Washington University in St. Louis

# Environmental Studies

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## Courses

Visit online course listings to view semester offerings for L82 EnSt.

**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: FYBB A&S IQ: NSM Arch: NSM Art: NSM BU: SCI

**L82 EnSt 102 To Sustainability and Beyond: People, Planet, Prosperity**
This class examines the subject of sustainability from multiple perspectives to gain an appreciation for its interconnected environmental, social, and economic dimensions. We explore foundational concepts and principles through a variety of activities and assignments, including readings, discussions, group work, games, presentations, and projects. The goal is to integrate knowledge and methods from different disciplines to achieve a holistic understanding of sustainability problems and solutions. 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 Arch: SSC Art: SSC 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: NSM Arch: NSM Art: NSM BU: SCI

**L82 EnSt 111 Environmental Racism and the Health of Everyone**
Environmental inequalities threaten the health and well-being of low-income communities and communities of color who are increasingly on the frontlines in the fight against climate change, air and water pollution, food security, and many other urgent environmental problems. Like many urban areas, the St. Louis region faces egregious social, environmental and health disparities. In this course, we critically examine the role of racism and other structural policy inequalities that produce unequal environments and how those unequal environments contribute to public health disparities in St. Louis and beyond. We explore the use of public health data, policy options, and case studies that allow for evidence-based solutions to environmental racism and improved population health. This course that combines small group sessions, case studies and speakers working on environmental justice in the St. Louis region. We provide students with interdisciplinary perspectives and methods, challenging them to address racism and environmental policy through a population health lens. Student learning will be assessed through case studies, reflections, online assignments, and exams. This course is for first-year (non-transfer) students only. Students who are not first year students will be unenrolled from this course.
Same as I60 BEYOND 115
Credit 3 units. A&S: FYBB A&S IQ: SSC Arch: ETH, S, SEM EN: S

**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: NSM Arch: NSM Art: NSM 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
Credit 3 units. A&S: AMP A&S IQ: NSM Arch: NSM Art: NSM BU: SCI

**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 first-hand 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 181P
Credit 1 unit. A&S: AMP A&S IQ: NSM Art: NSM

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**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, Environmental, and Planetary Sciences and Environmental Studies majors. Three class hours and one two-hour lab a week.
Same as L19 EEPS 201
Credit 4 units. A&S IQ: NSM Arch: NSM Art: NSM BU: SCI

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**L82 EnSt 210 Undergraduate Teaching Assistant**
Credit 3 units.

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**L82 EnSt 215 Introduction to Environmental Humanities**
In this environmental humanities course we will explore the human and ecosystem impacts resulting from Euro- American colonization and agricultural settlement of the U.S. Our reflection will include the social, political and economic factors which shape individual relationships with and experiences of nature in Indigenous, enslaved and newly-arrived immigrant communities. Topics will include: the fragmentation of the Sioux American Indian ecosystem and subsequently the dispersion of Sioux people into settled, disparate reservation lands; agrarian democracy, including plantation agriculture, improvement farming and Homestead farming on the Great Plains; and the Dust Bowl. This course is for first-year students and sophomore students only.
Credit 3 units. A&S: FYS A&S IQ: HUM Arch: HUM Art: HUM BU: HUM EN: H

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**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

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**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

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**L82 EnSt 251 Metropolitan Environment**
Understanding the forces shaping urban growth and change is increasingly important for addressing environmental issues. The United Nations projects up to 3/4ths of the world's population will live in urban areas by the end of the century. Urbanization rates now outpace population growth rates in many parts of the world. Changes within the metropolitan environment will have profound impacts on people and planet. This course provides an interdisciplinary overview of the metropolitan growth and change, paying particular attention to the role of planning, politics, and policy. Class time will be devoted to lectures, case studies, group activities and discussion. Student learning will be assessed through exams, online assignments, and a research paper on an environmental issues in a city of student's choice. This course is targeted toward first and second year students looking for foundational understand of urban environmentalism.
Credit 3 units. A&S IQ: SSC Arch: SSC Art: SSC EN: S

