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 2022–2023 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, it will have an updated list. See also Yale Course Search at https://courses.yale.edu for many other environmental courses in other Yale departments.

**ENV 511a, Ecological Foundations for Environmental Managers**

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

**ENV 512a, Microeconomic Foundations for Environmental Managers**

This six-week course provides an introduction to microeconomic analysis and its application to environmental policy. Students study how markets work to allocate scarce resources. This includes consideration of how individuals and firms make decisions, and how policy analysts seek to quantify the benefits and costs of consumption and production. We consider the conditions under which markets are beneficial to society and when they fail. We see that market failure arises frequently in the context of environmental and natural resource management. The last part of the course focuses on the design of environmental and natural resource policies to address such market failures. The course is designed to cover basic knowledge of economics analysis and prepare students for ENV 834 and other more advanced offerings. 1½ Course cr
ENV 521a, Physical Science Foundations for Environmental Managers
This required foundational course provides students with the physical science basics that they need to understand and manage environmental problems. The course draws on climatology, environmental chemistry, geology, hydrology, meteorology, oceanography, and soil science. Focus is on understanding both the underlying concepts and how they apply to real-world environmental challenges. Useful both as a freestanding course and as a gateway to a wide spectrum of intermediate and advanced courses. 1½ Course cr

ENV 522a, Social Science Foundations for Environmental Managers
The environmental social sciences shed light on how humans define, perceive, understand, manage, and otherwise influence the environment. Insights into the cultural, institutional, political-economic, and historic drivers of human actions are needed to describe and understand human-environment interactions as well as to move toward long-lasting and flexible responses to socio-environmental change. This basic knowledge course is designed to introduce students to a range of social science disciplines that are engaged in understanding the relationships between nature and society. Explicit focus is on how to mobilize the insights gained from environmental social sciences for natural resource management. 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 Social Science Research Methods
This course is designed to provide a broad introduction to issues of qualitative research methods and design. The course is intended for both doctoral students who are in the beginning stage of their dissertation research, as well as master’s students developing research proposals for their thesis projects with a focus on understanding the nexus of human-environment issues. The course covers the basic techniques of designing qualitative research and for collecting, interpreting, and analyzing qualitative data. We explore three interrelated dimensions of research: theoretical foundations of science and research, specific methods available to researchers for data collection and analysis, and the application and practice of research methods—all with a strong emphasis on the relationship between people and natural resources. The final product for this course is a research proposal. 3 Course cr

ENV 552b, Master Student Research Conf. Peter Raymond
One of the most important aspects of scientific research involves the communication of research findings to the wider scientific community. Therefore, second-year M.E.Sc. and M.F.S. students are required to present the results of their faculty-supervised research as participants in the Master’s Student Research Conference, a daylong event held near the end of the spring term. Student contributors participate by delivering a fifteen-minute oral presentation to the YSE faculty and student body or by presenting a research poster in a session open to the YSE community. Students receive a score of satisfactory completion for this effort. 0 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 573a, Urban Ecology for Local and Regional Decision-Making
Urban ecology is the interdisciplinary study of urban and urbanizing systems from local to global scales. While urban ecology shares many features with the biological science of ecology, it emphasizes linkages with social, economic, and physical sciences and the humanities. Geographically, the subject includes central and edge cities, suburbs of various ages and densities, and exurban settlements in which urban lifestyles and economic commitments are dominant. In application, urban ecology can be useful as a social-ecological science for making cities more sustainable, resilient, and equitable. Emerging “grand challenges” in urban ecology include the development of robust approaches to and understanding of (1) integrated social-ecological systems in urban and urbanizing environments; (2) the assembly and function of novel ecological communities and ecosystems under novel environmental conditions; (3) drivers of human well-being in diverse urban areas; (4) pathways for developing healthy, sustainable, and disaster-resilient cities; and (5) co-production of actionable science for policy, planning, design, and management.  3 Course cr

ENV 592a, Documentary Film Workshop  Charles Musser
This workshop in audiovisual scholarship explores ways to present research through the moving image. Students work within a Public Humanities framework to make a documentary that draws on their disciplinary fields of study. Designed to fulfill requirements for the M.A. with a concentration in Public Humanities.  3 Course cr

ENV 595a, 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 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
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 communicate effectively with data is equally essential for researchers, policy makers, 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. 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 term, 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.

