ENVIRONMENTAL SCIENCE AND TECHNOLOGY MAJOR

Program Director: Andrew Baldwin, Ph.D.

The Environmental Science and Technology major prepares students for graduate study and careers focusing on understanding the natural and built environments and resolving environmental problems and concerns for the benefit of humans and ecosystems. Specifically, the program encompasses impacts of human society on the natural environment, the effects of environmental conditions on humans and ecosystems, science-based management of ecosystems, watershed and soil-related processes related to environmental quality, and designing solutions to sustainably improve environmental quality of air, water, soil, and biological communities. The ENST major is a science- and math-based curriculum leading to a B.S. degree in Environmental Science and Technology with concentrations in Ecological Technology Design, Ecosystem Health, Soil and Watershed Science, or Natural Resources Management. These concentrations share a foundation in science and mathematics, offer specialization through required concentration core courses, and provide flexibility in course selection in concentration depth and technical elective categories. The concentrations are designed to provide students with a fundamental understanding of environmental systems and issues and the multidisciplinary quantitative design and analytical tools necessary to solve complex environmental problems.

For future updates and exciting changes, please visit our website at http://enst.umd.edu.

Concentrations:

Ecological Technological Design

The ENST concentration in Ecological Technology Design prepares students for integrating natural systems with the built environment to solve environmental problems while achieving economic, ecological and social sustainability. The science and applications of using natural systems, processes and organisms to address environmental issues has evolved during the last few decades to a mature level whereby there are strong employment opportunities for graduates that are cross-educated in ecology and technology. Examples of ecological technology design applications include restoration of urban and rural streams, creation of wastewater treatment wetlands, design of rain gardens and bioretention systems for low-impact stormwater management, design of eco-industrial parks, life cycle assessment of products for improved environmental performance, bioremediation and phytoremediation of contaminated groundwater, ecological systems for by-product recovery, and filtration of contaminated air with bioreactors. The curriculum consists of a broad set of background courses in environmental science, electives in applications of Ecological Technology Design, and upper-level courses that synthesize the major. Hands-on design experience is included in required internship and practicum courses.

Ecosystem Health

The ecosystem health concentration is a broad and increasingly important field with wide ranging applications in the environmental science and public health fields. The field encompasses environmental factors and ecosystem functions that affect human health and the effects of human activities on the ecosystem products and services we depend on. Example topics within the field include ecological risk analysis, environmental toxicology, environmental impact assessment, chemical fate and transport, human health risk assessment, industrial hygiene, air quality, environmental microbiology, food safety and security, biodiversity and human health, and children's environmental health. The Ecosystem Health concentration within the Department of Environmental Science and Technology offers a science-based curriculum that includes advanced studies in ecosystem health and environmental protection and the impacts of environmental degradation on human health.

Natural Resources Management

The goal of the Natural Resources Management concentration is to teach students concepts of the environmentally sound use and management of natural resources. Ecosystems and human societies are linked in complex cycles and relationships between vegetation and wildlife, forests and cities, conservation and development. By learning to participate effectively within these cycles, we will help sustain a harmonious relationship between the environment and human activities. This concentration provides students with the knowledge and skills they need to work in such positions as wildlife biologists, environmental consultants, wetland scientists, forest managers, fisheries biologists, aquatic biologists, and nature interpreters.

Soil and Watershed Science

The Soil and Watershed Science concentration enables students to understand the complex ways in which aquatic and terrestrial ecosystems are influenced by soil properties and processes and land management decisions. The soil performs such critical ecological functions as supplying and purifying water, recycling wastes, nurturing plants, modifying the atmosphere by emitting or sequestering gases and particulates, providing habitat for the most diverse biological communities on Earth, and serving as a medium for human engineering projects.

The concentration in Soil and Watershed Science in ENST provides students with one of the top soil science programs in the nation. The curriculum prepares graduates for work in variety of careers addressing natural resource and environmental issues and provides a rigorous science background for those planning to pursue post-graduate degrees in environmental sciences, soil science, watershed processes, and related fields. Students graduating from this program will make valuable contributions to society as they pursue challenging careers critical to the protection of the environment. In addition to pursuing advanced degrees, graduates may work in both the private and public sectors performing such services as soil mapping, wetland delineation, land conservation planning, forestry, waste management, farm advising, international development, and consulting in environmental, construction, and landscape architecture areas. Graduates from the Soil and Watershed Science concentration will be qualified to take the national exam to become a Certified Professional Soil Scientist (CPSS).