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**L82 EnSt 252 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 EN: S

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**L82 EnSt 255 Systems Thinking**
Our complex world is bound together by multiple overlapping systems. Social systems interact with physical and biological systems. Societies and individuals, ecosystems and species, interact in ways that influence each other. Systems thinking is the ability to see the relationships and patterns within and across systems, as well as the underlying structures which shape those relationships and patterns. This course provides an introduction into systems thinking for sustainability. We will explore the key features of systems and students will learn the basics of the systems thinking lens which they will be able to use for addressing sustainability in an ever-changing world. Class time will be devoted to lectures, case studies, group activities and discussions.
Credit 3 units. A&S IQ: SSC Arch: SSC Art: SSC BU: BA EN: S

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**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

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**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

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**L82 EnSt 3060 Community Based Conservation: Madagascar Sustainability Initiative**

This course in community-based conservation through the lens of Madagascar represents a partnership between Missouri Botanical Garden (MBG) and Washington University in Saint Louis. The course is designed to support MBG's Community Based Conservation Program sites, while building student understanding of challenges at the intersection of rural agricultural subsistence communities, climate change, and biodiversity "hot spots." The course involves preparatory learning during the WUSTL spring semester and ongoing communication and collaboration with Malagasy community representatives during this period. An additional lab credit option entails interactive research project deployment and monitoring on the ground in Madagascar during a summer window. MBG has been facilitating conservation work in Madagascar for over 40 years. Among these initiatives is a Community Based Conservation Program (CBCP) in Mahabo, a ten-community commune in southeastern Madagascar within a rare forest ecosystem. This commune is the most mature of MBG's eleven conservation sites, each of which share similar challenges for both biodiversity conservation and human wellbeing. Over several years MBG has established trusted relationships with rural Malagasy community members, building cooperation on community-specific, grassroots conservation efforts with indigenous communities. Such cooperation can be undermined by the forces of poverty, which compel communities to extract resources unsustainably from the sensitive forest. Therefore, the community-based conservation approach integrates a full understanding of the need for economic stability and health priorities alongside conservation of flora and fauna. Program targets range from forest conservation and use to nutrition, health, food security, clean water, and education. This course integrates study of biodiversity, poverty, and community-based conservation principles with research design, professional teamwork, and cultural competency skills. Through enrollment in this course and the optional subsequent field experience, students will select a focal area in community-based conservation, and build a robust understanding of a challenge in principle, as well as its specific manifestation in the Mahabo case. They will engage with preexisting and/or collaboratively proposed on-the-ground initiatives in MBG's CBCP, develop a study design to assess the efficacy of these initiatives, and support iterative implementation.

Credit 3 units. A&S IQ: LCD, SSC Arch: SSC Art: SSC EN: S

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**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 not deemed economically useful to us, but whose loss simplifies ecosystems to the point of collapse. If these trends continue, we will face 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 aspiration to analytic rigor, the field of economics has remained unaffected by the thermodynamic revolution that transformed the fields of biology, chemistry, physics, even history in the late nineteenth and early twentieth 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

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**L82 EnSt 315 Fallout: Analyzing Texts and Narratives of the Nuclear Era**

Nuclear technology has long been developed, used, studied, 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 change mitigation by delivering large amounts of nearly carbon-free energy. In this class you will trace the public perception and experience of this technology, and scientific and medical assessments of it through an environmental humanities lens. You will use texts such as literary non-fiction, history, environmental anthropology, natural history, and public health. Topics will include but not be limited to, the Manhattan Project, the Chernobyl nuclear reactor accident, and nuclear waste (including that from uranium processing in St. Louis). The course will include a visit to the Weldon Springs Interpretive Center and is designed as an upper-level elective for third- and fourth-year students. Note: While we will talk abut nuclear reactors in general, this course will not explore them from a detailed scientific or engineering perspective. For those who would like to pursue that understanding, see our new 1-hour course: EnSt 400 Topics in Environmental Science: Technical Overview of Nuclear Power. This course is taught by Lee Sobotka, nuclear scientist and Professor of Physics and Chemistry, who is also the science advisor for the Fallout course.

