Environmental Studies

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Courses

Visit online course listings to view semester offerings for L82 EnSt (https://courses.wustl.edu/CourseInfo.aspx?sch=L&dept=L82&crslvl=1:4).

L82 EnSt 101 Earth's Future: Causes and Consequences of Global Climate Change

Earth's Future: Causes and Consequences of Global Climate Change examines the following: 1) the physical basis for climate change; 2) how climates are changing and how we know and assess that climates are changing; and 3) the effects of climate change on natural and human systems. The course is team-taught and will involve participation by scholars across the university with expertise in specific subjects. This is a broad introductory course for first-year students, and it presumes no special subject matter knowledge on the part of the student. This course is for first-year (non-transfer) students only.

Same as I60 BEYOND 101
Credit 3 units. A&S IQ: FYBB A&S IQ: NRM Arch: NRM Art: NRM BU: SCI

L82 EnSt 102 To Sustainability and Beyond: People, Planet, Prosperity

This course combines interdisciplinary instruction with applied project work. Students will be introduced to global concepts in sustainability and examine how they relate to specific issues in the greater St. Louis community, learning what it means to be civic-minded stewards of social and ecological systems. In addition, students will work on developing the critical "soft skills" needed for success on the job, such as effective communication techniques, project management, and leadership. Students will emerge from the course with a systems-level understanding of sustainability, a working knowledge of the fundamentals of community engagement, and an appreciation for values-based civic stewardship. Experience in this course will prepare students for applied project-based work in other courses or internships, regardless of academic discipline. This course is for first-year (non-transfer) students only.

Same as I60 BEYOND 140
Credit 3 units. A&S: FYS A&S IQ: SSC EN: S

L82 EnSt 105 Sustainability in Business

In today's complex business environment, organizations are constantly challenged to develop innovative policies and processes that ensure profitability. Some leaders believe that the sole purpose of business is to maximize shareholder wealth and that fiscal sustainability is not compatible with environmental responsibility. In reality, ecological and economic performance need not — and should not — be mutually exclusive. Fortunately, the outmoded mindset of "profit-at-any-cost" is beginning to shift as organizations recognize the importance of adopting balanced business practices that promote social equity and environmental prosperity without sacrificing financial stability. Organizations that embed sustainability into their corporate strategies increase operational efficiency by using resources more responsibly and minimizing waste. In an increasingly crowded and competitive marketplace, sustainability has become a source of competitive advantage through which an organization can have a positive impact not only on the financial "bottom line" but also on the environment and society. In this course, we explore key concepts and issues driving sustainability in business. We also examine core sustainability principles, frameworks, and tools that companies can use to better understand and work within the natural systems that enable their existence and sustain their operations.

Credit 3 units. A&S IQ: SSC Arch: SSC Art: SSC BU: BA EN: S

L82 EnSt 110 Environmental Issues

This course examines the science behind current environmental issues, with emphasis on ecology and conservation. Students will gain an understanding about the consequences of the way that humans currently interact with the natural environment and potential solutions that would allow long-term sustainability of the Earth. Topics will include: human population growth, ecosystem structure and diversity, types and origin of pollution, global climate change, energy resources and use, challenges to feeding the world, and the interaction between the environment and human health.

Credit 3 units. A&S IQ: NRM Arch: NRM Art: NRM BU: SCI

L82 EnSt 115 Introduction to Conservation Biology

This course is introductory level and appropriate for both non-science majors as well as potential science majors who may be investigating their interests. Conservation Biology will focus on biodiversity, its preservation and current threats, as well as obstacles to its preservation for the future. We will examine the different levels of biodiversity present in nature as well as highlighting its importance, and why it matters to the human population. In studying Conservation Biology, students will also learn key concepts from related fields such as evolution and ecology that are necessary to understand concepts and concerns. Course topics include species and ecosystem management, restoration, strategies to combat threats, and past successes and failures relating to biodiversity conservation.

Credit 3 units. A&S IQ: NRM Arch: NRM Art: NRM BU: SCI

L82 EnSt 121 Ampersand: Pathfinder — A Sense of Place: Discovering Missouri’s Natural Heritage

This is the first course in the Pathfinder program, and it will introduce students to their new home for the next four years. This interdisciplinary course will cover Missouri geology, climate, archaeology, and native megafauna. We will explore many of the habitats found in Missouri (prairie, forest, glade, and stream) and the biology of our diverse plant and animal wildlife (arthropods, mollusks, fish, salamanders, lizards, birds, and mammals). This will provide a foundation that will inform the study of ecology, policy and management in other courses. In addition to weekly lectures and discussions, students in this course will visit sites across the state during three weekend camping trips and two one-day trips. Attendance on field trips is an essential component of the course. Course enrollment is open only to students admitted into the Pathfinder Fellowship program.