ENV 606a, Methods in Climate Change and Health Research
Climate change is recognized as one of the greatest public health challenges of the twenty-first century. This course takes multidisciplinary approaches to identify, assess, quantify, and project public health impacts of climate change and of measures to address climate change. It first introduces the fundamental principles of health impact assessment and gives a brief overview of the public health approaches to address climate change. Then it applies advanced data analysis methodologies in environmental epidemiology, including time-series analysis, spatial epidemiology, and vulnerability assessment, to characterize the present climate-health (exposure-response) relationships and to identify vulnerable populations. This course discusses key concepts of scenario-based climate projections and their applications in projecting future health impacts, evaluating health co-benefits of climate mitigation polices,
and assessing climate change adaptation measures. Emphasis is placed on hands-on computer lab exercises with real-data examples and R scripts.

**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.

**ENV 613b, Writing as a Public Scholar**  
Stephanie Hanes Wilson
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.

**ENV 617b, Real-World Environmental Data Science**  
Elena Grewal
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.

**ENV 618a, 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.

**ENV 619b, 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
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essays by philosophers and environmentalists. The total reading load averages about three philosophy papers weekly—roughly sixty pages. Course avoids environmental ethics topics that are treated in other Yale courses: e.g., religion and ecology, and all but a very little bit of indigenous views of ecology. 3 Course cr

ENV 625b, Writing Workshop  Roger Cohn
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. 3 Course cr

ENV 626a or b, Writing for Publication in the Natural Sciences  Simon Queenborough
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  Peter Raymond and Xuhui Lee
The course provides students with core knowledge on the processes controlling the earth’s climate system. The first half of the class focuses on the four components of the earth climate system, providing a knowledge base on the atmospheric energy and water budgets and the roles of anthropogenic greenhouse gases, the oceans, land and cryosphere in altering these budgets. Students also learn how to run a climate GCM (general circulation model). The second half of the class focuses on impacts of climate change on a number of societal sectors including natural ecosystems, energy use, water resources, the food system and the built environment. 3 Course cr

ENV 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 634b, Ecology of Global Drylands  William Lauenroth
This course explores the controls on the geographic distribution and community and ecosystem structure and functioning of drylands globally. Lectures, writing, and student-led discussions. 3 Course cr
ENV 635b, Renewable Energy Project Finance  Daniel Gross
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/u5Y84yWqiYVQbB867.

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 642b, Environmental Justice/Climate Justice  Gerald Torres
In this seminar, 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. Each student chooses a particular movement (or one expression of it) and writes a paper bringing to bear all of the questions we raise in the seminar. (For example, how did opposition from environmental justice advocates lead to a reformed climate change initiative in California? Or what is the genesis of the Sunrise movement, and what legal or policy changes would be required to make it a reality?) The paper need not focus on a domestic response, because the environmental/climate justice critique is now global.

3 Course cr
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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  Joseph Orefice
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

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 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 fieldwork. Recommended: some knowledge of soils, ecology, plant physiology, human behavior, and resource economics.  4 Course cr

ENV 660a, Forest Dynamics  Marlyse Duguid
This course introduces the study of forest stand dynamics—how forest structures and compositions change over time with growth and disturbances. Understanding the dynamic nature of forest stands is important for creating and maintaining a variety of critical ecosystem services sustainably and synergistically, including sustainable supplies of wood products, biodiversity and wildlife habitats, water, fire protection, and others. Through readings, lectures, discussions, and field trips we explore forest development processes and pathways, concentrating on the driving mechanisms and emergent properties including natural and human disturbances. We make use of New England forests as living laboratories while discussing how similar forest patterns and processes are played out throughout the temperate, tropical, and boreal worlds. 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 more than 120 individual species of woody plants using common morphological and ecological traits used for field identification. Dendrology is by nature context-specific, so this course has a focus on North American forest species, primarily of eastern North America. In addition, we use phylogenetic systematics as the structure for understanding taxonomy and the evolutionary history and relationships between species. Enrollment limited to thirteen.  3 Course cr

