



**KENTUCKY STATE
UNIVERSITY**

MASTER OF ENVIRONMENTAL SCIENCE AND TECHNOLOGY

Background of the program

Global environmental problems are among the biggest challenges of the 21st century. Environmental issues involving water pollution, soil degradation, and natural resource depletion have created new challenges of global warming, food insecurity, and economic and political turmoil across the globe. Understanding the principles, processes, and causes of these environmental problems requires comprehensive science and research-oriented curricula to understand the science underlying these problems and develop solutions.

Agricultural (including poultry and livestock) and tree farming, forest management, and a mining-based economy are rapidly changing in Kentucky. As the workforce attempts to find alternative, profit-maximizing, and sustainable land management practices, higher education must consider shifting trends of current and future job opportunities towards technology-oriented ones for optimizing resources. A significant component of future job opportunities and challenges will involve resource conservation, finding a sustainable nexus of food energy and water, AI, data and technology-savvy environmental policies & practices, efficient use of current energy sources, and development of alternative energy sources.

More environmental scientists, problem-solving professionals, and policymakers who can integrate scientific knowledge, interdisciplinary approaches, technology, and data analytics are needed to solve current environmental problems in Kentucky and worldwide. KSU's Master of Science in Environmental Science and Technology (MEST) is designed to address this demand.

Goal and Program Learning Outcomes

The goal of KSU's MEST degree program is the pursuit and dissemination of environmental knowledge and technology. The revised MES program broadens the scope of scientific and technological studies of the environment through the offering of innovative curricula grounded on the existing MES courses, faculty expertise, research, and laboratory capacity, as well as feedback received from former MES students, AFE/ MES Retreat, and campus-wide review workshop organized by CPE and Gray Associates in Summer 2023. The revised curricula include courses to teach fundamentals of environmental science, hydrology, Environmental Research methods, plant, water, and soil instrumentation, Ecosystems and Biome Science, bioremediation, toxicology and waste management, resources economics, environmental law, and policy, as well as application of GIScience Technology and Remote Sensing techniques. The revised program emphasizes basic and applied environmental and ecological science research and teaching (through the Capstone course) using case studies, land degradation, and ecosystem change data from Central and Eastern Kentucky. Graduates of the KSU MEST program are expected to hold positions as environmental

scientists, policy analysts, inspectors/regulators in state and local government agencies, and industries, as well as continue a career path to pursue doctoral programs at other universities.

The new MEST program is expected to grow fast by recruiting domestic students from diverse undergraduate backgrounds and various geographic locations. The program is designed to attract competitive students who have interests in blending science and technology for meaningful employment, a commitment to humanity, sustainable resource management, and problem-solving.

Degree Requirements

The MEST program is made up of 36 credits including thesis or capstone project work. It should be noted that the capstone project is typically less comprehensive than a traditional master's thesis, so students choosing this option are required to take two additional elective courses. Students interested in pursuing the master's degree full-time should plan to spend about two years in residence. Students in the online MEST program will complete all classes and capstone research without needing to be on campus.

Thesis Option

The purpose of the thesis option is to demonstrate the student's ability to investigate a research topic and report the findings in proper scientific publication style. This enables the student to gain experience in a specific area of environmental science and to report research results in a publishable document. The program has a student handbook that gives more specific requirements for the formatting and process that need to be followed. It is distributed at the orientation at the beginning of your first semester. Experience in the literature review, experimental design, data collection, statistical analysis, and manuscript preparation are obtained by students completing the thesis option. Students who intend to further their graduate education (e.g., obtain a doctoral degree) should choose this option because doctoral programs often require students to demonstrate their ability to successfully complete a master's thesis. Required courses and a thesis topic must be approved by the student's graduate committee.

Capstone Project Option

Graduate students enrolled in the non-thesis option are required to complete a capstone project as determined by their major professor and approved by their committee. The MEST graduate student Handbook provides specifics on formatting and other requirements and is available to all students during their first semester. Examples might include a literature review, a public service project, or Cooperative Extension work. A detailed proposal is submitted for approval to the student's committee before the project is conducted, and a final project report must be approved by the student's committee.

Graduate Committee

The Graduate Committee consists of three School of Agriculture and Natural Resources (SANR) faculty members, and it can include one additional member from outside of SANR. Students are required to hold their first committee meeting during their first semester and present a thesis/capstone proposal in the second semester of study.

