

SUBJECTS OF INSTRUCTION

Courses offered by the School of the Environment are described below. The letters “a” and “b” following the course numbers indicate fall- and spring-term courses, respectively. Courses with bracketed titles will not be offered during the 2024–2025 academic year.

Project courses involve individually assigned advanced field or laboratory work, or literature review, on topics of special interest to the student; credits and hours for these projects are determined for each student in consultation with the instructor.

Courses throughout the university are generally open to students enrolled in the School of the Environment, subject to limitations on class size and requirements for prerequisites.

COURSE DESCRIPTIONS

At YSE, new courses are often added after this bulletin is printed. Please visit our website at <https://resources.environment.yale.edu/courses> for an updated list. See also Yale Course Search at <https://courses.yale.edu> for many other environmental courses in other Yale departments.

ENV 511a, Ecological Foundations for Environmental Managers

This course gives students a fundamental mechanistic understanding about the way abiotic (e.g., climate) and biotic (e.g., resources, competitors, predators) factors determine pattern in the distribution and abundance of species. Students learn how individuals within a species cope with changing environmental conditions by altering their behavior, making physiological adjustments, and changing the allocation of resources among survival, growth, and reproduction. Students learn how populations of species coexist within communities and how species interactions within communities can drive ecosystem functioning. Students also learn how ecologists use scientific insight to deal with emerging environmental problems such as protecting biodiversity, understanding the consequences of habitat loss on species diversity, and forecasting the effects of global climate change on species population viability and geographic distribution. 1½ Course cr

ENV 512a, Microeconomic Foundations for Environmental Managers

This six-week course provides an introduction to microeconomic analysis and its application to environmental policy. Students study how markets work to allocate scarce resources. This includes consideration of how individuals and firms make decisions, and how policy analysts seek to quantify the benefits and costs of consumption and production. We consider the conditions under which markets are beneficial to society and when they fail. We see that market failure arises frequently in the context of environmental and natural resource management. The last part of the course focuses on the design of environmental and natural resource policies to address such market failures. The course is designed to cover basic knowledge of economics analysis and prepare students for ENV 834 and other more advanced offerings. 1½ Course cr

ENV 521a, Physical Science Foundations for Environmental Managers

This required foundational course provides students with the physical science basics that they need to understand and manage environmental problems. The course draws on climatology, environmental chemistry, geology, hydrology, meteorology, oceanography, and soil science. Focus is on understanding both the underlying concepts and how they apply to real-world environmental challenges. Useful both as a freestanding course and as a gateway to a wide spectrum of intermediate and advanced courses. 1½ Course cr

ENV 522a, Social Science Foundations for Environmental Managers

In this course, we investigate the role of culture, history, ethics, and governance in shaping varying perspectives on the natural world and management strategies for environmental resources. We explore the following questions: What does it mean to be an environmental steward in a world filled with social, political, and economic inequalities? Can we weave together multiple “ways of knowing” to better manage natural resources? Is it possible to balance the need for social and environmental change in a manner that is both place-based and responsive to global concerns? What would it look like to incorporate non-economic measures of human well-being into our decision making? Can a rights-based approach to natural resource management succeed in the twenty-first century? 1½ Course cr

ENV 550a, Natural Science Research: From Idea to Proposal

The course guides students through the process of developing an individualized research project in close partnership with their faculty adviser. We focus on writing a research proposal, which prepares students to apply for competitive research funding and is required of all M.E.Sc./M.F.S. students. In doing so, we cover critical reading of the literature, narrowing a broad topic of interest to a feasible research project, proposal writing, and a high-level introduction to the philosophy of science. Students engage in peer review throughout the course and present their completed proposals to the class at the end of the semester. 3 Course cr

ENV 551a, Research Methods for Qualitative Inquiry

This course covers approaches to designing and implementing qualitative research with a focus on understanding complex questions that lie at the nexus of people and the environment. Qualitative research is critical to understand the interconnected patterns and processes in the social world that cannot be reduced to quantitate data or mechanistic explanations. The methods covered in this course include interview techniques; document analysis of texts and social artifacts such as maps, images, public documents and archival material; ethnographic techniques such as observation and writing thick description; and participatory action tools that support community-based approaches to research. The strategies of inquiry of qualitative research we learn about include ethnography, oral history, participatory action research, and case study research. Finally, we probe the practice of social science research by engaging in a range of ethical and practical decisions that a researcher will encounter when examining the nature of the human condition. 3 Course cr

ENV 553a, Perspectives: Environmental Leadership

This course equips you with core leadership and systems-thinking tools to help you navigate YSE, Yale, and your future career with increased clarity and confidence, regardless of the specialization path you may take. Both leadership and systems-thinking tools are grounded in fostering an increased appreciation of

your unique perspective and the valuable perspectives of others. Through study of frameworks and reflection accompanied by peer-to-peer discussion, you will firmly establish a connection between a questioned and confirmed articulation of *purpose*, clarified *prioritization*, visualized *potential*, and maximized *progress* to effect positive change at individual, organizational, and system levels. The course also highlights opportunities for greater depth provided by other courses and activities across the school, including ENV 554 in Fall 2. An additional intended outcome is that you all feel welcome at YSE, appreciative of others, and confident you belong in an inclusive larger learning community of YSE. 1½ Course cr

ENV 573a, Urban Ecology for Local and Regional Decision-Making

Urban ecology is the interdisciplinary study of urban and urbanizing systems from local to global scales. While urban ecology shares many features with the biological science of ecology, it emphasizes linkages with social, economic, and physical sciences and the humanities. Geographically, the subject includes central and edge cities, suburbs of various ages and densities, and exurban settlements in which urban lifestyles and economic commitments are dominant. In application, urban ecology can be useful as a social-ecological science for making cities more sustainable, resilient, and equitable. Emerging “grand challenges” in urban ecology include the development of robust approaches to and understanding of (1) integrated social-ecological systems in urban and urbanizing environments; (2) the assembly and function of novel ecological communities and ecosystems under novel environmental conditions; (3) drivers of human well-being in diverse urban areas; (4) pathways for developing healthy, sustainable, and disaster-resilient cities; and (5) co-production of actionable science for policy, planning, design, and management. 3 Course cr

ENV 592a, Documentary Film Workshop Charles Musser

This workshop in audiovisual scholarship explores ways to present research through the moving image. Students work within a Public Humanities framework to make a documentary that draws on their disciplinary fields of study. Designed to fulfill requirements for the M.A. with a concentration in Public Humanities. 3 Course cr

ENV 594a, Global Carbon Cycle

Carbon is one of the most abundant elements in the universe, the building block for all of biochemistry, and the energy exchange material for the Earth's metabolism. Over the past two hundred years, people have mined fossil carbon to power the global economy, leading to profound transformations in the cycling of carbon among land, oceans, and atmosphere and disrupting Earth's climate. This course explores in detail the cycling of labile carbon among the major biogeochemical reservoirs. We spend roughly four weeks each on land and oceans and spend the final four weeks exploring carbon-climate interactions, including engineered carbon dioxide reduction. The course involves quite a bit of mathematics and computation. All are encouraged to register, but please be aware of the quantitative approach. 3 Course cr

ENV 602a, Ecosystems and Landscapes

Concepts and their application in ecosystem and landscape ecology. Topics covered include biogeochemical cycling, food web interactions, biodiversity, and the abiotic and biotic controls that act on them. The course emphasizes how to integrate this knowledge to understand and manage ecosystem budgets. 3 Course cr

ENV 604a, Public Health Entrepreneurship Teresa Chahine

This is a case based course about innovation and entrepreneurship for health equity and drivers of health. Health equity means that everyone has a fair and just opportunity to be as healthy as possible. This requires removing obstacles to health such as poverty, racism, gender and other biases and their consequences, including powerlessness and lack of access to good jobs with fair pay, quality education and housing, healthy foods, safe environments, and health care. We refer to these as drivers of health. COVID-19 has brought to light for many the complexities in drivers of health, and the role of entrepreneurship and cross-sectoral collaboration in eliminating health disparities.