ENV 679a, Plant Ecophysiology
This course focuses on the physiological ecology of plants and their interaction with the biotic and abiotic environment, understood through the lens of first principles. We use a quantitative approach to demonstrate the linkages between photosynthesis, growth, and carbon allocation at the tissue and whole plant level, which can then be scaled up to forests and ecosystems. We also focus on specific physiological and anatomical adaptations plants use to survive in the many varied habitats on Earth. The
laboratory component of this course (ENV 679L) involves the theory, programming, and deployment of micrometeorological equipment to monitor environmental conditions in the field, as well as methods for measuring photosynthesis and growth in the greenhouse and field. 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  Joseph Orefice
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 695a, Yale Forest Forum Series: (Re)Considering Planted Forests for the 21st Century
The Forest School at the Yale School of Environment has developed this seminar in collaboration with the UN Food and Agriculture Organization, The Forests Dialogue, and the Center for Business and the Environment at Yale. The series focuses on
(re)considering intensively managed planted forests for the 21st century, drawing on a wide range of perspectives and experiences from around the world. Planted forests, including tree plantations established for wood production, continue to grow in both extent and significance. Tree plantations currently provide almost half of the world’s industrial wood, a proportion expected to increase significantly in coming decades. They also have great potential to deliver environmental services and social benefits. However, many aspects of tree plantations have been and remain controversial, with concerns that associated environmental and social costs often outweigh economic and other benefits. The seminar is guest lecture/discussion based and includes a weekly public webinar hosted by the Yale Forest Forum (YFF). The seminar brings in a wide range of experts to discuss the future role of intensively managed planted forests (IMPF) in addressing urgent needs(changes related to climate, resource, societal, and environmental challenges at regional and global scales. Guest speakers represent forestry, industry, conservation, communities, and climate science. Speakers describe their personal and organizational experience with IMPF, and discuss the environmental, economic, and societal implications for increased development IMPFs for the plantations sector, forest products industry and society.

**ENV 706b, Organic Pollutants in the Environment**
An overview of the pollution problems posed by toxic organic chemicals, including petroleum, pesticides, PCBs, dioxins, chlorinated solvents, and emerging contaminants such as PFAS, personal care products, and brominated compounds. The course covers the processes governing the environmental fate of organic pollutants (e.g., evaporation, bioconcentration, sorption, biodegradation, migration in groundwater), as well as tools for the prevention and remediation of organic pollution. Previous knowledge of organic chemistry is not required (but is welcome). 3 Course cr

**ENV 708b / ENAS 640, Aquatic Chemistry**
A detailed examination of the principles governing chemical reactions in water. Emphasis on developing the ability to predict the aqueous chemistry of natural, engineered, and perturbed systems based on a knowledge of their biogeochemical setting. Calculation of quantitative solutions to chemical equilibria. Focus on inorganic chemistry. Topics include elementary thermodynamics, acid-base equilibria, alkalinity, speciation, solubility, mineral stability, redox chemistry, and surface complexation reactions. 3 Course cr

**ENV 712b, 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 717b, Tropical Field Ecology**
This course is designed to provide students with an introduction to tropical biology and the conservation of biodiversity in the tropics, through a combination of lectures, discussions, and hands-on research projects. Lectures provide background on the
climate, structure, function, and diversity of tropical forests, with an emphasis on the
 evolutionary and ecological processes shaping these ecosystems. Through guest lectures
 and hands-on projects, students also gain experience with study design, data collection
 methods, statistical analysis, and scientific writing and presentations. If conditions
 permit, this course includes a mandatory spring break field trip to the Neotropics.
 Prerequisite: a basic background in ecology through prior course work (either at YSE or
 through undergraduate courses).  3 Course cr

ENV 723a, Wetlands Ecology, Conservation, and Management  Kealoha Freidenburg
Wetlands are ubiquitous. Collectively they cover 370,000 square miles in the United
States and globally encompass more than five million square miles. Most points on
a map are less than one kilometer from the nearest wetland. Yet wetlands are nearly
invisible to most people. In this course we explore wetlands in all of their dimensions,
including the critical services they provide to other systems, the rich biodiversity
they harbor, and their impact on global climate. Additionally, wetlands are linchpin
environments for scientific policy and regulation. The overarching aim of the course is
to connect what we know about wetlands from a scientific perspective to the ways in
which wetlands matter for people.  3 Course cr

