

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 2023–2024 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, Human Science Foundations for Environmental Managers

The environmental fields of inquiry that focus on human behavior, culture, governance, and history have matured and proliferated in the twenty-first century (environmental anthropology, environmental sociology, environmental governance, environmental history, environmental humanities, and more). This new scholarship has advanced the academic state of knowledge and sharpened our collective ability to understand human-environmental relations. Yet despite better science, we struggle to make material change in the collective rate of human consumption of Earth's natural resources. Not only is the planet harmed by our failures, but millions of people are also harmed. Embedded in all scientific endeavors is a theory of change. But rarely are theories of change made explicit for environmental stewardship. In this course, we investigate new bodies of scholarship that explore relational values, varying concepts of stewardship, a range of theories of change, and, finally, capabilities or human rights-based measure of the life well lived. We explore the following questions: What does it mean to be an environmental steward in a world filled with social, political, and economic inequalities? How can we weave together multiple knowledge systems or ways of knowing through environmental stewardship? How can we balance the need for social and environmental change in a way that is both place-based and responsive to global concerns? Can theories of change help us act when the scientific data is both clear and uncertain? How can we incorporate non-economic measures of human well-being into our decision making? 1½ Course cr

ENV 550a, Natural Science Research Methods

The course prepares students to design and execute an intensive research project. It covers elementary principles and philosophy of science; research planning, including preparation, criticism, and oral presentation of study plans; communicating research findings; limitations of research techniques; the structure of research organizations; and professional scientific ethics. 3 Course cr

ENV 551a, Qualitative Inquiry and Environmental Human Sciences

Qualitative research is a robust and reliable means of knowledge production and is central to exploring questions of the human condition. As an approach to understanding the human-nature nexus, qualitative research prioritizes multiple ways of knowing the world (epistemology), engages with philosophical concerns about how can we know what is "truth" (ontology), and ultimately seeks to design better futures (a normative endeavor based in values or axiology). The tools we explore include 1) oral methods (interviews, life histories), 2) text-based methods (archival research and document or textual analysis), and 3) participatory methods based on observation and knowledge co-production. Students learn how to interpret and analyze qualitative data, as well as evaluate the claims made by qualitative researchers. The course is intended for doctoral students who are in the beginning stage of their dissertation research, as well as for MEd students developing research proposals for

their thesis projects. Advanced undergraduate students are welcome. The final project for this course is a research proposal and annotated bibliography. While we discuss the value of mixed methods, this course *does not* cover quantitative approaches such as survey research, econometrics, Q methodology, spatial analysis, or social network analysis. 3 Course cr

ENV 553a, Perspectives: Environmental Leadership

The course is intended to offer a common experience and exposure to the variety of perspectives represented by YSE faculty and guest experts on the challenges and opportunities of environmental management. This year's theme is Environmental Leadership, and over the term we create and foster a leadership toolkit and systems-thinking appreciation that enable first-year M.E.M. students to map out and maximize an impactful path through Yale, their careers, and their lives. 3 Course cr

ENV 561b, Energy Justice Seminar

Energy justice refers to the goal of achieving equity in the social and economic participation in the energy system, while also remedying social, economic, and health impacts on those disproportionately harmed by the energy system. This seminar-based course provides students with exposure to the latest thinking in the burgeoning field of energy justice. As this is an inherently interdisciplinary area, this course draws from multiple disciplines, including, but not limited to, law, sociology, anthropology, and economics. It covers topics relating to energy justice in the areas of policy and regulation, community advocacy, legal implications, health implications, and private sector interactions. 1½ Course cr

ENV 568a, Overshoot: The Environmental and Policy Implications of Exceeding 1.5°C

Despite dire warnings from the IPCC and earnest pledges of various governments and other institutions, including Yale, humanity is likely to surpass 1.5°C early in the next decade and 2°C by midcentury, placing us in the dangerous realm of temperature “overshoot.” This course starts by examining our likely climate trajectory, relying heavily on recent IPCC reporting including the AR6. We then delve into the toolkit of climate responses that would become relevant in an Overshoot Scenario – not merely mitigation and adaptation but also negative emissions technologies and strategies to reflect incoming sunlight. After exploring the technological, economic, and political feasibility of these potential interventions, we close by considering their governance requirements, ethical implications, and the impact of public perception on policy options. The entire course is framed via the lens of the Global Commission on Governing Risks from Climate Overshoot, an independent group of eminent global leaders assembled in 2022 to recommend strategies to reduce risks should global warming goals be exceeded. The Commission is scheduled to deliver its report in to the UN General Assembly in September 2023. We examine the report in detail and arrange dialogue (likely via Zoom) with members of the Commission and/or its Secretariat. A possible field trip to Manhattan to observe the report's initial presentation is explored (but cannot be assured). Prerequisite: This is intended as a second-level course for students who have already taken an introductory course on climate studies including: EVST 100, ENV 614, ENV 630, ENV 636, ENV 716, ENV 800, ENV 814, ENV 840, and ENV 878. 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 581a, Transportation and Climate Change

Transportation is the fastest-growing contributor to greenhouse gas emissions, worldwide, but has often been considered the most challenging sector to decarbonize. In this course, we critically analyze a range of policies to improve fuel economy, promote electric vehicles, and reduce vehicle travel. We briefly consider the range of infrastructure and policy changes that can reduce greenhouse gas emissions from transportation. But we spend more time on the question of how these changes can be implemented and the tradeoffs between emission reductions, equity, safety, and other policy goals. The course has a US focus, but we bring in examples from other contexts from time to time. 1½ Course cr

ENV 584a, Applications of Industrial Ecology

Industrial ecology (IE) is an interdisciplinary environmental field that blends environmental and social science, engineering, management, and policy analysis. IE is centered on the study of physical resource flows through systems at different scales. The unusual name “industrial ecology” stems from an analogy made with biological ecosystems and borrows from it on several fronts, such as its focus on resource cycling, multi-scalar systems, resource and energy stocks and flows, and food webs. Increasingly, industrial ecology contributes insights into environmental management and policy on issues ranging from industrial waste to global climate change. This is a survey course that combines basic introductions to industrial ecology tools and concepts with examples of their use in environmental policy and management. 1½ 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 595a or b, *Yale Environment Review*

The *Yale Environment Review* is a student-run publication that aims to increase access to the latest developments in environmental studies. We aim to shed light on cutting-edge environmental research through summaries, analysis, and interviews. During this one-credit course, students produce one or two articles on subjects of their choosing for publication on the *YER* website. Please refer to our website and Canvas for an overview of the different types of content that *YER* produces. Students receive coaching to improve their writing skills, and their work goes through a rigorous editing process.

