Environmental Studies

Students interested in studying the environment can choose among three majors in the following academic departments: Biology, Earth and Planetary Sciences, and Political Science. The curriculum for these majors is integrated and interdisciplinary and draws from many disciplines across Arts & Sciences and the university as a whole. In this way the majors capture the strengths of both the traditional academic departments and the interdisciplinary innovation necessary to explore fully the multiple issues and questions posed in the study of the environment.

Please visit the following pages for more information on these majors:
- Environmental Biology
- Environmental Earth Sciences
- Environmental Policy

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John Parks
PhD, Washington University
(Environmental Studies and University College)

The Major in Environmental Studies

Students interested in studying the environment can choose among three majors in the following academic departments: Biology, Earth and Planetary Sciences, and Political Science.

Please visit the following pages for more information on these majors:
- Environmental Biology
- Environmental Earth Sciences
- Environmental Policy

The Minor in Environmental Studies

Required Units: 19

Required Courses:
- EPSc 201 Earth and the Environment 4
- Biol 2950 Introduction to Environmental Biology 3
- Pol Sci 2010 Introduction to Environmental Policy 3

Elective Courses: 9 units — one course from each of the three categories below

One advanced science course:
- EPSc 323 Biogeochemistry 3
- Biol 372 Behavioral Ecology 4
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
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<tbody>
<tr>
<td>EnSt 375</td>
<td>Urban Ecology</td>
<td>3</td>
</tr>
<tr>
<td>Biol 381</td>
<td>Introduction to Ecology</td>
<td>3</td>
</tr>
<tr>
<td>EPSc 401</td>
<td>Earth Systems Science</td>
<td>3</td>
</tr>
<tr>
<td>EPSc 413</td>
<td>Introduction to Soil Science</td>
<td>3</td>
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**One advanced political science or law course:**

<table>
<thead>
<tr>
<th>Course Code</th>
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<tbody>
<tr>
<td>Pol Sci 3240</td>
<td>The Political Economy of Public Goods</td>
<td>3</td>
</tr>
<tr>
<td>Pol Sci 331</td>
<td>Topics in Politics</td>
<td>3</td>
</tr>
<tr>
<td>Pol Sci 332B</td>
<td>Environmental and Energy Issues</td>
<td>3</td>
</tr>
<tr>
<td>Pol Sci 3752</td>
<td>Topics in American Politics: Globalization, Urbanization and Environment</td>
<td>3</td>
</tr>
<tr>
<td>Pol Sci 4043</td>
<td>Public Policy Analysis, Assessment and Practical Wisdom</td>
<td>3</td>
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<tr>
<td>EnSt 539</td>
<td>Interdisciplinary Environmental Clinic</td>
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**One advanced anthropology or ethics course:**

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<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
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<tbody>
<tr>
<td>Anthro 3053</td>
<td>Nomadic Strategies and Extreme Ecologies</td>
<td>3</td>
</tr>
<tr>
<td>Anthro 3322</td>
<td>Brave New Crops</td>
<td>3</td>
</tr>
<tr>
<td>Anthro 3472</td>
<td>Global Energy and the American Dream</td>
<td>3</td>
</tr>
<tr>
<td>EnSt 335F</td>
<td>Introduction to Environmental Ethics</td>
<td>3</td>
</tr>
<tr>
<td>Anthro 361</td>
<td>Culture and Environment</td>
<td>3</td>
</tr>
<tr>
<td>Anthro 4211</td>
<td>Paleothnobotany and Ethnobotany</td>
<td>3</td>
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Courses that are offered less frequently or have more prerequisites but that are preapproved substitutions for these requirement categories include:

**Advanced science:**

<table>
<thead>
<tr>
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<th>Course Title</th>
<th>Units</th>
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</thead>
<tbody>
<tr>
<td>Biol 4170</td>
<td>Population Ecology</td>
<td>3</td>
</tr>
<tr>
<td>EPSc 408</td>
<td>Earth’s Atmospheric and Global Climate</td>
<td>3</td>
</tr>
<tr>
<td>EPSc 429</td>
<td>Environmental Hydrogeology</td>
<td>3</td>
</tr>
<tr>
<td>EPSc 444</td>
<td>Environmental Geochemistry</td>
<td>3</td>
</tr>
<tr>
<td>EPSc 484</td>
<td>Paleoenvironmetal Reconstruction</td>
<td>3</td>
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</table>

**Advanced political science or law:**

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<thead>
<tr>
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<tbody>
<tr>
<td>Econ 451</td>
<td>Environmental Policy</td>
<td>3</td>
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**Advanced anthropology or ethics:**

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<tr>
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<th>Units</th>
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</thead>
<tbody>
<tr>
<td>Anthro 3612</td>
<td>Population and Society</td>
<td>3</td>
</tr>
<tr>
<td>Anthro 379</td>
<td>Meltdown: The Archaeology of Climate Change</td>
<td>3</td>
</tr>
<tr>
<td>Anthro 4215</td>
<td>Anthropology of Food</td>
<td>3</td>
</tr>
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**L82 EnSt 109A Quantitative Reasoning in Environmental Science**

Introduction to practical mathematical methods for understanding environmental aspects of our planet, particularly how the environment changes with time through human interactions. Emphasis on intuitive approaches in devising simple relationships for understanding quantitative outcomes of natural processes. Introduction to basic statistical methods, including hypothesis testing, and how statistics can be applied to environmental problems.

Same as EPSc 109A

Credit 3 units. A&S: NS, QA A&S: IQ, NSM, AN BU: SCI FA: NSM

**L82 EnSt 122 Freshman Seminar — A Sense of Place: Discovering the Environment of St. Louis**

This seminar is designed to serve as an introductory science seminar course for freshman. The goals of the course include: Providing students with an introduction to the environmental setting of St. Louis; introducing students to topics of interest in the local environment; providing students with opportunities to identify and critically analyze environmental issues from a local perspective; and aiding students in their major selection by introducing them to a wide degree of scientific and environmental disciplines and perspectives.

Credit 3 units. A&S: NS A&S: IQ, NSM

**L82 EnSt 124 Hokule’a: National Environmental Issues**

This course guides students through the preparation of a poster, presentation and research paper after their four-week summer research internship. The goal of the class, which is the third part in a three-part program, is to introduce students to research, writing, presentation and publication of work, under the auspices and guidelines of the Office of Undergraduate Research.

Credit 1 unit. A&S: TH A&S: IQ, HUM EN: H

**L82 EnSt 201 Earth and the Environment**

Introduction to the study of the Earth as a dynamic, evolving planet. Emphasis on how internal and surface processes combine to shape the environment. Themes: Earth’s interior as revealed by seismic waves; Earth history and global tectonics shown by changes to ocean floors, mountain-building, formation of continents, earthquakes and volcanism; climate history and global biogeochemical cycles, influenced by circulation of atmosphere and oceans, ice ages and human activity. Composition and structure of rocks and minerals. Three class hours and one two-hour lab a week.

Same as EPSc 201

Credit 4 units. A&S: NS A&S: IQ, NSM BU: SCI FA: NSM

**L82 EnSt 210 Undergraduate Teaching Assistant**

Credit 3 units.

**L82 EnSt 221A Human Use of the Earth**

Same as EPSc 221A

Credit 3 units. A&S: NS A&S: IQ, NSM BU: SCI FA: NSM
L82 EnSt 222 Topics in Japanese Literature and Culture: Environmental Consciousness in Modern Japanese Literature  
Same as Japan 221  
Credit 3 units. A&S: TH A&S: IQ, HUM, LCD  EN: H

