ENVIRONMENTAL STUDIES (ENVS)

ENVS 060 Global Environmental History from Paleolithic to the Present
This course explores the changing relationships between human beings and the natural world from early history to the present. We will consider the various ways humans across the globe have interacted with and modified the natural world by using fire, domesticating plants and animals, extracting minerals and energy, designing petrochemicals, splitting atoms and leaving behind wastes of all sorts. Together we consider the impacts, ranging from population expansion to species extinctions and climate change. We examine how human interactions with the natural world relate to broader cultural processes such as religion, colonialism and capitalism, and why it is important to understand the past, even the deep past, in order to rise to the challenges of the present.
Taught by: Norton, Berg
Also Offered As: HIST 060
Activity: Lecture
1.0 Course Unit

ENVS 091 Sustainable Development and Culture in Latin America
This interdisciplinary course exposes students to the three dimensions of sustainable development - environmental, economic, and social - through an examination of three products - peyote, coca, and coffee - that are crucial in shaping modern identity in areas of Latin America. The course integrates this analysis of sustainable development in relation to cultural sustainability and cultural practices associated with peyote, coca, and coffee and their rich, traditional heritage and place in literature, film, and the arts.
Taught by: Gimenez
Course offered fall; even-numbered years
Also Offered As: ANTH 091, LALS 091, SPAN 091
Activity: Seminar
1.0 Course Unit

ENVS 100 Introduction to Environmental Science
This course will explore the physical science of the Earth's environment and human interactions with it. Coverage will include the Earth's various environmental systems, various environmental problems, and the direct and indirect causes of these environmental problems. Freshman seminar will mirror the ENVS100 recitation, and have additional discussions and social media projects.
For BA Students: Physical World Sector
Taught by: Plante
Course usually offered in spring term
Activity: Lecture
1.0 Course Unit

ENVS 102 Humans and the Earth System: How it Works, How We Got Here, and How to Save Our Planet
As our planet's climate changes, it is imperative to understand the basic structures of the earth system and our connections to these, past, present, and future. The goal of this course is to help students develop an integrated understanding of climate change, linking the fundamental science - from the microscopic to the global scale - to human actions and possible futures. This team-taught course brings together approaches from environmental science, social sciences, history, and policy. Beyond providing basic climate and environmental literacy, we will also explore current and projected impacts of change, including changes to human life and biodiversity as well as other physical and biological systems. The complexity and significance of planetary change demands new ways of thinking and new approaches that transcend traditional boundaries; for that reason the course will be co-taught by instructors from the natural sciences (Joseph Francisco), social science and humanities (Kathleen Morrison), and policy (Melissa Brown Goodall). We will use the foundation provided by the two first parts of the course to address potential responses and solutions to the current crisis. The course will be divided into three units: 1. Science: what are the chemical and physical drivers of our changing climate, and what are the biological, health and environmental implications so far. 2. Impacts: how human activity has affected environments and climate so far and how climate change is currently impacting society, nature, agriculture, health, cities, and the most vulnerable communities. 3. Solutions: the roles of policy, business, agriculture, planning, and personal choices. The course is open to undergraduate students of all disciplines. While the reading and weekly assignments will be specific to the module, students may define a capstone project that reflects their academic interests.
Taught by: Morrison
Course usually offered in spring term
Also Offered As: ANTH 161
Activity: Lecture
1.0 Course Unit

ENVS 150 Water Worlds: Cultural Responses to Sea Level Rise & Catastrophic Flooding
As a result of climate change, the world that will take shape in the course of this century will be decidedly more inundated with water than we're accustomed to. The polar ice caps are melting, glaciers are retreating, ocean levels are rising, polar bear habitat is disappearing, countries are jockeying for control over a new Arctic passage, while low-lying cities and small island nations are confronting the possibility of their own demise. Catastrophic flooding events are increasing in frequency, as are extreme droughts. Hurricane-related storm surges, tsunamis, and raging rivers have devastated regions on a local and global scale. In this seminar we will turn to the narratives and images that the human imagination has produced in response to the experience of overwhelming watery invasion, from Noah to New Orleans. Objects of analysis will include mytholog, ancient and early modern diluvialism, literature, art, film, and commemorative practice. The basic question we'll be asking is: What can we learn from the humanities that will be helpful for confronting the problems and challenges caused by climate change and sea level rise?
For BA Students: Arts and Letters Sector
Taught by: Richter, Simon
Course not offered every year
Also Offered As: CIMS 150, COML 151, GRMN 150
Activity: Lecture
1.0 Course Unit
ENVS 151 Forest Worlds: Mapping the Arboreal Imaginary in Literature and Film
The destruction of the world’s forests through wild fires, deforestation, and global heating threatens planetary bio-diversity and may even, as a 2020 shows, trigger civilizational collapse. Can the humanities help us think differently about the forest? At the same time that forests of the world are in crisis, the “rights of nature” movement is making progress in forcing courts to acknowledge the legal “personhood” of forests and other ecosystems. The stories that humans have told and continue to tell about forests are a source for the imaginative and cultural content of that claim. At a time when humans seem unable to curb the destructive practices that place themselves, biodiversity, and forests at risk, the humanities give us access to a record of the complex inter-relationship between forests and humanity. Forest Worlds serves as an introduction to the environmental humanities. The environmental humanities offer a perspective on the climate emergency and the human dimension of climate change that are typically not part of the study of climate science or climate policy. Students receive instruction in the methods of the humanities - cultural analysis and interpretation of literature and film - in relation to texts that illuminate patterns of human behavior, thought, and affect with regard to living in and with nature.
For BA Students: Arts and Letters Sector
Taught by: Richter
Course usually offered in spring term
Also Offered As: CIMS 152, COML 154, GRMN 151
Activity: Lecture
1.0 Course Unit

ENVS 152 Liquid Histories and Floating Archives
Climate change transforms the natural and built environments, and it is re-shaping how we understand, make sense, and care for our past. Climate changes history. This course explores the Anthropocene, the age when humans are remaking earth’s systems, from an on-water perspective. In on-line dialogue and video conferences with research teams in port cities on four continents, this undergraduate course focuses on Philadelphia as one case study of how rising waters are transfiguring urban history, as well as its present and future. Students projects take them into the archives at the Independence Seaport Museum and at Bartram’s Garden. Field trips by boat on the Schuykill and Delaware Rivers and on land to the Port of Philadelphia and to the John Heinz National Wildlife Refuge invite transhistorical dialogues about how colonial and then industrial-era energy and port infrastructure transformed the region’s vast tidal marshlands wetlands. Excursions also help document how extreme rain events, storms, and rising waters are re-making the built environment, redrawing lines that had demarcated land from water. In dialogue with one another and invited guest artists, writers, and landscape architects, students final projects consider how our waters might themselves be read and investigated as archives. What do rising seas subsume and hold? Whose stories do they tell? What floats to the surface?
Taught by: Wiggin
Course not offered every year
Also Offered As: ANTH 154, COML 152, ENGL 052, GRMN 152, HIST 152
Activity: Lecture
1.0 Course Unit

ENVS 157 Repairing the Planet: Tools for the Climate Emergency
This course is a comprehensive introduction to the climate emergency and the tools with which we can fight it. It will integrate natural science, social science, philosophy of science, history, ethics, and policy. The course opens with an overview of the historical discovery of global warming and our contemporary understanding of climate change. We then turn to the framework that the United Nations’ Intergovernmental Panel on Climate Change has developed to study climate risks, focusing on both general issues and case studies throughout the world. The existence and severity of these risks raises questions of climate justice at many levels: individuals to individuals, countries to countries, and the present generation to future generations. We will study these issues in detail, and then examine the policy tools developed to address them. Although we will discuss national and sub-national policy and policy proposals such as the Green New Deal, special attention will be given to global policy tools, especially the Framework Convention on Climate Change and the Paris Agreement. In addition to standard writing assignments, students will have a chance to develop policy proposals that address the core issues of the class.
Taught by: Weisberg
Also Offered As: PHIL 157
Activity: Lecture
1.0 Course Unit