ENV 726b, Observing Earth from Space  Xuhui Lee
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 729b, Caribbean Coastal Development: Science and Policy
This seminar explores human-ecosystem interactions at the land-sea interface in the
tropics, with Caribbean islands as the main study sites. Many tropical islands are
undergoing rapid, uncontrolled development, placing severe local stress on several
unique and vulnerable ecosystems types. In addition, human-induced environmental
changes on scales up to global also impose stresses. This course examines the normal
functioning of these ecosystems, scientific methods to evaluate and characterize
ecosystem condition and processes, how human activities interfere with natural cycles
in biophysical systems, and what management and policy tools can be applied to reduce
impacts.  3 Course cr
ENV 731b, Tropical Field Botany
This course teaches students how to identify the most important tropical plant families, with an emphasis on woody taxa. Students learn key characteristics for identification. We concentrate on families that have high economic, ecological, or ethnobotanical importance. We also discuss distribution, habitat, and ecology. The course has a strong practical component, and instructors emphasize vegetative characters to identify families and higher-level taxa. The course includes a two-week field trip to Costa Rica over spring break. Enrollment limited to twelve.  3 Course cr

ENV 734b, Biological Oceanography  Mary Beth Decker
This course explores a range of oceanic ecosystems and how these environments function as coupled physical/biological systems. Solar energy drives the structuring of the oceans in the vertical dimension, and the formation of both deep and surface currents. These currents are the means by which heat and material are redistributed and are the determinants of where nutrients are available for support of primary production. The currents and other physical processes also determine the distribution and abundance of organisms from phytoplankton to fish and whales. Anthropogenic impacts on oceans are also explored, such as the effects of fishing and climate change. This natural science course provides a foundation for those interested in the ecology of marine systems and in the management of coastal zones. Enrollment limited to fifteen. Recommended prerequisite: college-level biology or ecology course.  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 750a, Writing the World  Verlyn Klinkenborg
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
An introduction to the R computing language, statistical plots and transformations, a review of introductory statistics techniques, and an extension into more advanced topics including multiple regression, ANOVA and ANCOVA, binary and multinomial logistic regression, and non-parametric techniques such as the bootstrap and permutation tests. This course also covers data types, data cleaning, and web scraping.
This course is designed to follow a prior introduction to statistics course such as ENV 728. Weekly problem sets, two exams, and a final project. Three hours lecture.

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**

Course on the social scientific contributions to environmental and natural resource issues, emphasizing equity, politics, and knowledge. Section I, introduction to the course. Section II, disaster and environmental perturbation: the social science of emerging diseases; and the social origins of disaster. Section III, boundaries: cost and benefit in the Green Revolution; riverine restoration; and aspirational infrastructure. Section IV, methods: working within development projects, and rapid appraisal and consultancies. Section V, local communities, resources, and (under)development: representing the poor, development discourse, and indigenous peoples and knowledge. This is a core M.E.M. specialization course in YSE and a core course in the combined YSE/Anthropology doctoral degree program. Enrollment capped.

3 Course cr

**ENV 760b, Conservation in Practice: An International Perspective**

This seminar focuses on the practice of wildlife and wildlands conservation, examining key topics from the dual perspectives of academic literature and actual field experiences; bringing together interdisciplinary thinking; and drawing on examples from Africa, Asia, Latin America, and 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 764a, Sociology of Sacred Values: Modernity, Ecology, and Policy**

This course equips students to understand how moral culture shapes all environmental issues and management, driving even the most basic decisions that on the surface may appear to be entirely obvious, rational, or scientific. Modern people and modern institutions are propelled toward certain ends and possibilities that are inescapably rooted in questions of human culture about who we are, what we should do, and why it all matters. The first half of the course draws on theoretical readings from sociology, philosophy, and religious studies to understand the ubiquity of sacred codes and how they work, with an emphasis on late modernity, rationality, capitalism, and the sacred/profane. The second half of the course introduces recent case studies to see in practice how moral values are embedded in environmental work, including policy making, advocacy, the free market, scientific research, race and class, death and extinction, ecotourism, and more. Cultivating a lens to see culture and moral values in all things will improve students’ applied work in all sectors. 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
There is a broad desire to ensure that consumer products, manufacturing processes, and material and energy systems are compatible with public health and environmental sustainability. This course provides fundamental knowledge of the frameworks, methods, tools, and techniques of designing for sustainability. Through an understanding of conceptual contracts and application to real-world case studies, students learn the impacts of design on health (including toxic and ecotoxic effects) and the ways to ensure that new products, processes, and systems can be constructed through the principles of green engineering and green chemistry. This course provides the foundation for more advanced investigations in sustainable design; there are no prerequisites. 3 Course cr