1½ Course cr

ENV 612a, Transforming Global Value Chains for Sustainability: The Case of Fashion and Textiles

This course investigates what it means to create sustainable and resilient global value chains, with fashion and textiles serving as a primary case. We explore key questions about the relationship between global trade, governance, environmental management, and supply chain design. Rather than presuming fixed answers, students are invited to critically assess emerging frameworks, institutional challenges, and innovation strategies to advance environmental, economic, and social sustainability. Through a comparative and systems-based lens, we seek to understand how sustainability can be embedded within global production and consumption networks. 3 Course cr

ENV 620b, History of Environmental Thought and Activism

This course uses a race, class, and gender approach to examine the history of American environmental ideology and activism from the 1600s to the present. The course is divided into three units. The first unit examines environmental conditions in the city (health, sanitation, housing, overcrowding, occupational safety, and open space), the rise of urban American environmental consciousness, and activism related to urban issues. Unit II examines the rise of the conservation and preservation movements. It analyzes the relationship between hunting, wildlife extinction, and the rise of conservation ethics. This unit also examines the role of the countryside, frontier, and wilderness in environmental thought and activism. It examines conquest, conservation, primitivism, Transcendentalism, and Romanticism and the emergence of the preservation/conservation movement. Unit III focuses on contemporary environmental thought; it examines the birth of the modern environmental movement and the emergence of reform environmentalism. The course also examines the way in which a person's social class, race, gender, environmental, and labor market experiences influence their environmental perceptions and the kinds of environmental ideologies they develop. The course examines the rise of major environmental paradigms and the factors that make them influential. 3 Course cr

ENV 626b, Writing for Publication in the Natural Sciences

This course is intended to give students insights into the process of writing natural science manuscripts. The course guides students through writing a paper and ends the term with a submitted manuscript. We also consider various strategies for writing, accountability, time management, and productivity. The course is aimed at students in the natural sciences with analyzed data that they want to write up for publication.

3 Course cr

ENV 630b, The Physical Science of Climate Change Peter Raymond and Xuhui Lee

The course provides students with core knowledge on the processes controlling the earth's climate system. The first half of the class focuses on the four components of the earth climate system, providing a knowledge base on the atmospheric energy and water budgets and the roles of anthropogenic greenhouse gases, the oceans, land and cryosphere in altering these budgets. Students also learn how to run a climate GCM (general circulation model). The second half of the class focuses on impacts of climate change on a number of societal sectors including natural ecosystems, energy use, water resources, the food system and the built environment. 3 Course cr

ENV 633a, Critical Race Theory

This class studies critical race theory from its origins to its current expression. Understanding the deep interconnections between race and law, and how race and law are co-constitutive, is the project of critical race theory. One of the central claims of critical race theory is that racial subordination is not a deviation from the liberal legal ideal but is, unfortunately, part of its expression. We focus on the origins of the critique that is central to the development of the theory and contrast its analysis with conventional analytic frameworks on race and American law and society. Because it is a positive theory but also driven by a normative vision, we explore the possibility of transforming the relationship between law and racial power. The law is not the only site of critical race theory; it has had a significant impact on other disciplines in the social sciences. We examine those impacts as well. 3 Course cr

ENV 645a, Urbanization, Global Change, and Sustainability

Urbanization and associated changes in human activities on the land (*land use*) and in the physical attributes of Earth's surface (*land cover*) have profound environmental consequences. Aggregated globally, these effects constitute some of the most significant human impacts on the functioning of Earth as a system. This course examines the interactions and relationships between urbanization and global change at local, regional, and global scales with an emphasis on the biophysical aspects of urbanization. Topics include urbanization in the context of global land use change, habitat and biodiversity loss, modification of surface energy balance and the urban heat island, climate change and impacts on urban areas, urban biogeochemistry, and urbanization as a component of sustainability. Emphasis is on management of urban areas *worldwide* or at national scales for planetary sustainability. 3 Course cr

ENV 646b, Regenerative Agriculture Systems

Agriculture systems both depend and have a profound impact on the natural and human environment. There is widespread recognition of the need for agriculture systems to be more regenerative: regenerative food producing systems are ones that contribute to the improvement of the environment and to human wellbeing, not just avoid damages. The aim of this course is to explore what makes food producing systems regenerative. While there is a lot of momentum around the framing of "regenerative agriculture," there is not a lot of detail about what actually makes a system regenerative. The goals of the course are to: provide technical understanding of the science of agricultural systems; develop practical experience applying this science to real world scenarios of strategy development in agriculture; and increase exposure to practitioners at the interface of agriculture and the environment. 3 Course cr

ENV 650b, Fire Ecology and Management in the US West

The goal of this seminar is to offer an introduction to the ecology and management, and the policy drivers, of wildland fire in western North America. We seek to build a base of knowledge and understanding regarding fire and its applications/management in modern forestry. We start by learning the basic history and ecology of forest fire, then look at landscape-level fire behavior, prescribed fire applications, and the drivers of catastrophic fire. The course concludes with an applied field-learning experience managing fire at Yale-Myers Forest. We meet once a week, with an in-person or guest Zoom lecturer from the field of fire ecology and management joining most weeks. Each week, there is a presentation followed by a discussion of the lecture content and reading material assigned by the guest lecturer. Students are expected to have read the papers and to come with questions and thoughts ready to discuss. There are several field trips, and if logistically feasible, a prescribed burn that students are expected to participate in.

3 Course cr

ENV 653b, Maple: From Tree to Table

This course covers the cultural, industrial, and sustainable practices of nontimber forest products through the lens of maple sap and syrup. Maple sugar is a forest product unique to northeastern North America, and it has seen a resurgence in interest as global consumers seek nutritious, natural, and sustainably produced foods. This course covers the booming industry and culture around maple syrup, from backyard operations through modern 100,000-tap investment operations. Maple producers are on the front lines of climate change and forest health threats. The course provides students with the knowledge of how challenges related to forest health and climate change are directly impacting maple producers and how these producers are learning to adapt in ways that are environmentally friendly, ecologically sound, and financially competitive in a global market. 1½ Course cr

ENV 659b, The Practice of Silviculture: Principles in Applied Forest Ecology

The scientific principles and techniques of controlling, protecting, and restoring the regeneration, composition, and growth of natural forest vegetation and its plantation and agroforestry analogs worldwide. Analysis of biological and socioeconomic problems affecting specific forest stands and design of silvicultural systems to solve these problems. Applications are discussed for the management of wildlife habitat, bioenergy and carbon sequestration, water resources, urban environments, timber and nontimber products, and landscape design. Four to six hours lecture. One-hour tutorial. Seven days of fieldwork. Recommended: some knowledge of soils, ecology, plant physiology, human behavior, and resource economics. 4 Course cr

ENV 660a, Forest Dynamics Marlyse Duguid

This course introduces the study of forest stand dynamics—how forest structures and compositions change over time with growth and disturbances. Understanding the dynamic nature of forest stands is important for creating and maintaining a variety of critical ecosystem services sustainably and synergistically, including sustainable supplies of wood products, biodiversity and wildlife habitats, water, wildland fire, forest restoration and others. Through readings, lectures, field observation, and discussions we will explore forest development processes and pathways, concentrating on the driving mechanisms and emergent properties including natural and human disturbances. Non-YSE students must get instructor permission before registering. Capped at thirty students. 3 Course cr

ENV 670b, Southern Forest and Forestry Field Trip

This course augments our forestry curriculum by providing a forum for viewing and discussing forestry and forest management with practitioners. The trip provides M.F. candidates and other interested students with an opportunity to experience the diversity of southeastern forested ecosystems and ownership objectives ranging from intensively managed pine plantations to restoration and protection of endangered habitats. Students discuss forest management issues—including forest health, fragmentation, policy, law, and business perspectives—with landowners and managers from large industries, nonindustrial private landowners, TIMOs, federal and state land managers, NGOs, and forestry consultants. We also tour sawmills, paper mills, and other kinds of forest products processing facilities, active logging operations, and, weather permitting, participate on prescribed fires. Not least, we experience the unique cultures, food, and hospitality of the southeastern United States.

