

NATURAL RESOURCES (NR)

Course numbers with the # symbol included (e.g. #400) have not been taught in the last 3 years.

NR 801 - Ecological Sustainability and Values

Credits: 4

Deeper more fundamental philosophical questions, including spiritual values questions, are being asked concerning the ecological/environmental challenge of our time; its causes and resolution. Aspects of this challenge—environmental education, energy, food, agriculture, and natural resources—analyzed with ethics and values approaches. Students develop ways of responding to problem identification and resolution.

NR 802 - Workshops

Credits: 1-4

Short-term courses (generally a few days to two weeks) offered off campus, covering a broad variety of environmental and natural resource topics. May be repeated. Special fee required depending on topic. Prereq: permission required.

NR 803 - Watershed Water Quality Management

Credits: 4

Principles of land use as they relate to water quality and quantity. Lectures focus on biogeochemical cycles and the watershed approach to land and water resource management. Labs and field trips focus on methods of water sampling and analysis. One year of chemistry is recommended. Prereq: freshwater resources or watershed hydrology, or permission. Special fee. Lab/field trips.

NR 806 - Soil Ecology

Credits: 4

Examines the ecological relationships between soil microorganisms and their biotic and abiotic environment, with emphasis on the role of soil microorganisms in biogeochemical cycling. Specific objectives are to examine the biodiversity present in soil systems, factors controlling microbial community composition and diversity, and linkages between soil microbial communities, soil physical properties, and soil organic matter and nutrient cycling dynamics. Prereq: Introduction to principles of biology, general chemistry or equivalent, or permission. Lab. Special fee.

NR 807 - Environmental Modeling

Credits: 4

Environmental Modeling introduces students to a range of key mathematical and computer modeling concepts and the ways they can be used to address important scientific questions. The course is divided into four topical sections: Population and Community Ecology, Hydrology, Biogeochemistry, and Ecosystems. In each section, modeling concepts and skills are presented together with environmental information to emphasize the linkage between quantitative methods and relevant scientific results. Prereq: MATH 425. (Also listed as EOS 807.)

NR 810 - Endangered Species Seminar

Credits: 2

This seminar provides students with an interactive class of student presentations and guest lectures by endangered-species biologists. Emphasis is placed on biological, sociological, economic, and political factors that influence endangered-species policy. Prereq: basic ecology/biology; permission. Special fee.

NR 811 - Wetland Ecology and Management

Credits: 4

Analysis of the natural resources of coastal and inland wetlands and environmental problems caused by human use and misuse of these ecosystems. Groups will collect field data to summarize the structure and function of four wetland types within a management context. Special fee. Lab. Prereq: general ecology; watershed water quality management; or permission. Special fee. Lab/field trips.

NR 812 - Mammalogy

Credits: 4

Evolution, ecology, behavior, physiology and diversity of mammals. The focus of the course is on conceptual issues, such as the relation of structure, function, physiology and ecology of species; reproductive physiology and life history strategies; and the evolution of mating systems and social structure. Familiarity of mammalian groups to the family level and identification of local fauna to species will be required. Prereq: BIOL 411 and BIOL 412 or equivalent. Lab. (Not offered every year.) Special fee.

NR 816 - Wetland Delineation

Credits: 4

Examination of the soils, vegetation, and hydraulic functions of coastal and central New England wetlands. Students are responsible for the collection and identification of aquatic plant species, description of wetland soils, and delineation of wetland boundaries. Lectures and fieldwork. For graduate students and professionals. Special fee. Lab. (Offered summer session only.)

NR 818 - Law of Natural Resources and Environment

Credits: 3

Federal and state environmental statutory and administrative law, its application, strengths and weaknesses, and options for future amendment.

NR #819 - Wetlands Restoration and Mitigation

Credits: 3

Assesses the problems of wetlands loss and learning how to repair the damage. Asks what steps can be take. Does restoration work, can habitat value be replaced, what constitutes equivalent mitigation? Field experience and theoretical background in restoring marine and freshwater environments. First half of course involves field trips to visit and sample mitigation and restoration sites. Second half focuses on student projects using the scientific method to address wetland issues. Prereq: NR 811 or permission. Special fee. Lab/field trips. (Not offered every year.)

