

**STRATEGIC PLAN
2010-2015**

**DEPARTMENT OF
ENVIRONMENTAL SCIENCE AND TECHNOLOGY**

**COLLEGE OF AGRICULTURE AND NATURAL RESOURCES
UNIVERSITY OF MARYLAND**

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Department of Environmental Science and Technology Strategic Plan, 2010-2015

INTRODUCTION

The Department of Environmental Science and Technology is one of the newest departments on campus and in the College of Agriculture and Natural Resources. There are 25 faculty working to make this new endeavor a success. Consistent with the evolving mission of the College to expand teaching, research, and extension programs in environmental science, ENST offers a revolutionary perspective of the discipline that is strongly grounded on the ecological and natural sciences coupled with a pervasive ethic that the health of natural systems are the basis for strong agriculture, healthy societies, productive lives and vibrant economies.

As the global population continues to grow and developing countries increase their industrial and economic status, the natural environment is no longer considered a boundless exploitable resource, but rather a critical life-support system that is the basis of human welfare and creativity. Locally, the environments of Maryland face more urbanization and population growth, which continue to stress the State's natural resources, especially Chesapeake Bay. In addition, the crucial environmental services provided by ecosystems, such as cleaning air and water, providing floodwater storage and nutrient processing, have only recently become a major area of focus for environmental research. As human activities continue to alter the environment, increasingly the health of the environment is seen to affect humans, not only in terms of food, materials, and energy, but also via ecologically-driven and socio-economically catastrophic processes such as proliferation of disease vectors, soil desertification, food-web transmission of toxins, and climate change. University graduates will increasingly be called upon to investigate environmental problems and to design solutions that manage, mitigate, or reverse ecological impacts.

The Department of Environmental Science and Technology at the University of Maryland will develop into a world-class center of discovery and teaching that will innovate and educate to deal with increasingly complex environmental conditions. The Department serves the campus community as a key, foundational unit of its increasingly broader emphasis on the environment. It is unique among campus units because it is comprised of a critical mass of faculty fully involved in environmental science and problem solving. The Department also serves the needs of the world, nation, and state by offering unbiased expertise across a spectrum of environmental fields to international, federal and state organizations. Bringing together faculty with expertise in soil science, ecology, natural resource management and ecological engineering in this new department has set the stage for unique collaborations, the development of attractive courses and curricula, and new extension programs that not only lead to a better understanding of the complexity of environmental systems and issues, but also provides sustainable solutions.

OUR VISION

The Department of Environmental Science and Technology will become widely known and respected as:

1. one of the top ten undergraduate programs in the Nation in ecological technology design, environmental health, natural resources management and soil and watershed science in the nation;
2. one of the top ten graduate programs in the Nation in the ecological technology design, soil and watershed science, and wetland science in the nation;
3. a National center of excellence for extension education and outreach relating to the environmental quality in the nation;
4. the home of nationally and internationally recognized faculty in basic and applied environmental science research;
5. a national focal point and resource for interdisciplinary collaborative environmental science research that serves as the nexus for environmental science research, teaching, and extension education.

OUR MISSION

The mission of the Department of Environmental Science and Technology is to promote understanding and conscientious management of natural, agricultural and urban ecosystems by:

1. examining human impacts on ecosystem structure, function and services;
2. investigating the effects of environmental conditions on human health.
3. understanding the interactions among air, water, soil, living organisms, and people;
4. designing and implementing technology for enhanced environmental quality;
5. promoting a sustainable future and enhanced environmental quality through the study of conservation and management of our natural resources;

We aspire to build the human capital and knowledge base needed to meet these mission goals through excellence in scientific discovery, education and outreach programs.

STRENGTHS, CHALLENGES AND OPPORTUNITIES

An assessment of our strengths, challenges and opportunities provides insights into the environment in which we operate and the alternatives before us.

Strengths

As one of the newest Departments on campus the faculty, staff and students are energized and optimistic about their ability to excel at delivering on their new mission. We have laid the foundation for providing excellence in teaching, research and extension/outreach to our students, to the citizens of Maryland and to the world.

1. We continue to recruit and retain outstanding faculty.

2. Our ENST undergraduate student enrollment is growing approximately three times faster than anticipated when the program was launched in the 2008-2009 academic year.
3. Our ENST graduate program is attracting diverse and talented students who are enthusiastic and committed to expanding the environmental science knowledge base.
4. Our location provides students and faculty with unique access to public policy-makers, national research laboratories, libraries, agencies and professional networks.
5. Our curriculum in Environmental Health has been recognized by the Center for Disease Control and Prevention as a pioneering effort in undergraduate education.
6. Our graduates are being actively recruited by state and federal agencies to meet future staffing needs.
7. Because of our long-term involvement in environmental issues related to the Chesapeake Bay ecosystem, our faculty are considered to be national and international leaders in the field of environmental science and policy.