L82 EnSt 2431 Missouri’s Natural Heritage  
Missouri’s Natural Heritage is a multidisciplinary two-semester Freshman Focus course. The first semester of the sequence focuses on Missouri geology, climate, archaeology and native megafauna. This provides a foundation on which to examine the ecology, restoration and management of our diverse habitats (prairie, forest, glade and stream) and the biology of our diverse plant and animal wildlife (arthropods, mollusks, fish, salamanders, lizards, birds and mammals) in the second semester. We also introduce basic concepts in biodiversity and resource management with attention to resolution of conflicts of interest. In addition to weekly lecture and discussion, students in this class visit sites across the state during three weekend camping trips and a longer camping trip during winter break. Attendance on field trips is an essential component of the course and grade. Lab fee of $480 covers transportation and meals for all field trips.  
Same as Focus 2431  
Credit 3 units. A&S: IQ, NSM

L82 EnSt 272A Physics and Society  
Same as Physics 171A  
Credit 3 units. A&S: NS, QA A&S: IQ, NSM, AN BU: SCI FA: NSM

L82 EnSt 299 Directed Internship  
Internship with an environmental organization (commercial, not-for-profit, governmental, etc.) where the primary objective is to obtain professional experience outside of the classroom. Student must have a faculty sponsor and must file a Learning Agreement with the Career Center, the faculty sponsor and the site supervisor. A final written project is agreed upon between the student and faculty sponsor before work begins, and is evaluated by the faculty sponsor at the end of the internship. Detailed supervision of the intern is the responsibility of the site supervisor.  
Credit variable, maximum 3 units.

L82 EnSt 3053 Nomadic Strategies and Extreme Ecologies  
This course explores the archaeology and anthropology of nomadic pastoral societies in light of their ecological, political and cultural strategies and adaptation to extreme environments (deserts, mountains, the arctic). The aim of the course is to understand both the early development of pastoral ways of life, and how nomads have had an essential role in the formation and transfer of culture, language and power from prehistoric time to the current era.  
Same as Anthro 3053  
Credit 3 units. A&S: SS A&S: IQ, SSC BU: BA, IS EN: S FA: SSP

L82 EnSt 306B Africa: Peoples and Cultures  
An anthropological survey of Africa from the classic ethnographies to contemporary studies of development. Emphasis on the numerous social and economic changes African peoples have experienced from precolonial times to the present.  
Same as Anthro 306B  
Credit 3 units. A&S: SS, CD A&S: IQ, SSC, LCD BU: HUM, IS FA: SSP

L82 EnSt 323 Biogeochemistry  
Survey of biogeochemical interactions among Earth’s crust, oceans and atmosphere, including perturbations due to human activities. Carbon, nitrogen, phosphorus and sulfur biogeochemical cycles. Greenhouse warming of atmosphere from carbon dioxide and chlorofluorocarbons: effects of inorganic and organic wastes in groundwater systems. Introductory course for students of environmental science and nonscience majors. Prerequisite: permission of instructor.  
Same as EPSc 323  
Credit 3 units. A&S: NS A&S: IQ, NSM BU: SCI FA: NSM

L82 EnSt 332 Environmental and Energy Issues  
This course considers the major issues in these increasingly important areas of public policy. We discuss the importance of political processes and actors on such phenomenon as pollution, global warming and wilderness protection. This course emphasizes the American experience but also considers international implications. Two lectures and one section meeting each week.  
Same as Pol Sci 332B  
Credit 3 units. A&S: SS A&S: IQ, SSC BU: ETH EN: S FA: SSP

L82 EnSt 3322 Brave New Crops  
This course introduces students to the major issues surrounding the development and use in genetically modified (GM) crops. Its focus is international, but with particular focus on the developing
A variety of experts, available locally or through the internet, contribute perspectives. The course also includes field trips. For further information, see artsci.wustl.edu/~anthro/courses/3322. Same as Anthro 3322

Credit 3 units. A&S: SS A&S: IQ, SSC BU: IS FA: NSM

**L82 EnSt 335F Introduction to Environmental Ethics**

A general survey of current issues in environmental ethics, focusing on problems such as the obligation to future generations, protection of endangered species, animal rights, problems of energy and pollution, wilderness, global justice, and business obligations. Students also learn some ethical and political theory. Same as Phil 235F