Credit 3 units. A&S IQ: HUM Arch: HUM Art: HUM BU: HUM EN: H

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**L82 EnSt 316 Beyond the Evidence**

This class is about the science of science communication. Why, when all evidence points to the growing threats of climate change, is it so difficult to create movement toward addressing it? 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, not better education, nor guilt, nor fear has worked to produce change on important environmental and public health issues. In this class, we will explore how values, beliefs, emotions and identity shape how we receive and process information and make decisions. We will explore themes of moral world view, cognitive linguistics and framing, cognitive dissonance, risk perception, empathy, habit changes, and difficult dialoguing through the case studies 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. There are no prerequisites, but the class is designed for fourth-year students in environmental majors and pre-health studies. Upper-level environmental majors and minors will receive priority enrollment from the waitlist.
Credit 3 units. A&S IQ: SSC Arch: ETH, S, SSC Art: SSC BU: BA EN: S

**L82 EnSt 3171 Biology for Climate Solutions**
Human-induced climate change poses a pressing and pervasive threat to both human populations and to the biological world. The challenges of climate change are manifest and well known, increasing temperatures, greater variability of weather, sea level rise, leading to a host of consequences. Adapting to and mitigating climate change are essential activities for confronting the threats of climate change. The biological sciences offer great potential for addressing these threats. This course focus on efforts in biological research to adapt and to mitigate climate change. Topics will range across the biological sciences from microbial engineering and biotechnology to zoonotic diseases and one health, to ecosystem function and conservation of biodiversity. The course consists of lectures, discussion of assigned readings, and class projects. Class projects focus on science topics that addresses new approaches to climate adaptation and mitigation and constitute both of a written paper and class presentation. The goals of this class are: (1) to develop an understanding of basic climate science and the biological aspects of climate change, ( 2) to develop knowledge of the biological efforts towards adaption and mitigation for climate solutions. The class is open to both non-science and science majors. The course does not count for the biology major. 3 units credit. Class cannot be taken pass fail. Small class. Not for biology major credit
Same as L41 Biol 3171
Credit 3 units. A&S IQ: NSM

**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 on the "jewel in the crown" of the British empire: the Indian subcontinent. We'll learn how the colonized contributed to the science of environmentalism, and how they forged a distinctive politics of environmentalism built upon local resistance and global vision, inspired by religious traditions and formative thinkers, not least Mahatma Gandhi.
Same as L22 History 3194
Credit 3 units. A&S IQ: HUM, LCD BU: HUM, IS EN: H

**L82 EnSt 320 Pathfinder: Environmental Modernism**
As committed environmentalists, one of our greatest fears is that not enough people take climate change seriously. To ward off that fear, we assess the state of the world in the most dramatically pessimistic ways to indicate the seriousness of our situation and our personal commitment to "environmentalism." Highlighting (much less admiring) human progress in areas where solid evidence of its flourishing exists, seems blasphemous, dismissive of evident, copious human suffering and natural systems abuse. However, the absence of acknowledging human progress reinforces social fear and a sense of danger. The resulting panic leads to a preferencing of solutions which appear "in harmony with nature," limiting our understanding and trust of viable alternative solutions using our best social, economic and technological powers. As antidote to this cycle, in this course we will explore the precepts of environmental modernism, the reconciliation of environmental preservation with human development.
Credit 3 units. A&S IQ: HUM Arch: HUM Art: HUM BU: HUM EN: H