ENVS 165 Environment, Climate, and Culture in Japan
This course explores how Japanese literature, cinema, and popular culture have engaged with questions of environment, ecology, pollution, and climate change from the wake of the dropping of the atomic bomb on Hiroshima in 1945 to the ongoing Fukushima nuclear power plant disaster in the present. Environmental disasters and the slow violence of their aftermath have had an enormous impact on Japanese cultural production, and we examine how these cultural forms seek to negotiate and work through questions of representing the unrepresentable, victimhood and survival, trauma and national memory, uneven development and discrimination, the human and the nonhuman, and climate change’s impact on imagining the future. Special attention is given to the possibilities and limitations of different forms—the novel, poetry, film, manga, anime—that Japanese writers and artists have to think about humans’ relationship with the environment.
Taught by: Poland
Course not offered every year
Also Offered As: EALC 165, EALC 565
Activity: Seminar
1.0 Course Unit
ENVS 181 Comparative Cultures of Sustainability
Sustainability is more than science, engineering, policy, and design. Surveying the world, we see that the politics and practice of sustainability play out in different ways depending on cultural factors. Some cultures are more prone to pursue ecological goals than others. Why? Do the environmental history and experience of a nation affect policy? Do nature and the environment play a crucial role in the cultural memory of a nation? Can cultural components effectively be leveraged in order to win approval for a politics of sustainability? And what can we, as residents of a country where climate change and global warming are flashpoints in an enduring culture war, learn from other cultures? This course is designed to equip undergraduate students with the historical and cultural tools necessary to understand the cultural aspects of sustainability in two countries noted for their ecological leadership and cultural innovation, Germany and the Netherlands. Summer abroad course.
Taught by: Simon Richter
Course usually offered summer term only
Also Offered As: GRMN 181
Activity: Lecture
1.0 Course Unit

ENVS 211 Religion and Ecology
Also Offered As: ANTH 211, RELS 211
Activity: Lecture
1.0 Course Unit

ENVS 212 Animals & Religion
Religion is full of animals—lions and lambs, monkeys and elephants, buffalo and snakes, even mythical beasts. The identity of the human being is explained, in many traditions, by contrast with the identity of other species. We know who we are because we know who they are, or do we? This course interrogates—through an exploration of sacred texts, art, film, and museum artifacts—the tension present in many traditions between an anthropocentric prioritization of the human being and religious resources that encourage a valuing of other animal species. We'll explore the ways animals function both as religious objects and as religious subjects across diverse traditions, asking how human-animal relationships have shaped religion and how religion has shaped the way we think about and interact with other animals. We'll ask how religion has engaged with animals over time and across global cultures, understanding them as symbols, messengers, and manifestations of the divine; as material for ritual and sacrifice; as kin and subordinates; as food and as filth; as helpmeets and as tempters. How have these perspectives shaped animal ethics, influencing the treatment, use, and consumption of animals and their bodies? Finally, we'll ask what it means that we ourselves are evolved animals. How does our own animality factor into the practice of human religion? Is our religious capacity part of what sets us apart from other animals or is religiosity a trait we might expect to find in other species? To what extent is religion a function of the animal?
Taught by: Covey
Course not offered every year
Also Offered As: ANTH 212, RELS 212
Activity: Seminar
1.0 Course Unit

ENVS 239 Sustainability & Utopianism
This seminar explores how the humanities can contribute to discussions of sustainability. We begin by investigating the contested term itself, paying close attention to critics and activists who deplore the very idea that we should try to sustain our, in their eyes, dystopian present, one marked by environmental catastrophe as well as by an assault on the educational ideals long embodied in the humanities. We then turn to classic humanist texts on utopia, beginning with More’s fictive island of 1517. The “origins of environmentalism” lie in such depictions of island edens (Richard Grove), and our course proceeds to analyze classic utopian tests from American, English, and German literatures. Readings extend to utopian visions from Europe and America of the nineteenth and twentieth centuries, as well as literary and visual texts that deal with contemporary nuclear and flood catastrophes. Authors include: Bill McKibben, Jill Kerr Conway, Christopher Newfield, Thomas More, Francis Bacon, Karl Marx, Henry David Thoreau, Robert Owens, William Morris, Charlotte Perkins Gilman, Ayn Rand, Christa Wolf, and others. Taught in English.
For BA Students: Humanities and Social Science S
Taught by: Wiggin
Course not offered every year
Also Offered As: COML 209, ENGL 275, GRMN 239
Activity: Seminar
1.0 Course Unit

ENVS 245 Petrosylvania: Reckoning with Fossil Fuel
Fossil fuel powered the making—now the unmaking—of the modern world. As the first fossil fuel state, Pennsylvania led the United States toward an energy-intensive economy, a technological pathway with planetary consequences. The purpose of this seminar is to perform a historical accounting—and an ethical reckoning—of coal, oil, and natural gas. Specifically, students will investigate the histories and legacies of fossil fuel in connection to three entities: the Commonwealth of Pennsylvania, the City of Philadelphia, and the University of Pennsylvania. Under instructor guidance, students will do original research, some of it online, much the rest of it in archives, on and off campus, in and around Philadelphia. Philly-based research may also involve fieldwork. While based in historical sources and methods, this course intersects with business, finance, policy, environmental science, environmental engineering, urban and regional planning, public health, and social justice. Student projects may take multiple forms, individual and collaborative, from traditional papers to data visualizations prepared with assistance from the Price Lab for Digital Humanities. Through their research, students will contribute to a multi-year project that will ultimately be made available to the public.
Taught by: Farmer
Also Offered As: HIST 245
Activity: Seminar
1.0 Course Unit
ENV 246 Spirituality in the Age of Global Warming: How Can Science & the Humanities Work Together?
We are living in the midst of one of the most severe crisis in the Earth’s history. Science confirms the glaciers are melting, hurricanes are growing more intense, and the oceans are rising. But there is also a deeply spiritual dimension to global warming that does not factor into the scientific explanations. This part of the problem has been more powerfully expressed in film, literature, and art. We will be looking at films like Lee's "When the Levees Broke," about how the people of New Orleans turned to music and storytelling to rebuild their communities in the wake of Hurricane Katrina and Linda Hogan's novel, "Solar Storm" which explores how Native American women draw upon spirituality to heal their community after a dam flooded their ancestral homeland.

The class will also work on an ongoing research project in partnership with the Canadian government and Ojibwe First Nations who submitted a successful UNESCO World Heritage Site application to preserve the boreal forest and the Native people's traditional knowledge about their land. The class will be working on an interactive map to document how photographs, oral histories, and artwork helped convince UNESCO to preserve the land and the Traditional Ecological Knowledge (TEK) of the people who have lived on that land for thousands of years.

Taught by: Timothy Powell
Course not offered every year
Also Offered As: ENGL 246, RELS 246
Activity: Seminar
1.0 Course Unit

ENV 258 Extreme Heat: White Nationalism in the Age of Climate Change

The Amazon is burning. The glaciers are melting. Heat waves, hurricanes, earthquakes, floods, wildfires, and droughts devastate ever larger swaths of the earth, producing crop failures, air pollution, soil erosion, famine and terrifying individual hardship. At the same, time the so-called Western World is literally walling itself off from the millions who are fleeing from disaster and war with what little they can carry. White militants chant "blood and soil" and "Jews will not replace us," social media spreads memes and talking points about "white genocide" and "white replacement" and online ideologues fantasize about building white ethnostates. Are these developments connected? Is there a causal relationship? Or are these conditions purely coincidental? Increasingly, arguments about limits to growth, sustainability, development and climate change have come to stand in competitive tension with arguments for social and racial equality. Why is that case? What are the claims and underlying anxieties that polarize western societies? How do white nationalist movements relate to populist and fascist movements in the first half of the 20th century? What is new and different about them now? What is the relationship between environmentalism, rightwing populism and the climate crisis? And how have societies responded to the climate crisis, wealth inequality, finite resources and the threat posed by self-radicalizing white nationalist groups?