Same as L61 FYP 121
L82 EnSt 122 Ampersand: Pathfinder — A Sense of Place: Discovering the Environment of St. Louis
Go exploring in and around St Louis. You’ll learn about the St. Louis backyard, and your “home” for the next four years. Through field trips, readings, and discussion, you’ll see firsthand what challenges face the environment and the people who live here. You will learn how to examine multiple perspectives, how to think critically and how to approach problems from an interdisciplinary and holistic approach. You’ll also learn why it is important to know a community at the local level if you’re going to affect change on any level-state, national, or international. In addition to weekly readings and discussion, this class includes several field trips.
Same as L61 FYP 122
Credit 3 units. A&S: AMP A&S IQ: NSM BU: SCI

L82 EnSt 181 Ampersand: Pathfinder — Environmental Seminar
A survey of pressing environmental issues, both local and global, as well as an introduction to the breadth of environmental work occurring on campus. Credit/no credit only.
Same as L61 FYP 181 P
Credit 1 unit. A&S: AMP

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. Part of the introductory sequence of courses for all Earth and planetary sciences and environmental studies majors. Three class hours and one two-hour lab a week.
Same as L19 EPSc 201
Credit 4 units. A&S IQ: NSM Arch: NSM Art: NSM BU: SCI

L82 EnSt 210 Undergraduate Teaching Assistant
Credit 3 units.

L82 EnSt 215 Introduction to Environmental Humanities
In this environmental humanities seminar, we will consider texts illustrating how American citizens evolved in their perception, use, and expectations of the natural world during the 19th and early 20th centuries, especially with regard to (but not limited to) the practice of agriculture. How did the mandatory short-term goals of health and economic security sought so eagerly by citizens and supported by evolving technologies foreshadow the unintended consequences of long-term environmental damage that would contribute to climate change, and how can we understand this using a critical and hopeful lens? Considering contemporary writings on our perception of "environmentalism" will help us nuance our analysis. Topics will include agrarian democracy; settlement of the Great Plains by immigrant farmers; the Dust Bowl; and fragmentation of the Sioux ecosystem. This cultural research will frame our visits to the Tyson Research Center, Washington University’s field laboratory in west St. Louis County. The Tyson Research Center’s mission is to provide a living landscape for environmental research and education as a component of Washington University’s International Center for Energy, Environment and Sustainability (InCEES). As a class, we will meet with faculty researchers from both science and the humanities and hear about their work on ecosystem sustainability (i.e., thinking long-term for human and environmental health). We will use texts such as government reports, history, literature, environmental policy, and autobiography. This course is for first-year and sophomore students only.

L82 EnSt 222 Topics in Japanese Literature and Culture: Environmental Consciousness in Modern Japanese Literature
A topics course on Japanese literature and culture. Subject matter varies by semester; consult current semester listings for topic.
Same as L05 Japan 221
Credit 3 units. A&S IQ: HUM, LCD BU: IS EN: H

L82 EnSt 250 One Health: Linking the Health of Humans, Animals, and the Environment
This course provides an introduction to One Health, a collaborative effort of multiple disciplines — working locally, nationally, and globally — to attain optimal health for people, animals, and the environment. The student will learn about the challenges threatening environmental, animal, and human health. More importantly, they will learn about the transdisciplinary/holistic/One Health approach, which is necessary if we are to develop the solutions to these challenges. To address the loss of biodiversity, climate change, and environmental pollutants, students will participate in project-based learning modules to understand the how and why of these challenges as well as the mechanisms available to study current threats to conservation and public health. Class lessons will consist of lectures, clicker-based discussions, and case-study discussions. Assignments will include regular readings, quizzes, three exams, the creation of one infographic to convey a concept to a lay audience, and one short final reflection essay. This course will be limited to first- and second-year students.
Credit 3 units. A&S IQ: SSC Arch: SSC Art: SSC BU: BA EN: S

