
GEOS 110 The Coastal Zone: Intersection of Land, Sea, and Humanity with Laboratory
GEOS 208 Oceanography
GEOS 304 Sedimentology with Laboratory
GEOS 308 Wetlands Science with Laboratory
GEOS 320 Isotope Geochemistry
PHIL 233 Environmental Philosophy
POL3 332S Seminar. People, Agriculture, and the Environment

Requirements for the Major

There are three components to the 10-course major:

1.
Three core courses (ES 101, ES 102, and ES 300).

(Students who took ES 100 in 2006 or earlier may count that version of the course and may choose either to take ES 102 or to replace it with an elective; for students fulfilling the old version of the major, ES 101 can replace ES 100 in the requirements.)

2.
One course in each of these categories provides breadth:

- a. Science: ES 201 or BISC 201
- b. Social Science: ES 214 or ECON 228 (which requires ECON 101 as a prerequisite)
- c. Humanities: ES 203 or ES 299 or PHIL 233

3.
Four electives from Environmental Studies courses and the list of Related Courses, at least two of which must be at the 300 level.

Note that ES 201, ES 203, ES 214, ES 299, BISC 201, ECON 228, and PHIL 233 can be taken as electives (but no single course can fulfill two requirements for the major). These courses should be approved by the student's advisor prior to enrollment. Two half-credit courses may be combined to count towards a single elective.

Students who entered Wellesley before the fall of 2007 have the option to complete the current major requirements or the requirements in effect at the time of their declaration. For students who choose this option, the previous major requirements are as follows:

There are three components to the 11-course major:

1.
Two core courses (ES 100 and ES 300). Note, ES 100 is no longer offered. ES 101 may be taken as a substitute.

2.
Five courses in an area of concentration (at least one of which must be at the 300 level). The three areas of concentration are:
1) Environmental Justice and Philosophy;
2) Environmental Policy and Economics, and 3) Environmental Science.

3.
Four complementary elective courses from outside the area of concentration.

Students may count no more than three courses taken away from Wellesley towards the environmental studies major. These courses should be approved by the director prior to enrollment.

Requirements for the Minor

There are three components to the 5-course minor:

1. Core: Either ES 101 or ES 102.

2.
Breadth: one course in each of these categories:

- a. Science: ES 201 or BISC 201
- b. Social Science: ES 214 or ECON 228 (which requires ECON 101 as a prerequisite)
- c. Humanities: ES 203 or ES 299 or PHIL 233

3.
One elective from ES courses or Related Courses. (ES 300 may be chosen as the elective.)

Students may count no more than three courses taken away from Wellesley towards the environmental studies major and no more than one course taken away from Wellesley towards the environmental studies minor. These courses should be approved by the director prior to enrollment. AP credit in Environmental Science cannot be used to replace any Environmental Studies requirements.

Honors

The only route to honors in the major is writing a thesis and passing an oral examination. A student whose GPA in courses in her environmental studies major is 3.5 or higher may apply to write an honors thesis. The proposal should be submitted in April of the student's junior year. Students should have identified a topic, an advisor, and a committee of two additional faculty members (one of whom must have expertise in areas outside the topic or approach of the proposed thesis) before applying. The applications are evaluated by the advisory faculty. Students planning to study abroad should discuss their interest in honors with potential advisors during their sophomore year, and plan to submit their application in April of their junior year abroad.

Off-Campus Programs

By special arrangement with the Ecosystems Center of the Marine Biological Laboratory and the Marine Studies Consortium, Wellesley College students in good standing may apply for courses in these off-campus programs. The number of participants in each program is limited (see Special Academic Programs). Students should also consider courses at MIT and Olin College. Courses at MIT and Olin, as well as EXTD courses count as Wellesley courses, rather than as courses taken off campus, for the purposes of the environmental studies major, but specific courses must be approved by the student's advisor to count towards the major. For courses offered during the Semester in Environmental Studies, Ecosystems Center of the Marine Biological Laboratory, Woods Hole, Massachusetts, see www.mbl.edu/SES.