**L82 EnSt 323 Biogeochemistry**
Basic concepts of how elements cycle among Earth's crust, oceans, and 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 history. Biogeochemistry of greenhouse gases, biogeochemical feedbacks in the climate system. This course is appropriate for EEPS students, engineering students, environmental science majors, and other students with interest in the environmental or geological sciences. Prerequisites: EEPS 202 or EECE 210.
Same as L19 EEPS 323
Credit 3 units. A&S IQ: NSM Arch: NSM Art: NSM BU: SCI

**L82 EnSt 3410 Native American Storytelling - Healthy Land Practice**
The earth does not belong to man, man belongs to the earth. All things are connected like the blood that unites us all. Man did not weave the web of life, he is merely a strand in it. Whatever he does to the web, he does to himself. - Chief Seattle The history of this country has had many stories and many practices which shaped the landscape pre-colonization. These Indigenous practices regularly teach methods of living within the world and can provide significant insight into current practices to manage public and private lands. This course looks to examine some of those stories, cultural beliefs, and Native American life practices which have shaped the land. For example the practice of valuing and gaining insight from natural elements such grain and fire bring one into harmony with the earth. Many people, from pre-1492 to the present and agencies, such as the U.S. Forest Service and Bureau of Land Management have changed the landscape into what we have today. Through this course we will look at common agency-based practices which have caused harm to the earth and current indigenous inspired practices designed to restore a healthy eco-system. The final portion of this course will not only look at these positive outcomes of integration of indigenous practices in the environment, but to look at additional positive health outcomes in regards to individuals living within their environment.
Credit 3 units. A&S IQ: HUM Arch: HUM Art: HUM EN: H

**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 discussion. Student learning will be assessed through exams, reflection, online assignments, a policy brief on an environmental justice issue and a group presentation. This is an advanced elective targeted toward third and fourth year students.
Credit 3 units. A&S IQ: SSC Arch: SSC Art: CPSC, SSC BU: BA EN: S

**L82 EnSt 347 Sustainable Cities**
Urbanization is one of the most significant forces shaping today's environment. More than half of the world's population now lives in urban, rather than rural, areas. This migration has profound consequences for people and the planet, connecting a sustainable future to the developments in cities around the world. Many cities are already advancing sustainable policies and practices in all areas of urban systems and services - green infrastructure, renewable energy, waste management and climate mitigation. This course explores the impact of the rise of cities in an interconnected world and the efforts to sustainably address environmental issues in urban settings. This course pays particular attention to the role of planning, politics and policy. Class time will be devoted to lectures, case studies, group activities and discussion. Student learning will be assessed through exams, online assignments, and a research paper on an environmental issue in a city of the student's choice.
Credit 3 units. A&S IQ: SSC Arch: SSC Art: SSC BU: BA EN: S

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**L82 EnSt 350W Writing Skills for Environmental Professionals**
For students interested in climate change, sustainability and the environment. Consider writing as a tool. Who will read it? Why are you writing it? What do you want the reader to know or do? What structure or format effectively makes your case? We will consider these questions while building effective written communications with a focus on climate change. Students will explore audience awareness, purpose, and format as they analyze document types and create their own. Activities will include writing, reading, discussion, and peer workshops. Major assignments include a letter of inquiry and a grant proposal. Students will write a grant proposal to an imaginary climate change foundation. Preference given to upper-level majors in Environmental Analysis.
Credit 3 units. A&S IQ: NSM, WI BU: SCI

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**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 negotiation and 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. This classis designed as an upper-level elective for third and fourth year students.
Credit 3 units. A&S IQ: SSC Arch: ETH, S, SSC Art: SSC BU: BA EN: S

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**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: LCD, SSC Arch: SSC Art: SSC BU: ETH EN: S

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**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