ENV 671a, Dendrology: Woody Plant Taxonomy and Identification

Dendrology literally translates as “the study of trees” and integrates morphology, phenology, ecology, biogeography, and the natural history of tree species. In this course students learn how to identify the major temperate woody plant families, with a focus on eastern North American species. Students will learn to identify by sight using morphological and ecological traits of over 100 woody plant taxa, using an ecosystem focused approach for plant identification. Besides learning how to identify species, we discuss principles of plant ecology, biogeography, phylogenetic community structure, and natural history in each ecosystem. Class periods consist of practical field and laboratory skills used in plant taxonomy and field lecturing. Weather permitting, we are outside in the field/forest for most class periods. Limited to twelve students. Students are expected to take this concurrently with Forest Dynamics; a waiver can be given if the student has taken similar courses in forest ecology. 3 Course cr

ENV 679a, Plant Ecophysiology

This course focuses on the physiological ecology of plants and their interaction with the biotic and abiotic environment, understood through the lens of first principles. We use a quantitative approach to demonstrate the linkages between photosynthesis, growth, and carbon allocation at the tissue and whole plant level, which can then be scaled up to forests and ecosystems. We also focus on specific physiological and anatomical adaptations plants use to survive in the many varied habitats on Earth. Enrollment limited to twenty-four. 3 Course cr

ENV 684a, Forest and Ecosystem Finance

More than half of the forest land in the US is privately owned. Understanding the financial implications of forest management decisions is a key component and concern for many landowners, whether smallholders or large institutional investors. This course teaches students how to apply basic financial analysis to questions of forest management and explores how financial perspectives shape trends in land ownership and management. This course is predominately focused on the US timberland market and investor-oriented decision-making frameworks to support the valuation, acquisition, and management of forestland for timber production. However, individual class sessions provide complementary perspectives from professionals at the intersection of investing and international markets, environmental markets, agriculture, conservation or other land use strategies. Skills and principles learned in this course are readily applicable to different country contexts, operational scales, or landowner

goals. In the latter portion of the term, students apply concepts in a case study and final valuation memo based on an actual or realistically structured deal scenario. 3 Course cr

ENV 685b, Engaging Landholders and Communities in Conserving and Restoring Tropical Forest Landscapes

The design and implementation of sustainable land management strategies in tropical forest landscapes must effectively involve the people and communities who manage and govern these regions. In many cases, however, practitioners design projects that focus on technical solutions only and ignore people altogether, or base their projects upon incorrect assumptions about the people at the heart of their interventions. These trends ultimately lead to project failure and can cause a host of adverse unintended consequences that further exacerbate the problems that practitioners were trying to resolve. This pattern is particularly prevalent with recent pledges by global organizations and national governments to plant trillions of trees around the globe in an effort to address the adverse effects of climate change (The Bonn Challenge and Trillion Trees). While these initiatives are well-intended, they largely ignore the sociocultural and political complexities of the landscapes where the trees would be planted, including whether landholders already plant or protect trees and if they want to increase this practice and how; which species they want to plant or protect and how; and the effects of tree planting on land tenure systems, traditional livelihood strategies, and gender dynamics. Little attention is also given to examining who removed the trees from the landscape and why and whether tree planting is an appropriate solution. 3 Course cr

ENV 688b, Forest Management and Operations

This course provides students with an opportunity to understand many aspects of forest management, especially as it relates to multiple-use forestry. Course content includes understanding and critique of forest inventory, and students are introduced to growth and yield concepts. Forest planning and optimization for objectives such as forest products and carbon are covered. Stewardship of forestland is discussed, as are legal aspects to land ownership and forest conservation. Included are sections focused on forest operations. Students gain experience in the diverse elements and aspects of forest harvesting. The course is taught from the perspective of what a forester should know about harvesting, which includes logging safety, timber harvesting operations and sale administration, legal dimensions of harvesting, planning and maintaining forest access systems, timber procurement and appraisal, logging costs and analysis, and environmental and social influences. Field experiences complement lecture material. 3 Course cr

ENV 692a, Science and Practice of Temperate Agroforestry

This course explores the science and practices of temperate agroforestry, covering current knowledge of agroforestry science and shedding light on the myths and assumptions that have yet to be tested regarding the integration of trees in agricultural systems. The course begins with an overview of modern agriculture to help us better understand why agroforestry systems have potential to improve the sustainability of farming systems. We also cover the social science regarding agroforestry and why it has not been widely adopted. Silvopasture and forest farming systems are the primary focus, but windbreaks, alley cropping, and riparian forest buffers are also covered. The field of agroforestry has struggled with the promotion of hypothetical practices; this course introduces students to real-world production agroforestry systems and helps

them better contribute to financially viable and environmentally sound agricultural operations. 3 Course cr

ENV 705a, Climate Change: Simple, Serious, and Solvable A. Scott Denning

Simple: Earth's climate is determined by the balance of radiation inputs and outputs at planetary scale. Greenhouse gases produce a radiation imbalance that forces change. Basic physics and paleoclimate agree that modern changes are enormous. Serious: Impacts of twenty-first-century climate change on weather, drought, fires, famines, and floods pose the greatest threat to ecosystems in millions of years and the worst threat to the global economy since the Black Death. Worse, the changes are essentially permanent. Solvable: Rapid and complete decarbonization of the global energy system is feasible and affordable, but politically difficult. We consider economic, policy, and engineering solutions and finish by examine cultural narratives about solutions.

3 Course cr

ENV 706b, Toxic Organic Chemicals in the Environment

An overview of the pollution problems posed by toxic organic chemicals, including petroleum, pesticides, PCBs, dioxins, chlorinated solvents, PFAS, brominated compounds, and other emerging contaminants. The course covers the processes governing the environmental fate of organic pollutants (e.g., bioconcentration, biodegradation, groundwater transport), as well as tools for the prevention and remediation of organic pollution. Theory is illustrated with a variety of case studies. Previous knowledge of organic chemistry is not required (but is welcome). 3 Course cr

ENV 708a / ENVE 6400a, Aquatic Chemistry David Kwabi

A detailed examination of the principles governing chemical reactions in water. Emphasis is on developing the ability to predict the aqueous chemistry of natural and perturbed systems based on a knowledge of their biogeochemical setting. Focus is on inorganic chemistry, and topics include elementary thermodynamics, acid-base equilibria, alkalinity, speciation, solubility, mineral stability, redox chemistry, and surface complexation reactions. Illustrative examples are taken from the aquatic chemistry of estuaries, lakes, rivers, wetlands, soils, aquifers, and the atmosphere. A standard software package used to predict chemical equilibria may also be presented.

3 Course cr

ENV 712b, Water Management

An exploration of freshwater management at scales ranging from local to global. The course looks at multiple dimensions of the water crisis, including human and ecological impacts; water quality and quantity problems; and infrastructural and governance issues. Theory is illustrated through a variety of case studies. Topics covered include global water resources; flooding; water scarcity; residential, agricultural, and industrial water use; water and health; water justice; impacts of climate change and land-use change; stormwater management; dams and other technologies for water management; human impacts on aquatic ecosystems; water and energy; water economics; water rights; water conflict and cooperation. 3 Course cr

ENV 713a, Coastal Ecosystems

An examination of the natural processes controlling coastal ecosystems, the anthropogenic threats to the health of these systems, and the potential for restoration. Coverage of estuaries, seagrass meadows, macroalgal forests, rocky shores, coral reefs, and mangrove swamps, with a special emphasis on tidal marshes. The course covers

a wide range of physical, chemical, and ecological processes. Anthropogenic impacts covered range from local to global and include chemical pollution, climate change, habitat destruction, hypoxia, invasive species, nutrient enrichment, sea-level rise, and overfishing. 3 Course cr

ENV 722a, Boundary Layer Meteorology

This course examines the interactions between the atmosphere and Earth's surface. Students gain an understanding of the surface energy and radiation balance, air motion in the atmospheric boundary layer, impacts of land use on surface climate, land surface parameterization for climate models, and field research methods. Three hours lecture and discussion. Data analysis/problem sets/term paper/presentation. Permission of the instructor required. 3 Course cr

