ENVIRNMNTL SCI & POLICY (ESP)

ESP 5040 Environmental Consulting (3 Credits)
This course is designed to train students on scientific degree tracks in becoming valuable employees in the environmental consulting industry by introducing students to the technical skills, project planning, and business management skills in demand by environmental consulting firms. The course focuses on the technical aspects in areas such as brownfield redevelopement, natural resources and environmental permitting, environmental compliance, sustainable development planning, etc. Course elements stress the use of industry standard procedures and state regulations, data and information management, report preparation, development of findings and opinions, and verbal presentations.

ESP 5060 Ecological Economics: Theory and Application (3 Credits)
Ecological Economics (EE) is not a traditional discipline. Often referred to as a “transdiscipline” because it crosses the boundaries of several subjects, many say that ecological economics is the science of sustainability. In this introductory, graduate level course we will explore EE as a young and evolving field of inquiry. Standard and non-standard economic concepts will be explained along with ecological understanding to describe the challenges that arise in coupled natural-human systems. We will use problem and solution based inquiry to test out some of the methods advocated by ecological economists. This will include participatory research on ecosystem services in local communities. Specific topics to be covered may include: Abiotic and biotic resources; supply and demand; market failures; economic growth and human well-being; policy instruments; efficient allocation of resources; pricing and valuation of non-market goods; ecological economics case studies around biodiversity.

ESP 5070 Decision Making in Natural Resource Management (3 Credits)
Managing natural resources for multiple objectives, in a sustainable manner, is a challenge that both practitioners and researchers face in today’s highly complex socio-political environment. Decision analysis skills are highly valued in the field of environmental science. This course will present current theories and applications related to decision making for natural resource management. Students will have the chance to work through local and regional decision making scenarios and compare different tools and theories on the ground.

ESP 5080 Soils and Environmental Change (3 Credits)
The purpose of this course is to introduce soil science to environmental science, geology, geography and biology majors. The course's multidisciplinary topics inform students about the relevance of soil studies across a broad spectrum of modern issues. Students will learn the geologic, geographic and climatologic aspects of soil formation, the structural components of soil that impact diverse aspects of soil fertility, drought, and tendency to landslide or erode, the dynamical aspects of soil hydrology and geochemistry, and the biological aspects of soil nutrient availability, nitrification, carbon cycling and biodiversity. A detailed list of topics, together with a tentative schedule, is included at the end of this document. This class is integrated with a laboratory that allows exploration of soil science topics through field and laboratory exercises.

ESP 5090 Environmental Chemistry (3 Credits)
This course covers the chemistry of Earth's environment, including the natural chemical processes as well as anthropogenic contributions. The environment in this context is divided into the atmosphere, the hydrosphere, the lithosphere, and the anthrosphere. Particular emphasis is given to human influences in each of these "spheres," including the causes, effects, detection, prevention, and mitigation of pollution. Environmental pollution is a global problem, with many technological and cultural causes, and as such requires an understanding of numerous disciplines in order to solve. This course thus involves the integration of concepts from chemistry, biology, geology, ecology, atmospheric sciences, hydrology, toxicology, political science, and others. Major topics to be covered include stratospheric ozone depletion, global climate change and energy, acid rain, waste disposal, organic and inorganic pollutants, and environmental regulation in the United States. The lab component will focus primarily on detection of pollutants in air and water and will include a class research project.

ESP 5160 Land Conservation Techniques (3 Credits)
Conserving land is a common technique for protecting natural resources and critical habitats, providing recreational opportunities and maintaining forested and open land. This course explores diverse reasons for land conservation and various techniques and methods for land conservation and management of conserved areas. Field trips to conserved sites, meetings with land managers, and case studies provide first hand examples. Additional course fee is required.

ESP 5210 Forest Ecosystems (3 Credits)
The course will be structured around the advanced methods that have enhanced our understating of forest ecosystems. The course will explore concepts and techniques to address the changes in climatic cycles, the implications of wide-scale pollution, fire and other ecological disturbances that have an effect on forests ecosystems. Topics to be covered include forest water and biogeochemical cycles, forest ecology, forest diversity and global forest ecology. A field trip to the Hubbard Brook Experimental Forest or another location in the White Mountain National Forest is included.

