

ENST - ENVIRONMENTAL SCIENCE AND TECHNOLOGY

ENST403 Invasive Species Ecology (3 Credits)

We will examine ecological, evolutionary, and anthropogenic processes facilitating or resisting biological invasions, and consider their environmental, economic, and human health impacts. We will consider various management strategies to mitigate invasions and identify areas of future research. Field trips and detailed discussion of recent findings and controversies in the literature will help illustrate fundamental concepts of invasions among various ecosystems.

Credit Only Granted for: ENST403, ENST603, or ENST689R.

ENST404 Ecological and Natural Resources Ethics (3 Credits)

Bridges science and management with ethical theory and concepts to help scientists, regulators, and managers understand how to deal with potential ethical dilemmas that arise in natural resource and environmental management implementation and policy development.

Recommended: ENST214, ENST314, ENST360, ENST410, and ENST460.

Jointly offered with: ENST604.

Restriction: Senior standing or higher.

Credit Only Granted for: ENST604 or ENST404.

ENST405 Energy and Environment (3 Credits)

Introduction to the role of energy in environmental and human-dominated systems. Discussion of the historical and modern production and consumption of energy. Introduction to energy systems computer simulation and energy auditing.

Prerequisite: MATH140 or MATH120.

Jointly offered with: ENST605.

Restriction: Junior standing or higher. And must be in Environmental Sci & Tech program; or must be in Environmental Sci & Tech: Ecological Tech Design program; or must be in Environmental Sci & Tech: Environmental Health program; or must be in Environmental Sci & Tech: Soil & Watershed Science program; or must be in Environmental Sci & Tech: Natural Resources Mgmt program.

Credit Only Granted for: ENST405, ENSP350, ENST605, or MEES698Z.

ENST410 Ecosystem Services: An Integrated Analysis (3 Credits)

The importance of our ecosystems and the services they provide will be discussed. Basic principles used to analyze ecosystem services will be discussed and applied using case studies & field exercises. Forestland, wetlands and our marine resources are increasingly recognized for their ecosystem services provided to society, to include clean air and water, wildlife habitat, biodiversity, carbon storage and pollination services. This course will prepare students to deal with the complex issues involved in understanding those and other ecosystem services and their importance to society and environmental sustainability. Slowly, new markets are emerging for these services. Students will analyze the ecological, policy and financial dimensions of enhancing, restoring, and sustaining ecosystem services. New and on-going government programs and private business ventures will be discussed.

Prerequisite: ENST360 or BSCI361; or permission of instructor.

Restriction: Must be in one of the following programs (Environmental Sci & Tech: Ecological Tech Design; Environmental Sci & Tech; Environmental Sci & Tech: Natural Resources Mgmt; Environmental Sci & Tech: Soil & Watershed Science; Environmental Sci & Tech: Environmental Health).

ENST411 Principles of Soil Fertility (3 Credits)

Soil factors affecting plant growth and quality with emphasis on the bio-availability of mineral nutrients. The management of soil systems to enhance plant growth by means of crop rotations, microbial activities, and use of organic and inorganic amendments.

Prerequisite: ENST200; or students who have taken courses with comparable content may contact the department. Jointly offered with ENS T611.

Credit Only Granted for: ENST411 or NRSC411.

Formerly: NRS C411.

ENST414 Soil Morphology, Genesis and Classification (4 Credits)

Processes and factors of soil genesis. Taxonomy of soils of the world by U.S. System. Soil morphological characteristics, composition, classification, survey and field trips to examine and describe soils.

Prerequisite: Must have completed or be concurrently enrolled in ENST200.

ENST415 Renewable Energy (3 Credits)

An overview of renewable energy technologies and their current applications. Emphasis will be placed on technological readiness, efficiency and sustainability of renewable energy alternatives.

Technologies include solar thermal, photovoltaics, biodiesel, ethanol, anaerobic digestion, wind, hydroelectric, and microbial fuel cells.