NR 820 - International Environmental Politics and Policies for the 21st Century

Credits: 4

Students examine policies for managing human activities to sustain the health of regional ecosystems and planetary life-support systems. Selected problems of the international commons (oceans, marine resources, atmosphere, migratory species); global and regional carrying capacity (population, resource consumption), internationally shared ecosystems (trans-boundary watersheds, water-bodies, tropical forests); and the relevant international institutions and politics for policy formation, conflict resolution, and implementation. Using a policy-analytic framework, students develop case studies to assess international policies and institutional arrangements to achieve the objectives of Agenda 21—Earth Summit Strategy to Save the Planet. Prereq: permission.

NR 824 - Resolving Environmental Conflicts**Credits: 4**

Theories and practices of environmental dispute settlement. Roles of public, non-governmental and governmental organizations. Effectiveness of public participation initiatives in influencing public policy decisions and/or resolving environmental conflicts. Alternative approaches to consensus (policy dialogues, joint problem solving; strategic planning; negotiation, mediation) as well as litigation. Specific cases are critiqued and evaluated; conflict resolution skills are developed. Students observe and/or participate in ongoing local decision processes. Prereq: permission. Lab. Special fee.

NR 829 - Silviculture**Credits: 4**

The science and art of establishing, growing, and tending forests to meet multiple objectives. Basics of forest stand dynamics applied to the problems of timber management, wildlife habitat, water quality, and carbon sequestration. Prereq: NR 425 and NR 527 or permission. Special fee.

NR 830 - Terrestrial Ecosystems**Credits: 4**

Processes controlling the energy, water, and nutrient dynamics of terrestrial ecosystems; concepts of study at the ecosystem level, controls on primary production, transpiration, decomposition, herbivory; links to Earth-system science, acid deposition, agriculture. Prereq: forest ecology and introduction to botany or principles of biology, or permission.

NR 834 - Tropical Ecology**Credits: 4**

This course introduces students to the ecology of different tropical ecosystems, and involves students in analyzing and interpreting ecological field data and remotely sensed data. An important emphasis is to understand patterns and processes across scales - from individual plants to ecosystems and landscapes. The also addresses important global issues in the tropics, including climate change, land use change, diverse ecosystem services, and sustainable resource management.

NR 835 - Land Conservation Principles and Practices**Credits: 4**

Students gain practical knowledge, understanding and experience in land conservation planning and implementation of options for land protection based on current practice in New Hampshire. By interacting with practitioners, students learn what it takes to implement successful land conservation projects, and conservation stewardship requirements and practices. Permission. Special fee. Lab.

NR 836 - Tropical Ecology and Conservation**Credits: 4**

This intensive field course in Costa Rica introduces students to the science and practice of tropical ecology and conservation. The course includes visits to major tropical biomes, including cloud forest, rainforest, dry forest, and diverse arecosystems. A focus in on understanding how ecological information is scaled from trees to ecosystems and landscapes, and the impact of climate change and land management. Students conduct a project on a topic of interest, involving data collection, analysis, and interpretation. Special fee.

NR #838 - Wildlife Policy and Management**Credits: 4**

Local, regional, and national issues and strategies in policy and administration. Contemporary issues including land management, commercialization of wildlife, overpopulation, endangered species, wildlife diseases, and professionalism. Prereq: permission. Special fee. Lab.

NR 840 - Inventory and Monitoring of Ecological Communities**Credits: 4**

Provides an introduction to the major concepts associated with monitoring change in ecological communities. Students develop an appreciation for such issues as: identification of appropriate baselines for comparison; use of indicator species; the tools used to inventory common, rare, and secretive species; how trend data are analyzed; and the implications of failing to detect an indicator species. Restricted to senior wildlife majors others by permission. Special fee. Lab.

NR 844 - Biogeochemistry**Credits: 4**

Examines the influence of biological and physical processes on elemental cycling and geochemical transformations from the molecular to the global scale, involving microorganisms, higher plants and animals and whole ecosystems; factors that regulate element cycles including soils, climate, disturbance and human activities; interactions among the biosphere, hydrosphere, lithosphere, and atmosphere; transformations of C, N, S, and trace elements. Prereq: one semester biology and two semesters chemistry or permission. (Also offered as EOS 844.)