The major professor will guide the student on research, analysis, writing, and other scholarly aspects of the work. Members of the student's committee contribute, but the primary responsibility is that of the major professor.

Submission of a thesis or Capstone manuscript is defined as the time at which the first complete draft of such is submitted to the major professor for review. After the major professor approves the draft for committee revision, the student will then submit the manuscript for critical review by the committee. Each may suggest improvements and refuse approval pending additional work. When committee members and the major professor sign the Approval Page, they certify that the thesis or capstone manuscript is clear and accurate, that it represents an original and worthwhile contribution, that the suggestions made by them are incorporated into the final work, and that the work conforms to the standards of Kentucky State University College of Agriculture, Health, and Natural Resources (CAHNR). No faculty member will sign a thesis until it is of foremost quality and meets all requirements. The major professor and committee members must sign their names personally. There can be no temporary substitute members and no other person may sign a committee member's name on an Approval Page, even with the authorization of the committee member involved and the major professor. Electronic signatures are allowed for students completing their degree online.

Written Comprehensive Exams

All MEST students pursuing a thesis or capstone track will complete a written comprehensive exam to be administered by the faculty mentor with questions from the student's faculty mentor and committee members. This exam must be administered before the student defends and must have a majority of the committee members award a passing grade to the questions they have provided.

Code	Title	Hours
ENV 501	Fund. of Environ. Science	3
ENV 502	Population/Community Ecology	3
ENV 503	MES Student Team Project	3
Select one of the following:		3
ENV 506	Exper. Design & App. Stats.	
ENV/AQU 509	Biostatistics	
ENV 511	Energy & the Environment	3
Select one of the following:		9-21
Capstone Project Option		
Thesis Option		
ENV 600	MES Research	1-6
ENV 601	MES Thesis	1-3
Total Hours		26-45

Thesis Option

Code	Title	Hours
ENV 600 & ENV 601	MES Research and MES Thesis	9
Select 12 credit hours of elective courses		12
Total Hours		21

Capstone Project Option

Code	Title	Hours
ENV 699	MES Capstone Research Proj	3-6
Select 15 credit hours of electives		15
Total Hours		18-21

Elective Courses

Code	Title	Hours
ENV 507	Agroforestry	3
ENV 508	GIScience & Tech Applic.	3
ENV/AQU 513	Aquatic Ecology	4
ENV 515	Environmental Ethics	3
ENV 516	Environmental Justice	3
ENV 517	Environ & Resource Econom	3
ENV 519	Sustainable Agriculture Sys (moved from below)	3
ENV 525	Organic Agriculture	3
ENV 535	Urban Agriculture	3
ENV 540	Ornamental/Landscape Plant Pro	3
ENV 542	Plant Prop. & Prod. Systems	3
ENV 545	Molecular Tech Envir/Aqua Stud	3
ENV 550	Human Health/Environment	3
ENV 551	Livestock Production Practices	3
ENV 555	Food Safety and Microbiology	3
ENV 560	Agricultural & Environ. Policy	3
ENV 565	Environmental Law	3
ENV 585	Special Topics in AFE	3
ENV 589	Remote Sensing of the Env.0	3
ENV 595	Envir Sci/Bioremediation Tech	3

ENV 501: Fund. of Environ. Science

Introductory course to the interdisciplinary field of environmental studies with special emphasis on the relationship between human activities and the environment.

Credit Hours: 3

Contact Hours: 3

ENV 502: Population/Community Ecology

This course covers advanced ecological theory and applications relating to population and community dynamics, including population growth, species interactions, diversity, disturbance, succession, food webs, and their relation to conservation biology.

Credit Hours: 3

Contact Hours: 3

ENV 503: MES Student Team Project

The Student Team Project is a community service and educational program by the KSU MES Program. It is a one semester effort by teams of three to five students attempting to solve a current environmental problem facing a community organization or governmental unit in close proximity to KSU. Student team projects, required of all first-year students, mix students from different backgrounds and place them in contact with faculty members, government officials, and community leaders. Team members will gain experience initiating and terminating a long-term project, managing team members with diverse backgrounds, and collecting and disseminating information.