ENV 773a, Air Pollution Control  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 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 789a, 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 796b, Biopolitics of Human-Nonhuman Relations
Seminar on the “posthumanist” turn toward multispecies ethnography. Section I, introduction to the course. Section II, the ontological turn: multispecies ethnography; and ecology and human consciousness. Section III, fauna: human-animal conflict;
Subjects of Instruction

hunting and politics; and the bushmeat “crisis.” Section IV, flora: “weedy/invasive/pest” species; and ethnobotany. Section V, the long and broad view: the history of natural history; and the classics. Section VI, class contributions: student-selected readings; student presentations of seminar papers; and lecture by teaching fellow. Enrollment capped.

3 Course cr

**ENV 800b, Energy Economics and Policy Analysis**
This course examines energy policy issues that pertain to the environment, with a focus on providing tools for analyzing these issues. A primary objective is to apply economics to particular issues of energy markets, environmental impacts, investment in renewables, and other energy issues such as transportation and energy efficiency. We cover the economic and technical considerations behind a particular energy policy issue and then discuss a related article or case study. Prerequisites: ENV 512 (or equivalent background) and at least one course on energy. 3 Course cr

**ENV 804a, Economics of Natural Resources**  Robert Mendelsohn
Linking of abstract economic concepts to concrete policy and management decisions. Application of theoretical tools of economics to global warming, pollution control, fisheries, water management, forestry, recreation, and mining. 3 Course cr

**ENV 805a, Seminar on Environmental and Natural Resource Economics**
This seminar is based on outside speakers and internal student/faculty presentations oriented toward original research in the field of environmental and natural resource economics and policy. Presentations are aimed at the doctoral level, but interested master’s students may enroll with permission of the instructors. 1½ Course cr

**ENV 807a, Business and Environment: Management and Strategy**
This survey course focuses on the policy and business logic for making environmental issues and sustainability a core focus of corporate strategy and management. Students are asked to analyze when and how sustainability leadership can translate into competitive advantage by helping to cut costs, reduce risk, drive growth, and promote brand identity and intangible value. The course combines lectures, case studies, and class discussions on management theory and tools, the legal and regulatory frameworks that shape the business-environment interface, and the evolving role of business in society, including how to deal with a world of diverse stakeholders, increasing transparency, and rising expectations related to corporate environmental, social, and governance (ESG) performance. Self-scheduled examination. 3 Course cr

**ENV 814a, Energy Systems Analysis**
This lecture course offers a systems analysis approach to describe and explain the basics of energy systems, including all forms of energy (fossil and renewable), all sectors/activities of energy production/conversion, and all energy end uses, irrespective of the form of market transaction (commercial or noncommercial) or form of technology (traditional as well as novel advanced concepts) deployed. Students gain a comprehensive theoretical and empirical knowledge base from which to analyze energy-environmental issues as well as to participate effectively in policy debates. Special attention is given to introducing students to formal methods used to analyze energy systems or individual energy projects and also to discussing traditionally less-researched elements of energy systems (energy use in developing countries; energy densities and urban energy use; income, gender, and lifestyle differences in energy
end-use patterns) in addition to currently dominant energy issues such as climate change. Active student participation is required, including completion of problem sets. Participation in extra-credit skill development exercises (presentations, fact-finding missions, etc.) is encouraged. Invited outside speakers complement topics covered in class. 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 819b, 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/organizational 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 820b, Land Use Law and Environmental Planning
This course explores the regulation by local governments of land uses in urban, rural, and suburban areas and the effect of development on the natural environment. The course helps students understand how the environment can be protected through effective regulation at the local level. It provides an introduction to federal, state, regional, and local laws and programs that promote watershed protection and to the laws that delegate to local governments primary responsibility for decision-making in the land use field. Theories of federalism, regionalism, states’ rights, and localism are studied, as are the cases that provide a foundation in regulatory takings and the legitimate scope of land use regulation. The history of the delegation of planning and land use authority to local governments is traced, leading to an examination of local land use practices that relate to human settlement patterns, water resources, low-impact development, watershed protection, alternatives to Euclidean zoning, brownfields redevelopment, and resiliency and adaptation in response to sea-level rise and climate change. Students engage in empirical research to identify, catalog, and evaluate innovative local laws that successfully protect environmental functions and natural resources, and the manner in which towns incorporate climate change into their planning and regulations. Nearby watersheds are used as a context for the students’ understanding of the strengths and weaknesses of local planning and regulation. Attention is paid, in detail, to how the development of the land adversely affects natural resources and how these impacts can be mitigated through local planning and subsequent adoption of environmental and other regulations designed to promote sustainable development in a climate-changing world. 3 Course cr