Prerequisite: CHEM131; and PHYS121 must be completed or in progress; or permission of AGNR-Environmental Science & Technology department.

ENST417 Soil Hydrology and Physics (3 Credits)

A study of soil water interactions: the hydrologic cycle; the unique properties of water and soil; the soil components and their interactions; the field water cycle; transport processes involving water, heat and solutes; human effects on soil and groundwater; as well as the measurement, prediction, and control of the physical processes taking place in and through the soil.

Prerequisite: ENST200; and (MATH113 or MATH115).

ENST421 Soil Chemistry (4 Credits)

The chemistry and composition of mineral and organic colloids in soils, including ion exchange, oxidation-reduction, acidity, surface charge, and solution chemistry. Lectures and readings pertain to plant nutrition, waste disposal, and groundwater quality.

Prerequisite: ENST200.

ENST422 Soil Microbial Ecology (3 Credits)

The interdisciplinary study of soil microorganisms and their interactions with the mineral matrix; resulting in processes such as nutrient cycling, decontamination, and natural product production. We will focus on the diversity of soil communities, their survival strategies, and the new strategies used to study these communities.

Prerequisite: ENST200; or 1 course in BCHM; or must have completed a course in microbiology; or students who have taken courses with comparable content may contact the department.

Jointly offered with: ENST622.

ENST423 Soil-Water Pollution (3 Credits)

Reaction and fate of pesticides, agricultural fertilizers, industrial and animal wastes in soil and water with emphasis on their relation to the environment.

Prerequisite: CHEM131 and CHEM132; or permission of instructor.

ENST430 Wetland Soils (3 Credits)

The soils of wetlands including hydrology, chemistry, and genesis are discussed. Federal and regional guidelines for wetland soils are covered with an emphasis on validating interpretations through field observations.

Prerequisite: ENST200.

Credit Only Granted for: ENST430 or ENST630.

ENST431 Environmental Data Science (3 Credits)

Modern environmental science relies on data from many sources such as field observations, sensors, satellites, and models to understand how the planet is changing. This course introduces students to the core ideas and practices of environmental data science through theory and practice. Students will learn how to explore, visualize, and interpret environmental data. They will work with spatial datasets to map environmental patterns, build models to describe relationships among different environmental processes, and analyze time series. Emphasis is placed on developing algorithmic thinking, creativity in problem solving, and clear communication of results. By the end of the course, students will be able to work confidently with diverse datasets and models to solve real-world environmental problems. No prior programming experience is required, but familiarity with the R programming language is strongly recommended.

Recommended: ENST321 or other 300-level statistics course.

ENST432 Environmental Microbiology (3 Credits)

Microorganisms are everywhere and mediate many important processes. These organisms are the unseen catalysts for industrial processes and are critical to many emerging technologies. This course will explore how microorganisms benefit society through bioremediation, food safety and production, and biotechnology. Lectures, outside readings, and in-class discussions will help students gain an understanding of where microbiology fits into broader discussions of sustainability, green technology, and human and environmental health. This course is designed for undergraduates in a variety of environmental and life science majors who desire to understand how microorganisms can improve the lives of humans and the environment around us.

Prerequisite: BSCI160.

ENST434 Toxic Contaminants: Sources, Fate, and Effects (3 Credits)

Study of the release to the environment, transport through natural compartments, persistence and ultimate fate of various classes of contaminants produced as a result of human activities. Topics will culminate in discussions of impacts to wildlife and human health. Students should emerge with a practical appreciation of the actual risks from exposure to a variety of environmental contaminants and an understanding of the environmental and human health implications of continuing the contaminating activities.

Prerequisite: ENST333 and ENST334.

ENST436 Emerging Environmental Threats (3 Credits)

Examine new and potential environmental concerns in the air, water, soil, space, and the built environment. Emphasis on studying the intrinsic links between ecosystem and human health. Topics will include climate change, resource consumption, biodiversity change, infectious disease, non-traditional pollutants, and other complex and significant environmental concerns.