ENV 723a, Wetlands Ecology, Conservation, and Management Kealoha Freidenburg

Wetlands are ubiquitous. Collectively they cover 370,000 square miles in the United States and globally encompass more than five million square miles. Most points on a map are less than one kilometer from the nearest wetland. Yet wetlands are nearly invisible to most people. In this course we explore wetlands in all of their dimensions, including the critical services they provide to other systems, the rich biodiversity they harbor, and their impact on global climate. Additionally, wetlands are linchpin environments for scientific policy and regulation. The overarching aim of the course is to connect what we know about wetlands from a scientific perspective to the ways in which wetlands matter for people. 3 Course cr

ENV 726b, Observing Earth from Space

A practical introduction to satellite image analysis of Earth's surface. Topics include the spectrum of electromagnetic radiation, satellite-borne radiometers, data transmission and storage, computer image analysis, the merging of satellite imagery with GIS and applications to weather and climate, oceanography, surficial geology, ecology and epidemiology, forestry, agriculture, archaeology, and watershed management. 3 Course cr

ENV 727a, Food and Agriculture: Environmental and Health Challenges and Solutions

This seminar explores significant challenges posed by the global food supply to environmental quality and human health. The primary obligation is a research paper, dissertation chapter, master's project, or senior essay draft. We read critically 150–200 pages per week, and students should be prepared to discuss or present analyses. Challenges examined include fresh vs. processed foods, nutritional sufficiency and excess, radionuclides, pesticides, pharmaceuticals, fertilizers, animal feeds, plastics, flame retardants, flavors, fragrances, ingredient fraud, genetic modification, waste, energy input and yield, locality, processing technologies, packaging, and carbon emissions. Corporate case histories are considered in a number of sessions. Private innovations in the production and management of food are analyzed, including trends in certification and labeling initiatives. Most sessions examine one or several foods. Examples include cow's milk, human milk, infant formula, grapes, wine, corn, bananas, tomatoes, salmon, cod, tuna, sodas, fruit juice, water, coffee, and olive oil. Enrollment limited to sixteen. 3 Course cr

ENV 728a, Introduction to Statistics and Data Analysis in the Environmental Sciences

An introduction to statistics and data analysis with emphasis on practical applications in the environmental sciences. Includes graphical analysis, common probability distributions, hypothesis testing, confidence intervals, and simple linear regression.

The course also provides a basic introduction to the R programming language.

There are 5 problem sets and two exams. This course covers material equivalent to AP statistics and the material it covers is a prerequisite for other statistics courses offered through YSE including ENV 757 and ENV 75, and it presents statistical methods used in many Yale courses in both the natural and social sciences. This course is taught in a flipped classroom approach: students watch videos before class, and classroom time is spent answering questions and working examples on computers. 1½ Course cr

ENV 730a, Environmental Data Science in R: Introduction to Data Integration and Machine Learning

In today's world, understanding environmental data and making informed decisions based on it is crucial for addressing complex environmental challenges. This course serves as an introductory exploration into the integration of environmental data using R programming language coupled with machine learning techniques. Participants gain hands-on experience in handling, analyzing, and interpreting environmental datasets, with a focus on leveraging the power of R for data integration and predictive modeling.

3 Course cr

ENV 734b, Biological Oceanography Mary Beth Decker

Exploration of oceanic ecosystems and how these environments function as coupled physical/biological systems. Ocean currents and other physical processes determine where nutrients are available to support primary production and where organisms from plankton to top predators occur. Includes discussion of anthropogenic impacts, such as the effects of fishing and climate change on marine ecosystems. Recommended prerequisite: college-level biology or ecology course. 3 Course cr

ENV 745a, Global Human-Wildlife Interactions Nyeema Harris

Wildlife and humans have increasingly complex interactions, balancing a myriad of potentially positive and negative outcomes. In a highly interactive format, students evaluate the importance of human-wildlife interactions across diverse ecosystems, exacerbators that influence outcomes, and management interventions that promote coexistence. 3 Course cr

ENV 751a, Sampling Methodology and Practice

This course is intended to provide a fundamental understanding of the principles of statistical sampling, alternative estimators of population parameters, and the design basis for inference in survey sampling. Natural, ecological, and environmental resource applications of sampling are used to exemplify numerous sampling strategies. Sample designs to be studied include simple random; systematic; unequal probability, with and without replacement; stratified sampling; sampling with fixed-radius plots; horizontal point sampling; and line intercept. The Horvitz-Thompson, ratio, regression, and other estimators are introduced and used repeatedly throughout the course. Three hours lecture. Weekly and biweekly problem sets and final project. 3 Course cr

ENV 752a, Ecology and Conservation of Tropical Forests

Tropical forests contain extraordinarily high biological diversity and provide critical ecosystem services with complex interactions with humans. This course focuses on the structure, function, and diversity of intact and degraded tropical forests, with an emphasis on ecological processes that shape plant and animal communities in these unique and diverse ecosystems. We also discuss the major threats to tropical forests, as well as examples of tropical forest recovery following disturbance. The course involves a mix of lectures, classroom activities, and student-led discussions. Students who successfully complete this course are given priority for ENV 717, Tropical Field Ecology (field trip course). 3 Course cr

ENV 756a, Modeling Geographic Objects

Modeling Geographic Objects teaches the use of Geographic Information Systems (GIS), a collection of hardware and software tools that allow users to visualize and analyze geographic data in its spatial configuration. Geographic data is modeled spatially as drawings of discrete objects (vector) or as images of continuous space (raster). MGO focuses on the former, mapping the relationships among objects in space: cities, rivers, buildings, districts, parcels, trees, etc. Students learn the theory of geospatial analysis alongside practical methods for acquiring, manipulating, displaying, and analyzing cartographic data. 3 Course cr

ENV 757a or b, Data Exploration and Analysis Jonathan Reuning-Scherer

Survey of statistical methods: plots, transformations, regression, analysis of variance, clustering, principal components, contingency tables, and time series analysis. The R computing language and web data sources are used. 3 Course cr

ENV 758b, Multivariate Data Analysis in the Environmental Sciences Jonathan Reuning-Scherer

An introduction to the analysis of multivariate data. Topics include multivariate analysis of variance (MANOVA), principal components analysis, cluster analysis, canonical correlation, ordination methods including multidimensional scaling, discriminate analysis, factor analysis, and structural equations modeling. Emphasis is placed on practical application of multivariate techniques to a variety of examples in the natural and social sciences. Students are required to select a dataset early in the term for use throughout the term. There are regular assignments and a final project. Extensive use of computers is required—students may use any combination of R, SAS, SPSS, MINITAB, and STATA. Three hours lecture/discussion. Prerequisites: a prior course in introductory statistics and a good understanding of multiple linear regression.

3 Course cr

ENV 759a, Power, Knowledge, and the Environment: Social Science Theory and Method

Introductory graduate course on the social science of contemporary environmental and natural resource challenges, paying special attention to issues involving power and knowledge, first via the ethnographic method—the global connections of a tribal longhouse in Borneo, the political ecology of water in Mumbai, and micro vs macro views of irrigation in Egypt; next the question of perspective—the view from within development projects, the concept of “slow violence,” and waste politics in Beijing; and finally representation—of indigenous people, of the poor, and of the development discourse. The goal of the course is to develop analytic distance from

current conservation and development debates and discourse. Enrollment capped.