ENV 822a, Strategic Communication: Delivering Effective Presentations
Class attendance is mandatory, including the first day—students are required to attend the first class session in order to remain enrolled or to bid for the course. There are four sections to choose from: two sections offered in fall-2 and two sections offered in spring-2. They are all the same half-term course, just offered at different times in the term. The focus of this course is to increase one’s competencies in oral communication and presentation. Developing and executing effective communication strategies is essential in a variety of business settings. Business leaders are often expected to present their message with confidence and clarity to employees, clients, partners, investors, and the public. This highly interactive, practical course will help students develop confidence in public speaking through weekly presentations and assignments, lectures and discussions, guest speakers, simulated activities, and filmed feedback. Students will be given the opportunity to present both individually and as part of a team. We explore the essentials of communication strategy and persuasion: audience analysis, message construction, communicator credibility, and delivery. Students at all levels of mastery of public speaking will benefit from this course. Enrollment is limited to 36. Prerequisite: YSE students must submit a statement of interest to the instructor. 1½ 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, Agrarian Societies: Culture, Society, History, and Development**

Louisa Lombard and Elisabeth Wood

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

**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.  

**ENV 839b, 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.  

**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 860a, Understanding Environmental Campaigns**
This course is about the strategies and tactics used by successful environmental campaigns, taught from a practitioner’s perspective. It is also a course about environmental policy making. Policy doesn’t just happen the way it’s described in grade school civics textbooks. And it isn’t just policy makers who make it. Corporate and civic interests play an influential role at all levels of policy making. As future participants in the policy process, whether you come at it from a perch in government or business, as an advocate, or as a private citizen, you can jump-start your ability to participate and respond by understanding how policy campaign advocacy impacts policy making. Though this topic is neither well documented nor regularly taught, there is a toolkit that can be learned. Most environmental campaigners and policy makers learn about policy campaigning on the job. This course attempts to advance understanding of the policy-making process by exposing YSE students to case examples from the environmental policy-making world of the past decade. The course examines selected case examples of successful policy campaigns and seeks to tease out lessons and best practice. No single environmental campaign is the same, and strategies and tactics are always evolving, but there are key lessons about campaign practices that can be learned. Some of the case studies examined in this course in the past have included campaigns enacting anti-toxic legislation in Washington State; stopping the Keystone XL Pipeline; shutting coal-fired power plants across the United States; protecting the Great Bear Rainforest and the boreal forest in Canada; stopping water privatization in Bolivia; banning the use of high-sulphur fuels in the Arctic; securing an international ban on Arctic ocean fishing; catalyzing the decarbonization of supply chain emissions at Levi’s; and encouraging banks and insurers to commit to Paris-aligned lending and financing. Campaigners who have played leadership roles in the campaigns we examine will join us for class. We examine each case, seek a practical understanding of strategies and tactics used by each campaign, and attempt to synthesize lessons and best practice. 3 Course cr
Subjects of Instruction