Credit 3 units. A&S: TH A&S: IQ, HUM BU: ETH FA: SSP

**L82 EnSt 350W Environmental Issues: Writing**

For students interested in environmental issues — natural science, social science and policy. This course aims to provide students with the writing skills they need to be successful in the environmental field once they graduate. In doing so, students examine environmental issues and decision-making processes by examining data and facts underlying positions and decisions. They explore the role of audience, purpose and author angle of vision as they examine the role of multiple stakeholders in environmental issues and processes. Students also are exposed to different types of writing used in environmental studies professions. When the course includes a service learning component, students are exposed to the types of writing that are necessary in environmental careers and in environmental non-profits and governmental agencies in particular.

Credit 3 units. A&S: NS, WI A&S: IQ, NSM, WI

**L82 EnSt 361 Culture and Environment**

An introduction to the ecology of human culture, especially how “traditional” cultural ecosystems are organized and how they change with population density. Topics include foragers, extensive and intensive farming, industrial agriculture, the ecology of conflict, and problems in sustainability. Same as Anthro 361

Credit 3 units. A&S: SS A&S: IQ, SSC BU: ETH FA: SSP

**L82 EnSt 372 Behavioral Ecology**

This course examines animal behavior from an evolutionary perspective and explores the relationships between animal behavior, ecology and evolution. Topics include foraging behavior, mating systems, sexual selection, predator-prey relationships, cooperation and altruism, competition and parental care. Prerequisite: Biol 2970 or permission of instructor. Same as Biol 372

Credit 4 units. A&S: NS A&S: IQ, NSM FA: NSM

**L82 EnSt 374 Social Landscapes in Global View**

From the beginning of the human campaign, societies have socialized the spaces and places where they live. This socialization comes in many forms, including the generation of sacred natural places (e.g., Mt. Fuji) to the construction of planned urban settings where culture is writ large in overt and subtle contexts. Over the past two decades or so, anthropologists, archaeologists and geographers have developed a wide body of research concerning these socially constructed and perceived settings — commonly known as “landscapes.” This course takes a tour through time and across the globe to trace the formation of diverse social landscapes, starting in prehistoric times and ending in modern times. We cover various urban landscapes, rural landscapes, nomadic landscapes (and others) and the intersection of the natural environment, the built environments and the symbolism that weaves them together. Chronologically, we range from 3000 BCE to 2009 CE and we cover all the continents. This course also traces the intellectual history of the study of landscape as a social phenomenon and investigates the current methods used to recover and describe social landscapes around the world and through time. Join in situating your own social map alongside the most famous and the most obscure landscapes of the world and trace the global currents of your social landscape! Same as Anthro 374

Credit 3 units. A&S: SS A&S: IQ, SSC EN: S FA: SSP

**L82 EnSt 375 Urban Ecology**

Urban Ecology: a field of study within ecology that focuses on the urban environment as an ecosystem and attempts to understand how humans and nature can better coexist in these highly modified environments. The ultimate goal is to aid efforts for more sustainable cities through better urban planning and practices. The class format includes both lectures and discussions.

Credit 3 units. A&S: NS A&S: IQ, NSM

**L82 EnSt 379 Feast or Famine: Archaeology and Climate Change**

This course examines the temporal, geographical and environmental aspects of past climate changes, and by using specific examples, explores how climate changes may have affected the evolution of human culture and the course of human history. Archaeological and documentary examples from the Americas, Africa, Asia, Europe and the Near East are used to explore if or how significant events in human history have been influenced by changes in climate. Same as Anthro 379