Prerequisite(s): demonstration of competency in biogeochemistry, chemistry, ecology and quantitative analysis; or permission of instructor.

ESP 5215 Environmental GIS Mapping Applications (1 Credit)
This course provides GIS users with hands-on experience creating maps in ArcGIS Desktop and ArcGIS online to communicate spatial information. The course emphasizes effective map layout, data classification, and effective symbology. The course consists of a series of in-class demonstrations and tutorials designed to provide hands-on mapping in GIS and culminates with a self-led mapping experience.

ESP 5225 Environmental GIS Spatial Analysis (2 Credits)
This course provides hands-on experience for GIS users to build spatial analysis skills through a series of in-class tutorials and outside of class problem sets. We focus on the skills, techniques and tools most commonly used by environmental professionals to analyze and solve problems. These include watershed and stream network delineations, topographic and land cover assessments, and spatial pattern analysis. Prerequisite(s): ESP 5215 or permission of the instructor.
ESP 5230 Environmental GIS Project Management (1 Credit)
This is a project-based course designed for students with GIS mapping and spatial analysis experience. The course will develop project management skills in order to answer a spatially-related environmental question that they pursue independently. Students will engage in all phases of project development, execution, documentation, and dissemination using ArcGIS Desktop, and/or ArcGIS online or QGIS. This course is repeatable up to 2 credits. Prerequisite(s): ESP 5225 or permission of the instructor.

ESP 5320 Watershed Hydrology (3 Credits)
This course will provide a qualitative and quantitative understanding of concepts and physical principles governing the occurrence, distribution, and circulation of water near the Earth’s surface. Emphasis will be on the physical understanding and parameterization of hydrologic processes such as how rainfall and snowmelt become streamflow, evapotranspiration, and groundwater. This course is expected to serve as prerequisite to Watershed Management and Snow Hydrology, and co- or pre-requisite to Field Methods in Water Resources.

ESP 5430 Environmental Law, Policy & Management (3 Credits)
This introductory level course will help students understand the key “human” relationships in coupled natural and human systems. This will include understanding how the environment is affected by relationships among legal, political, and management players – including legislatures, administrative agencies, courts, federal, state, and local governments, nonprofit, private, and public stakeholders. We will explore key events and issues in the history of U.S. environmental law and policy and then analyze how those have impacted management practices. With historical perspective in context, we will explore current issues and project what the future landscape of environmental law, policy, and management might look like. Frequent case studies of varying scale (local, regional, international) will be used to examine the major theme and questions.

ESP 5440 Watershed Systems (3 Credits)
This course is dedicated to integrated environmental analysis of watersheds, but it is not the study of water, per se, but rather the spatial unit defined by the flow of water, and the dynamics within these environmental systems. Watersheds are a microcosm of global ecosystems, containing the same dynamic relationships between land, water, and air but on a scale more accessible to study. This course provides students with a detailed overview combined with specific, high-impact examples of complex earth systems. It uses the watershed concept as a tool for analyzing water, energy, element, and sediment budgets, including biogeochemical cycles with important feedbacks to larger systems. It includes human impacts and reliance on these budgets and prepares students to see how global-scale ecosystems are integrated with each other and with society. Students should be prepared to read, comprehend and analyze several scientific papers each week, and to discuss them in class.

ESP 5450 Environmental Outreach & Communication (3 Credits)
Communicating about environmental science is an important skill and helps in linking environmental science and policy. This course will provide an introduction to environmental science communication concepts, explore historical and theoretical aspects of environmental communication, and develop communication and outreach skills through a variety of activities and projects. Connections will be made to students’ research interests and projects to assist them in conveying their work to multiple audiences.

ESP 5500 Special Topics in Environmental Science and Policy (1-4 Credits)
An in-depth study of a particular topic, contemporary issue or concern. The course will be taught by a specialist within the field being studied or, as an alternative methodology, a faculty member will coordinate a series of guest speakers who will meaningfully address the topic. Since topics vary, the course may be repeated with permission of the instructor.