Participation in *Yale Environment Review* helps students sharpen their writing skills and familiarize themselves with science communication, and it provides a platform to showcase their expertise.

ENV 598b, Documentary and the Environment

Survey of documentaries about environmental issues, with a focus on *Darwin's Nightmare* (2004), *An Inconvenient Truth* (2006), *Food, Inc.* (2009), *GasLand* (2010), and related films. Brief historical overview, from early films such as *The River* (1937) to the proliferation of environmental film festivals. 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 603a, Environmental Data Visualization for Communication

Welcome to the Information Age! It is now much easier to generate and access more data than ever before. Yet, our ability to manage, analyze, understand, and communicate all this data is extremely limited. Visualization is a powerful means of enhancing our abilities to learn from data and to communicate results to others, especially when informed by insights into human behavior and social systems. Developing the quantitative skills necessary for analyzing data is important, but for addressing complex and often urgent environmental problems that involve diverse audiences: understanding how to effectively communicate with data is equally essential for researchers, policymakers, and the public alike. This course is for students who wish to gain an understanding of the principles, tools, and techniques needed to communicate effectively with data. The course primarily uses the programming language R. Students are required to demonstrate basic proficiency in this software before or during the course. Resources for learning R are provided. Classes consist of short lectures about principles of design, data preparation, and visual communication, discussions about examples from the news and scientific literature, guest lectures, peer critiques, and hands-on individual and collaborative group activities. Throughout the semester, we use Excel, PowerPoint, R, Tableau, and other tools to develop visualizations using diverse datasets. Students also work with a dataset of their own choice or from a partner organization to develop a final project consisting of a poster, infographic, report, dashboard, story map, or related product. Enrollment is limited and application is required. 3 Course cr

ENV 605a, Environmental Risk Communication

Risk communication is a critical but often overlooked part of how organizations identify and manage risks. Effective risk communication can help people understand risks and determine appropriate responses to them. It should help people to take seriously risks they might otherwise ignore (e.g., to get vaccinated or evacuate from a coming hurricane), or to understand that certain activities do not pose significant risks. Effective risk communication enables environmental professionals to communicate information in a way that is understood and accepted by different stakeholders (e.g., the public, industry, government leaders, etc.) and allows the participation of these stakeholders in risk management decisions. This course provides an overview of the theory and practice of effective communication about environmental and health risks to

diverse stakeholders. Students are expected to actively participate in class discussions, drawing upon assigned readings, lectures, and videos. 3 Course cr

ENV 608b, Our Air, Our Health

Exposure to air pollution is a leading contributor to the global disease burden. This course discusses major emission sources, atmospheric transformation and transport, measurement and modeling techniques for human exposure assessment, and the health impacts of air pollutants. Emphasis is placed on students gaining hands-on experience with measurement (e.g., low-cost sensors, passive samplers) and spatial analysis tools (e.g., ArcGIS) for application to research, public health practice, and community engagement. Through a series of laboratory sessions, students quantitatively characterize indoor and outdoor exposure concentrations and learn methods to critically assess data quality. The public health implications of air pollutant exposure are examined through review of recent epidemiological and toxicological research. The course discusses inequitable distribution of air pollutant exposure across the United States in relation to environmental health disparities. The health benefits of air pollutant intervention strategies in developed and developing regions and implications for policy action are also covered. 3 Course cr

ENV 610a, Managing Ecosystems for Climate Change Solutions

This course explores how natural climate solutions (i.e., actions to protect, better manage and restore ecosystems) can mitigate climate change. It also assesses the challenges and barriers that must be overcome in order to make natural climate solutions more sustainable. During the course, students are exposed to concepts about how the conservation and management of natural and anthropogenic terrestrial ecosystems (e.g., conservation of natural ecosystems, forest and agriculture management, and restoration of degraded areas) have influenced the carbon and water cycles, two important climate services provided by terrestrial ecosystems. Students also address some of the potential socio-ecological consequences of nature-based solutions, with a focus in the tropics. Finally, the course covers some of the main challenges and opportunities for scaling up carbon natural climate solutions. 3 Course cr

ENV 613b, Writing as a Public Scholar

Environmental scholars and practitioners increasingly recognize the need, and often have the desire, to communicate their passions and expertise to a wide lay audience. The seminar starts from the premise that to do this effectively requires a mastery of written storytelling, particularly in today's saturated and fractured media landscape. Students read popular works by classic and contemporary scholars, such as Rachel Carson and Richard Prum; practitioners in the sciences, such as Atul Gawande and Peter Wohlleben; and journalists such as Elizabeth Kolbert and John McPhee; as well as a growing number of authors, such as Bill McKibben, whose work crosses these categories. Students analyze some pieces multiple times, developing an increasingly nuanced understanding of storytelling technique. 3 Course cr

ENV 617b, Real-World Environmental Data Science

The goal of this course is to provide students with a foundational understanding of what it takes to perform environmental data work in a practical, professional setting. To make sound policy decisions, we need data, and the reality is that data is often messy, difficult to find, and incomplete. In order to effectively leverage the data, students need to be able to troubleshoot when there is a problem. We focus on understanding the mechanics and nuances of working with messy data in the professional setting, not

teaching statistics. We provide a high-level explanation of methods, what they tell us, and how they are useful, and then focus on implementation. 3 Course cr

ENV 618b, Anthropology of Smallholder Agriculture in Developing Countries

The premise of this course is that small-scale agriculture, its distinctive economic character, and its ecology shape each other in important ways. The course explores smallholder farming in the developing world through ethnographies. 3 Course cr

ENV 619a, Philosophical Environmental Ethics Stephen Latham

This is a philosophical introduction to environmental ethics. The course introduces students to the basic contours of the field and to a small number of special philosophical problems within the field. No philosophical background is required or expected. Readings are posted on Canvas and consist almost entirely of contemporary essays by philosophers and environmentalists. 3 Course cr

ENV 623a, The Role of Methane in Global Climate Disruption: The Search for Solutions