Program Learning Outcomes

1. Science and Technology Application. Students will demonstrate the ability to apply natural science principles and technology methods (particularly in ENST), and be able to express scientific questions and findings in the context of relevant socio-environmental dimensions.
2. Quantitative Reasoning. Students will demonstrate the ability to apply basic mathematical and quantitative reasoning in the context of relevant socio-environmental dimensions.
3. Written and Oral Communication. Students will be able to communicate clearly, concisely, and effectively in writing and speech to scientific, management, policy, or general audiences.

4. Information Literacy. Students will demonstrate information literacy skills that they can successfully apply in and outside their disciplines.
5. Technology Fluency. Students will be able to apply technologies to their research and academic efforts in the context of their specific disciplines.
6. Diversity, Equity, Inclusion and Respect (DEIR). Students will be able to apply their scientific and technological research and academic efforts in the context of diversity, equity, inclusion, and respect.

REQUIREMENTS

This program requires a total of 120 credits for a Bachelor of Science, including the general education program course credits, required major credits; Technology and Ecosystem elective credits, and free elective credits. All courses counted toward the major must be completed with a C- or better. An overall GPA of 2.0 in major courses is required for graduation.

Course	Title	Credits
ENST Core for all Areas of Concentration		
BSCI170 & BSCI171	Principles of Molecular & Cellular Biology and Principles of Molecular & Cellular Biology Laboratory	4
MATH120	Elementary Calculus I	3
BSCI160 & BSCI161	Principles of Ecology and Evolution and Principles of Ecology and Evolution Lab	4
CHEM131 & CHEM132	Chemistry I - Fundamentals of General Chemistry and General Chemistry I Laboratory	4
ENST200	Fundamentals of Soil Science	4
ENST233	Introduction to Environmental Health	4
CHEM231 & CHEM232	Organic Chemistry I and Organic Chemistry Laboratory I	4
PHYS121	Fundamentals of Physics I	4
GEOG306	Introduction to Quantitative Methods for the Geographical Environmental Sciences	3
or BIOM301	Introduction to Biometrics	
ENST360	Ecosystem Ecology	4
ENST389	Internship	3
Concentration (See list below)		**33-36**
Senior Integrative Experience - Choose one course from list below		**3**
ENST388	Honors Thesis Research	
ENST470	Ideas into Impact	
ENST486	Senior Professional Experience	
ENST472	Capstone	
Total Credits		**77-80**

Concentrations: Ecological Technology Design

Course	Title	Credits
Concentration Core		
ENST281	Computer Aided Design in Ecology	2
ENST481	Ecological Design	4
MATH121	Elementary Calculus II	3
Concentration Depth - Ecology (2 Courses)		**6**
ENST410	Ecosystem Services: An Integrated Analysis	
ENST422	Soil Microbial Ecology	
ENST450	Wetland Ecology	
ENST453	Watershed Science: Water Balance, Open Channel Flow, and Near Surface Hydrology	
GEOL453	Ecosystem Restoration	
Concentration Depth - Design (3 Courses)		**9**
ENST282	Ecological Innovation and Entrepreneurship	
ENST405	Energy and Environment	
ENST415	Renewable Energy	
ENST443		
ENST485	Water Management in Urban Environment	
ENST456	Spatial Analysis and Ecological Sampling	
or GEOG272	Introduction to Earth Observation Science	
or GEOG373	Geographic Information Systems	
or INAG237	GPS & Drone Applications in Surveying	
Ecological Technology Design Technical Electives [1]		**12**
Urban Ecosystems and Human Dimensions:		
ENST461	Urban Wildlife Management	
GEOG331	Introduction to Human Dimensions of Global Change	
LARC452	Green Infrastructure and Community Greening	
PLSC480	Urban Ecology	
Sustainable Technology:		
ENST432	Environmental Microbiology	
ENST441	Sustainable Agriculture	
GEOL453	Ecosystem Restoration	
INAG250	Fundamentals of Agricultural Mechanics	
PLSC425	Green Roofs and Urban Sustainability	
Wetlands:		
ENST430	Wetland Soils	
ENST450	Wetland Ecology	
ENST452	Wetland Restoration	
GEOL452	Watershed and Wetland Hydrology	
Ecology and Ecosystem Management:		
BSCI467	Freshwater Biology	
ENST373	Natural History of the Chesapeake Bay	
ENST460	Principles of Wildlife Management	
PLSC471	Forest Ecology	
Total Credits		**36**