L82 EnSt 290 Sophomore Seminar in Sustainability and the Environment
This course will provide an opportunity for students to evaluate and explore potential paths in environmental studies, and learn presentation skills to carry forward in their careers. Students will also get the opportunity to get out of the classroom and participate in environmental field trips and activities.
Credit 3 units. A&S IQ: NSM Arch: NSM Art: NSM

L82 EnSt 2950 Introduction to Environmental Biology
Introduction to Environmental Biology is designed to teach important principles of environmental biology and general science literacy skills. We cover the foundational biological principles and contemporary issues within four main topics: human population growth, transfer of energy and carbon in the ecosystem, biodiversity, and food production. We focus on the biological principles involved as we examine these topics in the context of some contentious and confusing issues related
to environmental biology in everyday life. The science literacy skills that you master in this course will help you address the issues you face in your everyday life regarding scientific and pseudoscientific claims about the environment and society and will form the foundation for your development as a critical consumer of science information in the media. This course is required for all environmental biology majors and environmental studies minors. We recommend you take this course in your first- or second-year if possible. If your interests align and your schedule allows, we recommend co-enrolling in ENST 215: Introduction to Environmental Humanities.

Same as L41 Biol 2950
Credit 3 units. A&S IQ: NSM Arch; NSM Art; NSM BU: SCI

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 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 precivilization times to the present. Same as L48 Anthro 306B
Credit 3 units. A&S IQ: LCD, SSC Arch; SSC Art; SSC BU: HUM, IS

L82 EnSt 310 Ecological Economics
Our planet is finite but our economic theories and practices assume that our economy can grow forever. The paradoxical pursuit of infinite growth on a finite planet has real-world consequences: from climate change to increasing income inequality to stagnant and declining quality of life for most of us to the ongoing mass extinction of species that are not economically useful to us, but whose loss simplifies ecosystems to the point of collapse. If these trends continue we will face some very difficult times ecologically and socio-politically. One alternative to infinite-planet economic theory is Ecological Economics, which can be described as economics as if the laws of thermodynamics are true and apply to us. Alone among disciplines with any aspiration to analytic rigor, the field of economics has remained unaffected by the thermodynamic revolution that transformed such fields as biology, chemistry, physics, even history in the late 19th and early 20th centuries. This failure to take physical law into account is one great source of our society's environmental (and social and political) problems. Ecological economics thus represents the continuation of the thermodynamic revolution begun in the 1880s. This course is designed to give you an appropriate grounding in the fundamental assumptions, the conceptual novelties, and the distinctive tools of analysis that comprise this emergent school of economic theory, while placing this theorizing in historical (and ecological) context. We'll pay particular attention to how the precepts and practice of Ecological Economics illuminate the largest challenge facing humans today, the necessity of developing an ecologically sustainable society, one that is sized to the limits of our finite planet.
Credit 3 units. A&S IQ: SSC Arch; SSC Art; SSC BU: BA EN: S

L82 EnSt 315 Fallout: Analyzing Texts and Narratives of the Nuclear Era
In this environmental humanities course we will compare and integrate diverse texts and narratives through which Americans have developed a complex relationship to nuclear technology. Nuclear technology has long been developed, used and debated. Capable of both healing and harm, it challenges our notions of risk verses benefit at every level. It is also poised to potentially play a significant environmental role in climate mitigation by delivering large amounts of nearly carbon-free energy. Using texts such as literary nonfiction, history, environmental anthropology, natural history and public health, we will explore aspects of the Manhattan Project, the Chernobyl Nuclear Reactor accident, the presence of fear in the public perception of nuclear technology, and debates regarding the current and future use of nuclear energy. Two or three Saturday field site visits will be required, one to Weldon Springs Interpretive Center.
Credit 3 units. A&S IQ: HUM Arch; HUM Art; HUM BU: HUM EN: H