NR 845 - Forest Management**Credits: 4**

Forest land ownership; management objectives; forest inventory regulation and policy; forest administration; professional responsibilities and opportunities. Restricted to Natural Resources majors. Lab. Special fee.

NR 849 - Forest Inventory and Modeling**Credits: 4**

Applied sampling and statistical techniques for assessing current forest conditions and predicting future growth, yield, and structure. Topics include plot and point sampling, ecological inventory, and evaluation of site quality and stand density. Prereq: MATH 420 and BIOL 528. Special fee.

NR 851 - Aquatic Ecosystems**Credits: 4**

Energy flow and nutrient cycling in streams, rivers and lakes, with an emphasis on understanding the control of primary productivity, decomposition and community structure by both hydrologic and biotic drivers. Role of aquatic ecosystems in carbon and nitrogen budgets at watershed, regional, and global scales. Impacts of environmental changes such as global climate change and suburbanization on aquatic ecosystems. Lab. Prereq: General Ecology.

NR 857 - Remote Sensing of the Environment**Credits: 4**

Practical and conceptual presentation of the use of remote sensing and other geospatial technologies for mapping and monitoring the environment. This course begins with the use of aerial photographs (photogrammetry, and photo interpretation) and includes measures of photo scale and area, parallax and stereo viewing, object heights, flight planning, photo geometry, the electromagnetic spectrum, camera systems and vegetation/land cover mapping. The course concludes with an introduction to other geospatial technologies including digital image analysis, global positioning (GPS), and geographic information systems (GIS). Conceptual lectures are augmented with practical homework assignments and hands-on lab exercises. Prereq: algebra. Special fee. Lab.

NR 859 - Digital Image Processing for Natural Resources**Credits: 4**

Introduction to digital remote sensing, including multispectral scanners (Landsat and SPOT) radar, and thermal imagery. Hands-on image processing including filtering, image display, ratios, classification, registration, and accuracy assessment. GIS as it applies to image processing. Discussion of practical applications. Use of ERDAS image-processing software. Knowledge of PCs required. Prereq: NR 857 or equivalent and permission.

NR 860 - Geographic Information Systems in Natural Resources**Credits: 4**

This course in geographic information systems (GIS), covers advanced theory, concepts, and applications of GIS for natural resource and related disciplines. Discussion of database structures, data sources, spatial data manipulation/analysis/modeling, data quality and assessment. Students conduct a project of their design exploring aspects of GIS most useful to them. Lecture emphasizes concepts and applications through a text and selected peer-reviewed articles. Lab uses the latest version of ArcGIS software and provides hands-on experience. Prereq: introductory GIS course. Permission required.

NR 861 - Environmental Soil Chemistry**Credits: 4**

Chemical transformations in soils are the basis for soil fertility and plant productivity in natural and managed ecosystems, and also influence key ecosystem processes including soil organic matter turnover and soil-atmosphere exchange of trace gases. This class will explore soil chemistry processes and transformations related to soil nutrient cycling, plant nutrient acquisition, and other critical environmental services. Prereq: a course in soil science or instructor permission.

NR 882 - Forest Health**Credits: 4**

Forests cover over 30% of the land surface of the Earth and are incredibly important ecologically, economically, and to the health of the planet. While forests show great capacity to withstand disturbance, these ecosystems are increasingly threatened worldwide by climate change, native and introduced insects and disease, poor management practices, land clearing, drought, fire, and pollution. This course offers an overview of the dominant threats to forests, their causes and consequences, and options for monitoring, management, and mitigation. Special fee.

NR 883 - Forest Communities of New Hampshire**Credits: 4**

A hands-on field course designed to introduce students to the diverse forest community types of New Hampshire. Topics include: 1) field identification of forest types using different classification systems and keys; 2) identification of characteristic plant and animal species; 3) the roles of climate, geology, soils, natural disturbance, forest management, and biotic factors in determining forest community type; 4) primary and secondary succession, including old-growth. Prereq: One course in ecology or environmental biology or permission. Special fee.