3 Course cr

ENV 760b, Conservation in Practice: An International Perspective

This seminar focuses on the practice of wildlife and wildlands conservation, examining key topics from the dual perspectives of academic literature and actual field experiences; bringing together interdisciplinary thinking; and drawing on examples from Africa, Asia, Latin America, and North America. The thematic outline of the seminar is organized around three fundamental questions in nature conservation: What are we trying to save – and why? How is this being done – and how has it changed over time? What lessons are we learning – and what overarching issues remain problematic? Specific topics include how different players define and value wildness; selection and prioritization of conservation targets; comparisons of various species and landscape conservation approaches; and the central importance of governance in conservation including community-based conservation. During the term, students work in small teams to assess one of several current case studies – integrating biological, social, economic, and governance considerations – to propose an effective path forward for conservation. Participation is key, as the seminar is discussion-based and case study sessions are student-led. Evaluation is based on in-class participation, written reflections on readings, and case study presentations. 3 Course cr

ENV 761a, Negotiating International Agreements: The Case of Climate Change

This class is a practical introduction to the negotiation of international agreements, with a focus on climate change. Through the climate lens, students explore cross-cutting features of international agreements, the process of international negotiations, the development of national positions, advocacy of national positions internationally, and the many ways in which differences among negotiating countries are resolved. The seminar also examines the history and substance of the climate change regime, including, inter alia, the 1992 UN Framework Convention on Climate Change, the 1997 Kyoto Protocol, the 2009 Copenhagen Accord, the 2015 Paris Agreement, the UAE Consensus, and other recent developments. There are two mock negotiations.

3 Course cr

ENV 762a, Foundations of Applied Math for the Environment (FAME)

The language of mathematics is an important leg in the stool of interdisciplinary research and analysis, and many graduate courses at YSE involve mathematical content. However, many graduate students have not taken a math course in years, and their math skills are rusty. Furthermore, many graduate-level mathematical concepts may be entirely new. Experience suggests that many students either opt out of taking courses they are truly interested in or muddle through, struggle with the math, and miss important concepts. FAME is meant to help students refresh or acquire new math skills and succeed in content and provide a foundational “toolbox” for graduate-level courses. FAME provides a structured opportunity to learn a range of mathematical concepts used in environmental research. The course assumes that, at a minimum, students took college algebra (and have been exposed to calculus). Concepts are presented heuristically in a “how to” and “why” approach with examples from environmental research and policy questions. The goal is for students to be conversant and have intuition about (i.e., to demystify) why logs, exponents, derivatives, integrals. Also covered is a bit of history of math and an introduction to computer programming.

1½ Course cr

ENV 767b, Tools for Conservation Project Design and Management

As wildlife and wildland conservation programs have multiplied and grown in size, conservation organizations have sought methods to improve strategic project planning, assessment of progress, cross-project comparison, learning of lessons, and transparency for donors. To address these challenges, major nonprofit organizations have collaboratively designed a set of decision-support tools for planning field projects and programs and for monitoring their progress, summarized in the “Open Standards for the Practice of Conservation” (<http://cmp-openstandards.org>). Use of these tools has allowed organizations to more clearly articulate strategies and their logic, define priority actions, critically assess success, manage adaptively, and derive lessons—all of which help to improve effectiveness. Students in this course explore a mutually reinforcing suite of these project tools: their underlying principles are introduced, students practice the techniques, and current case studies from field conservation are examined to explore tool utility. Students synthesize use of these design tools in a final project design focused on a single case study of their choice. The suite of decision-support tools covered includes situation (logic) models for project design, stakeholder assessments, threats and opportunities analysis, conservation target identification, and monitoring frameworks. Students gain experience in design of projects and their monitoring, as well as familiarity with budgeting. Evaluation is based on class participation, regular assignments, and a final project design paper. 3 Course cr

ENV 769b, Water, Sanitation, and Hygiene in Developing Countries

This course examines water, sanitation, and hygiene (WASH) programs in developing countries. The course primarily focuses on drinking water and sanitation interventions. Students study the roles of major international organizations alongside domestic policies. Students critically evaluate the evidence base for WASH interventions using both randomized controlled trials (RCTs) and observational methods, assessing the strengths and limitations of each approach. Readings draw from peer-reviewed academic articles and policy documents. Additional topics include financing mechanisms for WASH programs, equity concerns, and the implications of climate change for water security. Students leave equipped to interpret empirical evidence and inform real-world WASH policy and program decisions. 3 Course cr

ENV 771b, Fundamentals of Green Engineering and Green Chemistry

There is a broad desire to ensure that consumer products, manufacturing processes, and material and energy systems are compatible with public health and environmental sustainability. This course provides fundamental knowledge of the frameworks, methods, tools, and techniques of designing for sustainability. Through an understanding of conceptual contracts and application to real-world case studies, students learn the impacts of design on health (including toxic and ecotoxic effects) and the ways to ensure that new products, processes, and systems can be constructed through the principles of green engineering and green chemistry. This course provides the foundation for more advanced investigations in sustainable design; there are no prerequisites. 3 Course cr

ENV 773a, Air Pollution Control

An overview of air quality problems worldwide with a focus on emissions, chemistry, transport, and other processes that govern dynamic behavior in the atmosphere. Quantitative assessment of the determining factors of air pollution (e.g., transportation and other combustion-related sources, chemical transformations), climate change,

photochemical “smog,” pollutant measurement techniques, and air quality management strategies. 3 Course cr

ENV 775b, Federal Indian Law

This course covers the basics of federal Indian law. It does not address the substantive content of tribal law. Tribal law is a specialized study arising from the exercise of the legal authority that the tribes retain. This course is designed to lay the groundwork for a deep understanding of what kinds of sovereignty Indian nations may exercise within the framework of our legal system. Normally, courses of this type begin with an historical exploration of the foundations of the relations between Indian and non-Indian peoples. Instead, we begin with questions that are current and sketch out, roughly, where we are now. Typically, we start with cases pending before or recently decided by the Supreme Court. We use the Marshall Trilogy to build from the present back to the origins to see how the doctrines reflect the positive aspects of the legal expression of contact between Europe and the native nations of the Western hemisphere as well as the more malign aspects. We also situate the doctrinal evolution of federal Indian law with the struggle over colonialism as expressed in the insular cases. We do not neglect the history; it proves critical for understanding the ways in which federal Indian law is *sui generis* in domestic jurisprudence, but we see how that history is always haunted by the specter of colonialism, extra-legality, and finally, international legal norms. Every student must complete the discussion question requirements to sit for the examination or to submit a paper. 3 Course cr

ENV 783b, Making Regenerative Cities

This course is a research and design seminar with lectures delivered by a constellation of Yale and guest scientific researchers, scholars, teachers, designers, and engineers in collaboration with partners from science and industry, architecture and engineering practice, policymaking, and finance. The objective of the curriculum is the acceleration of system change across the urban building life cycle through the dissemination and uptake of scientific knowledge and the adoption of innovative implementation strategies in the emerging field of regenerative urban design, development, and resource management. Open to an interdisciplinary cohort of future change-makers in the fields of building design, and urban planning, policy, and governance, the seminar targets thinkers and doers from a range of disciplines and sectors who are uniquely positioned to translate cutting-edge science and novel approaches to design and policy development directly into everyday practice, all while recursively informing ongoing inquiry, research, and experimentation by industry and institutions of higher learning. By laying the groundwork for deeply synergistic relationships between terrestrial ecosystems and the construction economies and planning policies that inevitably draw upon them, the seminar explores means to create socially vibrant and healthy urban communities that simultaneously incentivizing the restoration and stabilization of landscapes that offer our cities invaluable ecosystem services. From silviculture to infrastructure, from material science to urban planning, the Regenerative Human Settlements seminar offers multiple entry points throughout complex material cycles and socioeconomic processes to catalyze innovative urban planetary solutions and spark system change. 3 Course cr

ENV 785a, Climate Change and Urban Nature Based Solutions in the Global South

Unprecedented rates of population growth in cities of the Global South, coupled with climate change-related risks, have led to challenges for urban resilience. Cities

in the Global South are exposed to unequal burdens of climate risks of heat waves, high humidity and flooding. Structural differences between northern and southern cities – including the lack of infrastructural, financial, and administrative capacities in many southern cities – shape unequal capacities for climate adaptation. Despite these differences, the substantial corpus of research on urban climate resilience emanates from the Global North. The purpose of this course is to study urban climate resilience in the Global South for more effective theory building as well as for context-specific, effective, and ultimately global action. Through student-led presentations, we wrap up each unit by delving into data analyses, comparisons, and case studies of cities and climate adaptation initiatives that have succeeded and failed on diverse parameters – in a range of urban contexts across Asia, Africa, and Latin America. 3 Course cr