Taught by: Berg
Also Offered As: HIST 258
Activity: Seminar
1.0 Course Unit

ENV 279 Nature's Nation: Americans and Their Environment

The United States is "nature's nation." Blessed with an enormous, resource-rich geographically diverse and sparsely settled territory, Americans have long seen "nature" as central to their identity, prosperity, politics and power, and have transformed their natural environment accordingly. But what does it mean to be "nature's nation? This course describes and explores how American "nature” has changed over time. How and why has American nature changed over the last four centuries? What have Americans believed about the nation's nature, what have they known about the environment, how did they know it and how have they acted on beliefs and knowledge? What didn't or don't they know? How have political institutions, economic arrangements, social groups and cultural values shaped attitudes and policies? How have natural actors (such landscape features, weather events, plants, animals, microorganisms) played roles in national history? In addition to exploring the history of American nature, we will look for the nature in American history. Where is "nature" in some of the key events of American history that may not, on the surface, appear to be "environmental?"

Taught by: Greene, A
Course not offered every year
Also Offered As: HIST 320, HSOC 279, STSC 279
Activity: Seminar
1.0 Course Unit
ENVS 295 Maritime Science and Technology: Woods Hole Sea Semester
A rigorous semester-length academic and practical experience leading to an understanding of the oceans. The Sea Semester is composed of two intensive six-week components taken off-campus. The Shore Component is six weeks at Woods Hole, Massachusetts, with formal study in: Oceanography, Maritime Studies, and Nautical Science. This is followed by six weeks aboard a sailing research vessel, during which students conduct oceanographic research projects as part of the courses, Practical Oceanography I and II. Prerequisite: Laboratory course in physical or biological science or its equivalent; college algebra or its equivalent. This set of courses requires special application procedures. Contact Maria Andrews for information and an application. Only the "SEA semester: Ocean Exploration" and "SEA Semester: Oceans and Climates" can be taken for Penn credit without taking a leave, and all students must have permission from Maria Andrews before registering at SEA. Maritime Studies. A multidisciplinary study of the history, literature, and art of our maritime heritage, and the political and economic problems of contemporary maritime affairs. Nautical Science. The technologies of operation at sea. Concepts of navigation, naval architecture, ship construction, marine engineering systems, and ship management are taught from their bases in physics, mathematics, and astronomy. Practical Oceanography I. Taken aboard SSV Westward or SSV Corwith Cramer. Theories and problems raised in the shore component are tested in the practice of oceanography at sea. Students are introduced to the tools and techniques of the practicing oceanographer. During two lectures daily and while standing watch, students learn the operation of basic oceanographic equipment, the methodologies involved in the collection, reduction, and analysis of oceanographic data, and the attendant operations of a sailing oceanographic research vessel. Practical Oceanography II. Taken aboard SSV Westward or SSV Corwith Cramer. Students assume increasing responsibility for conducting oceanographic research and the attendant operations of the vessel. The individual student is responsible directly to the chief scientist and the master of the vessel for the safe and orderly conduct of research activities and related operation of the vessel. Each student completes an individual oceanographic research project designed during the shore component.

Taught by: Andrews
One-term course offered either term
Activity: Independent Study
1.0 Course Unit
Notes: This set of courses requires special application procedures. Contact Maria Andrews for information and an application. Only the "SEA semester: Ocean Exploration" and "SEA Semester: Oceans and Climates" can be taken for Penn credit without taking a leave, and all students must have permission from Maria Andrews before registering at SEA.

ENVS 299 Independent Study
Directed study for individuals or small groups under supervision of a faculty member. Permission of department required.
One-term course offered either term
Activity: Independent Study
1.0 Course Unit
Notes: May be repeated for credit

ENVS 301 Environmental Case Studies
A detailed, comprehensive investigation of selected environmental problems. Guest speakers from the government and industry will give their accounts of various environmental cases. Students will then present information on a case study of their choosing.

Taught by: Dmochowski
Course usually offered in fall term
Prerequisite: ENVS 200
Activity: Lecture
1.0 Course Unit

ENVS 302 Case Studies in Environmental Sustainability
A detailed, comprehensive investigation of selected environmental sustainability problems specific to a selected region. This course aims to introduce students to myriad Earth and environmental issues (understanding how humans interact, affect and are influenced by our environment) through the analysis of several environmental case studies, as well as giving students an introduction to how complex cases are analyzed and what goes into decision-making at the individual, group, state, federal and global levels. The course includes an intensive field trip at the end of the semester - locations will vary by offering.

Taught by: Plante
Course offered spring; odd-numbered years
Prerequisite: ENVS 100 OR GEOL 100 OR GEOL 103 OR GEOL 125 OR GEOL 130
Activity: Seminar
1.0 Course Unit
Notes: Application required through Penn Global: <a href="https://global.upenn.edu/pennabroad/pgs">https://global.upenn.edu/pennabroad/pgs</a>

ENVS 312 Ocean-Atmosphere Dynamics and Implications for Future Climate Change
This course covers the fundamentals of atmosphere and ocean dynamics, and aims to put these in the context of climate change in the 21st century. Large-scale atmospheric and oceanic circulation, the global energy balance, and the global energy balance, and the global hydrological cycle. We will introduce concepts of fluid dynamics and we will apply these to the vertical and horizontal motions in the atmosphere and ocean. Concepts covered include: hydrostatic law, buoyancy and convection, basic equations of fluid motions, Hadley and Ferrel cells in the atmosphere, thermohaline circulation, Sverdrup ocean flow, modes of climate variability (El-Nino, North Atlantic Oscillation, Southern Annular Mode). The course will incorporate student led discussions based on readings of the 2007 Intergovernmental Panel on Climate Change (IPCC) report and recent literature on climate change. Aimed at undergraduate or graduate students who have no prior knowledge of meteorology or oceanography or training in fluid mechanics. Previous background in calculus and/or introductory physics is helpful. This is a general course which spans many subdisciplines (fluid mechanics, atmospheric science, oceanography, hydrology).

Taught by: Marinov
Course usually offered in spring term
Also Offered As: ENVS 640, PHYS 314
Prerequisite: MATH 114
Activity: Lecture
1.0 Course Unit
ENVS 325 Sustainable Goods
The study of sustainability-the long term viability of humans in harmony with the environment has been identified as a critical issue for society and industry and is evolving to examine how society should conduct itself in order to survive. This issue impacts the consumer goods that we use in our lives, the processes that are designed to make these goods, and the raw materials that we obtain to create these goods. The questions that we will examine will be: can these goods be obtained, made, and consumed in a fashion that allows the current quality of life to be maintained (or enhanced) for future generations? Can these processes be sustainable? A review of consumer goods is necessary as the starting point in order to understand the basic needs of people in society and why people consume goods as they do. Subsequently, each student will choose a product to examine in detail and will research the product for its impact with respect to natural resource selection, production, use, and disposal/reuse.
Taught by: Hagan
Activity: Lecture
1.0 Course Unit

ENVS 326 GIS: Mapping Places & Analyzing Spaces
This course is a hands-on introduction to the concepts and capabilities of geographic information systems (GIS). Students will develop the skills necessary for carrying out basic GIS projects and for advanced GIS coursework. The class will focus on a broad range of functional and practical applications, ranging from environmental science and planning to land use history, social demography, and public health. By the end of the course, students will be able to find, organize, map, and analyze data using both vector (i.e., drawing-based) and raster (i.e., image-based) GIS tools, while developing an appreciation for basic cartographic principles relating to map presentation. This course fulfills the spatial analysis requirement for ENVS and EASC Majors. Previous experience in the use of GIS is not required.
Taught by: Heinlen
Activity: Lecture
1.0 Course Unit