In this course students develop methane literacy, reviewing evidence from primary literature to understand the methane cycle and how it impacts the global climate system. Students read primary scientific literature, contribute questions/topics for discussion, and map the provenance of research. Meeting time is used for presentations and discussions. Enrollment is limited to twenty-five. 3 Course cr

ENV 624a, The Science, Policy, and Management of GHG Removal Strategies

In order to avoid the worst effects of climate change, there is growing interest in the advancement of greenhouse gas (GHG) removal from the atmosphere as a complementary strategy to emission reductions. This interdisciplinary seminar covers the science, policy, and management of a broad range of GHG removal strategies. What are they? What is the current scientific basis? What are their potentials? And how might policy, markets, and institutions promote or impede GHG removal? While the seminar covers a set of nature-based climate solutions, we also consider more engineered approaches, along with original research related to advancing new technologies and program evaluation. The seminar is organized around readings in the primary literature with weekly student presentations and discussion. 3 Course cr

ENV 625b, Writing Workshop

This course is aimed at helping students improve their writing. The goal is to develop writing skills and make students better able to communicate their work and ideas through writing that is clear, accessible, and free of jargon. Students are required to write every week throughout the course: short assignments (600–800 words) each week, and one longer assignment (1,500–2,000 words) due at the end of the term.

1½ Course cr

ENV 626a, Writing for Publication in the Natural Sciences

This course is intended to give students insights into the process of writing natural science manuscripts. The seminar 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 cleaned and analyzed data that they want to write up for publication.

ENV 630b, The Physical Science of Climate Change

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 631a, Poverty, Environment, and Inequality

This course explores the relationship between poverty, environment, and social inequality. It examines how race and class interact in American rural and urban environments to produce or sustain inequalities. The course examines how structural factors and community characteristics influence environmental outcomes. Students begin by examining the relationship between degraded environments and poor schooling. They examine the environmental hazards that exist in or adjacent to urban and rural public schools. Students will analyze inner-city and poor rural communities as they examine disinvestment, the concentration of poverty, efforts to disperse the poor, and the potential for community revitalization. Students examine homelessness and the ways in which climate disasters impact housing experiences. The course also examines another aspect of poverty: the issue of food security; it looks at the rise in community gardening in poor communities as an attempt to combat lack of access to healthy food. Students examine residential segregation and zoning and study the spatial inequalities that arise from the siting of hazardous facilities in minority and low-income urban and rural communities. The course examines the classic environmental justice question: which came first the facilities or the people? It examines economic questions related to costs of hosting noxious facilities and if and how communities can seek compensation to host such facilities. The course also examines the quandary communities face when presented with economic models that seek to provide compensation – the question of the long-term health of the people and environment takes center stage as community residents seek to determine how to balance economic development with concerns about sustainability. Students analyze water, energy, and climate justice. 3 Course cr

ENV 632a, Social Entrepreneurship Lab

Have you ever wondered what it would be like to practice social entrepreneurship? You don't have to found your own company to make a difference. Everyone can learn from the social entrepreneurship mindset and skillset, and apply it in their own way to create social impact. In this course, we combine theory and practice, applying a systematic framework to guide students through the social entrepreneurship experience. We start by identifying a social or environmental challenge each student is interested in tackling. Students form interdisciplinary teams to immerse themselves in characterizing the challenge, ideating potential solutions, and building business models around those solutions. Social Entrepreneurship Lab is a safe space to experiment, iterate, prototype, test, and fail. You don't need to launch your venture, though some teams will. You'll meet alumni who launched new ventures and social entrepreneurs from New Haven and around the world. All students are welcome; no prior experience necessary. 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 635b, Renewable Energy Project Finance

The course is intended to be a practicum, exposing students to real-world tools of the trade as well as the theory underlying them. In place of a textbook, students are provided with approximately 400 pages of actual project documents used for a U.S. wind energy project constructed relatively recently. Through weekly homework assignments, students develop the skills necessary to construct a detailed financial model, largely comparable to what would be used by an investment firm, project developer, or independent power producer. Modeling skills include sizing debt capacity, sensitivity analysis, stochastic forecasting, taxes, and the creation of financial statements. Lectures also provide an introduction to risk management, energy market dynamics, alternative contractual structures, financial structuring, and the core engineering and risks inherent in the most common renewable energy technologies. This course is entirely online. While cross-listed at the School of Management, it follow the YSE academic calendar. Admission requires an application consisting of a one-paragraph statement of interest. The application is available on Google Forms and can be submitted at <https://forms.gle/YHEM8fWh75f3AwmYA> 3 Course cr

ENV 641a, Market-Based Mechanisms for Water Management

This course provides students with both the theory and application of environmental water transactions (EWTs) to water management challenges, such as river restoration, drought-mitigation, and agricultural allocation. The geographic focus is primarily the western United States, as this region, out of necessity, has been very active in implementing EWTs in recent years. Other market-based mechanisms for water management also are explored, such as groundwater mitigation banks, urban stormwater markets, and water quality markets. The course also covers considerations such as environmental justice, tribal access to and use of water, and diversity/equity/inclusion in water management. A final project gives students the opportunity to develop a simple hydrological and water rights model for a fictional watershed to use as the basis for designing a suite of water transactions and market-based water management solutions. This is an online course taught by experienced professionals who value a hands-on approach to learning. In addition, the course features discussion of current events in water, case studies, and guest lectures from practitioners actively using market-based mechanisms for water management. 3 Course cr

ENV 642a, Environmental Justice/Climate Justice

In this course, we focus on the evolution and development of the environmental justice movement. We pay particular attention to its embrace of climate justice, and we ask what conception of justice is at play in both the environmental justice and climate justice movements. We begin with a legal and social-historical survey but quickly bring the inquiry up to the current moment. We explore the legal and policy developments that have followed the environmental justice critique. 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 646a, Foundations of Agriculture and Environment

Agricultural systems have a profound impact on the environment, but also depend on environmental processes—such as climate and nutrient cycling—for continued productivity. Because of this two-way relationship, there has been a growing integration of environmental and agricultural sciences over the past several decades with growing recognition that designing and implementing agricultural systems that minimize environmental harm and benefit people is necessary to sustainable development. This course provides foundational knowledge of how agricultural and environmental systems are linked. The goal is to provide theoretical understanding of the important environmental and human processes, as well as practical experience interpreting these processes and applying them to real-world scenarios. 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.