Prerequisite: ENST233; or permission of AGNR-Environmental Science & Technology department.

ENST441 Sustainable Agriculture (3 Credits)

Environmental, social and economic needs for alternatives to the conventional, high-input farming systems which currently predominate in industrial countries. Strategies and practices that minimize the use of non-renewable resources.

ENST445 Ecological Risk Assessment (3 Credits)

Assessment of ecological impacts of perturbations on natural systems. Course will describe methods for estimating environmental impacts including extrapolating from laboratory and field data. The role of regulatory agencies and implications of scientific uncertainty on risk management will be covered.

Prerequisite: ENST360 or BSCI361; and (BIOM301 and ENST334).

ENST450 Wetland Ecology (3 Credits)

Plant and animal communities, biogeochemistry, and ecosystem properties of wetlands. Lectures are supplemented by field trips and in-class labs. Hands-on activities include identification of wetland plant species, wetland delineation, and collection and analysis of field data on wetland vegetation, soil, and hydrology. Wading boots (at least hip length) are strongly recommended.

Prerequisite: BIOM301 and ENST360, or equivalent courses in data analysis and ecology; or permission of AGNR-Environmental Science & Technology department.

Jointly offered with: ENST650.

Credit Only Granted for: ENST450, ENST650, or MEES650.

ENST452 Wetland Restoration (3 Credits)

Design, construction, and evaluation of wetlands restored or created to provide ecosystem services or to mitigate losses due to development. Topics include fundamental properties of wetlands, ecological restoration theory, site selection and goal-setting, design plans, practices for establishing wetland hydrology, substrate, and vegetation, and restored ecosystem monitoring.

Prerequisite: BSCI160 and (BSCI180 or BSCI161); or permission of instructor.

ENST453 Watershed Science: Water Balance, Open Channel Flow, and Near Surface Hydrology (3 Credits)

Definition and delineation of watersheds based on the stream orders. Discussion of the principle of conservation of mass in the context of life cycles (water cycle, carbon cycle, photosynthesis, aerobic cycle, anaerobic cycle, and nitrogen cycle) as it relates to our Biosystem. Conceptual study of hydrologic cycle components and their prediction using empirical and physical-based models is covered. Role of water as the dynamic force within the context of its interaction with landscapes of diverse geology and land cover will be discussed. Elements of watershed management is discussed.

Prerequisite: MATH120 or MATH140, ENST200, GEOG306 or BIOM301.

Recommended: PHYS121.

Credit Only Granted for: ENST453 or ENST653.

ENST456 Spatial Analysis and Ecological Sampling (3 Credits)

Teaches ENST students ecological sampling methods and applied spatial analysis skills. Students will work in small groups on research projects they develop and test during the semester. Students will develop a research hypothesis, test their hypothesis, display it visually in QGIS, and analyze it with appropriate statistical methods in QGIS and R Studio culminating in a final presentation.

Recommended: GEOG306 and GEOG373.

Restriction: Senior standing or higher; and permission of instructor.

Additional Information: Students will need to provide an 8GB (or larger) thumb drive for data storage.

ENST460 Principles of Wildlife Management (3 Credits)

In this course, we integrate animal behavior, population dynamics, and the social and political aspects of wildlife ecology within the context of wildlife management. We focus primarily on ecological aspects of population dynamics and responses of animal populations to disturbances and specific management actions.

Prerequisite: BSCI160 and BSCI170.

ENST461 Urban Wildlife Management (3 Credits)

Ecology and management of wildlife in urban areas. For students in biological sciences, geography, landscape design, natural resources management, recreation and urban studies. Planning, design, and wildlife conservation in landscape ecology. Public attitudes, preferences, and values, review of private conservation organizations.