Ecosystem Health

Course	Title	Credits
Concentration Core		
ENST333	Ecosystem Health and Protection	3
ENST334	Environmental Toxicology	3
ENST436	Emerging Environmental Threats	3
BSCI207	Principles of Biology III - Organismal Biology	3
BSCI222	Principles of Genetics	4
or BSCI223	General Microbiology	
Concentration Depth (2 Courses)		**6**
ENST403	Invasive Species Ecology	
ENST423	Soil-Water Pollution	

ENST432	Environmental Microbiology	
ENST445	Ecological Risk Assessment	
Ecosystem Health Technical Electives [1]		**12**
Environmental Health:		
ENST403	Invasive Species Ecology	
ENST423	Soil-Water Pollution	
ENST434	Toxic Contaminants: Sources, Fate, and Effects	
ENST436	Emerging Environmental Threats	
ENST445	Ecological Risk Assessment	
Environmental Science and Management:		
ENST405	Energy and Environment	
GEOG415	Land Use, Climate Change, and Sustainability	
GEOL452	Watershed and Wetland Hydrology	
ENST432	Environmental Microbiology	
LARC450		
Ecological Processes:		
ENST422	Soil Microbial Ecology	
ENST450	Wetland Ecology	
ENST460	Principles of Wildlife Management	
PLSC400	Plant Physiology	
BSCI467	Freshwater Biology	
Human Health:		
BSCI424	Pathogenic Microbiology	
BSCI425	Advanced Cell Biology Lab Practices	
BSCI437	General Virology	
BSCI450	Mammalian Systems Physiology	
Chemistry Depth:		
CHEM241	Organic Chemistry II	
CHEM242	Organic Chemistry Laboratory II	
Cultural or Social Dimensions:		
ENST410	Ecosystem Services: An Integrated Analysis	
GEOG331	Introduction to Human Dimensions of Global Change	
GEOG431	Culture and Natural Resource Management	
PLCY301	Sustainability	
SOCY405	Scarcity and Modern Society	
Total Credits		**34**

Natural Resources Management

Course	Title	Credits
Concentration Core		
BSCI222	Principles of Genetics	4
ENST214	Introduction to Natural Resources Management	3
ENST487	Environmental Conflicts and Decision Making	2
Concentration Depth (4 Courses)		**12**
ENST456	Spatial Analysis and Ecological Sampling	
or GEOG272	Introduction to Earth Observation Science	
or GEOG373	Geographic Information Systems	
or INAG237	GPS & Drone Applications in Surveying	
ENST450	Wetland Ecology	
or ENST453	Watershed Science: Water Balance, Open Channel Flow, and Near Surface Hydrology	
AREC240	Introduction to Economics and the Environment	
or AREC241	Environment, Economics and Policy	
or ENST410	Ecosystem Services: An Integrated Analysis	
or AREC250	Elements of Agricultural and Resource Economics	
ENST424		
or ENST430	Wetland Soils	
or ENST441	Sustainable Agriculture	
or ENST462	Field Techniques in Wildlife Management	
or GEOG418	Field and Laboratory Techniques in Environmental Science	
Natural Resources Management Technical Electives [1]		**12**
Wildlife:		
ENST460	Principles of Wildlife Management [2]	
ENST461	Urban Wildlife Management [2]	
BSCI334 & BSCI335	Mammalogy and Mammalogy Laboratory [2]	
ENSP102	Introduction to Environmental Policy [2]	
PLSC254	Woody Plants for Mid-Atlantic Landscape II	
ENSP330	Introduction to Environmental Law [2]	
or GVPT273	Introduction to Environmental Politics	
Fisheries:		
ENST314	[3]	
COMM250	Introduction to Communication Inquiry [3]	
COMM382	Essentials of Intercultural Communication [3]	
GEOG331	Introduction to Human Dimensions of Global Change [3]	
GEOG416	Conceptualizing and Modeling Human-Environmental Interactions [3]	
ENSP102	Introduction to Environmental Policy [3]	
ENSP330	Introduction to Environmental Law [3]	
GVPT273	Introduction to Environmental Politics [3]	
Wetlands:		
ENST430	Wetland Soils [4]	
ENST450	Wetland Ecology [4]	
ENST452	Wetland Restoration [4]	
GEOL452	Watershed and Wetland Hydrology [4]	
PLSC489	Special Topics in Plant Science (PLSC489O Plant Taxonomy) [4]	
or PLSC254	Woody Plants for Mid-Atlantic Landscape II	
Forestry:		
PLSC253	Woody Plants for Mid-Atlantic Landscapes I	
PLSC254	Woody Plants for Mid-Atlantic Landscape II	
PLSC400	Plant Physiology	
PLSC471	Forest Ecology	
Total Credits		**33**