Challenges

Our Department is growing and rapidly gaining recognition for excellence. However, there are threats to our progress that could prevent us from achieving our vision. Some challenges, such as the state of the local, national and world economy, are external to the Department but could exert negative impacts on our programs and goals. By identifying our vulnerabilities, we can anticipate problems and devise plans to overcome them.

1. As student demand for our courses and curriculum increases, we must expand the number of courses we offer, increase the class size for existing courses, and add more experiential laboratory sections to courses. This will increase the demand for teaching faculty, teaching assistants, teaching laboratory space, teaching technology, and other teaching resources.
2. As State support for higher education has diminished over time, we will need to form new partnerships and cultivate new sources of external financial support to enable us to continue to expand and improve our high-quality research efforts and strengthen our extension/outreach programs.
3. Because of our region's high cost of living, adequate financial compensation for faculty, staff and graduate students is essential for us to be competitive with peer institutions. If we are to recruit and retain the most highly-qualified individuals, salaries must increase.

Opportunities

The Department is new and unique, so its aim is to create a reputation as a premier academic department with a keen focus on solving environmental problems with innovative technologies, promoting sustainable agricultural production, managing our natural resources, developing sources of bioenergy, and understanding the impact of ecological change on human and the environment.

1. We have the opportunity to expand on a current area of excellence and firmly establish our agricultural nutrient management program as a national and international model for developing new knowledge, dissemination of new technologies to practitioners, and incorporation of sound science into policy decision making process.
2. We have the opportunity to expand our leadership in Soil Science by building on of the top programs in the eastern U.S.
3. We have the opportunity to fill a void that has been identified at the national scale in the field of environmental health. Our curricular offerings in environmental health can be expanded into a national model curriculum for higher education. Community outreach and extension education programs can partner with existing public health organization to educate our citizenry on the important links between ecological health and human health.
4. We have the opportunity to establish an internationally renowned, multi-disciplinary research and education program in wetland science.
5. We have the opportunity to develop a center for excellence in ecological engineering with a focus on green technologies and bioenergy production.

INITIATIVES

Initiative 1: Complete development, staffing and delivery of the new Environmental Science and Technology undergraduate curriculum that attracts high quality majors from within and outside Maryland.

The ENST undergraduate major prepares students for 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 the environmental quality of air, water, and for living systems. The ENST major is a science and math based curriculum leading to a B.S. degree in Environmental Science and Technology with concentration in Ecological Technology Design, Environmental Health, Soil and Watershed Science, or Natural Resources Management.

ENST Concentration in Ecological Technology 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 eco-technological applications include restoration of urban and rural streams, creation of wastewater treatment wetlands, design of raingardens 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, generation of biological feedstock for biofuels, and transformation of organic wastes to bioenergy through anaerobic digestion.

ENST Concentration in Environmental Health

Environmental health 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 for which we depend. 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.

ENST Concentration in 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 a 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 science, soil science, watershed processes, and related fields.

ENST Concentration in Natural Resources Management

The goal of the Natural Resources Management Program 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.

Specific Steps:

1. Hire five new full-time tenure-track faculty with undergraduate teaching responsibilities in the following discipline areas:
 - a. Ecological Toxicology
 - b. Environmental Microbiology
 - c. Ecological Risk Assessment
 - d. Landscape and Watershed Processes
 - e. Wildlife Ecology
2. Continue to increase recruitment of the best students from within and outside the state using the most effective digital and print media.
3. Ensure course offerings for ENST majors incorporate the most up-to-date knowledge delivered via the most effective means.
4. Participate more in the University's general education program by offering courses that instill an appreciation for lifetime learning, critical analysis, and creative and reflective thinking related to environmental science.
5. Expand the use of adjunct faculty for teaching undergraduate courses.
6. Support the College's efforts to secure more scholarship funding.

Measures of Success:

1. Continued increase in number of majors.
2. Increase in academic quality of majors.
3. Hiring of top faculty.

4. Addition of new courses with additional sections or seats for increased campus demand.
5. Number of adjunct faculty involved in teaching ENST courses.
6. Number of undergraduates with partial and full scholarships offered by the College.

Initiative 2: Complete development of the new Environmental Science and Technology graduate program to support nationally and internationally recognized research.