NR 884 - Sustainable Living - Global Perspectives**Credits: 4**

The pursuit of sustainable solutions to living in our contemporary world is a global endeavor. In this course, the concept of living sustainably is explored from a broad international perspective. Global scale issues impacting sustainable resource use are considered, including population growth, economic globalization and development, social equity, and cultural values. We will expand our awareness of alternatives to those current practices that impede the sustainability of human societies as part of the earth's natural systems. We will also pursue an understanding of the interrelated socio-economic conditions, combined with social and personal ethics and values necessary to move toward a more sustainable future. And each of us will come to value what sustainable living means for our own lives. Prereq: NR 437 or NR 435.

NR 885 - Systems Thinking for Sustainable Solutions**Credits: 4**

This course applies systems thinking as a problem-solving approach aimed at exploring possibilities for creating a future based on sustainable relationships between healthy human societies and their natural environments. Types of systems and systems tools are utilized to describe human-environment relationships and to emphasize their resiliency or vulnerability to future unsustainable events and/or practices. We explore how systems may be restructured to create more sustainable outcomes. Pre- or Coreq: NR 437 or NR 435.

NR 887 - Advanced Topics in Sustainable Energy**Credits: 4**

This course will engage students in advanced topics in sustainable energy. Course reviews basic structure of our energy system, energy markets and economics, and the environmental, economic and technological of our energy landscape. Focus will be on electricity and building use with introductions to the transportation system. Students will gain the knowledge to evaluate innovations in technology, policy and financing necessary to implement sustainable energy goals from conservation and efficiency to renewables and energy storage. Prereq: NR 507 or CHE 410 or POLT 444.

NR 897 - Special Topics**Credits: 1-4**

An experimental course for the purpose of introducing a new course or teaching a special topic for a semester in an area of specialization in natural resources. Permission required. Special fee on some sections.

NR 899 - Master's Thesis**Credits: 1-10**

Usually 6 credits, but up to 10 credits when the problem warrants. Cr/F.

NR 902 - Ecological Ethics and Values**Credits: 4**

Increasingly fundamental philosophical questions, including spiritual values questions, are posited concerning the ecological/environmental challenge of our time, its causes, and its resolution. Examination of these questions, put forth with ethics and values approaches. Students work to develop responses to both problem identification and resolution.

NR 903 - Approach to Research**Credits: 2**

Provides incoming graduate students with an overview of the scientific method, peer review, and various research approaches and methods. Ethics, institutional and individual responsibilities, and effective communication are also addressed in a seminar and discussion format. Cr/F.

NR 904 - Survey Research Methods**Credits:** 2

Theoretical foundations and practical considerations in conducting survey research. Methods for obtaining high-quality responses using current technology. Topics include questionnaire design, survey implementation, and strategies for reducing errors encountered in the conduct of surveys.

NR 905 - Grant Writing**Credits:** 2

The ability to secure financial support for research and outreach activities is becoming increasingly important. This course is intended for graduate and post-graduate level students who need to write proposals for their graduate work or to gain external funding from government agencies. Students will gain in-depth understanding of the proposal writing process through class discussions, insights shared by UNH faculty, and by writing a research proposal following the entire process.

NR 909 - Analysis of Ecological Communities and Complex Data**Credits:** 4

This course introduces you to a suite of tools appropriate for analyzing and interpreting multivariate data arising from agroecological (and other ecological) research. In this course we cover a variety of multivariate analyses, including clustering, ordination (principle components analysis, nonmetric multidimensional scaling, correspondence analysis), group comparisons (multi-response permutation procedures, PerMANOVA, indicator species analysis, discriminant analysis, mantel test), and other hypothesis-driven techniques, including structural equation modeling.

NR 910 - Forest Stand Dynamics**Credits:** 4

Discussion and presentation on forest dynamics to include soil-site quality evaluation, individual tree growth, stand growth and yield, stand and forest management, and related resource politics. (Not offered every year.)

NR 912 - Sampling Techniques**Credits:** 2-4

Techniques of sampling finite populations in environmental sciences; choice of sampling unit and frame, estimation of sample size, confidence limits, and comparisons of sample designs. Prereq: Applied statistics or equivalent. (Not offered every year.)