Soil and Watershed Science

Course	Title	Credits
Concentration Core		
GEOL100 & GEOL110	Physical Geology and Physical Geology Laboratory	4
ENST456	Spatial Analysis and Ecological Sampling	3
or GEOG272	Introduction to Earth Observation Science	

or GEOG373	Geographic Information Systems	
or INAG237	GPS & Drone Applications in Surveying	
Concentration Depth - Soil Sciences		**7**
ENST411	Principles of Soil Fertility	
ENST414	Soil Morphology, Genesis and Classification [5]	
ENST417	Soil Hydrology and Physics [5]	
ENST421	Soil Chemistry [5]	
ENST422	Soil Microbial Ecology [5]	
Concentration Depth - Field Experiences		**3**
ENST301	Field Soil Morphology I	
ENST302	Field Soil Morphology II	
ENST303	Field Soil Morphology III	
ENST309	Advanced Field Soil Morphology	
ENST424		
ENST430	Wetland Soils	
ENST441	Sustainable Agriculture	
ENST450	Wetland Ecology	
Concentration Depth - Systems		**6**
AREC365	World Hunger, Population, and Food Supplies	
ENST410	Ecosystem Services: An Integrated Analysis	
ENST432	Environmental Microbiology	
PLSC400	Plant Physiology	
Soil and Watershed Science Technical Electives [1]		**12**
Agriculture and Sustainable Land Use:		
AREC365	World Hunger, Population, and Food Supplies	
PLSC303	Global Food Systems	
PLSC405	Agroecology	
Social Ecology:		
BSCI223	General Microbiology	
BSCI337	Biology of Insects	
BSCI467	Freshwater Biology	
ENST410	Ecosystem Services: An Integrated Analysis	
Geosciences:		
GEOL322	Mineralogy	
GEOL340	Geomorphology	
GEOL341	Structural Geology	
GEOL342	Sedimentation and Stratigraphy	
GEOL444	Low Temperature Geochemistry	
Watersheds:		
ENST334	Environmental Toxicology	
ENST423	Soil-Water Pollution	
ENST453	Watershed Science: Water Balance, Open Channel Flow, and Near Surface Hydrology	
GEOL451	Groundwater	
GEOL452	Watershed and Wetland Hydrology	
GEOL453	Ecosystem Restoration	
Total Credits		**35**

[1] Any combination of electives can be taken. Courses appear in blocks of related topics to assist students in tailoring their program to particular interests within the concentration. Under some circumstances, other 300 or 400 level electives can be substituted with advisor's approval.

[2] Required for Professional Certification as an Associate Wildlife Biologist by The Wildlife Society.

[3] Required for Professional Certification as an Associate Fisheries Professional by American Fisheries Society.

[4] Required for Professional Certification as a Wetland Professional in Training (WPIT) by The Society of Wetland Scientists Professional Certification Program (SWSPCP).

[5] Required for Soil Certification Exam.

GRADUATION PLANS

Click here (https://agnr.umd.edu/academics/advising/four-year-plans/) for roadmaps for graduation plans in the College of Agricultural and Natural Resources.

Additional information on developing a graduation plan can be found on the following pages:

- http://4yearplans.umd.edu
- the Student Academic Success-Degree Completion Policy (https://academiccatalog.umd.edu/undergraduate/registration-academic-requirements-regulations/academic-advising/#success) section of this catalog