ENVS 327 Principles of Sustainability
What is sustainability? Can any fundamental concepts, principles or framework be constructed that adequately describes the search for sustainability? Is there a meaningful methodology? Sustainability science is a trans-disciplinary approach in which the quantitative and qualitative, natural and social, and theory and practice are reconciled and creatively combined. The objective of this course is to provide an in-depth analysis of the foundational concepts, principles, processes and practices of sustainability science. The course will explore three foundational laws governing sustainability: the law of limits to growth, the second law of thermodynamics, and the law of self-organization. Students will examine how these laws operate in biological, ecological, and physical systems, and then apply them to social, economic and political systems.
Taught by: Alain Plante
Activity: Lecture
1.0 Course Unit

ENVS 328 Principles of Sustainability
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ENVS 391 Sustainable Development And Culture in Latin America
This interdisciplinary course exposes students to the three dimensions of sustainable development—environmental, economic, and social—through an examination of three products—peyote, coca, and coffee—that are crucial in shaping modern identity in areas of Latin America. The course integrates this analysis of sustainable development in relation to cultural sustainability and cultural practices associated with peyote, coca, and coffee and their rich, traditional heritage and place in literature, film, and the arts. This is an upper level seminar open to majors and minors of Spanish and those who have completed Pre-requisite SPAN 219 or SPAN 223 or permission of the Undergraduate Chair.
Taught by: Gimenez
Course offered fall; even-numbered years
Also Offered As: LALS 391, SPAN 391
Prerequisite: SPAN 219 OR SPAN 223
Activity: Seminar
1.0 Course Unit

ENVS 399 Environmental Studies Research Seminar for Juniors
This seminar is designed to help Juniors prepare for the Senior Thesis research. Topic selection, advisor identification, funding options, and basic research methods will be discussed.
Taught by: Andrews
Course usually offered in spring term
Also Offered As: GEOL 399
Prerequisite: ENVS 100
Activity: Seminar
1.0 Course Unit

ENVS 400 Environmental Studies Seminar
Application of student and faculty expertise to a specific environmental problem, chosen expressly for the seminar. May be repeated for credit.
For BA Students: Natural Science and Math Sector
Taught by: Plante, Jerolmack, Kulik
Course usually offered in spring term
Activity: Seminar
1.0 Course Unit
Notes: May be repeated for credit

ENVS 404 Urban Environments: Speaking About Lead in West Philadelphia
Lead poisoning can cause learning disabilities, impaired hearing, behavioral problems, and at very high levels, seizures, coma and even death. Children up to the age of six are especially at risk because of their developing systems; they often ingest lead chips and dust while playing in their home and yards. In ENVS 404, Penn undergraduates learn about the epidemiology of lead poisoning, the pathways of exposure, and methods for community outreach and education. Penn students collaborate with middle school and high school teachers in West Philadelphia to engage middle school children in exercises that apply environmental research relating to lead poisoning to their homes and neighborhoods.
For BA Students: Natural Science and Math Sector
Taught by: Pepino
Course usually offered in spring term
Activity: Seminar
1.0 Course Unit
Notes: ABCS Course. Requires community service in addition to class time.
ENVS 406 Community Based Environmental Health
From the fall of the Roman Empire to Love Canal to the epidemics of asthma, childhood obesity and lead poisoning in West Philadelphia, the impact of the environment on health has been a continuous challenge to society. The environment can affect people's health more strongly than biological factors, medical care and lifestyle. The water we drink, the food we eat, the air we breathe, and the neighborhood we live in are all components of the environment that impact our health. Some estimates, based on morbidity and mortality statistics, indicate that the impact of the environment on health is as high as 80%. These impacts are particularly significant in urban areas like West Philadelphia. Over the last 20 years, the field of environmental health has matured and expanded to become one of the most comprehensive and humanly relevant disciplines in science. This course will examine not only the toxicity of physical agents, but also the effects on human health of lifestyle, social and economic factors, and the built environment. Topics include cancer clusters, water borne diseases, radon and lung cancer, lead poisoning, environmental tobacco smoke, respiratory diseases and obesity. Students will research the health impacts of classic industrial pollution case studies in the US. Class discussions will also include risk communication, community outreach and education, access to health care and impact on vulnerable populations. Each student will have the opportunity to focus on Public Health, Environmental Protection, Public Policy, and Environmental Education issues as they discuss approaches to mitigating environmental health risks. This honors seminar will consist of lectures, guest speakers, readings, student presentations, discussions, research, and community service. The students will have two small research assignments including an Environmental and Health Policy Analysis and an Industrial Pollution Case Study Analysis. Both assignments will include class presentations. The major research assignment for the course will be a problem-oriented research paper and presentation on a topic related to community-based environmental health selected by the student. In this paper, the student must also devise practical recommendations for the problem based on their research. For BA Students: Natural Science and Math Sector
Taught by: Kulik
Course usually offered in fall term
Activity: Seminar
1.0 Course Unit
Notes: ABCS Course. Requires community service in addition to class time.

ENVS 407 Urban Environments: Prevention of Tobacco Smoking in Adolescents
Cigarette smoking is a major public health problem. The Centers for Disease Control and Prevention reports that more than 80% of current adult tobacco users started smoking before age 18. The National Youth Tobacco Survey indicated that 12.8% of middle school students and 34.8% of high school students in their study used some form of tobacco products. In ENVS 407, Penn undergraduates learn about the short and long term physiological consequences of smoking, social influences and peer norms regarding tobacco use, the effectiveness of cessation programs, tobacco advocacy and the impact of the tobacco settlement. Penn students will collaborate with teachers in West Philadelphia to prepare and deliver lessons to middle school students. The undergraduates will survey and evaluate middle school and Penn student smoking. One of the course goals is to raise awareness of the middle school children to prevent addiction to tobacco smoke during adolescence. Collaboration with the middle schools gives Penn students the opportunity to apply their study of the prevention of tobacco smoking to real world situations.
Taught by: Pepino
Course usually offered in spring term
Activity: Seminar
1.0 Course Unit
Notes: ABCS Course. Requires community service in addition to class time.

ENVS 408 Urban Environments: The Urban Asthma Epidemic
Asthma as a pediatric chronic disease is undergoing a dramatic and unexplained increase. It has become the number one cause of public school absenteeism and now accounts for a significant number of childhood deaths each year in the USA. The Surgeon General of the United States has characterized childhood asthma as an epidemic. In ENVS 408, Penn undergraduates learn about the epidemiology of urban asthma, the debate about the probable causes of the current asthma crisis, and the nature and distribution of environmental factors that modern medicine describes as potential triggers of asthma episodes. Penn students will co-teach asthma classes offered in public schools in West Philadelphia and survey asthma caregivers, providing them with the opportunity to apply theoretical knowledge to real-world situations, promote community education and awareness about asthma, and use problem-solving learning to enhance student education in environmental health.
Taught by: Kulik
Course usually offered in spring term
Activity: Seminar
1.0 Course Unit
Notes: ABCS Course. Requires community service in addition to class time.
ENVS 410 The Role of Water in Urban Sustainability and Resiliency
This course will provide an overview of the cross-disciplinary fields of civil engineering, environmental sciences, urban hydrology, landscape architecture, green building, public outreach and politics. Students will be expected to conduct field investigations, review scientific data and create indicator reports, working with stakeholders and presenting the results at an annual symposium. There is no metaphor like water itself to describe the cumulative effects of our practices, with every upstream action having an impact downstream. In our urban environment, too often we find degraded streams filled with trash, silt, weeds and dilapidated structures. The water may look clean, but is it? We blame others, but the condition of the creeks is directly related to how we manage our water resources and our land. In cities, these resources are often our homes, our streets and our communities. This course will define the current issues of the urban ecosystem and how we move toward managing this system in a sustainable manner. We will gain an understanding of the dynamic, reciprocal relationship between practices in an watershed and its waterfront. Topics discussed include: drinking water quality and protection, green infrastructure, urban impacts of climate change, watershed monitoring, public education, creating strategies and more.
Taught by: Neukrug
Course not offered every year
Activity: Seminar
1.0 Course Unit
Notes: An academically-based curriculum service learning approach to using water, science and politics to create a sustainable Philadelphia.