ESP 5510 Analysis of Limnological Systems (3 Credits)
This course will examine the structure and function of freshwater ecosystems. Topics to be covered will include the geology, chemistry, physics and biology of such systems. Special emphasis will be given to biogeochemical cycles, energy flow and productivity, and relationships of freshwater systems to human existence. Lab work will include studies of both lotic and lentic systems.

ESP 5530 Science-Based Research Design and Data Visualization (3 Credits)
This course will focus on data analysis techniques in environmental science. Topics will include exploratory analysis, research design, univariate and multivariate statistical approaches, a few basic machine learning algorithms, and Monte Carlo propagation of uncertainty. The course is project based, so students will work with a large data set of their choice throughout the semester.

ESP 5550 Climate Change (3 Credits)
This combined lecture and discussion course examines Earth’s climate system and the feedbacks that affect it over annual to millennial (thousands of years) timescales. It is a highly interdisciplinary course that integrates information on climate from atmospheric, oceanographic and geologic sciences, and broadens overall comprehension of natural and human-invoked changes in earth’s critical zone systems. Students from meteorology, environmental science and policy, and ecology should find this course highly informative and useful. Topics include past and present records of climate change, the various fields of study that contribute to climate knowledge, the effects of scale and frequency on the quality and reliability of climate records, and the state-of-the-art in climate assessment and prediction. Lecture sessions will provide fundamental information, especially with regard to the scientific basis for our current understanding of climate, and will introduce “hot” topics for discussion. Discussion sessions will focus on the most-recent status of these “hot” topics using recently published scientific papers and also online professional-level discussion forums. The role of science in politics and society will be an integral part of many of these discussions, including the obstacles created by declining public proficiencies in science and math and varying perceptions of risk.

ESP 5560 Environmental Law & Policy (3 Credits)
This course reflects the legal and political aspects of major environmental issues as embodied in environmental laws. The course will teach learners about the law and the policies that are the basis for environmental laws. Concurrent examination is proposed in order to provide linkage between policy and law as we will discuss real world events and issues. The course will be presented in a form to convey a robust understanding of the bigger procedural and theoretical picture in the formation, implementation, and facets for each topic. Topics include the legal process, the policy process, ownership and property rights, and how these relate to major environmental issues; water, air, waste, wildlife, and forestry. Emerging new issues will also be discussed.
ESP 5700 Graduate Seminar in Ecology and the Environment (3 Credits)
This graduate seminar focuses on how ecological concepts and studies inform scientists, managers, and decision makers about the nature of and solutions to environmental problems. Specific topics, each will clearly demonstrate the central role of ecology in understanding ecosystem function and how ecosystems respond to disturbances at multiple scales. Through readings and discussion, students become knowledgeable and critical of ecological theory and practice. The concepts are fleshed out through case studies taken directly from peer-reviewed literature.
Prerequisite(s): Demonstrated competency in the principles of ecology, including ecosystem ecology, landscape ecology and/or community ecology, or permission of the instructor.

ESP 5720 Environmental Planning Seminar (1-3 Credits)
Land use planning is a dynamic field that involves the integration of a variety of components to improve communities and places. This graduate seminar will focus on furthering knowledge on specific topics related to environmental planning and explore interrelationships between topics. Topics might include smart growth, low impact design, transportation, energy, sustainable design, watershed planning, and community involvement.

ESP 5900 Master's Thesis Research (1-6 Credits)
Students select a topic in consultation with their advisor and committee. A timeline, proposal, and defense are outlined. A final thesis is prepared in accordance with program thesis guidelines. Pass/No Pass.

ESP 5910 Independent Study in Environmental Science and Policy (1-3 Credits)
Independent study provides enrichment of the background of students through the pursuit of a special topic pertinent to their interests and abilities. It is an opportunity for an in-depth study of a problem in environmental science or policy. Consent of a faculty supervisor and the student's advisor is required.

ESP 5920 Independent Environmental Research (1-3 Credits)
Students select a topic and project in consultation with their advisor and committee. Collaboration with external organizations and partners is encouraged. A timeline, goals, deliverables, credits and expected outcomes are outlined for each project. Pass/No Pass.