Credit 3 units. A&S: SS A&S: IQ, SSC EN: S FA: SSP
L82 EnSt 380 Applications in GIS
This introductory course in Geographic Information Systems (GIS) is designed to provide basic knowledge of GIS theory and applications using the existing state-of-the-art GIS software. The course is taught using a combination of lectures, demonstrations and hands-on, interactive tutorials in the classroom. The first week of the course provides a broad view of how students can display and query spatial data and produce map products. The remainder of the course focuses on applying spatial analytical tools to address questions and solve problems. As the semester develops, more tools are added to students' GIS toolbox so that they can complete a final independent project that integrates material learned during the course. Students are encouraged to design individualized final projects using their own or other available data; however, some already-prepared final projects also are available.
Credit 3 units. A&S : NS  A&S : IQ , NSM

L82 EnSt 381 Introduction to Ecology
This course explores the science of ecology, including factors that control the distribution and population dynamics of organisms, the structure and function of biological communities, how energy and nutrients flow across ecosystems, and what principles govern ecological responses to global climatic and other environmental changes. The class format includes lectures, discussions and small group exercises. Assignments include quantitative data analysis, ecological modeling and scientific writing.
Same as Biol 381
Credit 3 units. A&S : NS A&S : IQ, NSM FA: NSM

L82 EnSt 390 Independent Study
Independent study for undergraduates, supervised by a faculty member. Prerequisite: permission of instructor.
Credit variable, maximum 6 units.

L82 EnSt 391 Directed Research in Environmental Studies
Research activities or project in environmental studies done under the direction of an instructor in the program. Permission of an instructor and the chair of the program is required.
Credit variable, maximum 6 units.

L82 EnSt 392 Directed Fieldwork in Environmental Studies
Fieldwork carried out under the direction or supervision of an instructor in the Program. Permission of an instructor and of the chair of the program is required.
Credit variable, maximum 6 units.

L82 EnSt 393 Practical Skills in Environmental Biology Research
This course provides students with an interest in research in environmental biology and a broad overview of the skills and tools needed for a successful career. Topics covered include: (1) developing ideas/approaches for research projects, (2) experimental design and analyses, (3) using the primary literature effectively, (4) writing successful small grant and fellowship proposals, and (5) writing/reporting results. In addition, students learn other important field biology skills, including a variety of field methods, as well as coping with rough field conditions. Some Saturday and nighttime field trips required. Grading is based primarily on class participation and take-home assignments. Prerequisites/corequisites: permission of Professor Knight and at least one of the following courses: EnSt 370, EnSt 373, Biol 2950, Biol 3501, Biol 372, Biol/EnSt 381, Biol/EnSt 4170, Biol/EnSt 419, Biol 4191, Biol/EnSt 4193.
Credit 2 units. A&S: NS A&S: IQ, NSM

L82 EnSt 408 Earth's Atmosphere and Global Climate
Structure and dynamics of Earth's atmosphere. Basic factors controlling global climate of Earth. Quantitative aspects of remote sensing of atmosphere. Remote sensing instrumentation. Prerequisites: Math 233 and Phys 117A (or Phys 197); or permission of instructor.
Same as EPSc 408
Credit 3 units. A&S : NS A&S : IQ, NSM FA : NSM

L82 EnSt 413 Introduction to Soil Science
Physical, chemical and biological processes that occur within soil systems. Types of soils and how these relate to soil formation. Major components of soil, including soil water, minerals, organic matter and microorganisms. Soils in wetlands and arid regions. Cycling of nutrients and contaminants in soils. Soil quality, conservation and sustainability. Two one-day field trips required. Prerequisites: EPSc 323 or Chem 112A (or AP Chem score of 4) or permission of instructor.
Same as EPSc 413
Credit 3 units. A&S : NS A&S : IQ, NSM FA : NSM

L82 EnSt 419 Community Ecology
Basic principles of community ecology, including species interactions, spatial and temporal patterns of biodiversity, and ecosystem functioning. Analytical theory, statistical patterns, and experimental approaches are emphasized. Intended for students wanting a rigorous overview of ecological principles. Prerequisite: at least one of the following courses: Biol 3501, 372, 381, 4170, 4193, EnSt 370 or permission of instructor.
Same as Biol 419
Credit 3 units. A&S : NS A&S : IQ, NSM FA : NSM