The ENST graduate program offers Masters of Science and Doctor of Philosophy degrees in Environmental Science and Technology with three areas of specialization: 1) Soil and Watershed Sciences; 2) Ecological Technology Design; and 3) Wetland Science. The Department will initiate development of a fourth area of specialization in Ecology & Health.

ENST Specialization in Soil and Watershed Sciences

The ENST specialization in Soil and Watershed Sciences prepares students to address challenging environmental issues that involve the soil resource at field, landscape and watershed scales. Soils are the most complex and ecologically significant biogeochemical systems on Earth. Soil processes and the soil resource are critical to all terrestrial ecosystems from prairies to the Alaskan tundra, to wetlands, to our cities, to forests to biofuel farms. Soil Science is at the center of the study of what the National Science Foundation terms the Critical Zone - the confluence of atmosphere, lithosphere, hydrosphere and biosphere near the surface of the Earth.

ENST Specialization in Ecological Technology Design

The ENST specialization in Ecological Technology Design is a distinct program that prepares students to integrate natural systems with the built environment to solve environmental problems while achieving economic, ecological and social sustainability. The science and application 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 educated jointly in ecology and technology. Examples of eco-technological applications include: the restoration of urban and rural streams, the creation of wastewater treatment wetlands, the design of raingardens and bioretention systems for low-impact stormwater management, the design of eco-industrial parks, the life cycle assessment of products for improved environmental performance, the bioremediation and phytoremediation of contaminated land and groundwater, generation of biological feedstock for biofuels, and transformation of organic wastes to bioenergy through anaerobic digestion.

ENST Specialization in Wetland Science

The ENST specialization in Wetland Science addresses the national and international need to produce advanced students and more knowledge on one of the most historically underappreciated, but most critical ecosystems on the landscape. The preservation and restoration of wetlands has rapidly gained public support as their ability to provide many ecosystem services to society, such as protection against catastrophic storm flooding during hurricanes, has become more fully appreciated. The departmental organization provides a critical

mass, greater cooperation and synergism in Wetland Science research and education and a real opportunity to move forward.

Proposed Specialization in Ecology & Health

Ecology & Health is an aspect of Environmental Health that focuses on the mechanisms that link anthropogenic and natural environmental change to the health of humans and the flora and fauna of natural systems. Ecological change has far reaching implications for human health and sustainable development at local, regional and global scales. The focus on human and wildlife health reflects their importance as criterion for humankind's search for a sustainable future. The Department has a rare combination of research expertise and academic infrastructure that integrates human, wildlife, and ecosystem health that is required to launch a graduate specialization that builds on the new the undergraduate specialization in Environmental Health.

Specific Steps:

1. Hire five new full-time tenure-track faculty with graduate teaching and advising responsibilities in the following areas:
 - a. Ecological Toxicology
 - b. Environmental Microbiology
 - c. Ecological Risk Assessment
 - d. Landscape and Watershed Processes
 - e. Wildlife Ecology
2. Develop a graduate specialization in Ecology & Health.
3. Increase graduate student assistantship stipends by 20%.
4. Continue to increase recruitment efforts via improved digital and print media.
5. Establish a endowed research and teaching professorship in ENST.
6. Increase graduate teaching assistantship funding by 100%.
7. Expand the number of Affiliate and Adjunct Professorships.
8. Increase extramural grant funding.

Measures of Success:

1. Hire high quality faculty.
2. Establishment of specialization in Ecology & Health.
3. Improved recruitment of highly capable graduate students from around the world.
4. Increased funding for teaching assistantships.
5. Increase the number of affiliate and adjunct professors actively engaged in ENST.
6. Increase number of nationally and internationally recognized research programs.
7. Place doctoral students in tenure-track positions at peer institutions.
8. Creation of an endowed professorship.

Initiative 3: Develop a framework for departmental outreach and Extension education that includes all of the disciplines represented within the ENST faculty.

As we move forward in a time period of economic downturn and strategic decision-making it is incumbent on the department to remain faithful to the land-grant mission of which Extension is an integral component. We must provide accessible, unbiased, expert knowledge that Maryland citizens can use to improve their economic stability, their quality of life, and the environment in which they live. As such it is critical to align our Extension efforts with our research strength to build the information base needed to help our stakeholders. Currently we have strong Extension expertise in some of our research areas, but we need additional faculty with dedicated Extension responsibilities to improve the overall quality of our outreach mission. Our current expertise lies within nutrient management; waste management and resource recovery; precision water and nutrient management of container and in-field ornamental horticultural systems; ecological services such as environmental restoration, natural resource management, and restoration aquaculture; and water quality and quantity. These are areas that will continue to be essential as components of Maryland's agricultural industry and the Chesapeake Bay recovery. The ENST Extension program has a long-term involvement in Chesapeake Bay ecosystem issues and will continue to be a national and international leader in environmental science and technology.