ENST462 Field Techniques in Wildlife Management (3 Credits)

Hands-on experience with field techniques in wildlife management focusing on various methods of conducting indices, estimates, and censuses of wildlife populations. Includes capture and handling of amphibians, reptiles, birds, and mammals by use of drift fences, cover boards, mist nets, box traps, and dart guns.

Prerequisite: (BSCI160 and BSCI161) and (BSCI170 and BSCI171); and ENST460 must be completed or in progress; or permission of instructor.

Recommended: ENST461.

Restriction: Permission of AGNR-College of Agriculture & Natural Resources.

ENST470 Ideas into Impact (3 Credits)

This will be a capstone-type course based around developing proposals for projects emphasizing research, monitoring, design, restoration, management, entrepreneurship, or other approaches to ecological or environmental questions, issues, or problems.

Restriction: Junior or Senior standing only; Permission of AGNR-Environmental Science & Technology department.

ENST472 Capstone (3 Credits)

This capstone course focuses on professional project preparation, presentation, and critical evaluation on environmental science research. Students will develop and present original projects and critique projects presented by others.

Restriction: Must be in a major within AGNR-Environmental Science & Technology department; and permission of AGNR-Environmental Science & Technology department.

Additional Information: This is the pinnacle course for students majoring in ENST and is therefore recommended in one of the students' final semesters.

ENST481 Ecological Design (4 Credits)

This advanced course explores green technologies, waste treatment, and ecological solutions. It covers principles of ecological design, biologically-based waste treatment systems, water quality parameters, and the implementation of green technologies. Key topics include ecology, ecological engineering, nutrient cycling, wastewater treatment, wetland treatment, leach fields, anaerobic digestion, composting, stream restoration, LEED certification, green walls, green roofs, living machines, rain gardens, bioswales, and algal turf scrubbers.

Prerequisite: MATH120 or MATH140; BSCI160; and must have completed or be concurrently enrolled in CHEM121 and PHYS131.

Jointly offered with: MEES681.

Credit Only Granted for: ENST481, ENST681, or MEES681.

ENST485 Water Management in Urban Environment (3 Credits)

In this course we explore relevant processes in pathways and fluxes of water in urban areas; urban water balance and consequences of urbanization on surface and groundwater regimes; effects of climate and hydrology; quantity and quality of urban runoff, sources of pollution and behavior of contaminants; and ecological quality and processes associated with urban water. We study design and planning for water quality and quantity management in urban water systems; and engineered and ecologically engineered alternatives for stormwater management. Additionally, we look at the climate impacts on the urban water cycle.

Prerequisite: MATH120, MATH136, or MATH140.

ENST486 Senior Professional Experience (3 Credits)

Students will arrange an off-campus professional-level work experience related to Environmental Science and Technology (ENST) to develop expertise in a specific area of their ENST concentration curriculum. Classroom sessions will frame student experiences within the broader discipline of Environmental Science and Technology. This course will tie together current practices in the ENST career industry, proposal writing, critical analysis, and culminate in a final paper and presentation.

Prerequisite: ENST389.

Restriction: Must be in the Environmental Science and Technology program; and permission of AGNR-Environmental Science & Technology department.

Additional Information: The course has two types of activities: lecture and experiential learning. Students are expected to work on their professional-level experience for 90 hours and participate in a 2-hour lecture every other week, during the semester to develop their Senior Integrative Experience (SIE) project. Each student's research question, proposal methodology, analysis, paper, and presentation will follow learning outcomes of all ENST SIE course options.

ENST487 Environmental Conflicts and Decision Making (2 Credits)

Study major cases which focus on environmental science with concentration on the role and techniques of negotiation, collaborative decision making, and adaptive resource management as an environmental conflict resolution process.

Restriction: Senior standing. And must be in one of the following programs (Environmental Sci & Tech: Natural Resources Mgmt; Environmental Sci&Pol-Wildlife Ecology & Mgmt) ; or permission of AGNR-Environmental Science & Technology department.

ENST489 Research Experience (3 Credits)

An advanced research-based course in the field of environmental science and technology.