L82 EnSt 4193 Experimental Ecology Laboratory
Design and interpretation of ecological experiments, with an emphasis on hypothesis testing, sampling methodology, and data analyses. Sessions address fundamental ecological
questions and include field, greenhouse, and laboratory (microcosm) studies on a variety of taxa and ecosystems. Generally work is done before dark (5-6 p.m.), although occasionally goes later (7 p.m.). Includes occasional required Saturday field trips to local sites (e.g., forests, wetlands, prairies, streams) for in-depth study. Assignments are primarily several written assignments, including final projects and in-class participation. Fulfills the upper-level laboratory requirement for the Biology major. One hour of lecture and 4 hours of laboratory per week. Prerequisites: permission of instructor and at least one of the following: Introduction to Ecology (Biol 381), Behavioral Ecology (Biol 372), Biological Conservation (EnSt 370), Population Ecology (Biol 4170), Community Ecology (Biol 419), or Evolution (Biol 3501). Credit will not be awarded for both 4191 and 4193. Enrollment is limited to 15 students.

Same as Biol 4193
Credit 4 units. A&S: NS, WI A&S: IQ, NSM, WI FA: NSM

L82 EnSt 428 Hydrology
Survey of principles that govern the flow of water in river and groundwater systems in deep geologic environments. Basic equations of fluid flow, dynamics and the characteristics of drainage basins, rivers, floods and important aquifers. Exploitation of ground water systems. Prerequisites: EPSc 353, Physics 117A (or Physics 197), Math 233, or permission of instructor.
Same as EPSc 428
Credit 3 units. A&S: NS A&S: IQ, NSM FA: NSM

L82 EnSt 432 Environmental Mineralogy
Same as EPSc 430
Credit 4 units. A&S: NS A&S: IQ, NSM FA: NSM

L82 EnSt 444 Environmental Geochemistry
Interaction of water with minerals and organic compounds at the low temperatures of many environmental settings. Emphasis on understanding groundwater compositions and capacity for transporting metals and organic solutes in the subsurface. Speciation, mass transport, surface reactions, contaminant sources and remediation methods. Prerequisite: EPSc 333 or permission of the instructor.
Same as EPSc 444
Credit 3 units. A&S: NS A&S: IQ, NSM BU: SCI FA: NSM

L82 EnSt 451 Environmental Policy
This course examines the relationship between environmental economics and environmental policy. The course focuses on air pollution, water pollution, and hazardous wastes, with some attention given to biodiversity and global climate change. The course examines critically two prescriptions that economics usually endorses: (1) “balancing” of benefits against costs (e.g., benefit-cost analysis) and the use of risk analysis in evaluating policy alternatives; (2) use of market incentives (e.g., prices, taxes or charges) or “property rights” instead of traditional command-and-control regulations to implement environmental policy. Prerequisite: Econ 1011.
Same as Econ 451
Credit 3 units. A&S: SS A&S: IQ, SSC BU: BA, ETH FA: SSP

L82 EnSt 4980 Undergraduate Research Seminar
Provides an opportunity for advanced undergraduates to synthesize many of the diverse subdisciplines of Earth and Planetary Sciences while focusing on a research topic. Subject changes each offering. Each subject is unique and timely, but broad enough to encompass wide-ranging interests among students. Students conduct original research, make written reports of the results, and make oral presentations of their projects in class. Prerequisite: senior standing or permission of instructor.
Same as EPSc 498
Credit 3 units. A&S: NS, WI A&S: IQ, NSM, WI FA: NSM

L82 EnSt 499 Senior Honors
Independent work for undergraduate Honors, supervised by a faculty member. Prerequisites: senior standing, eligibility for Honors and permission of instructor.
Credit 3 units.