L82 EnSt 316 Beyond the Evidence
Why, when all evidence points to the growing threats of climate change, is it so difficult to create movement toward addressing this issue? Why, when we have so much evidence that vaccines reduce illness and death and are extremely safe, do individuals still choose not to vaccinate their children? What if I told you that the scientific evidence does not matter? Over the last few decades, neither better education, nor guilt, nor fear has worked to produce change on important environmental and public health issues. In this course, we will explore the different factors that contribute to the reasons why scientific evidence does not matter for the individual choices we make or policies we support. We will especially consider how values, beliefs, emotions, and identity shape how we process information and make decisions. We will examine how we might talk to one another in a way that might shift thinking or behavior as well as how we can create evidence-based policy. We will explore themes of worldview, cognitive linguistics and framing, cognitive dissonance, risk perception, empathy, habit changes, bungles in messaging, and difficult dialoguing through the examples of climate change and vaccination. Course activities will consist of regular reading, some online research, reflective journaling at home, and engaging in conversation during class. This course is designed to target upper-level students in environmental majors and pre-health studies.
Credit 3 units. A&S IQ: SSC Arch; SSC Art; SSC BU: BA EN: S

L82 EnSt 3194 Environment and Empire
In this course we study British imperialism from the ground up. At bottom, the British empire was about extracting the wealth contained in the labour and the natural resources of the colonized. How did imperial efforts to maximize productivity and profits impact the ecological balance of forests, pastures, and farm lands, rivers and rainfall, animals and humans? We'll ask, with environmental historians of the U.S., how colonialism marked a watershed of radical ecological change. The course will cover examples from Asia to Africa, with a focus
L82 EnSt 320 Pathfinder: Environmental Modernism
Credit 3 units. A&S IQ: HUM Arch: HUM Art: HUM BU: HUM EN: H

L82 EnSt 323 Biogeochemistry
This course covers basic concepts of how elements cycle among the Earth's crust, the oceans, and the atmosphere, including perturbations due to human activities. Carbon, nitrogen, phosphorus, sulfur, and water cycles. Isotopic tracers. Feedbacks, forcings, and residence times. Redox cycling and thermodynamics. Biogeochemical box models and changes in biogeochemical cycles over Earth's history. Biogeochemistry of greenhouse gases; biogeochemical feedbacks in the climate system. This course is appropriate for EPS students, engineering students, environmental science majors, and other students with interest in the environmental or geological sciences. Same as L19 EPSc 323
Credit 3 units. A&S IQ: NSM Arch: NSM Art: NSM BU: SCI

L82 EnSt 340 Energy Governance in Israel and the Middle East
This course focuses on the energy policy concerns of Israel and its surrounding region. Students gain a deep understanding of the complexities involved in energy policy formulation and its profound impact on the security, economy and foreign policy of the Middle East. The course examines such issues as securing energy markets and suppliers, managing oil revenue, deciding on the country's energy mix for electricity, balancing environmental concerns, using energy resources as a "weapon" in foreign policy, subsidizing renewable energy, dealing with water scarcity, promoting nuclear energy, and the role of energy in armed conflicts. Each lesson focuses on one policy concern or dilemma, reviews the main theories and approaches to it, and uses Israel and its surrounding region as case studies for analysis. Although the course focuses on Israel and the East Mediterranean area, it is widely relevant to students interested in energy policy formulation in the United States, Europe, or elsewhere.
Credit 3 units. A&S IQ: LCD, SSC Arch: SSC Art: SSC BU: BA, IS EN: S

L82 EnSt 341 International Energy Politics
What determines the global price of oil? What is the relationship between oil, democracy, poverty, and war? Can renewable energy ever fully replace fossil fuels? In this course, we will analyze long-term trends in the international energy markets while focusing on the political, economic, and security considerations that influence them. We first review the effects of fossil fuels (oil, natural gas, coal) on peace and conflict in the international system and on the stability and well-being of regimes that are rich with such resources. We discuss the major role that energy plays in regional and interstate politics by examining the energy policy of various actors in the international system, including the United States, the European Union, Saudi Arabia, China, Russia, Nigeria, Venezuela, and Iran. The course will also deal with various issues in global environmental politics as well as global trends in the use of renewable and nuclear energy. Grades are based on a short research paper, a class presentation, and a mid-term exam.
Credit 3 units. A&S IQ: SSC Arch: SSC Art: SSC BU: IS EN: S

L82 EnSt 346 Environmental Justice
Environmental quality varies widely across race, class, gender and other forms of social difference. This course explores how and why these differences exist. It provides an overview of the history and foundations of the environmental justice movement in the United States while covering classic environmental justice issues, such as toxic waste and pollution, along with more recent issues, such as food access, urban green space, transportation and climate change. Environmental justice concerns in St. Louis are featured as part of the course. Class time will be devoted to lectures, case studies, group activities and discussions. Student learning will be assessed through exams, reflection, online assignments, a policy brief on an environmental justice issue and a group presentation.
Credit 3 units. A&S IQ: SSC Arch: SSC Art: CPSC, SSC BU: BA EN: S