ENV 793a, Climate Change, Societal Collapse, and Resilience Harvey Weiss
Collapse documented in the archaeological and early historical records of the Old and New Worlds, including Mesopotamia, Mesoamerica, the Andes, and Europe. Analysis of politico-economic vulnerabilities, resiliencies, and adaptations in the face of abrupt climate change, anthropogenic environmental degradation, resource depletion, “barbarian” incursions, or class conflict. 3 Course cr

ENV 800b, Energy Economics and Policy Analysis

This course examines energy policy issues that pertain to the environment, with a focus on providing tools for analyzing these issues. A primary objective is to apply economics to particular issues of energy markets, environmental impacts, investment in renewables, and other energy issues such as transportation and energy efficiency. We cover the economic and technical considerations behind a particular energy policy issue and then discuss a related article or case study. Prerequisites: ENV 512 (or equivalent background) and at least one course on energy. 3 Course cr

ENV 804b, Economics of Sustainability and Natural Resources

An introduction to the economics of natural resource use and the design of policies to promote sustainability. Topics include climate change, renewable resources (fisheries, forests, water), nonrenewable resources (oil, gas, minerals), and pollution control. 3 Course cr

ENV 805a or b, Seminar on Environmental and Natural Resource Economics

This seminar is based on outside speakers and internal student/faculty presentations oriented toward original research in the field of environmental and natural resource economics and policy. Presentations are aimed at the doctoral level, but interested master's students may enroll with permission of the instructors. 1½ Course cr

ENV 807a, Corporate Sustainability: Strategy and Management

This survey course focuses on the policy and business logic for making environmental issues and sustainability a core focus of corporate strategy and management. Students are asked to analyze when and how sustainability leadership can translate into competitive advantage by helping to cut costs, reduce risk, drive growth, and promote brand identity and intangible value. The course seeks to provide students with an introduction to the range of sustainability issues and challenges that companies face in today's fast-changing marketplace. It introduces key corporate sustainability terms, concepts, tools, strategies, and frameworks based on the overarching theory that the traditional profit-maximizing mission of business (often called *shareholder primacy*) is giving way to a new vision of *stakeholder responsibility* that still seeks to provide good

returns to the enterprise's owners but also acknowledges obligations to employees, suppliers, customers, communities, and society more broadly. The course combines lectures, case studies, and class discussions on management theory and tools, the legal and regulatory frameworks that shape the business-environment interface, and the evolving role of business in society. It explores how to deal with a world of diverse stakeholders, increasing transparency, and rising expectations related to corporate environmental, social, and governance (ESG) performance. Self-scheduled examination. 3 Course cr

ENV 811a, Pricing and Managing Sustainable Assets

This is an applied course on the metrics, indicators and tools used by businesses to implement strategically relevant Corporate Social and Environmentally Responsibility (CR) or Sustainability programs. The purpose of this course is to introduce students to the knowledge and tools used by practitioners in CR. Although this course explores details of the CR strategy implementation, it is designed to link CR to the overall business drivers and is therefore relevant for any potential corporate manager or consultant. Non-SOM students taking a YSOM course are assessed a fee for copyright charges. The fee is \$30 for a full-semester course and \$15 for a half-semester course. Students enrolled in either the YSOM course number or the cross-listed course number will be charged. 3 Course cr

ENV 814a, Energy Systems Analysis

This three-credit lecture course offers an overview of all aspects of energy systems and their interaction with society and the environment. The course provides students with a comprehensive theoretical and empirical knowledge base about energy systems in the world. This course describes and explains the basics of energy and the laws that govern it, the different components of an energy system (supply technologies, delivery systems, and demand), the institutions that govern the energy sectors, the role of energy in development, its impact on climate change, and an understanding of the key challenges of an energy transition towards a sustainable future. The course has a specific emphasis on electricity systems, how they are operated and governed, and how they have to be transformed to tackle climate change. Students receive a unique exposure to energy issues in the Global South. This course provides students with basic analytical tools and knowledge to formulate and solve energy-related decisions at an individual, national, and global scale and to understand and critique ongoing policy dialogues on energy and climate. 3 Course cr

ENV 816a, Electric Utilities: An Industry in Transition

The U.S. electric utility industry is a \$400 billion business with capital expenditures on the order of \$100 billion per year to replace aging infrastructure, implement new technologies, and meet new regulatory requirements. A reliable electricity infrastructure is essential for the U.S. economy and the health and safety of its citizens. The electric industry also has a significant impact on the environment. In the United States, electric power generation is responsible for about 40 percent of human-caused emissions of carbon dioxide, the primary greenhouse gas. Electric utilities in the United States are at a crossroads. Technological innovations, improving economics, and regulatory incentives provide a transformational opportunity to implement demand-side resources and distributed energy technologies that will both lower emissions and improve service to customers. Such significant changes could, however, disrupt existing utility business models and therefore may not be fully supported by incumbent utilities. This course

focuses on the issues, challenges, risks, and trade-offs associated with moving the U.S. utility industry toward a cleaner, more sustainable energy future. We explore how utilities are regulated and how economic factors and regulatory policies influence outcomes and opportunities to align customer, environmental, and utility shareholder interests to craft win-win-win solutions. 3 Course cr

ENV 820a, Urban Adaptation to Climate Change

This course explores how urban environments—from global hubs to peripheral communities—navigate the challenges of a warming world. We move beyond purely technical solutions to examine the social, political, and everyday dimensions of climate management. The semester begins by investigating the landscape of climate change adaptation policy and establishing a rigorous understanding of climate vulnerability. We analyze how local geographies and societies interact to produce uneven patterns of risk and how these factors determine the feasibility of policy interventions. A significant portion of the course is dedicated to bottom-up strategies, including individual adaptation in everyday life and the scaling of regenerative systems. By analyzing the movement of practice across scales—from shoreline housing to regional food systems—students learn to design integrated adaptation strategies that move toward transformational urban systems. 3 Course cr

ENV 821a, Environmental Policy Making: From Local to Global

This course focuses on policy making around environmental issues. We explore and analyze institutions at all levels of government, from community management of forests to global management of greenhouse gas emissions. We also explore a variety of environmental case studies. Students learn to examine issues and institutions through the lens of the actors involved, their incentives, and the information they have. The course includes a simulation taking place over multiple weeks at which students negotiate an international environmental agreement. 3 Course cr

ENV 824b, Environmental Law and Policy

This course provides an introduction to the legal requirements and policy underpinnings of the basic U.S. environmental laws, including the Clean Air Act, Clean Water Act, and various statutes governing waste, food safety, and toxic substances. Students examine and evaluate current approaches to pollution control and resource management as well as the “next generation” of regulatory strategies, including economic incentives, voluntary emissions reductions, and information disclosure requirements. This course investigates mechanisms for addressing environmental issues at the local, regional, and global levels, and explores the intersection between environmental and energy law and policy. Students gain an understanding of overarching legal and policy concepts, such as federalism, administrative procedure, separation of powers, environmental justice, judicial review, and statutory interpretation. 3 Course cr

ENV 834b, Environmental Economics and Policy

This is a course in environmental and natural resource economics and policy. It covers both general methodological principles and specific applications. Rather than serving as a standard course in environmental and natural resource economics, the material is tailored specifically to master’s students pursuing professional degrees in environmental management. The course therefore has a focus on environmental problem solving in the real world. Topics covered include, but are not limited to, evaluation of environmental policies (e.g., standards, taxes, cap-and-trade); cost-

benefit analysis and its critiques; nonmarket valuation (ecosystem services, revealed and stated preferences); discounting and macroeconomic perspectives on climate change; management of nonrenewable resources (oil, minerals, etc.); management of renewable resources (forests, fisheries, etc.); land and biodiversity conservation; the relationship between development, trade, and the environment; strategic incentives for international environmental agreements; and environmental behavioral economics. Prerequisite: ENV 512 or equivalent. 3 Course cr