NR 913 - Quantitative Ecology**Credits:** 4

Applied quantitative techniques: basic concepts in probability and statistics applied to ecological systems; population dynamics; spatial patterns; species abundance and diversity; classification and ordination; production; and energy and nutrient flow. Prereq: calculus, statistics, and ecology. (Not offered every year.)

NR 915 - Coastal Challenges Sci-Policy**Credits:** 2

This seminar introduces TIDES students to the environment in which they will develop an understanding of the organization and workings of NOAA's Estuarine Research Reserve System, how this system serves the research needs of coastal communities and how the NERRS collaborate with other coastal and estuarine programs (e.g. Coastal Zone Management, National Estuarine Program), and develop strategies to solve coastal problems. The course involves field work at NERRS and other coastal areas in ME, NH and MA. Permission.

NR 916 - Linking Decision-making and Coastal Ecosystem Science**Credits:** 4

Integrating coastal ecosystem science, policy and management is the focus of this course, designed as an inquiry-based collaborative learning laboratory, with both classroom and field components. Students explore ways to effectively link knowledge to action(s) designed to address complex coastal and related watershed problems, including those related to climate change. We examine both theories and practices that are more likely to foster the production and use of salient, credible and legitimate knowledge that is trusted by scientists/technical experts, citizens and decision-makers and thus likely to meet the needs of and be used by the decision-makers. In addition to developing an understanding of criteria used to judge the adequacy of ecosystem-based knowledge and its relevance to support decisions, students are exposed to a range of models for analyzing complex problems, including the process of joint fact finding and other collaborative problem solving mechanisms. These are examined and tested by the students. Students develop specific problem assessment, communication, and process skills, and examine and evaluate a range of specific cases through in class simulations and practical applications relevant to real world initiatives. Original case studies of specific current coastal issues are undertaken to test their models. Permission required.

NR 917 - Coastal Ecosystem Science Policy and Management Internship**Credits:** 6

TIDES Program Internship is served at a National Estuarine Research Reserve, Coastal Community or NEP where TIDES program graduate student interns help facilitate collaborative learning and problem solving with scientists, decision-makers and coastal resource users, assist with information transfer, and help coastal communities plan for and protect coastal and estuarine related resources. TIDES M.S. students only.

NR 947 - Current Issues in Ecosystem Ecology**Credits:** 2

Examines current issues in ecosystem ecology and biogeochemistry by weekly discussion of primary research articles. Topics covered include elemental interactions in biogeochemical processes, mechanisms regulating nitrogen losses from terrestrial ecosystems, and hydrologic-chemical interactions in streams and groundwater. Cr/F.

NR 965 - Community Ecology**Credits:** 4

This course investigates how community properties – species richness, and abundance distribution – are influenced by evolutionary history, landscape phenomena such as dispersal and migration, and local factors such as the physical environment, disturbance, competition, predation, and positive interactions. Mechanistic models of community dynamics, including succession, are discussed. The influence of species diversity on ecosystem function is discussed, and all aspects of the course are related to conservation science.

NR 993 - Natural and Environmental Resources Seminar**Credits:** 1 or 2

Presentation and discussion of recent research, literature, and policy problems in the natural and social sciences influencing resource use. Cr/F.

NR 995 - Investigations**Credits:** 1-4

Investigations in Natural Resources may include topics in environmental conservation, forestry, soil science, water resources, and wildlife management. Permission required.

NR 996 - Natural Resource Education

Credits: 1

Responsibilities include set-up, teaching, and grading of one lab section per week or equivalent lecture experience. Required of all M.S. degree students in the department. Cr/F.

NR 997 - Special Topics

Credits: 1-4

An experimental course for the purpose of introducing a new course or teaching a special topic for a semester in an area of specialization in natural resources. Permission required. Special fee on some sections.

NR 998 - Directed Research

Credits: 1-4

Student designs and conducts original research that culminates in a paper of publishable quality. Alternative to NR 899 for those choosing non-thesis degree option. Cr/F. IA (continuous grading). May be repeated up to a maximum of 4 credits.