L82 EnSt 347 Sustainable Cities
Credit 3 units. A&S IQ: SSC Arch: SSC Art: SSC BU: BA EN: S

L82 EnSt 350W Writing Skills for Environmental Professionals
For students interested in climate change, sustainability and the environment. Who are you writing for? Why are you writing? What format makes sense? These are key questions we will ask in this course as we discuss intentionally building effective written communications. Students will explore building blocks of written communication such as audience, purpose, format and angle of vision as they examine current relevant publications, such as the National Climate Assessment or an IPCC report. Readings are intended to highlight these building blocks and students will engage with them through workshops and reflective writing. Major assignments include a proposal letter of intent and a proposal. For the proposal, students will select a climate related topic of interest and, using their building blocks, create an effectively constructed proposal to persuade an imaginary foundation to support their idea. Preference given to majors in Environmental Analysis.
Credit 3 units. A&S IQ: NSM, WI BU: SCI

L82 EnSt 357 Multiparty Environmental Decision Making
This course aims to provide students with the opportunity to develop and apply problem-solving skills in the context of environmental challenges. Students will learn basic frameworks of decision-making through readings and role-play. Through the role-play, students will grapple with the perspectives of multiple stakeholders, the interplay of science and policy, and the ambiguity and uncertainty inherent in decision-making processes.
Credit 3 units. A&S IQ: SSC Arch: SSC Art: SSC BU: BA EN: S
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 L48 Anthro 361
Credit 3 units. A&S IQ: SSC Arch: SSC Art: SSC BU: ETH EN: S

L82 EnSt 3615 Environmental Anthropology
This course will provide students with a working knowledge of how the study of humans across space and time has fundamentally impacted the way we understand the idea of nature, the environment and what it means to be human. The course will ground students in both historical and cutting-edge anthropological theories with units on subsistence, transformative nature, imagining wilds in the Anthropocene and pluralizing environmentalisms.
Same as L48 Anthro 3615
Credit 3 units. A&S IQ: SSC Arch: SSC Art: CPSC, SSC BU: BA EN: S

L82 EnSt 364 Field Methods for Environmental Science
This course provides a broad survey of practical and applied methods for environmental field work for site assessments, ecological studies, conservation land management, habitat monitoring, and ecological restoration. A primary focus will be sources and techniques for obtaining and interpreting field data across a range of abiotic, organismal and system/community parameters, with emphasis on hands-on field experience providing students with direct knowledge highlighting the advantages and limitations of various methods. In the process, students will learn about multiple taxonomic and organismal groups and natural community types, and the relationships among these and the physical environment in functional natural systems. Course topics include theory and practice of methods for sampling biotic and abiotic resources, including vegetation, fauna, aquatic systems, stream geomorphology, and soils, as well as using these data for assessments, habitat monitoring, land management decisions, and developing ecological restorations. Students will gain familiarity with responding to issues driving applied environmental science and related fields today, including data quality, sampling design, field techniques, viability and threat analyses, and incorporating field data into multi-scale conservation planning and design work. The course consists of instructor presentations, guest lectures, readings and written response papers, student projects and presentations, classroom discussions, and extensive field exercises and hands-on training. Class logistics: one lecture (1.5 hours) and one lab (5 hours) per week, plus 2-3 all day Saturday field trips (see policy on absences for back-up plan regarding field trips).
Credit 3 units. A&S IQ: NSM BU: SCI

L82 EnSt 365 Applied Conservation Biology
A hands-on introduction to the concepts of conservation biology and applied conservation practice, including designing and implementing conservation projects. Readings, lectures, classroom exercises, and field projects will immerse students in all aspects of conservation in the contemporary landscape, and the tools and techniques needed for successful and sustainable conservation outcomes will be introduced. Three Saturday field trips are required.
Credit 3 units. A&S IQ: NSM Arch: NSM Art: NSM BU: SCI

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 L48 Anthro 374
Credit 3 units. A&S IQ: LCD, SSC Arch: SSC Art: SSC BU: BA, IS EN: S UColl: CD

L82 EnSt 375 Urban Ecology
Urban Ecology is 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. It is a multidisciplinary study including topics from ecology, evolution and conservation biology, as well as architecture, economics and business. The class format will include both lectures and discussions.
Credit 3 units. A&S IQ: NSM Arch: NSM Art: NSM BU: SCI