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**L82 EnSt 3630 Arctic Climate System**
In this course we will learn about the Arctic region, with an emphasis on how the Arctic plays a key role in the global climate system. Students will be introduced to the basic physical characteristics of the Arctic and its climate. They will learn how the physical and geographic characteristics of the Arctic contribute to, and are shaped by, the Arctic climate system. Emphasis will be placed on studying the Arctic from a systems science perspective, highlighting the complex interactions between different subsystems of the Arctic, such as the hydrosphere, atmosphere, cryosphere, and biosphere. We will also explore how the Arctic has changed in the past, and what the future holds for the Arctic. Students will develop critical thinking and analysis skills through our emphasis on applying systems-level thinking to understand the interplay between physical principles, geography, landscape, climate, and human society. Class sections will be a mix of lectures and collaborative discussions on readings and course content. Most class sections will begin with a short reading recap. Completion of ENST 202 may be helpful but is not required; please ask instructor if you have questions about enrolling in this class.
Credit 3 units. A&S IQ: NSM, AN Art: NSM

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**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 Arch: ETH, S Art: NSM BU: SCI

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**L82 EnSt 3640 Plants, People and the Environment**
Human life, health, and civilization depend on plants. This course introduces basic plant biology, the role of plants in natural ecosystems, and the various uses of plants in both traditional cultures and in developed countries. Topics include the medicinal uses of plants, domestication of plants for agriculture, biotechnology and plant conservation. Prerequisite: Junior standing or permission of instructor. Does not count toward upper-division credits required for the major.
Same as L41 Biol 343A
Credit 3 units. A&S IQ: NSM Art: NSM BU: SCI

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**L82 EnSt 365 Applied Conservation Biology**
A practical, case-based approach to the concepts of conservation biology and applied conservation practice, including designing and implementing conservation projects. Readings, lectures, classroom activities and discussions, student presentations, and exercises will immerse students in all aspects of conservation in the contemporary

landscape, and provide the tools and techniques needed for successful and sustainable conservation outcomes. Two Saturday field trips required. Prerequisites: a biology/ecology class or permission of instructor.
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 will 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 will range from 3000 BCE to 2009 CE and we will cover all the continents. This course will also trace the intellectual history of the study of landscape as a social phenomenon, and will investigate 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
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**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. Students will have the choice of using a prepared final project, a provided data set, or designing an individualized final project using their own or other available data.
Credit 3 units. A&S IQ: NSM Arch: ETH, NS, ETH, S, NSM Art: NSM

**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 BU: SCI

**L82 EnSt 390 Independent Study**
Independent study for undergraduates, to be 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 of the Chair of the program is required.
Credit variable, maximum 6 units.

**L82 EnSt 392 Directed Field Work 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.

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**L82 EnSt 400 Topics in Environmental Science**
Credit 1 unit. A&S IQ: NSM Arch: NSM Art: NSM BU: SCI

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**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. New and varied projects are introduced each semester. Past projects have included conducting greenhouse gas inventories for a community organization; developing a tool to screen University investments for sustainability parameters; developing a sustainability plan for a local nonprofit; addressing water savings initiatives for local breweries; and assessing the vulnerability of city sanitation systems. 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 I50 INTER D 405
Credit 3 units. A&S IQ: SSC Arch: ETH, S, SSC Art: CPSC, SSC EN: S

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**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 will bring together experts and students in ecology, urban design, architecture/landscape architecture, economics, social work, and engineering, drawing from inside and outside the WU community. Building from our knowledge of ecosystem principles and function, a diverse group of leaders in their fields will provide lectures, readings, and student project leadership to understand and test Healthy Urban Ecosystems Principles among human and ecological (non---human) systems and the range of socio---political 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 fall seminar (not a pre---requisite) that introduces challenges and solutions to achieving healthy urban ecosystems, and provides students an opportunity to more deeply engage and manipulate the interrelationships of symbiotic urban systems and apply those concepts in multi---disciplinary project applications. Projects will leverage student---defined challenges in the evolving laboratory of urban St. Louis using Healthy Urban Ecosystems Principles to develop multi---disciplinary integrated solutions to challenges encountered in urban areas such as climate change and resilience, security of ecosystem services, social inequity, economic strife, and community vitality. Students will present their work in a public forum at semester's end.
Same as I50 INTER D 406
Credit 3 units. A&S IQ: SSC Arch: SSP EN: S