Restriction: Permission of AGNR-Environmental Science & Technology department.

Repeatable to: 6 credits.

ENST499 Special Topics in Environmental Science and Technology (1-4 Credits)

An independent study, and/or lecture, and/or laboratory series organized to study a selected phase of Environmental Science and Technology not covered by existing courses. Credit arranged with supervising faculty member.

Restriction: Permission of AGNR-Environmental Science & Technology department.

ENST602 Research Principles and Methodology in Environmental Science and Technology (3 Credits)

Fundamental research strategies and methods of investigation in Environmental Science and Technology including field and laboratory procedures.

Restriction: Must be in Environmental Sci & Tech program.

ENST603 Advanced Invasive Species Ecology (3 Credits)

We will examine ecological, evolutionary, and anthropogenic processes facilitating or resisting biological invasions, and consider their environmental, economic, and human health impacts. We will consider various management strategies to mitigate invasions and identify areas of future research. Field trips and detailed discussion of recent findings and controversies in the literature will help illustrate fundamental concepts of invasions among various ecosystems. Jointly offered with ENST403.

Credit Only Granted for: ENST403, ENST603, or ENST689R.

Formerly: ENST689R.

Additional Information: Two field trips are planned for this class.

ENST604 Advanced Ecological and Natural Resource Ethics (3 Credits)

Bridges science and management with ethical theory and concepts to help scientists, regulators, and managers understand how to deal with potential ethical dilemmas that arise in natural resource and environmental management implementation and policy development.

Recommended: ENST314, ENST410, and ENST460.

Credit Only Granted for: ENST404 or ENST604.

Additional Information: Students must have prior coursework similar to the content offered in undergraduate courses ENST214 and ENST360.

ENST605 Energy and Environment (3 Credits)

Role of energy in environmental and human-dominated systems and their linkage. Discussion of the historical and modern production and consumption of energy. Energy systems simulation modeling, energy analysis and energy auditing. Review of national energy policies and proposed alternatives.

Jointly offered with: ENST405.

Credit Only Granted for: ENST405, ENST605, or MEES698Z.

Formerly: MEES698Z.

Additional Information: Students must have prior coursework similar to the content offered in undergraduate course MATH120; or students who have taken courses with comparable content may contact the department.

ENST606 Advanced Ecosystem Health and Natural Resource Management (3 Credits)

Explore some of the most important and current global environmental and health challenges. Investigate fundamental and new concepts from the fields of ecology, eco-epidemiology, social anthropology, and environmental and health policy, as well as interdisciplinary cross-sectorial approaches such as One Health, Eco-Health, and Planetary Health.

Restriction: Permission of AGNR-Environmental Science & Technology department.

Credit Only Granted for: ENST606 or ENST689E.

Formerly: ENST689E.

Additional Information: Priority in enrollment will be given to students in ENST program.

ENST607 Adaptation and Resilience in Cities (3 Credits)

Knowledge about the relations between urbanization and global and local challenges, such as climate change, biodiversity loss, resource deficiency, poverty, justice and health, is of key importance to move towards sustainable development and resilient systems. This course takes a trans-disciplinary approach to understanding urban questions. Urban possibilities and challenges are analyzed by using a systems approach where ecological, social, and economic aspects are integrated through a social-ecological perspective to analyze resilience and sustainability. Linkages between and perspectives from science, social-sciences, and practice are emphasized throughout the course.

Restriction: Must be a graduate student; or permission of AGNR-Environmental Science & Technology department.

Credit Only Granted for: ENST607 or ENST689C.

Formerly: ENST689C.

ENST608 Research Methods (1-4 Credits)

Development of research viewpoint by detailed study and report on crop and soil research of the Maryland Agriculture Experiment Station or review and discussion of literature on specific agricultural problems or new research techniques.

Restriction: Permission of AGNR-Environmental Science & Technology department.

Repeatable to: 4 credits if content differs.