**ENV 878a, Climate and Society: Past to Present**  Michael Dove
Seminar on the major traditions of thought regarding climate, climate change, and society, drawing largely on the social sciences and humanities. Section I, introduction to the course. Section II, disaster: the social origins of disaster; and the attribution of societal "collapse" to extreme climatic events. Section III, causality: climatic perturbation as revelatory; the politics of weather/climate control; and nineteenth-twentieth-century theories of environmental determinism. Section IV, history and culture: explaining differences among people in terms of differences in climate; and western vs. non-western views of climate. Section V, knowledge: folk knowledge of climate; and local views of climatic perturbation and change. Section VI, politics: climatic change and perturbation in national politics; and contesting global views of climate change. The goal of the course is to clarify the historical, cultural, and political drivers of climate change debates and discourses. Enrollment capped. 3 Course cr

**ENV 884a, Industrial Ecology**
Industrial ecology studies (1) the flows of materials and energy in industrial and consumer activities, (2) the effects of these flows on the environment, and (3) the influences of economic, political, regulatory, and social factors on the flow, use, and transformation of resources (White 1994). The goals of the course are to define and describe industrial ecology; to demonstrate the relationships among production, consumption, sustainability, and industrial ecology in diverse settings and at multiple scales; to show how industrial ecology serves as a framework for the consideration of environmental and sustainability-related aspects of science, technology, and policy; and to define and describe tools, applications, and implications of industrial ecology. 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**
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 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 or b, Environmental Anthropology Research Lab
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 905a, Doctoral Seminar in Environmental and Energy Economics
This course is designed to bring doctoral students up to speed on the latest developments in the literature on environmental and energy economics. Key papers are presented, and associated mathematical and empirical methods are covered. Topics include uncertainty and climate change policy, estimating energy demand, electricity markets, and behavioral economics and the environment. A focus is on identifying areas that deserve future research attention. Open to advanced master’s students with permission of the instructor. 3 Course cr

ENV 907a, Justice, Equity, Diversity, and Sustainable Laboratory Seminar
This course is only open to graduate students. The course examines food insecurity; inequities in access to fresh, healthy, and affordable foods; and disparate impacts arising from exposure to environmental hazards. Students also examine issues such as energy and health justice, as well as the distribution of and access to environmental amenities such as parks and open space. 3 Course cr

ENV 910b, Survival Skills for Finishing Doctoral Students
This course is aimed at preparing advanced doctoral students for successful and rewarding careers in ecology and environmental science. Students learn about academic and non-academic careers from readings of and presentations by scientists in those positions. Students identify important steps toward planning and launching their career paths, and skills for being effective in these positions; and they develop their own career plan, curriculum vitae, teaching and research plans, and critiques of professional webpages. Finally, the course exposes students to resources and opportunities for continuing to apply and polish their skills. Pass/Fail.

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 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.

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

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.

ENV 970a or b, Environmental Protection Clinic: Policy and Advocacy
The clinic’s mission is to train students in environmental advocacy through skills-based seminars, interdisciplinary project work, and collaboration with the Natural Resources Defense Council and other significant environmental organizations. Students are assigned to teams of two-to-four members drawn from both the Law School and the School of the Environment. Teams work on a project developed in collaboration with client organizations, with most projects having both legal and policy components. In addition to covering substantive areas of environmental law, clinic seminars help students master the tools of effective environmental advocacy, including the abilities to research law and science, write and cite persuasively, navigate environmental organizations, and manage projects cooperatively. Enrollment limited. For all questions, please email Sam Whillans at swhillans@nrdc.org. Note: Attendance at the first class meeting is mandatory for admitted students and for those on the waiting list who wish to remain in consideration for admission if a place becomes available.
Admitted students must confirm their participation in advance of the first class by a date designated by the instructors. A no-drop policy applies. Course Bidding: Students in the School of the Environment (and students from any other school besides Yale Law School) must complete the Clinic’s Bidding Form by 5 p.m. on June 30.

**ENV 971b, Land Use Clinic**

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.

**ENV 972a or b, Advanced Environmental Protection Clinic**

Open only to students who have successfully completed the Environmental Protection Clinic (ENV 970). No statement of interest required. Attendance at clinic seminar is optional. For all questions, please email Alison Gocke (alison.gocke@yale.edu). Permission of the instructor required.