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**L82 EnSt 407 RESET - Renewable Energy Policy, Engineering and Business**
RESET is an interdisciplinary course that explores the incredible potential of renewable energy, energy storage, and electrification to mitigate climate change. Students will gain an in-depth understanding of the complex dynamics that are driving rapid deployment of renewables and present both opportunities and challenges to decarbonization in the years ahead. Through the lenses of business, policy, and engineering, students in RESET will learn through classroom lectures from faculty, industry professionals, and policy-makers; group discussions; field trips to solar arrays and a landfill gas power plant; and a final team project where students serve as consultants to a local government, proposing an on-site solar strategy, local policy changes to support decarbonization, and more. By the end of the course, students will have an understanding of many large-scale issues influencing decarbonization, as well as the real-world factors that are necessary for designing, financing, and building new renewable energy projects. Why renewables and the grid? Decarbonizing the electric grid paired with electrifying sectors that currently run on fossil fuels - including transportation, heating, buildings, and manufacturing and construction - together have the potential to reduce more than 50% of global greenhouse gas emissions. The global energy transition, which was already well-underway, accelerated in 2022 due to a combination of countries' energy security concerns following Russia's invasion of Ukraine and expanding climate ambition resulting in new policies that support renewable energy, including the Inflation Reduction Act in the United States. The International Energy Agency's 2022 Renewables report found that "renewables are set to account for over 90% of global electricity expansion over the next five years, overtaking coal to become the largest source of global electricity by early 2025." Registration for this course is direct to the waitlist, and students are selected by application. The application can be found here . The deadline for the application is 5 PM on April 24th.
Credit 3 units. A&S IQ: NSM Arch: NSM Art: NSM BU: SCI

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**L82 EnSt 408 Earth's Atmosphere & 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 232 and Phys 191.
Same as L19 EEPS 408
Credit 3 units. A&S IQ: NSM Arch: NSM Art: NSM

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**L82 EnSt 413 Introduction to Soil Science**
Physical, chemical, and biological processes that occur within soil systems. Types of soils and their formation. Major components of soil, including soil water, minerals, organic matter, and organisms. Soils in wetlands and arid regions. Mapping of soils and their spatial variability. Cycling of nutrients and contaminants in soils. Sustainable use of soils and their role in climate change. Prerequisites: EEPS 202 and EEPS 323 or CHEM 106 or CHEM 112.
Same as L19 EEPS 413
Credit 3 units. A&S IQ: NSM Arch: NSM Art: NSM

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**L82 EnSt 415W Writing Home: Creating Cultural Guides for Environmental Site Workers**
Each of you comes from a different cultural landscape, each with its own demographic, racial, religious, linguistic, economic profile, (and endless other attributes). Effectively describing your community is integral to its sense of being respected by outsiders and to its capacity to support others. For example, each community carries a different sense of what kind of landscape constitutes safety, well-being, and happiness. Whatever your cultural landscape, sharing the unique nature of your commuity with global citizen experts is integral to the success of applied environmental solutions to climate change. Towards the attainment of that success, join this guided, writing intensive class

to identify and reflect upon the cultural attributes that constitute your community, and how those are reflected in its landscape requirements. Identify, assess, and prioritize those sensitivities deemed most important by you for others to understand,. By semester's end, write a cultural guide for environmental site workers, leading them to a better awareness of how best to help and move through, your world. Revisions and resubmission of writing work will be emphasized, as well as camaraderie and mutual interest in each other's landscapes.
Credit 3 units. A&S IQ: HUM, WI Arch: ETH, S, HUM Art: HUM BU: ETH EN: H