Credit Only Granted for: ENST608 or NRSC608.

Formerly: NRSC608.

ENST611 Advanced Principles of Soil Fertility (3 Credits)

Soil factors affecting plant growth and quality with emphasis on the bio-availability of mineral nutrients. The management of soil systems to enhance plant growth by means of crop rotations, microbial activities, and use of organic and inorganic amendments.

Jointly offered with: ENST411.

Credit Only Granted for: ENST411 or ENST611.

Additional Information: Students must have prior coursework similar to the content offered in undergraduate course ENST200; or students who have taken courses with comparable content may contact the department.

ENST622 Advanced Soil Microbial Ecology (3 Credits)

The interdisciplinary study of soil microorganisms and their interactions with the mineral matrix; resulting in processes such as nutrient cycling, decontamination, and natural product production. We will focus on the diversity of soil communities, their survival strategies, and the new strategies used to study these communities. The course will include an examination of current literature in this field.

Jointly offered with: ENST422.

Credit Only Granted for: ENST422 or ENST622.

Additional Information: Students must have prior coursework similar to the content offered in undergraduate course ENST200; or 1 course in BCHM; or must have completed one course in microbiology; or students who have taken courses with comparable content may contact the department.

ENST630 Advanced Wetland Soils (3 Credits)

The soils of wetlands including hydrology, biogeochemistry, and pedogenesis, including a focused discussion of current literature. Federal and regional guidelines for wetland soils are covered with an emphasis on validating interpretations through field observations.

Credit Only Granted for: ENST630 or ENST430.

ENST631 Environmental Data Science (3 Credits)

Modern environmental science relies on data from many sources such as field observations, sensors, satellites, and models to understand how the planet is changing. This course introduces students to the core ideas and practices of environmental data science through theory and practice. Students will learn how to explore, visualize, and interpret environmental data. They will work with spatial datasets to map environmental patterns, build models to describe relationships among different environmental processes, and analyze time series. Emphasis is placed on developing algorithmic thinking, creativity in problem solving, and clear communication of results. By the end of the course, students will be able to work confidently with diverse datasets and models to solve real-world environmental problems. No prior programming experience is required, but familiarity with the R programming language is strongly recommended.

Recommended: Completion of a 300-level or higher statistics course.

ENST640 Advanced Crops, Soils, and Civilization (3 Credits)

Explore the rise, cycling, resilience, and decline of civilizations and apply learning to modern issues in the fields of sustainability, environmental ethics, natural resource management, and agriculture. Role and importance of crop and soil resources in the development of human civilization. History of crop and soil use and management as they relate to the persistence of ancient and modern cultures.

Jointly offered with: ENST440.

Credit Only Granted for: ENST440 or ENST640.

ENST643 Advanced Industrial Ecology (3 Credits)

Problems of waste management and recycling in human societies are covered. The industrial ecology approach to design is contrasted with analogous patterns and processes from natural ecosystems.

Jointly offered with: ENST443.

Credit Only Granted for: ENST443 or ENST643.

ENST645 Water and Development: A Global Challenge (3 Credits)

Broad study of water systems by integrating elements of environmental sciences, engineering, and policy analysis. Explore several real-world case studies, focusing on practical approaches for developing and managing water resources and derivative services. Review advanced methodologies for quantitative and qualitative policy analysis. Design management policies pertaining to complex water systems.

Credit Only Granted for: ENST689P or ENST645.

Formerly: ENST689P.

Additional Information: Students must have prior coursework similar to the content offered in undergraduate courses MATH120, MATH220 or MATH140 (students who have taken courses with comparable content may contact the faculty).

ENST650 Advanced Wetland Ecology (3 Credits)

Plant and animal communities, biogeochemistry, and ecosystem properties of wetlands. Lectures are supplemented by field trips (normally 2 days total during the semester) and in-class labs. Hands-on activities and exercises include identification of wetland plant species, wetland mapping and delineation, and collection and analysis of field data on wetland vegetation, soil, and hydrology. Wading boots (at least hip length) are strongly recommended.