**ENV 980a, Social Justice in the Global Food System Capstone**

This course examines social and environmental justice dimensions of today’s globalized food system. Using a critical participatory action research (cPAR) approach, we connect theory to practice through a project with partnering community food and justice organizations. Seminar discussions explore topics connected to the course project including: food sovereignty, agroecology, Black agrarianism, migration/immigration, and the Right to Food; the relevance of structural violence to food system inequities; and how land grabbing or food insecurity are connected to relative power on the global stage. Project work is grounded in understandings developed in the seminar, and involves research or practice projects designed in collaboration with partner groups (e.g., community-based non-profits; alliance organizations). Students develop competencies in analyzing global food systems phenomena through justice frameworks; contributing to the work of community-based initiatives; and working in diverse settings on food and environmental issues, as practice for management, leadership, policymaking, collaborative/action research, or other professional roles. Yale School of the Environment students may count the course toward the MEM capstone requirement, as an elective in the "People, Equity, and Environment" specialization, or
as a general elective. Students may enroll without counting the course toward the YSE capstone requirement. The course is also open to students from across the University, including Yale School of Public Health, Yale School of Management; and to Yale College seniors, upon application. 3 Course cr

**ENV 985b, Capstone: Neighborhood Planning Workshop**
This capstone workshop provides an opportunity for students to apply the theory of practice developed in ENV 817 (or comparable study/experience) to a real-world, local urban planning project as part of an interdisciplinary student team. Up to two teams of up to six students each work together, for a client, to develop a strategy for a neighborhood in New Haven or its environs. The emphasis in each neighborhood is on identifying and overcoming the tensions and conflicts between economic, social, and environmental objectives to develop a balanced strategy for each neighborhood that meets stakeholders’ goals while acknowledging the context of overarching regional, national, and global challenges and opportunities (e.g., climate change, demographic shifts). Toward that end, students are exposed to the detailed processes of local government as well as techniques used by city planners to collect and assess data and combine those quantitative tools with stakeholder engagement to develop strategies to achieve community vision. With a focus on interdisciplinary problem solving and the collective project management resulting in a client-driven work product, students learn valuable skills for their future careers. 3 Course cr

**ENV 999a or b, Directed Research-Doctoral Staff**

**Modules**

**ENV 001a, Urban Ecosystem Analysis**
The goal of this module is to acquaint students with field skills for characterizing and understanding urban ecosystems. It is designed to complement the Yale Myers module, which uses an ecosystem framework and examines comparatively undisturbed systems. In contrast, the urban module explicitly considers how the actions of humans and the existence of the built environment alter ecosystem structure and function. Throughout this module, students also gain a better understanding of the New Haven community, including its resources, history, and challenges. At the same time this module is an opportunity to explore themes and techniques that are especially well suited for human-dominated environments. An emphasis is also placed on qualitative methods and social science research, to complement quantitative methods highlighted at Yale Myers. 0 Course cr

**ENV 002a, People and Pathways**
In this module, students explore the breadth and dimensions of our diverse perspectives and backgrounds, the flows of energy and food in our economy, and how personal and societal forces shape the development of our communities. Students begin by exploring how we value, produce, and consume energy and food. We examine our own perspectives and environmental footprints, explore the theory and physical realities in energy and food systems, and begin identifying key questions on how to reimagine and adapt these systems toward a sustainable future. We explore the dimensions of these issues through interactive workshops at Yale, lectures from faculty and state leaders, and site visits to better understand the communities, infrastructure, and systems upon which we all depend. 0 Course cr
ENV 003a, Ecosystem Science
In their book on the fundamentals of ecosystem science, Weathers et al. (2013) start by introducing the idea that humans have devised many intellectual systems to understand and manage the complicated world in which we live, from physics to philosophy to economics. One such intellectual system is ecosystem science. It is a science that tries to make sense of the complex natural world and help us to better manage it. Ecosystems can be highly varied in size and character, from a little pool of water in a tree cavity, to a redwood forest, to a neighborhood in a city, to a frigid river, to the entire globe. Nevertheless, a common set of tools and ideas can be used to analyze and understand these varied and complicated systems. The results of these analyses are both intellectually satisfying and useful in managing our planet for the benefit of humankind and nature. Indeed, because of the growing demands placed on living and nonliving resources by humans, it could be argued that ecosystem science is one of the essential core disciplines needed to understand and manage the modern planet Earth. The overarching objective of this module is to explore the ecosystem framework for sustainable resource science, assessment, and management.