ENV 654a, Structure, Function, and Development of Trees

This course focuses on two aspects of plant life: (1) basic processes that drive plant development, such as seed formation, germination, seedling establishment, maturation, and senescence; and (2) basic structure and function of plants (such as root systems, leaf formation and development, height, and diameter growth). Differences between

different groups of seed plants are analyzed from structural, functional, ecological, and evolutionary standpoints. Special attention is given to woody plants and their importance in the biosphere and human life. Coverage includes tropical, temperate, and boreal trees. Plant biology is discussed in the context of physiological and structural adaptations in terms of strength, storage, and water and solute transport. 3 Course cr

ENV 656b, Tree Physiology and Ecophysiology

Mineral nutrition and cycling, mycorrhizas, symbiosis, nitrogen fixation, light processing, photosynthesis, respiration, water relations including transpiration, and ecophysiology are covered. The interaction of photosynthesis with water relations, mineral nutrition, temperature, and environmental stress is discussed. Effects of climate changes on forests, past and present, and other current topics are also considered. Term paper required. 3 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

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, fire protection, and others. Through readings, lectures, and discussions we explore forest development processes and pathways, concentrating on the driving mechanisms and emergent properties including natural and human disturbances. This course is a core component of the M.F. degree but is explicitly designed to be accessible to anyone interested in an in-depth exploration of forest ecosystems. 3 Course cr

ENV 671a, Temperate Woody Plant Taxonomy and Dendrology

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 North American forest species. In addition, students learn the morphological and ecological traits used for field identification of woody plants. We use phylogenetic systematics as the structure for understanding the evolutionary history and relationships between species. Class periods consist of practical field and laboratory skills used in plant taxonomy and field lecturing. Weather permitting, we are in the field for the majority of class periods. We use an ecosystem focused approach for plant identification. Besides learning how to identify species, we discuss principles of plant ecology, biogeography, and natural history in each of the ecosystems we visit. Limited to thirteen. 3 Course cr

ENV 674b, Forest Ecosystem Health

This course is an introduction to the biotic and abiotic agents affecting the health of forest ecosystems and forest sustainability, including insects, pathogens, parasites, climate change, and other large-scale disturbances, and includes the consideration of linkages between forest health and human health. Using a case-study approach, several different forest types are examined in detail, with students interacting with research and management professionals who visit the class in person or via remote conferencing. Students learn concepts and methods of assessing forest health, as well as some of the challenges in describing and defining forest health. The course emphasizes the ecological roles played by disturbance agents (both biotic and abiotic), discusses how they affect the health and sustainability of forest ecosystems, and identifies when and how management can be used to improve forest health and/or forest sustainability to manage or mitigate disturbance agents such as invasive pathogens and insects. The course provides students with the necessary background to determine how different stressors may negatively impact management objectives, to identify the probable stress agents, and to decide what, if any, actions should be initiated to protect forest health and sustainability. The course includes several field trips and workshops on the weekends. 4 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 Finance

Understanding the tools used in financial analysis is an important component of successful forestland investment and forest management decision-making. This course provides students with a basic suite of financial tools used in the acquisition and management of forestland/timber. It includes an overview of traditional financial analysis metrics used in land acquisition, timber management, and risk management, as well as topics related to supply and demand for forest products, international timberland investment, and emerging trends in forestland investing. The first eight weeks of the course are in lecture format, and the remainder of the course is a case study/project that gives students an opportunity to apply their knowledge in the analysis of an actual “deal.” 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 704a, Workshop on Remote Sensing and Photogrammetry with Drones

A workshop that explores the current state and future outlook of remote sensing with unmanned aerial vehicles (UAVs or drones) for environmental monitoring. UAV-based remote sensing is a rapidly developing field in environmental science and technology. Versatile and inexpensive, it has the potential to offer solutions in a wide range of applications, such as forestry inventory, precision agriculture, flood hazard assessment, pollution monitoring, and land surveys. The class meets once a week for three hours. The workshop is divided into three parts: (1) reviewing the state of the technology on UAV types, sensor configurations, and data acquisition methods; (2) exploring GIS and remote-sensing software tools for analyzing super-high-resolution spectral data acquired by fixed-wing drones; (3) cross-validating drone products against Lidar data and satellite imagery. Students may also have the opportunity to participate in drone flight missions. Data analysis, presentation, literature critique, field trips. Prerequisite: ENV 726 or equivalent experience. 3 Course cr

ENV 708b / ENAS 640b, Aquatic Chemistry Jordan Peccia

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 709b, Lectures, Discussions, and Applications of Soil Science

Topics cover the structure and functioning of soils, and how this relates to soil fertility, carbon accounting, climate feedbacks, and ecosystem function in a changing environment. 3 Course cr

ENV 712a, Water Management

An exploration of water management at scales ranging from local to global. The course looks at multiple dimensions of the water crisis, including both human and ecosystem impacts; quantity and quality problems; and infrastructural and institutional 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, rocky shores, seagrass meadows, 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 nutrient enrichment, hypoxia, sea-level rise, invasive species, over-fishing, chemical pollution, marsh drowning, and wetland filling. 3 Course cr

ENV 723a, Wetlands Ecology, Conservation, and Management

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 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 linear regression. The second part of the course introduces the topics of multiple regression and ANOVA that are typically not covered in an introductory class such as AP statistics. There are weekly problem sets, 2 exams, and a final project. Assignments require use of Minitab, SPSS, or R. This course is a prerequisite for other statistics courses offered through YSE, and

it presents statistical methods used in many Yale courses in both the natural and social sciences. Three hours lecture. 3 Course cr

ENV 730b, Environmental Data Science in R: Understanding Methane Dynamics

Over a 100-year timeframe CH₄ is 28–34 times more effective at trapping heat in the atmosphere compared to an equivalent mass of CO₂ and accounts for # 42 % of warming since the pre-industrial period (IPCC, 2021). To date we have caused about 1.3°C of warming, and with this we have observed changes in the productivity of natural and managed ecosystems and an increase in extreme events that could lead to further increases in carbon (C) emissions (IPCC 2021). To prepare for an uncertain future, we are looking to understand how surface processes influence atmospheric composition of CH₄ by developing dynamic models. In this course we work with different data sources to design models that allow us to evaluate CH₄ dynamics in natural ecosystems. Enrollment is limited to fifteen. 3 Course cr