L82 EnSt 380 Applications in GIS
This introductory course in Geographic Information Systems (GIS) is designed to provide you with the knowledge, skills, and confidence to be an independent user of GIS. The course will use the latest version of ESRI ArcGIS. The course is taught using a combination of lectures, demonstrations, and hands-on, interactive tutorials in the classroom. You will also explore the scientific literature to understand how GIS is being used by various disciplines to address spatial questions. The course takes a multidisciplinary approach that is focused on learning the tools of GIS versus working with data from a particular field. The goal is to establish a solid foundation you can use to address spatial questions that interest you, your mentor, or your employee. The first weeks of the course will provide a broad view of how you can display and query spatial data and produce map products. The remainder of the course will explore the power of GIS with a focus on applying spatial analytical tools to address questions and solve problems. As the semester develops, more tools will be added to your GIS toolbox so that you can complete a final independent project that integrates materials learned during the course with those spatial analyses that interest you the most. Options include the use of a prepared final project, a provided data set, or designing an individualized final project using their own or other available data.
L82 EnSt 381 Introduction to Ecology
This course explores the central theories and principles in ecology and evolution, and the use of these principles to study and predict human-induced environmental changes. It emphasizes understanding species interactions and population dynamics in biological communities, and the relationships between communities and their environment. It regularly touches on applications of these principles such as ecological responses to global climate change, consequences of habitat fragmentation, disease ecology, and conservation medicine. Principles of experimental design, quantitative data analysis and interpretation, and mathematical models are critical to the field of ecology and are also emphasized throughout the course. Class meetings will include lectures, class activities, computer simulation labs, and smaller group discussions to familiarize students with peer-reviewed journals, scientific writing, and current issues in ecology. Assignments include regular homework reading, occasional problem sets, participation in tutorials/discussions, and a small term-paper. Prerequisite: Bio 2970 or Bio 2950 or permission of instructor.
Same as L41 Biol 381
Credit 3 units. A&S IQ: NSM Arch: NSM Art: 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 3900 Science for Agriculture and Environmental Policy
Government policies at the local, state, and national levels determine and regulate activities that range from local farmers markets to U.S. membership in the Paris Climate Agreement. Science can and should play a critical role in developing policy. This course focuses on the biological science behind policies for climate change and agricultural practice as well as the role of various organizations in providing science for policy. Now is a particularly interesting time for science-based policy with the election of a new U.S. President and the elevation of the President's science advisor to Cabinet level. This course is divided into three parts. First, we review how policy is developed and how various agencies and actors affect policy. The next section looks at biological topics that have policy implications. These case studies are presented by expert speakers who have had experience in various science-related roles in the federal government, foundations, professional associations, advisory organizations, and scientific publications. Finally, students conduct individual research projects on a science topic that affects current legislative efforts, either state or national. Students investigate the basic science of their chosen topic and how this could affect proposed legislation. As part of the research project, students give a class presentation, lead a class discussion, and write a term paper on the foundational biological science. The goals of this course are as follows: (1) to develop an understanding of how science is used to develop policy by examining case studies presented by experts; and (2) to critique a proposed science-based policy either at the state or federal level.
Same as L41 Biol 3900
Credit 3 units. A&S IQ: NSM Arch: NSM Art: NSM

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 405 Sustainability Exchange: Community and University Practicums
The Sustainability Exchange engages interdisciplinary teams of students to tackle real-world energy, environmental, and sustainability problems through an experiential form of education. Students participate in projects with on- or off-campus clients developed with and guided by faculty advisors from across the University. Teams deliver to their clients an end-product that explores "wicked" problems requiring innovative methods and solutions. Past projects have included investigating soil impacts of de-icing practices on campus, collecting data on inequitable trash collection in neighborhoods, working with St. Louis City's building division to make buildings more energy efficient, developing an understanding of how buildings impact birds on campus, and analyzing the performance and viability of sustainable investments. Upcoming projects are still being finalized and may include mitigating plastic pollution in the Mississippi, creating and publishing an illustrated book on the social, cultural, and ecological importance of Forest Park, and assisting with the planning and development of a rain-scaping proposal for a St. Louis City neighborhood. Team-based projects are complemented by seminars that explore problem solving strategies and methodologies drawn from a wide range of creative practices, including design, engineering, and science, as well as contemporary topics in energy, environment, and sustainability. Students will draw on these topics to influence their projects. The course is designed primarily for undergraduates, with preference given to seniors.
Same as IS0 INTER D 405
Credit 3 units. A&S IQ: SSC Arch: SSC Art: CPSC, SSC EN: S