ENVS 411 Air Pollution: Sources & Effects in Urban Environments
This is an ABCS course designed to provide the student with an understanding of air pollution at the local, regional and global levels. The nature, composition, and properties of air pollutants in the atmosphere will also be studied. The course will focus on Philadelphia’s air quality and how air pollutants have an adverse effect on the health of the residents. The recent designation by IARC of Air Pollution as a known carcinogen will be explored. How the community is exposed to air pollutants with consideration of vulnerable populations will be considered. Through a partnership with Philadelphia Air Management Service (AMS) agency the science of air monitoring and trends over time will be explored. Philadelphia’s current non-attainment status for PM2.5 and ozone will be studied. Philadelphia’s current initiatives to improve the air quality of the city will be discussed. Students will learn to measure PM2.5 in outdoor and indoor settings and develop community-based outreach tools to effectively inform the community of Philadelphia regarding air pollution. The outreach tools developed by students may be presentations, written materials, apps, websites or other strategies for enhancing environmental health literacy of the community. A project based approach will be used to include student monitoring of area schools, school bus routes, and the community at large. The data collected will be presented to students in the partner elementary school in West Philadelphia. Upon completion of this course, students should expect to have attained a broad understanding of and familiarity with the sources, fate, and the environmental impacts and health effects of air pollutants.
For BA Students: Natural Science and Math Sector
Taught by: Andrews and Howarth
Course usually offered in fall term
Activity: Seminar
1.0 Course Unit

ENVS 416 Freshwater Ecology
Survey of the physical, chemical and biological properties of freshwater ecosystems, both riverine and lentic, natural and polluted. Prerequisite: One semester of college chemistry.
Taught by: Arscott
Course usually offered in spring term
Also Offered As: BIOL 415
Prerequisite: BIOL 101 OR BIOL 121
Activity: Lecture
1.0 Course Unit

ENVS 417 The Anthropocene: Human-dominated Earth
How much have humans altered the planet they live on? Beyond climate change, humans have altered the Earth’s land, oceans and biosphere to such an extent that the concept of a new geologic epoch defined by the ejection of humans is seriously debated. This seminar will examine the origins of the Anthropocene, the ways in which humans have altered Earth systems, whether or not these alterations warrant a new geologic designation, and what the future potentially holds for both humans and the planet.
Taught by: Alain Plante
Activity: Seminar
1.0 Course Unit

ENVS 420 Regional Field Ecology
Over the course of six Sunday field trips, we will travel from the barrier islands along the Atlantic Ocean in southern New Jersey to the Pocono Mountains in northeastern Pennsylvania, visiting representative sites of the diverse landscapes in the region along the way. At each site we will study and consider interactions between geology, topography, hydrology, soils, vegetation, wildlife, and disturbance. Students will summarize field trip data in a weekly site report. Evening class meetings will provide the opportunity to review field trips and reports and preview upcoming trips. Six all-day Sunday field trips are required.
For BA Students: Natural Science and Math Sector
Taught by: Willig
Course usually offered summer term only
Also Offered As: ENVS 610
Activity: Lecture
1.0 Course Unit

ENVS 451 Sustainable Landscapes
Sustainable Landscapes
Taught by: Jerolmack
Course not offered every year
Activity: Seminar
1.0 Course Unit

ENVS 460 Environmental Policy
Environmental policy
Taught by: Kulik
Course usually offered in fall term
Activity: Lecture
1.0 Course Unit
ENVS 498 Senior Thesis
The culmination of the Environmental Studies major. Students, while working with an advisor in their concentration, conduct research and write a thesis. Prerequisite: ENVS 400-level course and declaration of the ENVS major. The environmental studies major, as of the fall of 2008, requires 1 semester of ENVS 399 and two semesters of ENVS 498. Taught by: Dmochowski
Two terms. student may enter either term.
Activity: Senior Thesis
0.5 Course Units
Notes: The Environmental Studies major, as of the fall of 2008, requires 1 semester of ENVS399 and two semesters of ENVS498.

ENVS 507 Wetlands
The course focuses on the natural history of different wetland types including climate, geology, and hydrology factors that influence wetland development. Associated soil, vegetation, and wildlife characteristics and key ecological processes will be covered as well. Lectures will be supplemented with weekend wetland types, ranging from tidal salt marshes to non-tidal marshes, swamps, and glacial bogs in order to provide field experience in wetland identification, characterization, and functional assessment. Outside speakers will discuss issues in wetland seed bank ecology, federal regulation, and mitigation. Students will present a short paper on the ecology of a wetland animal and a longer term paper on a selected wetland topic. Readings from the text, assorted journal papers, government technical documents, and book excerpts will provide a broad overview of the multifaceted field of wetland study. Taught by: Willig
Course usually offered in fall term
Activity: Lecture
1.0 Course Unit

ENVS 510 Regional Ecology: Restoration and Management to Build Resilience
Using the regional geology as a framework for comparison, this online course aims to 1) introduce the varied ecosystems of the region extending from the Atlantic Ocean to the Appalachian Mountains, 2) provide an approach to site analysis that examines connections between climate, geology, topography, hydrology, soils, vegetation, wildlife, and disturbance, both natural and anthropogenic, and 3) investigate restoration and management efforts to build resilience in a changing climate. We will study natural and modified areas representative of regional physiographic provinces (areas of similar geology and topography) to better understand landscape patterns and processes as well as case studies of restoration and management projects. Students will complete weekly assignments and a research project involving a presentation and paper on a topic of interest. *This is an online course**
Taught by: Sarah Willig, PhD
Activity: Online Course
1.0 Course Unit

ENVS 526 The History and Science of Climate Change
This course will provide an understanding of the Earth's climate system and how and why this has changed through time. The emphasis will be placed on spatial and temporal scales in the modern system while exploring the evidence for past change, possible mechanisms to explain these changes and the implications of these changes to past, present and future global climate. Students will learn to reconstruct the history and scales of climate change through the use of proxies; understand the mechanisms that act to drive climate change; show and understanding of the long-term natural climate variability on a global and regional scale; understand the importance of natural environmental change, against which to assess human impacts, recent climate change and issues of future environmental change.
Taught by: Yvette Bordeaux
Activity: Online Course
1.0 Course Unit

ENVS 541 Modeling Geographical Objects
This course offers a broad and practical introduction to the acquisition, storage, retrieval, maintenance, use, and presentation of digital cartographic data with both image and drawing based geographic information systems (GIS) for a variety of environmental science, planning, and management applications. Its major objectives are to provide the training necessary to make productive use of at least two well known software packages, and to establish the conceptual foundation on which to build further skills and knowledge in late practice.
Taught by: Tomlin
Course usually offered in fall term
Activity: Lecture
1.0 Course Unit

ENVS 544 Public Environmental Humanities
This broadly interdisciplinary course is designed for Graduate and Undergraduate Fellows in the Penn Program in Environmental Humanities (PPEH) who hail from departments across Arts and Sciences as well as other schools at the university. The course is also open to others with permission of the instructors. Work in environmental humanities by necessity spans academic disciplines. By design, it can also address and engage publics beyond traditional academic settings. This seminar, with limited enrollment, explores best practices in public environmental humanities. Students receive close mentoring to develop and execute cross-disciplinary, public engagement projects on the environment.
Taught by: Wiggin
Course not offered every year
Also Offered As: ANTH 543, COML 562, GRMN 544, URBS 544
Activity: Seminar
1.0 Course Unit