ENV 736a, Impacts of Climate Change on Freshwater Ecosystems

This course is a graduate-level ecology course on impacts and responses to global change, especially climate change, of freshwater ecosystems, including lakes, rivers, and wetlands. The course provides an overview of several major global change threats, such as pollution, emerging diseases, hydrologic alteration, species introductions, urbanization, and land-use change, which gives context to the relative importance of climate change as a global-change driver in freshwater ecosystems. The course then covers changes in the hydrologic cycle, temperature, and extreme events attributed to climate change and their impacts in different settings where freshwater ecosystems occur. The course also covers the ecosystem services provided by freshwater ecosystems, how they are threatened by global change, and strategies for mitigating and adapting to these threats. 3 Course cr

ENV 738a, Wildlife Movement Ecology

On a crowded planet, wildlife must navigate multiple forces to guide their movement. Through a flipped and interactive classroom, students evaluate and model drivers of animal movement across different spatial and temporal scales as well as draw connections to human societies and landscape histories. 1) prerequisites will be required (General Ecology, Statistic course with R programming), 2) access to GIS lab needed 3 Course cr

ENV 742b, Fundamentals of Working with People

Environmental scientists and environmental managers are working to transform environmental outcomes by changing institutional and human behavior. Research indicates time and time again that teams are important for tackling these important challenges. From developing research projects to building a business or NGO, teams can lead to better, more efficient output because they incorporate various perspectives and benefit from a wider range of skill sets. But developing and deploying effective teams is an art and a science, full of its own challenges. It requires a deep understanding of self, including one's own strengths, blind spots, priorities, and needs. It also requires reflection, empathy, communication, and collaboration. This course aims to introduce students – particularly scientists and environmental managers – to the theory and practice of team management. Through a series of lectures, simulations, reflections, discussions, and exercises, students will increase their ability to: (1) Understand themselves and other individuals; (2) Form and lead diverse teams; (3) Influence the

actions of the organizations within which they are working; (4) Collaborate with others affecting the resources about which they care. 3 Course cr

ENV 744b, Conservation Science and Landscape Planning

This advanced course applies ecological principles to understand and manage biodiversity and attendant ecosystem functioning and services in the anthropocene. The course addresses the ethical and functional basis for conservation and fosters thinking about why and how humans ought to share the planet with nonhuman life. It covers scientific principles such as evolution, life-history and the viability of species, species endangerment and extinction risk, the kinds of biodiversity, the spatial distribution of biodiversity, the functional roles of species in ecosystems, vulnerability and risk assessments, and valuing biodiversity and ecosystem services. The course applies these principles to the exploration of such topics as biodiversity's role in the functioning and sustainability of ecological systems, restoration of environmental damages, conserving biodiversity in dynamic landscapes, adapting landscapes to climate change, balancing conservation with urban development and agriculture, and renewable energy siting. It provides students with the quantitative skills to conduct population viability analyses, geospatial analyses of the distribution of biodiversity across landscapes, vulnerability analyses, and decision analysis to balance trade-offs among multiple objectives of human land development and biodiversity conservation. Prerequisites: ENV 602 or equivalent course in population or community ecology, F&ES 755 or equivalent course in GIS, and ENV 728 or equivalent course in statistical analysis of biological data. A course in economics or applied math for environmental studies is strongly encouraged. 4 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 750a, Writing the World

This is a practical writing course meant to develop the student's skills as a writer. But its real subject is perception and the writer's authority – the relationship between what you notice in the world around you and what, culturally speaking, you are allowed to notice. What you write during the term is driven entirely by your own interest and attention. How you write is the question at hand. We explore the overlapping habitats of language – present and past – and the natural environment. And, to a lesser extent, we explore the character of persuasion in environmental themes. Every member of the class writes every week, and we all read what everyone writes every week. It makes no difference whether you are a would-be journalist, scientist, environmental advocate, or policy maker. The goal is to rework your writing and sharpen your perceptions, both sensory and intellectual. Enrollment limited to fifteen. 3 Course cr

ENV 751b, 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 753a, Regression Modeling of Ecological and Environmental Data

This course in applied statistics assists scientific researchers in the analysis and interpretation of observational and field data. After considering the notion of a random variable, the statistical properties of linear transformations and linear combinations of random data are established. This serves as a foundation for the major topics of the course, which explore the estimation and fitting of linear and nonlinear regression models to observed data. Three hours lecture. Statistical computing with R, weekly problem exercises. Prerequisite: a course in introductory statistics. 3 Course cr

ENV 755b, Modeling Geographic Space

An introduction to the conventions and capabilities of image-based (raster) geographic information systems (GIS) for the analysis and synthesis of spatial patterns and processes. In contrast to ENV 756, the course is oriented more toward the qualities of geographic space itself (e.g., proximity, density, or interspersion) than the discrete objects that may occupy such space (e.g., water bodies, land parcels, or structures). Three hours lecture, problem sets. No previous experience is required. 3 Course cr

ENV 756a, Modeling Geographic Objects

This course offers a broad and practical introduction to the nature and use of drawing-based (vector) geographic information systems (GIS) for the preparation, interpretation, and presentation of digital cartographic data. In contrast to ENV 755, the course is oriented more toward discrete objects in geographical space (e.g., water bodies, land parcels, or structures) than the qualities of that space itself (e.g., proximity, density, or interspersion). Three hours lecture, problem sets. No previous experience is required. 3 Course cr

ENV 757a or b, Data Exploration and Analysis Ethan Meyers

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

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. Section I, overview of the course. Section II, disasters and environmental perturbation: pandemics, and the social dimensions of disaster. Section III, power and politics: river restoration in Nepal; the conceptual boundaries of resource systems, and the political ecology of water in Mumbai. Section IV, methods: the dynamics of working within development projects; and a multi-sited study of irrigation in Egypt. Section V, local communities: representing the poor, development discourse, and indigenous peoples and knowledge. The goal of the course is to develop analytic distance from current conservation and development debates and discourse. This is a core course for M.E.M. students in YSE, and a core course in the combined YSE/Anthropology degree program. Enrollment is 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 the United States. 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 governance and decision-making in conservation, including ties between conservation and development and 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 and leadership are key, as the seminar is discussion-based and approximately half the sessions are student-led. Evaluation is based on participation, presentations, and a final paper. 3 Course cr

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

Susan Biniaz

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, and recent developments. There are two mock negotiations. 3 Course cr