L82 EnSt 406 Urban Ecosystem Principles Integration
In today's world, your discipline has grand challenges whose solutions often lay in other realms. How will you train yourself to leverage the interdisciplinary partnerships required to innovatively solve and evolve in a rapidly changing world? The mission of this interdisciplinary course is to "Advance the interrelationships of ecological and human systems toward creating a healthy, resilient, and biodiverse urban environment," and bring together experts and students in ecology, urban design, architecture/landscape architecture, economics, social work and engineering, drawing from inside and outside the Washington University community. Building from our knowledge of ecosystem principles and function, a diverse group of leaders in their fields provides lectures, readings and student project leadership to understand and test Healthy Urban Ecosystems Principles among human and ecological (nonhuman) systems and the range of sociopolitical processes entailed with their implementation. Class content is developed by Washington University leaders in their disciplines as well as external organizations such as the Missouri Botanical Garden, the Field Museum in Chicago and others. This course builds upon a 1-unit
Credit 3 units. A&S IQ: NSM Arch: NSM Art: NSM

L82 EnSt 419 Community Ecology
Community ecology is an interdisciplinary field that bridges concepts in biodiversity science, biogeography, evolution and conservation. This course provides an introduction to the study of pattern and process in ecological communities, with an emphasis on theoretical, statistical and experimental approaches. Topics include ecological and evolutionary processes that create and maintain patterns of biodiversity; biodiversity and ecosystem function; island biogeography, metacommunity dynamics, niche and neutral theory; species interactions (competition, predation, food webs); species coexistence; and environmental change. The class format includes lectures, discussions, and computer labs focused on the analysis, modeling, and presentation of ecological data using the statistical program R. Prerequisite: Bio 2970, Bio 381 (recommended), or permission of instructor.

Same as L41 Biol 419
Credit 3 units. A&S IQ: NSM Arch: NSM Art: NSM

L82 EnSt 4193 Experimental Ecology Laboratory
The goal of this course is to provide skills in the design, interpretation, and written presentation of ecological and evolutionary experiments, with emphasis on sampling methodology, hypothesis testing, and data analysis. A key objective of this course is to familiarize students with the importance of statistics and experimental design as unified tool, rather than two separate processes. We will practice how to abstract theories, hypotheses, predictions, mathematically, how to contrast them with data, and interpret the results. The course does not seek to be exhaustive of all experimental designs or statistical techniques, nor intensive in any given one. Rather, its focus is on providing the tools and concepts for the critical evaluation, choice, interpretation and further independent learning of the experimental and statistical tools needed for research. Practical analysis of data will be taught in program R, but no prior knowledge is required. During the course, students will plan and execute their own ecological studies, within the limitations of the current pandemic. This is a writing intensive course and grades are based on written assignments, including final projects, and in-class participation. This course fulfills the upper-level laboratory requirement for the Biology major. Prereq: Permission of instructor and at least one of the following: Bio 3501, Bio 372, Bio 381, Bio 419, or Bio 472. Enrollment is limited to 10 students. Credit 4 units.

Same as L41 Biol 4193
Credit 4 units. A&S IQ: NSM, WI Arch: NSM Art: NSM

L82 EnSt 426 Topics in American Politics
This course is intended primarily for sophomores and juniors. The topic of this course varies by semester, dependent on faculty and student interests. Prerequisite: L32 101B.

Same as L32 Pol Sci 426
Credit 3 units. A&S IQ: SSC, SD Art: SSC EN: S

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. Prerequisite: EPSc 353; or permission of instructor.