**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 analysis, modeling and presentation of ecological data using the statistical program R. Prereq: Bio 2970 required, Bio 381 recommended, or permission of instructor. (Biology Major Area C)
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 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. Prerequisites: L32 101B American Politics
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: EEPS 353 or Physics 191.
Same as L19 EEPS 428
Credit 3 units. A&S IQ: NSM Arch: NSM Art: NSM

**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.
Same as L19 EEPS 430
Credit 3 units. A&S IQ: NSM Arch: NSM Art: NSM

**L82 EnSt 451 Environmental Policy**
Course will examine the relationship between environmental economics and environmental policy. The course will focus on air pollution, water pollution, and hazardous wastes, with some attention given to biodiversity and global climate change. The course will examine 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 EN: S

**L82 EnSt 452 International Climate Negotiation Seminar**
This course 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 COP 29 meeting will be held in Baku, Azerbaijan, from Monday, November 11, 2024 to Friday, November 22, 2024. While the number of students who can attend meetings is limited by the United Nations, we will do our best to have course participants attend one week of the COP. Course enrollment is limited. Indicate your interest by placing yourself on the waitlist and completing an application.The cost of meeting attendance is partially covered by the College of Arts & Sciences and need based support is available. More information on cost is included on the course FAQ page. Pre-requisite: junior standing. Contact the instructor with questions at martin@wustl.edu. Registration for this course is direct to the waitlist, and students are selected by application. The application can be found here . The deadline for the application is 5 PM on April 24th.
Credit 4 units. A&S IQ: SSC Arch: SSC Art: SSC EN: S

**L82 EnSt 4527 IPCC: Governance, Policy and Science**
This course is a three-credit advanced seminar for students who are interested in the intersection of science and policy in the area of climate change. The Intergovernmental Panel on Climate Change (IPCC) is regarded as world's top scientific authority on climate change. Using the Synthesis Report of the IPCC's 6th Assessment Review as our guide, students will explore the unique role of the IPCC as an intergovernmental body. We will dig into what it means for the IPCC to be an intergovernmental body, the underlying reports that makeup the AR6 assessment cycle, and what the future holds for the IPCC. In

doing so we will explore the current science and knowledge around land use, oceans and cryosphere, mitigation, adaptation, loss and damage, vulnerability and how that is presented in a 'policy relevant but not policy prescriptive' format. Students will be able to evaluate key questions and concepts around climate change as they find and understand how they are included in the IPCC reports. They will then learn to assess and analyze the questions/concepts in the context of the IPCC findings and see how those findings are integrated in the international policy space. Prerequisites: junior level standing.
Credit 3 units. A&S IQ: SSC Arch: SSC Art: SSC 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 Art: 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 you 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, you will gain a variety of new tools and techniques that will allow you to complete a final independent project that integrates the material learned during the course.
Credit 3 units. A&S IQ: NSM Arch: NSM Art: NSM

**L82 EnSt 482 Applications in Geospatial Intelligence**
This course introduces the concept of geospatial intelligence (GEOINT) and how to use location to see patterns, connections and relationships to ultimately "see what others can't". Learn about the Intelligence Cycle, the mission of the National Geospatial-Intelligence Agency (NGA), potential career pathways in GEOINT, and other members of the Intelligence Community (IC) leveraging GIS to solve problems and make decisions related to Intelligence. This course is designed to incorporate both a theoretical understanding with a variety of subject matter expert (SME) presentations from the industry, as well as a practical understanding with hands-on exercises using ArcGIS Pro and other Esri software applications.
Credit 3 units. A&S IQ: NSM