ENV 762a, Applied Math for Environmental Studies

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. AMES is meant to help students refresh or acquire new math skills and succeed in content and “toolbox” graduate-level courses. AMES provides a structured opportunity to learn a range of mathematical concepts used in environmental studies. The course assumes that, at a minimum, students took college algebra and perhaps a semester of calculus (but might not really remember it). Concepts are presented heuristically in a “how to” and “why” approach with examples from environmental studies. The goal is for students to be conversant and have intuition about (i.e., to demystify) why logs, exponents, derivatives, integrals, linear algebra, probability, optimization, stability analysis, and differential equations show up throughout environmental studies. Students learn (review) how to use these techniques. Also covered is a bit of history of math and an introduction to computer programming. 3 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, define priority actions, critically assess success, manage adaptively, and derive lessons – all of which help to improve effectiveness and respond to donor interests. 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 proposal 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. Enrollment limited to twelve. 3 Course cr

ENV 771b, Fundamentals of Green Engineering and Green Chemistry Staff

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 772a, Indigenous Self-Government in the U.S. Constitutional Order

Native people in the United States have been building institutions of self-governance in the face of enormous colonial pressure for centuries. This course considers the unique legal positions of Native American, Alaska Native, and Native Hawai'ian citizens in the United States as well as the residents of the U.S. territories. The course introduces students to contemporary legal debates and social movements in the U.S. territories, Indian Country, and Hawai'i and explore how overseas expansionism and relations with Indigenous peoples have shaped U.S. constitutional theory and doctrine. This course demonstrates how the constitutional condition of the U.S. territories, Tribal nations, Alaska villages, and Hawai'i occupy more than niche legal issues but require us to think more broadly about borders, race, indigeneity, and citizenship in the U.S. We focus on the institutions of self-governance both to illustrate the continued resistance to colonial rule and to highlight the unique constitutional questions U.S. colonial actions have posed from the very beginning. 2 Course cr

ENV 773a, Air Pollution Control Drew Gentner

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 a 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 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. Self-scheduled examination or paper option. Students are required to attend the first day of class.

3 Course cr

ENV 781b, Applied Spatial Statistics

An introduction to spatial statistical techniques with computer applications. Topics include modeling spatially correlated data, quantifying spatial association and autocorrelation, interpolation methods, variograms, kriging, and spatial point patterns. Examples are drawn from ecology, sociology, public health, and subjects proposed by students. Four to five lab/homework assignments and a final project. The class makes extensive use of the R programming language. Prerequisite: introductory course

in statistics is mandatory. An intermediate-level course in statistical modeling and handling spatial data is strongly preferred, but not required. 3 Course cr

ENV 782b, Globalization Space

Infrastructure space as a primary medium of change in global polity. Networks of trade, energy, communication, transportation, spatial products, finance, management, and labor, as well as new strains of political opportunity that reside within their spatial disposition. Case studies include free zones and automated ports around the world, satellite urbanism in South Asia, high-speed rail in Japan and the Middle East, agripoles in southern Spain, fiber optic submarine cable in East Africa, spatial products of tourism in North Korea, and management platforms of the International Organization for Standardization. 3 Course cr

ENV 789b, Energy and Development

This course delves into the relationship between energy use and economic development, at a household, national, and global scale. The course provides both a quantitative and qualitative understanding of poverty, energy demand, and the relationship between the two. Students grapple with different income and multidimensional poverty and standard of living indicators, and with GDP and its limitations as a human development measure. They learn about energy poverty in various parts of the world and about energy consumption patterns with rising income. Students study actual household survey and national statistics data on consumption and energy use, and are exposed to cutting-edge research on standard of living measures and their embodied energy needs. The course covers basic models for household energy transitions and appliance diffusion. This is a seminar course, wherein students are expected to present readings in class. The course involves one term project and presentation, which may be quantitative or qualitative. Prerequisites: basic math, Excel, and microeconomics. Those selecting technical projects should have basic R or other data manipulation skills. 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 807b, Business and Environment: Management and Strategy

This course focuses on understanding the legal, business, and policy logic for making the environment and sustainability a core element of corporate management and strategy. Participants are asked to analyze how and when environmental, energy, and other sustainability issues can be translated into business model innovation and competitive advantage. The course combines lectures, case studies, and class discussions on management theory and tools, legal and regulatory frameworks shaping the business-environment interface, and evolving requirements for business success. Scheduled examination. Also MGT 688 and LAW 20490. 3 Course cr

ENV 811b, Metrics, Tools, and Indicators in Corporate Responsibility

This is an applied course on the standards, guidelines, and tools for designing, implementing, auditing, and communicating a corporate environmental and social responsibility (CR) program. The purpose of the course is to introduce students to the knowledge and tools needed to enter a career in CR and sustainability. The course

is designed for students who currently hold or will hold positions in organizations where they are or will be responsible for creating, implementing, measuring, and/or managing internal CR and sustainability programs, or responsible for assisting a corporation in this area. 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 817a, Urban, Suburban, and Regional Planning Practice

Our cities, towns, and regions represent the cumulative impact of planning policies implemented at multiple scales over the past century. This course explores the dynamic trends facing the United States and its communities and the evolution in planning practice that is occurring at the local and regional scale to address them. It looks at both suburban and urban approaches. The recent pandemic, multiple recessions, climate change, and a lack of social cohesion call for a new triple bottom-line approach to decision-making for our future. Existing policies and governance structures are not always well suited for the new challenges and opportunities that we face. Local, state,

and the national government are, to varying degrees, crafting new solutions to the challenges of urban and suburban America. 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 823a, Energy Law and Policy

This course explores the troubled intersection between energy, environmental, economic and national security policies. We consider a diverse range of regulatory approaches to minimize adverse environmental effects of various forms of energy development. These include emerging issues regarding climate change and promoting renewable energy; hydraulic fracturing (“fracking”); regulation of off-shore drilling and lessons from the Deepwater Horizon oil spill; liability for natural resources and other damages from oil spills under the Oil Pollution Act of 1990 (OPA90); the Fukushima, Three Mile Island and Chernobyl nuclear accidents; and the role of nuclear energy, if any, going forward. We also cover the basics of utility rate setting and the role of the Federal Energy Regulatory Agency (FERC). We conclude by considering the geopolitical implications of various energy policies. Supervised Analytic Writing or Substantial Paper credit available for three credits, or a shorter seminar paper or self-scheduled essay exam for two credits. Self-scheduled examination or paper option. 2 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 835a and ENV 835Eb, 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. Guest speakers are professionals involved in sustainable development, land conservation, smart growth, renewable energy, and climate change management. 1½ Course cr per term