ENVS 601 Proseminar: Contemporary Issues in Environmental Studies
A detailed, comprehensive investigation of selected environmental problems. This is the first course taken by students entering the Master of Environmental Studies Program.
Taught by: Bordeaux/Colijn
One-term course offered either term
Activity: Seminar
1.0 Course Unit
ENVS 602 Conservation Management in the Delaware Valley
Using protected lands in the Delaware Valley, this field-based course will explore various strategies for open space conservation and protection, along with cultural perspectives on land preservation. In addition, students will be introduced to land management techniques used on such sites to restore or preserve them in accordance with goals set for their use or protection. Emphasis will be placed on developing skills in "reading the landscape" to determine conservation and restoration priorities. Students will produce a paper based on notes from field trips, class, and readings.
Taught by: Tom Brightman
Course not offered every year
Activity: Lecture
1.0 Course Unit

ENVS 603 Topics Course in Resource Management
This is a topics course exploring resource management issues.
Activity: Lecture
1.0 Course Unit

ENVS 604 Conservation and Land Management
Understanding a region's natural resources and its threats are a key component in land preservation. This course will explore the different drivers and the techniques used to achieve success in small and large scale land protection. This field-based course will explore various strategies for open space conservation and protection, along with cultural perspectives on land preservation. Evaluation of management techniques used on preserved lands will also be investigated. Emphasis will be placed on developing skills in reading the landscape, the landowner, and the political motivators to determine conservation and restoration priorities.
Taught by: John Goodall
Course usually offered summer term only
Activity: Lecture
1.0 Course Unit
Notes: Some Saturday field trips will be required.

ENVS 605 Bioremediation
This course is an introduction to current and developing techniques for analyzing environmental contamination and for remediation of damaged environments. Knowledge of these options is important for students interested in public/law applications and environmental/landscape design and as a starting point for those pursuing a more science-oriented understanding. The first portion of this course will address bioindicators-the use of living systems to assess environmental contamination. These include systems ranging from biochemical assays to monitoring of whole organisms or ecosystems, as well as techniques ranging from laboratory to field and satellite surveys. The second portion of the course will introduce technologies for bioremediation-the use of living systems to restore contaminated environments. The technologies scale from single-species systems to complex ecosystems such as constructed wetlands; case studies will be examined. Students will be expected to participate in field trips, as well as prepare a final paper examining a particular technology in detail.
Taught by: Vann
Course not offered every year
Activity: Lecture
1.0 Course Unit

ENVS 606 Avifaunal Ecology: Studying ornithological principles & behaviors to indicate ecosystem health
This class will explore the foundations of avifaunal biology and ecology using a combination of hands-on classroom and in-the-field experiences. Classroom content includes physiology, anatomy, and morphology of birds. The fall migration of birds in North America is an epic and often tragic event. Sampling birds in migration has resulted in foundational understandings about stopover habitats, species-specific energy budgets and has helped realize the complete life cycle of hundreds of species. We will enter the field and participate in actual ornithological research, explore avifaunal ecology through birdwatching, and meet with regional leaders in the ornithological field.
Taught by: McGraw
Course usually offered in spring term
Activity: Seminar
1.0 Course Unit

ENVS 610 Regional Field Ecology
Over the course of six Sunday field trips, we will travel from the barrier islands along the Atlantic Ocean in southern New Jersey to the Pocono Mountains in northeastern Pennsylvania, visiting representative sites of the diverse landscapes in the region along the way. At each site we will study and consider interactions between geology, topography, hydrology, soils, vegetation, wildlife, and disturbance. Students will summarize field trip data in a weekly site report. Evening class meetings will provide the opportunity to review field trips and reports and preview upcoming trips. Six all-day Sunday field trips are required. Prerequisite: Some Sunday field trips required.
Taught by: Willig
Course usually offered summer term only
Also Offered As: ENVS 420
Activity: Lecture
1.0 Course Unit
ENVS 616 Risk Assessment: Science & Policy Challenges
How do government policy-makers make decisions about potential threats to human health and the environment in the face of scientific uncertainty? The course develops the concept of Risk Assessment from the publication of the 1983 National Research Council (NRC) report commonly known as the "Red Book" which was used to rank the initial hazardous waste sites under the Superfund program. Using a variety of teaching tools, including lectures, panel discussions, and case studies, the course examines how public policy decisions regarding environmental risk are made and how effective those decisions are at reducing risks to affected populations. The course focuses on the complex interaction of science, economics, politics, laws, and regulations in dealing with environmental and public health risks. The course will begin with a review of the policy process and methods used in evaluating human health and environmental risks, including the traditional steps in the risk assessment process, including quantitative and qualitative aspects of hazard identification, dose-response assessment, exposure assessment, and risk characterization. The course will then focus on how scientific uncertainty, risk perceptions, socio-economic disparities, risk communication, and politics influence environmental risk-based decision-making. Issues such as special populations (e.g., children, elderly, immune-compromised, woman of pregnancy age, etc.) must be considered when developing risk reduction strategies. The use of the "precautionary principle" will be discussed in the context of different types of environmental stressors (e.g., pesticides, chemicals, climate change, air pollution, water quality, and land use) and how this important controversial principle is applied differently in contrasting national and European risk management policies.
Taught by: Pepino
Course usually offered summer term only
Activity: Seminar
1.0 Course Unit

ENVS 617 Sustainable Estuaries: An Investigation of Resources & Recovery
This course will evaluate the multiple factors that must function to ensure the sustainability of estuaries of national significance. Since the beginning of the environmental movement in the 1960s, we have attempted to protect and improve our watersheds and estuaries through a series of environmental laws, but we learned over the last three decades that regulatory-based "command & control" approaches may have achieved their limits of success, and we now need to think more holistically in order to achieve the Clean Water Act goal of "fishable and swimmable" waters. In this course we will explore the new collaborative strategies and partnerships, which are available, and how social, economic and cultural factors are equally important as regulation to achieve estuary restoration. The National Estuary Program (NEP) was established in 1987 by amendments to the Clean Water Act (Section 320) to identify, restore and protect estuaries along the coasts of the U.S. Unlike traditional regulatory approaches to environmental protection, the NEP targets a broad range of issues and engages local communities in the process. The program focuses not just on improving water quality in an estuary, but on maintaining the integrity of the whole system - its chemical, physical, and biological properties, as well as its economic, recreational, and aesthetic. This course will examine the twenty estuaries of national significance, including the Chesapeake and the Delaware Bays, in an effort to define the condition of estuaries in the US and what strategies can be utilized to attain water quality and habitat goals while achieving important socioeconomic needs of the estuary's diverse stakeholders. You will examine the history of estuary management, the factors that stress water quality and habitat, and what strategies are commonly used to reduce risks while safeguarding the environment and public health.
Taught by: Pepino
Course usually offered summer term only
Activity: Seminar
1.0 Course Unit
ENVS 620 Developing Environmental Policy
When we think of environmental policies in the USA, we may think of one or more laws geared to improve our nation’s air, water, ecosystems, and biodiversity. However, environmental policies and policy-making comprise more than just specific laws and regulations. Making and implementing environmental policy is a process influenced by multiple political, cultural, and economic factors in addition to scientific factors, all of which impact the ability of policies to be effective, that is, to actually improve the environment. In this course, we develop a framework to analyze the effectiveness of the social actors, process and outcomes of environmental policy-making. We ask questions such as: How do policy makers define environmental problems and solutions? Who are the social actors involved in the process? How are policies created and negotiated? What underlying assumptions and realities about the roles of government and society shape policy instruments and design? Are science and risk accurate or distorted? How are social and environmental justice intertwined? To answer these complex questions, we contextualize and critically analyze policies to determine how both government and society impact on regulatory approaches. We study the institutions involved and examine social and ecological outcomes of environmental policies. We also discuss contemporary issues and policy situations that arise throughout the course of the semester, and comment on them in a class blog. Finally, students will select an environmental issue and formulate a policy proposal to recommend to decisionmakers.
Taught by: Kulik
Course usually offered in spring term
Activity: Seminar
1.0 Course Unit