ENV 835b, Seminar on Land Use Planning

Land use control exercised by state and local governments determines where development occurs on the American landscape, the preservation of natural resources, the emission of greenhouse gases, the conservation of energy, and the shape and livability of cities and towns. The exercise of legal authority to plan and regulate the development and conservation of privately owned land plays a key role in meeting the needs of the nation's growing population for equitable housing, energy, and nonresidential development as well as ensuring that critical environmental functions are protected from the adverse impacts of land development. This course explores the multifaceted discipline of land use and urban planning and their associated ecological implications. Numerous land use strategies are discussed, including identifying and defining climate change mitigation and adaptation strategies, including affordable housing, community revitalization, energy development and siting, equitable community engagement, transit-oriented development, building and neighborhood energy conservation, distressed building remediation, jobs and housing balance, coastal resiliency, and biological carbon sequestration. The course also explores how recent events impact these planning issues. The focus is on exposing students to the basics of land use and urban planning, especially in the United States but also internationally, and serving as an introduction for a YSE curricular concentration in land use. The majority of classes highlight guest speakers who are professionals involved in sustainable development, land conservation, smart growth, renewable energy, and climate change management. Some synchronized classes are held online to accommodate guest speakers around the country and outside of the US. 1½ Course cr

ENV 836a / ANTH 6841a / HIST 8160a / PLSC 7790a / SOCY 7170a, Agrarian Societies: Culture, Society, History, and Development Jonathan Wyrzten and Elisabeth Wood

An interdisciplinary examination of agrarian societies, contemporary and historical, Western and non-Western. Major analytical perspectives from anthropology, economics, history, political science, and environmental studies are used to develop a meaning-centered and historically grounded account of the transformations of rural society. Team-taught. 3 Course cr

ENV 838b, Life-Cycle Assessment

The increasing concerns about environmental pollution and resource challenges drive the development of sustainable solutions that can meet societal needs without compromising the environment or depleting the resources for future generations. Given many technological, behavioral, and policy options, it is challenging to determine which option best serves humanity and the environment. Life-cycle assessment (LCA) offers a systems approach to support these decisions. This course is an overview of life-cycle thinking, the fundamental theory of LCA framework, and practical applications in supporting real-world decision-making. Students learn state-of-the-art LCA tools,

industrial case studies, and advanced LCA methodologies. The course has an emphasis on systems thinking. It is appropriate for all M.E.M. specializations. Enrollment by application. 3 Course cr

ENV 839b, Climate Mitigation and Cities

This course investigates the intersecting drivers and forms of human mobility and immobility in a warming world. We examine how individuals navigate decisions to move or stay and how cities and national institutions plan for these demographic shifts. The seminar explores the intersection of migration, urban resilience, and national security, providing the governance tools necessary to manage climate-driven movement across scales. 3 Course cr

ENV 840a / GLBL 7170, Climate Change Policy and Perspectives

This course examines the scientific, economic, legal, political, institutional, and historic underpinnings of climate change and the related policy challenge of developing the energy system needed to support a prosperous and sustainable modern society. Particular attention is given to analyzing the existing framework of treaties, law, regulations, and policy—and the incentives they have created—which have done little over the past several decades to change the world’s trajectory with regard to the build-up of greenhouse gas emissions in the atmosphere. What would a twenty-first-century policy framework that is designed to deliver a sustainable energy future and a successful response to climate change look like? How would such a framework address issues of equity? How might incentives be structured to engage the business community and deliver the innovation needed in many domains? While designed as a lecture course, class sessions are highly interactive. Scheduled examination. 3 Course cr

ENV 850a, International Organizations and Conferences

This course focuses on the historic, present, and future roles of international environmental conferences. Through guest speakers, assigned readings, and discussions, students explore conferences including IUCN’s World Conservation Congress, the UN’s Convention on Biological Diversity, UNFCCC’s climate change conference, the UN Environment Programme (UNEP), and the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). Students, along with visiting alumni and guest speakers, discuss the roles and impacts of the various conferences in international environmental decision-making and the future of international conferences in a post-COVID world. The course also assesses the potential for improved equity, justice, and inclusion in international conferences, organizations, and their secretariats. Students attending fall conferences (in person or virtually) develop work plans to be completed during the conference under the guidance of their host delegations and the instructor. 3 Course cr

ENV 878a, Climate and Society: Past to Present

Seminar on the major currents of thought regarding climate and climate change; first looking at disaster—the social origins of disastrous events, and the attribution of societal “collapse” to extreme climatic events; then causality—the revelatory character of climatic perturbation, politics and the history of efforts to control weather/climate, and modern theories of environmental determinism; next history and culture—the ancient tradition of explaining differences among people in terms of differences in climate, and cross-cultural differences in views of climate; and finally knowledge—the study of folk knowledge of climate, local views of climatic perturbation and change, and storytelling and landscape. The course concludes with classes devoted to readings selected

by students, student presentations of term papers, and a lecture by the class TF/CA. The goal of the course is to examine the embedded historical, cultural, and political drivers of current climate change debates. This course counts towards Yale College requirements in social science and writing. It is open to graduate and undergraduate students. Enrollment capped. 3 Course cr

ENV 884a, Industrial Ecology

Industrial ecology studies (1) the flows of materials and energy in industrial and consumer activities, (2) the effects of these flows on the environment, and (3) the influences of economic, regulatory, and social factors on the flow, use, and transformation of resources. The goals of the course are to define and describe industrial ecology; to demonstrate the relationships among production, consumption, sustainability, and industrial ecology in diverse settings, from firms to cities to international trade flows; to show how industrial ecology provides scientific knowledge and essential assessment tools for developing a sustainable circular economy; and to define and describe tools, applications, and implications of industrial ecology.

3 Course cr

ENV 894a, Green Building: Issues and Perspectives

Our built environment shapes the planet, our communities, and each of us. Green buildings seek to minimize environmental impacts, strengthen the fabric of our cities and towns, and make our work and our homes more productive and fulfilling. This course is an applied course, exploring both the technical and the social-business-political aspects of buildings. Topics range from building science (hygrothermal performance of building enclosures) to indoor environmental quality; from product certifications to resilience (robust buildings and communities in the face of disasters and extended service outages). The purpose of the course is to build a solid background in the processes and issues related to green buildings, equipping students with practical knowledge about the built environment. Extensive use is made of resources from BuildingGreen, Inc., one of the leading information companies supporting green building and green building professionals. The course takes a “joint-discovery” approach with substantial emphasis on research and group project work, some fieldwork, and online individual testing. There are too many topics within green building to cover in one term, so the course is broken down into two sections. The first six weeks focus on the following topics, led by the instructor and/or an expert guest lecturer: building science, materials, indoor environmental quality, rating programs and systems, resilience, systems integration. The second half of the course focuses on selected topics driven by students and their particular interest/academic focus. The class meets once a week, with the instructor available to students that same day. Enrollment limited to twenty. 3 Course cr

ENV 898a, Environment and Human Health

This course provides an overview of the critical relationships between the environment and human health. The class explores the interaction between health and different parts of the environmental system including weather, air pollution, greenspace, environmental justice, and occupational health. Other topics include environmental ethics, exposure assessment, case studies of environmental health disasters, links between climate change and health, and integration of scientific evidence on environmental health. Students learn about current key topics in environmental health

and how to critique and understand scientific studies on the environment and human health. The course incorporates lectures and discussion. 3 Course cr

ENV 900a, Doctoral Student Seminar and Responsible Conduct of Research

The main objective of this course is to help first-year doctoral students build the knowledge, skills, and cohort for a successful Ph.D. at YSE. This is done through building a cohort of doctoral students, introducing key Yale resources, interacting with scientists at different career stages, and developing professional skills including scholarly writing and presentation of scientific material. The course involves guest speakers, group discussions, and peer-to-peer learning. Particular skills include time management, strategies for high productivity, scientific writing, oral communication, professional citizenship, peer review and constructive feedback, ethics, and mentoring. There are sessions with introductions to university resources such as Yale centers, offices, and programs that can provide support, resources, and opportunities for doctoral students. We also review the structure and policies of the YSE doctoral program. Students are encouraged to attend the YSE BIOMES seminars (Wednesdays, noon–1 p.m., Burke Hall) as we meet with many seminar speakers and other scholars for “Career and Journey of a Scientist” sessions in which a scholar shares their insights into doctoral studies, their career journey, and the scientific community. Some classes have an “Anything On Your Mind Session” as an opportunity for students to ask questions about their doctoral program, research, etc. This class is only open to YSE Ph.D. students, including joint doctoral students.