ENV 836a / ANTH 541a / HIST 965a / PLSC 779a / SOCY 617a, Agrarian Societies: Culture, Society, History, and Development Jonathan Wyrzten and Marcela Echeverri Munoz

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. 3 Course cr

ENV 839a, Power in Conservation

This course examines the anthropology of power, particularly power in conservation interventions in the global South. It is intended to give students a toolbox of ideas about power in order to improve the effectiveness of conservation. Conservation thought and practice are power-laden: conservation thought is powerfully shaped by the history of ideas of nature and its relation to people, and conservation interventions govern and affect peoples and ecologies. This course argues that being able to think deeply, particularly about power, improves conservation policy making and practice. Political ecology is by far the best known and published approach to thinking about power in conservation; this course emphasizes the relatively neglected but robust anthropology of conservation literature outside political ecology, especially literature rooted in Foucault. It is intended to make four of Foucault's concepts of power accessible, concepts that are the most used in the anthropology of conservation: the power of discourses, discipline and governmentality, subject formation, and neoliberal governmentality. The important ethnographic literature that these concepts have stimulated is also examined. Together, theory and ethnography can underpin our emerging understanding of a new, Anthropocene-shaped world. This course will be of interest to students and scholars of conservation, environmental anthropology, and political ecology, as well as conservation practitioners and policy makers. It is a required course for students in the combined YSE/Anthropology doctoral degree program. It is highly recommended for M.E.Sc. students who need an in-depth course on social science theory. M.E.M. students interested in conservation practice and policy making are also encouraged to consider this course, which makes an effort to bridge the gap between the best academic literature and practice. Open to advanced undergraduates. No prerequisites. Three-hour discussion-centered seminar. 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. Self-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 857a, Financing Climate Change Adaptation in Developing Countries

This course is intended for students who are interested in applied work in development organizations or public institutions focused on nature, climate, energy and waste that are involved in catalyzing finance for climate change adaptation, particularly in the global south. The course has no specific prerequisites but students will find that courses in development economics, natural resources management, finance and law are helpful. The class entails in-class discussions where students are expected to critically analyze course content, discuss and debate, as well as present material. Enrollment is limited to fifteen. 3 Course cr

ENV 860a, Developing Environmental Policies and Winning Campaigns

This course is about what makes an environmental policy idea successful—one that can go from concept to law, get implemented well, and achieve its intended goals. In addition, this class covers how to develop and run effective campaigns to win environmental policies. Good policy does not just happen. It takes creative thinking, learning from experience and history, and an ability to “look around corners” to help ensure that your idea can actually be well implemented, won’t have unintended consequences, and will actually solve the problem you set out to alleviate. And, once you have a honed policy idea, there is no magic wand that will turn it into the law of the land. Whether in city hall, the state legislature, the U.S. Congress, or a corporate boardroom, many stakeholders will have a hand in determining whether an idea turns into a law. 3 Course cr

ENV 878a, Climate and Society: Past to Present

Seminar on the major traditions of thought and debate regarding climate, climate change, and society, drawing largely on the social sciences and humanities. Section I, overview of the course. Section II, disaster: the social origins of disastrous events; and the attribution of societal “collapse” to extreme climatic events. Section III, causality: the revelatory character of climatic perturbation; politics and the history of efforts to control weather/climate; and nineteenth–twentieth-century theories of environmental determinism. Section IV, 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. Section V, knowledge: the study of folk knowledge of climate; and local views of climatic perturbation and change. Section VI, politics: knowledge, humor, and symbolism in North–South climate debates. The goal of the course is to examine the embedded historical, cultural, and political drivers of current climate change debates and discourses. This course can be applied towards Yale College distributional requirements in Social Science and Writing. The course is open to both graduate and undergraduate students. Enrollment capped. 3 Course cr

ENV 893b, Principles of Risk Assessment

This course introduces students to the nomenclature, concepts, and basic skills of quantitative risk assessment (QRA). The goal is to provide an understanding necessary to read and critically evaluate and perform QRA. Emphasis is on the intellectual and conceptual basis of risk assessment, particularly its dependence on

toxicology, epidemiology, and exposure assessment. Quantitation of exposure and dose response provides practical skills and theoretical background, although not detailed in mathematical and model derivations. Specific cases consider the use of risk assessment for setting occupational exposure limits, establishing community exposure limits, and quantifying the hazards of environmental exposures to chemicals in air, drinking water, consumer products, and the built environment. 3 Course cr

ENV 894a, Green Building: Issues and Perspectives

Buildings have an outsized impact on human and environmental health. The building sector is the largest contributor to greenhouse gas emissions globally, responsible for almost 40 percent of total emissions. Construction and demolition activities generated 600 million tons of waste in 2018 in the United States, more than twice what was generated in municipal solid waste. Buildings represent an enormous opportunity to reduce environmental impact, and the movement that represents this approach is commonly called green building. But green building is broad and deep – involving process, products, and policy – and crisscrosses many disciplines. This course examines green building from a variety of perspectives, placing it in a technical, social, financial, and historical context. The task of reducing the environmental impact of our buildings requires cross-disciplinary integration and touches nearly every aspect of our lives as occupants and managers of interior spaces. Individual topics in green building – such as building science, indoor environmental quality, innovative finance, and public- and private-sector programs – are covered through research, class discussion, guest lectures, field trips, and group projects. Great emphasis is placed on the practical challenges and opportunities that green building presents to building and non-building professionals working together to design, specify, construct, operate, renovate, and finance our nation's buildings. Enrollment limited to fifteen. 3 Course cr

ENV 896b, Public Health Toxicology

This course is designed to serve as a foundation for understanding public health toxicology in the twenty-first century. Although it includes the basic principles of toxicology such as dose response and mechanisms of toxicity and cellular defense, this course introduces new concepts of toxicology such as lifetime exposures, low-level exposure to mixtures, high-throughput screening and computational toxicology, and green chemistry in order to understand fundamental interactions between chemicals and biological systems and possible health outcomes. Through the use of case studies and up-to-date published research, the course provides insights into prevention of mortality and morbidity resulting from environmental exposure to toxic substances, the next-generation risk assessment and regulatory toxicology, and the causes underlying the variability in susceptibility of people to chemicals. 3 Course cr

ENV 897b, Environmental and Occupational Exposure Science Nicole Deziel

This course examines the fundamental and practical aspects of assessing exposures to environmental agents, broadly defined, in the residential, ambient, and workplace environments. The course provides the knowledge and skills to design and conduct exposure assessments, and has a particular focus on applications to environmental epidemiology and risk assessment. Indirect and direct methods of assessing exposures, such as questionnaires, environmental sampling, biological monitoring, and spatial modeling, are reviewed; and case studies and hands-on projects are presented.