ENVS 622 Environmental Enforcement
The goal of the course is to provide students with an introduction to the role of enforcement in federal, state and local environmental regulatory programs. Emphasis will be placed on federal enforcement actions initiated by the U.S. Environmental Protection Agency and U.S. Department of Justice. The course will provide students with an introduction to the American Legal System and legal concepts, like standing, jurisdiction, and burden of proof. A number of case studies and classroom exercises will be utilized as part of the discussion of civil and criminal enforcement actions. For example, a detailed case study will be presented concerning a successful prosecution by the federal government of a wastewater treatment plant operator (from the receipt of the initial tip through the sentencing of the defendant). A theme of all classes, presentations and assignments will be the role of the environmental professional in the enforcement context (e.g., the environmental professional who testifies as an expert in a judicial proceeding, or performs an audit that becomes the subject of a self-disclosure to EPA). Taught by: Lisa
Course usually offered in fall term
Activity: Seminar
1.0 Course Unit

ENVS 625 Meaningful Participation: Race, Place and Environmental Justice
This course will focus on a critical exploration of the social movements and policies related to environmental injustices from a community development perspective. The course includes an overview of the Environmental Justice Movement as an evolution from the Civil Rights Movement as well as an exploration of the political economy of environmental inequalities and uneven development that contribute to urban land use patterns that catalyze a range of environmental injustices. This course will emphasize authentic engagement of frontline communities to address a range of environmental inequalities using urban planning and community based solutions. Exploring a Philadelphia-area organization is a key component in this course.
Taught by: Katera Moore
Course not offered every year
Activity: Lecture
1.0 Course Unit

ENVS 629 The US Water Industry in the 21st Century
The course will explore all 4 sectors of the water business in the United States: The Drinking Water Industry, The Stormwater Utility, Water Resources (rivers, streams, reservoirs) Management and the Water Pollution Control Industry. The course will have 2 primary foci: 1. The influences on the industry from new technologies and infrastructure, acceptable levels of risk, public and private sector competition, climate change, the bottled water industry, resource recovery, rates and affordability and other influences will be investigated. 2. The management of a 21st century utility will be explored, including topics of organization and leadership, the role of environmentalism, infrastructure financing, water / wastewater treatment facility operations, public affairs and media, and designing a capital improvement program are examples of topic areas.
Taught by: Neukrug
Course usually offered in fall term
Activity: Seminar
1.0 Course Unit

ENVS 634 Topics in Water Policy
This course will explore various themes such as the UN Millennium Development Goals, EPA regulatory practices, and global water policy and governance.
Taught by: Laskowski
Course usually offered in spring term
Activity: Seminar
1.0 Course Unit

ENVS 642 Global Water Conference in Stockholm, Sweden
The global water and sanitation crisis kills over 4,000 children each day and represents one of the biggest health problems in the world. At the University of Pennsylvania school year 2010-2011 was declared the “Year of Water” in recognition of the many challenges that lie ahead as global increases in population and affluence and the influences of climate change will stress limited water resources. Each year the Stockholm International Water Institute convenes a Conference with experts from around the globe to exchange the latest water research findings and develop new networks. Students will attend the Conference, present research by presentations/posters, document a key issue, interview experts, and meet colleagues with common interests. They will also help other organizations at the Conference.
Taught by: Laskowski
Course usually offered summer term only
Activity: Seminar
1.0 Course Unit
ENVS 643 From Brownfield Remediation to Land Revitalization: US Strategies for Reducing Soil Contamination
This course is intended to give students an overview of the genesis of the so-called "Brownfield" problem and of the various efforts our society is taking to solve or, at least, ameliorate it. The course will place the "Brownfield" problem in the broader context of the growth and decline of the industrial base of cities like Philadelphia. Students will study the general constitutional and statutory framework within which we approach the problems of orphan, polluted sites and the disposal of contemporary solid wastes. They will also analyze the principal actions that have been taken by Federal and state government to address remediation and redevelopment of abandoned industrial sites. The course will also explore environmental equity issues. The students will collaborate with high school students at the West Philadelphia High School to identify sites in their neighborhoods and to learn how to determine the sites ownership and land use history. The students will study ways of determining environmental risk and the various options that are available for remediation in light of community ideas about re-use. Students will be expected to participate actively in the seminar and the sessions with high school students. Students in the course are required to prepare and present a term paper on a topic in the general area of "Brownfield" analysis and remediation.
Taught by: Keene
Course not offered every year
Activity: Seminar
1.0 Course Unit

ENVS 644 Energy, Waste and the Environment
The aim of this course is to provide an incentive to use geochemical and mineralogical principles to address and solve major environmental problems. The students identify the problems that are associated with different types of waste. This course covers a wide range of problems associated with the waste arising from the generation of electricity. The main topics will be the uranium cycle, characterization of nuclear waste, and the containment and disposal of nuclear waste. Based on insights from the nuclear fuel cycle, solutions are presented that diminish the environmental impacts of coal and biomass combustion products, incineration of municipal solid waste, toxic waste due to refuse incineration, and landfills and landfill gases.
Taught by: Giere
Course usually offered in spring term
Activity: Seminar
1.0 Course Unit

ENVS 657 Introduction to Superfund Sites and Health Effects of Hazardous Waste
Superfund hazardous waste sites are prevalent in our nation and the exposures to toxicants from these sites raise immediate health concerns. The aims of this course are to educate students about such sites and provide a scientific basis for hazard identification, hazard characterization, risk communication and risk management. The course will describe the effect of these hazardous chemicals on the ecosystem and vice-versa, and remediation and mitigation approaches. These environmental science issues will lead into the environmental health aspects of exposures including: biomonitoring (external and internal dose, biomarkers and the exposome), toxicological properties of contaminants and mode-of-action. The course will be complemented with visits to two Superfund sites in the region: Ambler (asbestos) and Palmerton (heavy metals). Prerequisite: 400 level course in Biology/Chemistry and Biochemistry
Taught by: Jane Willenbring, Richard Pepino, Trevor Penning
Also Offered As: PHRM 657
Activity: Lecture
1.0 Course Unit

ENVS 665 Industrial Ecology and the Circular Economy
Industrial Ecology is the multidisciplinary study of industrial systems and economic activities and their links to natural systems. The word "industrial" represents how humans use natural resources in the production of goods and services. "Ecology" refers to the concept that our industrial systems need to operate within sustainable natural ecosystems. The application of industrial ecology requires a movement of industrial processes from open loop business processes, where resource and capital investments move through the system to create products and waste, to a closed loop system where wastes (aka by-products) become inputs for new processes. This approach will allow to move to a circular economy. The implementation of industrial ecology, which aligns business operations with the natural cycle, creates the opportunity for a circular economy and has the potential for significant benefit for industry as well as for the long term viability of the human population and the natural ecosystem. Prerequisite: Approval from the instructor if course prerequisites not met.
Taught by: James Hagan
Course usually offered summer term only
Prerequisite: ENVS 667
Activity: Seminar
1.0 Course Unit
**ENVS 669 Corporate Sustainability Strategies**
Before the year 2000, "environmental management" for a business was typically driven by the need to respond to restrictions imposed by environmental regulation. But, at the dawn of the new millennium, leading businesses began to change their concept of environmental management to look beyond simply meeting governmental dictates. These organizations began to evolve and utilize "environmental strategy" to create new ways of growing their businesses by bringing sustainability to the core of their business strategies. This seismic shift in view was accompanied by a bottom line emphasis that, in some cases, turned sustainability efforts into profit centers. Sustainability increasingly is not hidden within the silo of environmental, health, and safety departments but has become much more seamlessly integrated into the operations of corporate functional disciplines. Today, to effectively work in senior management, an executive needs to be knowledgeable not only about his or her specific business function but also how his or her business will be impacted by governmental regulations, policies, corporate sustainability initiatives, green marketing regulations, industry guidelines or 'best practices', new sustainable technologies, energy planning, environmental performance metrics, and required reporting on the environmental impact of their business unit.
Taught by: Survis
Course usually offered in spring term
Activity: Seminar
1.0 Course Unit

**ENVS 670 Topics Course in Sustainability**
This course will explore the various themes in sustainability management.
Course not offered every year
Activity: Lecture
1.0 Course Unit