ENV 902a or b, Environmental Anthropology Colloquy

A biweekly seminar for students in the combined YSE/Anthropology doctoral program. Presentation and discussion of grant proposals, dissertation prospectuses, and dissertation chapters; trial runs of conference presentations and job talks; discussion of comprehensive exams, grantsmanship, fieldwork, data analysis, writing and publishing, and the job search; and collaborative writing and publishing projects. One course credit/pass-fail. 3 Course cr

ENV 908a, Urban and Environmental Economics Mushfiq Mobarak and Mark Rosenzweig

A Ph.D. field course covering latest research topics in urban economics and in environmental and energy economics. Topics include the links between urban planning and city productivity and livability, infrastructure investments in electrification and water management, managing externalities, environmental regulation, and the effects of climate change in cities and in rural areas. Prerequisites: First-year Ph.D. economics courses in microeconomics, macroeconomics, and econometrics (or equivalent), or instructor permission. 3 Course cr

ENV 953b, Sustainable Business Capstone Consulting Clinic

This course provides a ‘capstone’ experience; an opportunity to consult to start-up and established organizations confronting real-life challenges at the intersection of business and environmental sustainability. The course is designed for you to apply tools and insights gained in this and other courses to a defined project, creating deliverables that will be useful to the executives leading their organizations. This course is designed to help prepare anyone who wishes to become a consultant after graduation; though it is also intended to be useful for those that intend engaging *with* consultants in their career post-Yale. In short, there is hopefully something in it for many of you! The brief from the client will be topical and relevant to challenges and opportunities faced

by the organization, and the clients will be on hand to provide insight and guidance throughout the term. 3 Course cr

ENV 954a, Management Plans for Protected Areas

A seminar that comprises the documentation of land use history and zoning, mapping and interpretation, and the collection and analysis of socioeconomic, biological, and physical information for the construction of management plans. Field skills are gained in assessing soils, hydrology, vegetation, and wildlife habitat. Plans are constructed for private small-holders within the Quiet Corner Initiative partnership managed by the Yale School Forests. In the past plans have been completed for the Nature Conservancy; Massachusetts Trustees of Reservations; town land trusts; city parks and woodlands of New Haven, New York, and Boston; The National Park Service, and the Appalachian Mountain Club. Ten days fieldwork. Must also take ENV 957 in same semester. Prerequisite: ENV 659b, 660a, or permission of the instructor. 3 Course cr

ENV 955a or b, Seminar in Research Analysis and Communication in Forest Ecology

A seminar for students in their second year working on research projects. Students start by working through the peer-review publication process. They identify the scope and scale of the appropriate journal for their work. They then work on their projects, which comprise data and projects in applied forest ecology. Discussions involve rationale and hypothesis testing for a project, data analysis techniques, and reporting and interpretation of results. It is expected that manuscripts developed in the course are worthy of publication and that oral presentations are of a caliber for subject-area conferences and meetings. Students are expected to present at a conference and at YSE Research day. Extensive training in writing and presenting work is provided. This course qualifies for project work for the M.E.Sc./M.F.S. and as the capstone for the M.F. degree Prerequisite: ENV 659 or permission of the instructor. 3 Course cr

ENV 956b, Strategies for Land Conservation

This is a professional seminar on land conservation strategies and techniques, with particular emphasis on the legal, financial, and management tools used in the United States. The seminar is built around presentations by guest speakers from land conservation organizations and in-class discussion to further explore the content. Speakers present on topics critical to land conservation practitioners: acquisition, funding, stewardship, and key strategic issues facing land conservation today. Tools discussed include: basics of real estate law, types of conservation finance, and approaches to organizational management. Students undertake a clinical project with a local land conservation organization. Enrollment limited to twenty-five; preference to second-year students if limit reached. 3 Course cr

ENV 957a, Field Skills in Land Stewardship

A seminar that comprises the documentation of land use history and zoning, mapping and interpretation, and the collection and analysis of socioeconomic, biological, and physical information for the construction of management plans. Field skills are gained in assessing soils, hydrology, vegetation, and wildlife habitat. Plans are constructed for private small-holders within the Quiet Corner Initiative partnership managed by the Yale School Forests. In the past plans have been completed for the Nature Conservancy; Massachusetts Trustees of Reservations; town land trusts; city parks and woodlands of New Haven, New York, and Boston; The National Park Service, and

the Appalachian Mountain Club. Ten days fieldwork. Must also take ENV 954 in same semester. Prerequisite: ENV 659b, 660a, or permission of the instructor. 3 Course cr

ENV 959a, Clinic in Climate Justice and Public Health

In the course, interdisciplinary student teams carry out applied projects at the intersection of climate justice, law and public policy, and public health. Each team works with a partner organization (e.g., state agency, community organization, other nongovernmental organization) to study, design, and implement a project, typically through community-based participatory research practices. The course affords the opportunity to have a real-world impact by applying concepts and competencies learned in the classroom. This course should be of interest to graduate and professional students across the University and is open to Yale College juniors and seniors. In addition, this course is one of the options available to students to fulfill the practice requirement for the M.P.H. degree at YSPH and the capstone requirement for the M.E.M. degree at YSE. Students who plan to enroll must complete an application, which will be used to match each student with a clinic project. Check the course's Canvas site or contact the instructor for more information. Prerequisite: EHS 547 or permission of the instructor. Not open to auditors. 3 Course cr

ENV 966a, Sustainability Implementation: Change Management in Institutional Settings

Yale's formal sustainability efforts are nearing the two-decade mark, with the Office of Sustainability established in 2005, but the work to make the campus more sustainable has been going on far longer. From sending food scraps to pig farmers in the 1800s, to responding to energy crises and crashes with infrastructure changes, to establishing early recycling programs in the 1980s, the University's work has deep roots, if not always the comprehensive impact some would desire. This YSE Capstone course provides students with the opportunity to learn about this long history of effort to improve the University's sustainability and engage in the real act of change management in current efforts on campus. Exploring change management theory and learning from many on campus experts, students work in groups, bringing a diversity of experiences and knowledge to the table to tackle real and wicked problems in our midst. In taking on these timely projects, students have the opportunity to tangibly impact Yale's ongoing efforts to fully embrace sustainable operations while experiencing the friction, joy, disappointment, learning, and challenge that are all part of working to make real change happen. 3 Course cr

ENV 971b, Land Use Clinic

The Land Use Clinic gives students the opportunity to explore a variety of specific land use topics that are of current concern and relevance to the field, to the curriculum, and to society, including renewable energy, natural resources, rural-based land uses, watershed management, agriculture, and sustainable urban planning. In our rapidly changing political environment, strategies that focus on the local level are increasingly more important to achieving our global sustainability goals. Students work with the clinic professor and practitioners in the field to develop papers, research memoranda, and publications on a selected topic. The clinic professor and guest speakers conduct skill-based workshops focused on the tools and techniques needed to pursue a career in community land use planning. Some synchronized classes are held online to accommodate guest speakers around the country and outside of the U.S. The clinic includes a field trip over spring break and is available by application only. 3 Course cr

Modules

ENV 001a, Self to System

Students work to gain the tools needed to thoughtfully design and maximize an impactful path through YSE, Yale University, and to their careers and lives beyond Yale. Students work through their own personal motivations and variety of lived experience. This MOD is designed to help students appreciate themselves and those around them and prepare them to maximize their time at YSE. o Course cr

ENV 002a, Science to Solutions

Students work to understand different strategies for knowing how to collect primary data; how to evaluate evidence; how to generate, visualize, and communicate alternative solutions; and how to iterate, monitor, and adaptively manage solutions. Students then opt into one of two pathways: A New Haven experience or Yale-Myers Forest experience. o Course cr