Prerequisite: BIOM301; and ENST360 or other ecology equivalent; or permission of AGNR-Environmental Science and Technology department; or permission of CMNS-Marine & Estuarine-Environmental Science Program).

Cross-listed with: MEES650.

Jointly offered with: ENST450, MEES650.

Credit Only Granted for: ENST450, ENST650, or MEES650.

Additional Information: Wading boots (at least hip length) are strongly recommended.

ENST681 Advanced Ecological Design (3 Credits)

An advanced survey course on the field of ecological design. Principles of design are illustrated with case studies from biologically-based waste treatment systems, ecosystem management and sustainable development.

Cross-listed with: MEES681.

Credit Only Granted for: ENST481, ENST681, or MEES681.

ENST689 Special Topics (1-3 Credits)

Credit according to time scheduled and organization of the course. Organized as a lecture series on a specialized advanced topic.

Repeatable to: 6 credits if content differs.

Credit Only Granted for: ENST689 or NRSC689.

Formerly: NRSC689.

ENST702 Environmental Science and Technology: Communication and Professional Development (2 Credits)

Training in communication and professional development to prepare students to succeed in careers within the fields of environmental science and technology. Topics will include manuscript and technical writing, job search, communication with academic and non-academic audiences, multi-disciplinary collaboration, management (project, personnel, time), professionalism, leadership, ethics, and career opportunities. Course emphasizes practical training through facilitated discussions and critique practicums.

Prerequisite: ENST602.

Restriction: Must be in Environmental Science and Technology (Master's) program; or must be in Environmental Science and Technology (Doctoral) program; or permission of instructor.

ENST761 Methods in Pedological Investigations (4 Credits)

This is designed to equip students with analytical tools for soil microfabric and mineralogical analysis in order to understand soil properties and processes. A number of techniques will be discussed, but emphasis will be placed on micromorphology and x-ray diffractometry.

Both theoretical and applied considerations will be covered, and students will gain substantial hands on experience in collecting and interpreting data germane to their research interests.

Additional Information: Students must have prior coursework similar to the content offered in undergraduate course ENST414; or permission of AGNR-Environmental Science & Technology department .

ENST789 Advances in Research (1-4 Credits)

A study of recent advances in agronomy research.

Repeatable to: 4 credits if content differs.

Credit Only Granted for: ENST789 or NRSC789.

Formerly: NRSC789.

ENST798 Graduate Seminar (1 Credit)

Designed to provide a venue for interactive discussion between ENST graduate students and other members of the ENST community regarding thesis/dissertation research planned or conducted as part of the students graduate program.

Restriction: Must be in one of the following programs (Environmental Science and Technology (Doctoral); Environmental Science and Technology (Master's)); or permission of AGNR-Environmental Science & Technology department.

Repeatable to: 6 credits.

Credit Only Granted for: ENST798 or NRSC798.

ENST799 Master's Thesis Research (1-6 Credits)**ENST821 Advanced Methods of Soil Investigation (3 Credits)**

First semester, alternate years. An advanced study of the theory of the chemical methods of soil investigation with emphasis on problems involving application of physical chemistry.

Credit Only Granted for: ENST821 or NRSC821.

Formerly: NRSC821.

ENST831 Soil Mineralogy (4 Credits)

Soil minerals, with emphasis on clay minerals, are studied from the viewpoint of soil genesis and physical chemistry. Mineralogical analyses by x-ray and chemical techniques.

ENST832 Advanced Soil Physics (3 Credits)

An advanced study of physical properties of soils.

Restriction: Permission of instructor; and permission of AGNR-Environmental Science & Technology department.

Credit Only Granted for: ENST832 or NRSC832.

Formerly: NRSC832.

ENST898 Pre-Candidacy Research (1-8 Credits)

ENST899 Doctoral Dissertation Research (1-8 Credits)