**L82 EnSt 483 Introduction to Spatial Epidemiology**
This 14-week course is to introduce essential concepts and methods of spatial epidemiology. Spatial epidemiology is a methodology for dealing with spatial-correlated issues in environmental and public health,epidemiological, and medical research. The lecture will give the knowledge in the designs and approaches of spatial epidemiology. Homework assignments after each lecture will test student knowledge the concepts we covered. GIS mapping exercises will allow students to practice and apply their knowledge of basic geospatial analyses in epidemiology. The paper discussions and final project (presentation and paper) will help the students develop a better understanding how to integrate geospatial and GIS modeling into epidemiological and population health studies to address spatial-correlated research questions. This course requires a previous completion of a GIS course with basic skill in the application of GIS software (such as ESRI ArcGIS) for mapping. This course will be suggested to the third-, fourth-year undergraduate students and/or master students.
Credit 3 units. A&S IQ: NSM Art: NSM

**L82 EnSt 492 Environmental Studies Fourth-Year Reflection Seminar**
Over the course of your time at Washington University, you have taken a depth and breadth of coursework toward your major in Environmental Analysis. Your major coursework has likely been supplemented by your oursework in other departments and programs of study. The purpose of this course is for you to meet your peers who have done the same. As a group you will reflect on and share representations of your learning across the years, make connections among thngs you have learned and to experiences in other arenas of your life. Reflection will occur through personal writing, discussion with peers in the course and the sharing of favorite podcasts, films, etc.
Credit 1 unit.

**L82 EnSt 498 Senior Honors Research**
This course is designed to support fourth-year students who are working on research and thesis development for mentored research, honors research, or Latin Honors with the Environmental Studies Program. In this pass/fail, one-hour seminar course, instructors will guide students through common elements of the research process and teach skills for thesis writing that cross disciplines, such as goal setting and planning, developing a proposal, outlining methodology and findings, and using bibliographic reference software. Instructors and students will co-create a supportive environment for students to share ideas, feedback, and support as they engage in their independent reserach processes. This course is REQUIRED for all students completing Latin Honors and STRONGLY ENCOURAGED for students conducting mentored "senior" research regardless of GPA. Students graduating in spring or summer should take ENST 498 in fall and ENST 499 in spring of their final year; students graduating in December should take ENST 498 in the fall of their graduating year.
Credit 3 units.

**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.

**L82 EnSt 4995 Foundations of Research: Building a literature review**
The goal of this course is to introduce you to many of the skills that are required to generate, contextualize, and justify research. The final product of the course will be a literature review and tractable research question about a topic of your choice. One of the most important pieces of conducting research is to generate an interesting and important research question that is grounded in what we already know, contextualized by previous research, and justified by what gaps yet remain in our knowledge. Researchers craft and share this motivation in a literature review, contextualizes, justifies, and motivates the research question. Drafting a literature review is a critical and large part of the process, because working through writing of ideas is often how the ideas are shaped and refined, in large part because writing is thinking. In class we will cover a variety of concepts and skills that are useful in any discipline in terms of searching for the right kind of background information and data, evaluating types and quality of sources, reading and summarizing literature, constructing a logical and persuasive written argument, reference management, and data management and visualization. This course serves all students in the interdisciplinary environmental space, because the content and skills of this course

apply to the literature review process across the range of humanities, social science, and natural science disciplines. We will touch on disciplinary conventions where they differ, but most of the content and skills are common and apply to all disciplines. Some students will go on to pursue a senior thesis research project while others may not, but all students will be able to transfer the skills you learn here into other course and capstone work, professional school and professional work going forward. Through reading, individual homework activities, and group discussion and class activities, you will learn and practice skills. Over the course of the semester, you will complete phased assignments that build up to a written literature review on a topic of your choice. Your course grade will be based on participation, homework, class activities, and assignments related to the literature review. This course is offered every semester. It is designed for third year students with a major or minor in Environmental Analysis/Environmental Studies. It is not required but is strongly recommended for any student who is considering senior thesis research in Environmental Analysis. Fourth-year and second-year Environmental Analysis/Environmental Studies students will be considered on a case-by case basis based on available seats.

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