**ENVS 673 The Future of Water**
From Wall Street to rural Sub-Saharan Africa, technology innovation to aging infrastructure-this course will explore the; impact of water and consider what future leaders need to know about the dynamics of the industry, investment and business opportunities, and water-related risk; Opportunities for water are booming around the world, in large part because of existing or looming shortages and decades of underinvestment, population growth, rapid industrialization and urbanization, pollution, and climate change. Water is the only irreplaceable natural resource on the planet. Its critical role in every aspect of the global economy, could, in fact, lead it to be the next gold or the next oil. This course will address the fundamentals of the water sector from an international perspective. The future of water will be critical to our global economic, social and political development and will likely become one of the most influential factors in business decisions for the future. Furthermore, it is essential for leaders across all sectors-from pharmaceuticals to financials, energy to agriculture-to understand how to sustainably manage and account for water resources, capitalize on new technologies, mitigate water-related risks and navigate through complex and dynamic policy and regulation. The course will engage students in high-level discussion and strategy formation, challenging them to develop creative and sustainable solutions to some of the greatest challenges facing environmental, business and water industry leaders today. Interactive sessions and projects will provide an introduction to appropriately managing, valuing and investing in water assets to create sustainable and compelling business opportunities.
Course usually offered in fall term
Activity: Seminar
1.0 Course Unit

**ENVS 674 Life Cycle Assessment**
In order to make sensible decisions on products or projects, people need to understand the environmental impacts of these actions. Life cycle assessment (LCA) is a process to assess environmental impacts throughout the different stages of a product or project's life. This seminar is intended to be comprehensive and covers material extraction, processing, manufacture, distribution, use and end of life reuse, recovery or disposal. The objective of conducting an LCA is to compare the full range of environmental impacts that emanate from the provision of these products or services and then use that information to improve the situation to minimize or eliminate harm. The focus of this class will be to understand the phases of an LCA as well as conduct LCAs that compare the impacts of two related options. This course will enable the student to conduct LCAs and examine the use of software that could be used in this regard. The classic examples are cloth vs. disposable diapers, paper vs. ceramic cups, and so on. This course will enable the student to conduct LCAs and examine the use of software that could be used in this regard.
Prerequisite: If course requirement not met, permission of instructor required.
Taught by: Hagan/English
Course usually offered in fall term
Prerequisite: ENVS 667
Activity: Seminar
1.0 Course Unit

**ENVS 675 Charting a New Course for the Water Industry**
We are entering an era of growing water infrastructure failures and remaining "legacy" water pollution challenges. Fortunately, a network of global water CEOs from water utilities, industry and engineering consulting are leading the water sector towards innovative change. They are finding solutions at the intersection of science, engineering/technology and policy and paving the path forward for our water industry and our global water resources. This short course is led by the former CEO of Philadelphia Water and the Chair of the Leading Utilities of the World Network. Professor of Practice Howard Neukrug will lead a series of discussions on: (1) a brief history of water infrastructure systems in the US and the paradox of how our water resources have been used, valued, and priced over time; (2) a specific focus on the past 50 years of Philadelphia's efforts to meet the challenges of the Clean Water Act and Safe Drinking Water Act through leadership in the legislative, regulatory, management, and policy and research arenas of the water business; and (3) personal interviews with key water leaders on their greatest challenges past and future and how they are managing change and innovation towards more sustainable water systems in the 21st century.
Taught by: Howard Neukrug
Course not offered every year
Activity: Online Course
0.5 Course Units

**ENVS 677 Sustainable Agriculture and Product Stewardship.**
This course will focus on how food is produced around the globe and inputs required to ensure food security. Topics explored include: Integrated Pest Management, Precision Agriculture, Product Stewardship, Biodiversity, Biologicals, Organics and Synthetic Products, GMOs, Sustainable Development Goals, Regulations, Stakeholders (Growers, NGOs, consumers, etc.), and Food waste.
Taught by: Linda Froelich
Activity: Seminar
1.0 Course Unit
ENVS 681 Modeling Geographical Space
This course explores the nature and use of raster-based geographic information systems (GIS) for the analysis and synthesis of spatial patterns and processes through ‘cartographic modeling’. Cartographic modeling is a general but well defined methodology that can be used to address a wide variety of analytical mapping applications in a clear and consistent manner. It does so by decomposing both data and data-processing tasks into elemental components that can then be recomposed with relative ease and with great flexibility.
Taught by: Tomlin
Course usually offered in spring term
Activity: Lecture
1.0 Course Unit

ENVS 685 Topics Course in Resilience and Adaptation
This is a topics course exploring current issues in resilience and adaptation.
Course not offered every year
Activity: Lecture
1.0 Course Unit

ENVS 686 Resiliency, Health & Built Environment
Additional fees apply. Healthy resilient communities are successful outcomes of built places. This course is designed for MES students to build area expertise through lectures, on-site visits and real time simulations. Students will travel to New York City and Washington DC to learn about these topics and observe current practices first hand. Through the design and synthesis of place, including educational and health facilities, and the workplace, the class will investigate the impact of Social Determinants of Health and sustainability. They will also integrate resiliency planning to address impacts of sea level rise, severe heat and different climate and environmental conditions affecting the built environment. Course work covers design and planning theory that intersects with diseases, mental health, climate action and their interconnectivity. Case studies, seminars and tours of projects and health departments will bring to focus how the built environment can be a culprit and a solution.
Taught by: Joyce Lee, FAIA, LEED Fellow
Activity: Seminar
1.0 Course Unit

ENVS 688 Floodplain Management in a Changing Climate
According to a 2019 paper by Scott A. Kulp and Benjamin H. Strauss in the journal Nature Communications, 230 million people worldwide occupy land that is less than 1 meter above current high tide. These lands will be inundated by sea level rise by the end of this century, or earlier. Add to this the inherent flood risks in riverine and urban settings. How do we prepare and adapt? The class will explore the challenge of floodplain management in a changing climate through lectures, talks by guest experts, readings and multimedia, and exploration in the field. We will take a field trip to the New Jersey coast to witness home elevations, beach nourishment, and locales that are already experiencing chronic tidal flooding; we will meet with municipal officials challenged by increasingly persistent sea level rise. Our class will look at the National Flood Insurance Program, examine its goals, critique its 50 year history and debate reforms to the program at the same time the US Congress is considering reauthorization of the program. We will look at resiliency efforts that states and local governments are pursuing and the new city- and state-level position of Chief Resiliency Officer. In class we will cover hazard mitigation planning, land use, hard and natural infrastructure, regulations, the Community Rating System and other issues pertaining to flooding and climate change, including social justice and public health issues. Throughout the course, material will be introduced to prepare the student to take the Certified Floodplain Manager exam administered by the Association of State Floodplain Managers. This optional test, should the student pass, will provide credentialing that is well recognized in the United States.
Taught by: John Miller
Course usually offered in fall term
Activity: Lecture
1.0 Course Unit

ENVS 699 Masters of Environmental Studies Capstone Seminar
This course is designed to help students successfully complete their MES Capstone. A set of milestones will be set and regular meetings will be held in groups and individually to aid the student as they complete the research portion of their degree. We will be working together to complete a series of steps towards the final project. These steps fall into five major areas 1) Reviewing the literature; 2) Finding a model; 3) Framing your research; 4) managing data; and 5) Writing your results. Throughout the semester, we will also discuss career goals and the job search. Prerequisite: Project proposal and Online Application equired for course registration. See MES Office and "Guide to the Capatone" for more information.
Taught by: Bordeaux
Course usually offered in spring term
Activity: Seminar
1.0 Course Unit
Notes: Project proposal and Online Application required for course registration. See MES Office and "Guide to the Capatone" for more information.

ENVS 999 Independent Study
Directed study for individuals or small groups under supervision of a faculty member.
One-term course offered either term
Activity: Independent Study
1.0 Course Unit
Notes: Permission of instructor required