3 Course cr

ENV 898a, Environment and Human Health Michelle Bell

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

This course provides the foundation for doctoral study at the School of the Environment. Students learn what it means to do scholarly research as well as become adept with philosophy of science and research methodology and proposal writing, as a basis for exploring diverse approaches to formulating and addressing research questions. Students work with their advisers to put these concepts and principles into practice to develop the basis for their dissertation research (including building bibliography, identifying and crafting research questions, formulating research hypotheses, and drafting a research proposal). Students further learn about funding opportunities and procedures for submitting grants. The course also covers professional ethics and responsible conduct of research, including ethical approaches to inquiry and measurement, data acquisition and management, authorship and publication, peer review, conflicts of interest, mentoring, collaborative research, and animal and human subjects research. Finally, the course explores ethical ways to advocate for the application of scholarly knowledge in the interest of environmental problem solving. Weekly assigned readings support concepts and issues addressed in class. Students present their embryonic research ideas in class and use feedback from the group to further develop their ideas.

ENV 902a, Environmental Anthropology Colloquy

A biweekly seminar for Dove doctoral advisees and 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.

ENV 908a, Urban and Environmental Economics

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 951b, Strategic Environmental Communication

Strategic communication is a powerful means of achieving an organization's mission, especially when informed by insights into human behavior and social systems. By the end of this course, students are able to develop communication strategies and apply

insights from the social and behavioral sciences to improve the effectiveness of their communication campaigns. Enrollment limited to twelve. 3 Course cr

ENV 953b, Sustainable Business Capstone Consulting Clinic

The intended outcome of this course is to provide you with a ‘capstone’ experience; consulting to an organization in its early formative years, confronting real-life challenges at the intersections of starting-up, business strategy, and environmental sustainability; all with regular contact with the Founder/Founding team of an entrepreneurial venture started by recent alumni or current student Founders. 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 entrepreneurs leading their organization. It 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 to engage with consultants in their careers post-Yale and may be considering becoming an entrepreneur themselves. In short, there is hopefully something in it for many of you! If interested, please complete the online application form before 9am Wednesday January 12th. We will review applications and inform you of acceptance and project assignments by end of day on Friday January 14th. This course is cross-listed with Environment and will follow their academic calendar. Application: <https://docs.google.com/forms/d/e/1FAIpQLSf9toRWaY5v57f7YgbrNgAVKKOGPx8w7xjm3WzWuhkHSTCikA/viewform> 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. Plans are constructed for private smallholders 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; and the Appalachian Mountain Club. Ten days fieldwork. Enrollment limited to twenty. Must also register for ENV 957, Field Skills in Land Stewardship. Prerequisite: ENV 659 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. Extensive training in writing and presenting work is provided. 1 credit option is available for incoming students only. Must be taken for 3 credits to count as a capstone course. Limited to twelve.

Prerequisite: ENV 659 or permission of the instructor. 3 Course cr

ENV 956b, Strategies for Land Conservation

This is a professional seminar on private 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. Speakers are assigned topics across the land conservation spectrum, from identification of target sites, through the acquisition process, to ongoing stewardship of the land after the deal is done. The tools used to protect land are discussed, including the basics of real estate law, conservation finance, and project/organization management. Students are required to 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

An intensive technical and field ecology seminar that is taught in combination with ENV 954. In this course students learn field skills that contribute to the base set of information used in assessment, planning, prescription writing, and management of forest and open space. Students learn to identify plants; interpret surficial geology, soils, and hydrology; and read the land for use history. Assessments learned in a series of field exercises comprise forest health and invasive surveys, wildlife habitat evaluations, and soil surveys and wetland delineation. This culminates in understanding and developing a site classification. Lastly, students learn field inventory and sampling techniques in data collection for soils, geology, plants, and wildlife habitat. 3 Course cr

ENV 959a or b, Clinic in Climate Justice, Law, and Public Health Staff

This course is an innovative collaboration between Yale School of Public Health and Vermont Law School and includes faculty and students from both Yale and Vermont Law School. 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. Class sessions and team meetings are conducted using a hybrid approach that combines in-person, all-virtual, and virtually connected classroom arrangements. 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 Yale instructor at laura.bozzi@yale.edu for more information. Prerequisite: EHS 547 or permission of the instructor. 3 Course cr

ENV 962a or b, Tribal Resources and Sovereignty-Clinic

Understanding Tribal Resource Management: we identify and describe the varieties of tribal resources and the limitation of the management prerogatives facing Tribal Nations under the current legal regime. We explore those resources governed by the trust duty and the federal government's role. We also look at the emerging resources in the green economy and investigate the relations between tribes, states, and private actors. Co-management, the trust duty, and tribal sovereignty are the main themes around which the clinic is structured. Application required. 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 974a, Social Innovation Starter Teresa Chahine

In this course based at Jackson School of Global Affairs, students apply the ten stage framework of the textbook *Social Entrepreneurship: Building Impact Step by Step* to innovate new solutions for host organizations. Host organizations are social enterprises or other social purpose organizations based globally and locally who present Yale students with a problem statement to work on over the course of one term. This could include creating new programs or products, reaching new populations, measuring the impact of existing work, creating new communications tools for existing work, or other challenges. Students gain social innovation and entrepreneurship experience and host organizations benefit from students' problem solving. Students from all programs and concentrations at Yale are welcome to join Jackson students in forming inter-disciplinary teams to tackle social challenges. This course runs during the same time as Social Entrepreneurship Lab. The key distinction is that in that lab, students pick their own topic to research and ideate on, whereas in this course students work on projects for host organizations. Jackson students may elect to follow up on this course with a summer internship to the host organization, to help support implementation of their solution, if the host organization and the School administration accepts their application. 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. 0 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