Same as L19 EPSc 428
L82 EnSt 432 Environmental Mineralogy
Topics connected with environmental mineralogy, some selected by students. Topics may include: mineral dust such as asbestos, containment materials for nuclear waste disposal, environmental ramifications of the processing and use of phosphate fertilizers, lead in the environment, acid mine drainage, microbial mediation of sulfide oxidation, minerals in the human body, weathering of building materials, materials engineering, and engineering of materials for more effective recycling. Three class hours and one two-hour laboratory a week. Participation in discussions, term paper, two field trips required. Most readings from primary sources. Prerequisite: EPSc 352 or permission of instructor. Same as L19 EPSc 430
Credit 3 units. A&S IQ: NSM Arch: NSM Art: NSM

L82 EnSt 444 Environmental Geochemistry
Introduction to the geochemistry of natural waters and the processes that alter their composition. Key principles of aqueous geochemistry and their application to describe the main controls on the chemistry of pristine and polluted soil, surface, and ground water environments. Acids and bases, mineral solubility, carbonate chemistry, chemical speciation, redox reactions, adsorption and ion exchange, and the speciation, mobility, and toxicity of metals. Prerequisites: EPSc 201 and Chem 106 (or AP Chem score of 4); or permission of instructor. Same as L19 EPSc 444
Credit 3 units. A&S IQ: NSM Arch: NSM Art: NSM BU: SCI

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 L11 Econ 451
Credit 3 units. A&S IQ: SSC Arch: SSC Art: SSC BU: BA, ETH EN: S

L82 EnSt 452 International Climate Negotiation Seminar
This variable credit course (all students will register for 3 CREDITS) is designed to prepare students to attend and observe annual meetings associated with the United Nations Framework Convention on Climate Change (UNFCCC) as a delegate of Washington University. The course and meetings provide student delegates with a unique educational experience to observe the development of international climate policy through interdisciplinary negotiations and interactions inside the negotiating space. Students see the interaction between climate policy, science and technology as they identify and analyze policy decisions across the international climate regime. The number of students who can attend meetings is limited by the United Nations. We will do our best to have course participants attend either the COP or Subsidiary Body meetings. Students attend one week. The COP 25 meeting will be held in Santiago, Chile from December 2 to December 13, 2019. The Subsidiary Body meetings will be in Bonn, Germany in June 2020. Enrollment is limited. Indicate your interest by placing yourself on the waitlist (registering for 3 credits) and completing an application. All students will be placed on the waitlist upon registration and students will be selected to enroll from the waitlist after all the applications are reviewed. The application will be open March 1 and will be available on the course website https://sites.wustl.edu/wustlcop/ and on the Climate Change Program website at climatechange.wustl.edu. Application review will begin April 12. Interviews will take place between April 16 and April 25, and enrollment decisions will be made by April 26. Participation in the course is possible without traveling to the meetings. The course is currently scheduled for T/Th 11:30 - 1:00. Contact the instructor with questions at martin@wustl.edu. Credit variable, maximum 6 units. A&S IQ: SSC Arch: SSC Art: SSC BU: BA EN: S

L82 EnSt 461 Intro to Environmental Law
Survey of the most prominent federal laws designed to control pollution and protect human health and the environment. Examines laws applicable to environmental impact statements, biodiversity, air pollution, water pollution, and hazardous waste. Discusses the role of state law and cooperative federalism, as well as the roles of the courts, the legislature, and the administrative state in protecting the environment. Credit 3 units. A&S IQ: SSC Arch: SSC BU: BA EN: S

L82 EnSt 481 Advanced GIS
This course is designed to move beyond tools and skills learned in Applications in GIS (EnSt 380/580). Classes will feature hands-on exercises selected to help students master advanced GIS analysis tools and techniques, while providing experience in the planning and execution of real-world projects. Primary emphasis will be on applying fundamental GIS concepts, performing spatial analysis, developing proficiency with core ArcGIS software (e.g., Network Analyst extension), resolution of problems, and efficient delivery of results. Readings from books and scientific literature will introduce key concepts and provide real-world examples that will be reinforced in the hands-on exercises, assignments and projects. As the semester develops, students will gain a variety of new tools and techniques that will allow them to complete a final independent project that integrates the material learned during the course. Credit 3 units. A&S IQ: SSC Arch: SSC BU: BA EN: S

L82 EnSt 498 Senior Honors Research
Independent research for undergraduate honors, to be supervised by a faculty member. Prerequisites: senior standing, eligibility for honors, and permission of instructor. Credit 3 units.

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 L19 EPSc 498
Credit 3 units. A&S IQ: NSM, WI Art: NSM
L82 EnSt 499 Senior Honors
Independent work for undergraduate Honors, to be supervised
by a faculty member. Prerequisites, senior standing, eligibility for
Honors, and permission of instructor.
Credit 3 units.