Efforts in water and nutrient management and environmental restoration are at the heart of Chesapeake Bay recovery efforts. Efforts will focus on efficient nutrient application and removal, drainage ditch and stormwater run-off nutrient removal, wetland protection and restoration of near and on-shore areas, and other processes. The ornamental horticultural industry will need to develop wireless sensor networks, real-time data management, crop modeling and control algorithms to better manage water and soluble nutrients. These technologies will likely spread to all crops in time.

Existing research and teaching expertise in energy recovery from waste should complement the work of extension faculty conducting research in bioenergy. These two topics fit with both national energy concerns and the College's strategic plan.

Existing research and teaching expertise in low-impact development and green roof technology is an expanding program that requires strengthening in Extension. This particular area should be coupled with ecological services outreach expertise. A new area for ENST Extension is Leadership in Energy and Environmental Design (LEED). There is public interest and there are cooperators across the college and campus community that can forge an interdisciplinary team addressing many ecological engineering topics. ENST is where engineering expertise resides within the College.

Beyond the specifics of the growing "green" industry with its innovative approaches to energy conservation is the broader area of ecological services in general that promotes sustainability of

state and regional natural resources. While we have a presence in ecological services in the Research and Teaching, we do not have a critical mass in Extension.

ENST extension will address technology issues in environmental health by hiring a new faculty member in Environmental Air Quality, including animal housing issues (poultry, swine, dairy) and indoor air quality in residential and business settings. Among other topics, ammonia, dust, odor, and airborne nutrient transport are specific issues on the horizon. It is anticipated that greenhouse gasses from various enterprises would be a component of such a focus.

The current programs in ENST and areas where we do not have a critical mass of expertise should be complemented by outreach and on-site applied research that will be relevant for the next 10-20 years. Interdisciplinary collaborations will be essential and cross-unit Extension programming will be required.

The overall goal of ENST Extension programs is to discover, apply, and disseminate new scientific and engineering knowledge for agricultural and ecological systems. Clearly, the extension programs in ENST center around two of the Land Grant missions; outreach and applied research. The outreach component interprets and distributes scientific, engineering, and design knowledge to professionals, operators, advisors, state agencies, local municipalities, and the general public. Applied research is critical in providing unbiased research that is essential for our outreach programming. Areas of current and planned outreach and applied research include energy in agriculture, environmental contamination and public health, environmental services, natural resource management and restoration (including aquacultural resources), nutrient management, water quality and quantity, waste management and resource recovery, and environmental microbiology.

Specific Steps:

1. Align extension faculty FTEs as positions become available to achieve critical mass of extension faculty within our priority areas that complement our departmental research and teaching efforts.
2. Reallocate all extension FTEs to create research-extension split appointments. The target for the splits is 60% Extension-40% research.
3. Increase extension programmatic capabilities by hiring grant-funded Faculty Extension Assistants to aid in program delivery.
4. Maintain a multidisciplinary strength within ENST, including in agricultural, biological, ecological and environmental engineering to further the development of technology.

Measures of Success:

1. Redistribution of partial extension FTEs among departmental disciplines.
2. Realization of a critical mass of faculty that represent priority Extension areas.
3. Creation of research-extension split appointments.
4. Number of grant-funded Faculty Extension Assistants.
5. Successful multi-departmental partnerships.
6. Successful Extension partnerships with agencies (MDA, DNR, MDE, EPA, USDA)

7. Successful outreach programming to educate the public and implement environmental changes.

INTEGRATIVE SUPPORT EFFORT

Research, teaching, and extension activities in the Department can be strengthened by synergistic efforts that integrate the three and allows them to interact in formal and informal ways.

Integration of department activities with the College and Campus community can also strengthen the capabilities of ENST.

Create a fee-for-service Environmental Testing Laboratory

One effort that would integrate research, teaching and extension is the creation of the capacity to perform quantitative analysis of chemical, physical, and microbiological properties of soils, natural waters, and biological materials. The Department would like to create an Environmental Testing Laboratory and operate it on a revenue-neutral or revenue-generating financial model. The Environmental Testing Laboratory would generate revenue by charging fees to clients from the Department, College, University and regional stakeholders. The Lab would require at least one full-time analytical chemist or biochemist. Teaching would benefit by allowing undergraduate and graduate courses to use the Lab to learn analytical techniques. Research and extension would benefit from having state-of-the-art analytical support.