Credit Hours: 3

Contact Hours: 3

ENV 504: Environ. Meth. & Instrumentati

Credit Hours: 3

Contact Hours: 3

ENV 505: Scientific Research Methodolog

This course equips graduate students with essential theoretical and practical approaches to conducting scientific environmental research and impact assessment. It includes critically reviewing literature, formulating clear research problems and questions, research and evaluation plans for crops, forests, grass, water and energy data analysis. It teaches effective presentation, research proposal, and manuscript preparation skills. Emphasis is placed on critical aspects of good scientific conduct, including research integrity, ethical considerations, and professional standards in scientific research and communication in the environmental field.

Credit Hours: 3

Contact Hours: 3

ENV 506: Exper. Design & App. Stats.

This course will cover principles of experimental design and statistical analysis of data, their application in a statistical program, and use in research.

Credit Hours: 3

Contact Hours: 3

ENV 507: Agroforestry

Students will examine and have an understanding of how different agroforestry systems function with landscapes across multiple scales (plot, watershed, landscape) and how these systems contribute to achieving multiple benefits (environmental, social, economic, etc.). Credit: 3 semester hours.

Credit Hours: 3

Contact Hours: 3

ENV 508: GIScience & Tech Applic.

This graduate course will expose students to the concepts, software, data and analysis processes of Geographic Information Systems (GIS). Students will develop a real world, working knowledge of GIS through hands-on work with mapping software, its potential, its limitations and future trends in the mapping industry. MES graduate students will develop a real world project that examines spatial data and utilizes modeling software to create a production quality, full scale, mapping product.

Credit Hours: 3

Contact Hours: 3

ENV 509: Biostatistics

Basic principles of experimental design and data analysis with emphasis on their applications in environmental studies and aquaculture research.

Credit Hours: 3

Contact Hours: 3

ENV 511: Energy & the Environment

Integrated study of the environmental impact of human energy use patterns. Overview of current energy resources, current energy production and use patterns, alternative energy production options, and environmental, social, and economic consequences of each.

Credit Hours: 3

Contact Hours: 3

ENV 513: Aquatic Ecology

This course investigates the interaction of aquatic organisms with their biotic and abiotic environment. Sampling and laboratory methods of limnological analysis will be covered.

Credit Hours: 4

Contact Hours: 4

ENV 515: Environmental Ethics

This course explores a wide range of issues in contemporary environmental ethics. Employing one of the most respected anthologies in the field, the course will engage such important issues as the nature of environmental ethics, who counts in environmental ethics, and is sustainability possible.

Credit Hours: 3

Contact Hours: 3

ENV 516: Environmental Justice

This course attempts a critical investigation of major issues in environmental justice, including tensions between justice for ecosystems and justice for urban populations; regional as well as global issues are examined.

Credit Hours: 3

Contact Hours: 3

ENV 517: Environ & Resource Econom

This course will cover topics such as application of microeconomics on environmental problems, elements of renewable resource and forestry economics, cost-benefit analysis of environmental renewal projects, economics of the environmental impacts of different agricultural practices such as livestock farming, aquaculture, and chemical use in row crop farming.

Credit Hours: 3

Contact Hours: 3

ENV 519: Sustainable Agriculture Sys

Exploration of the ecological effects of modern intensive agriculture, and the challenge of attaining a secure supply of food through ecologically sound and sustainable practices. The definition, emergence, and growth of sustainable agriculture will be discussed along with pertinent soil, crop and livestock management practices.

Credit Hours: 3

Contact Hours: 3

ENV 525: Organic Agriculture

Principles and practices of organic agriculture are presented in the context of their historical, philosophical, economic, and scientific underpinnings. Students will develop a broad theoretical and practical understanding of organic agriculture. Credit: 3 semester hours.

Prerequisite: MAT 120 or MAT 125 or Consent of Instructor

Credit Hours: 3

Contact Hours: 3

ENV 535: Urban Agriculture

Examine contributions of food gardens to community health and food system sustainability. Explore potential of compact urban agriculture to offset community food needs through high and low input production. Gain hands-on experience with tools, techniques and practices used to grow and process food and ornamental crops in urban environments.

Credit Hours: 3

Contact Hours: 3

ENV 540: Ornamental/Landscape Plant Pro

Provides a thorough understanding of the identification, morphology, classification, nomenclature and adaptability of ornamental plants used in landscape environments. Students will examine the use of plants in home, business, and public landscapes to reduce water use, pollutants, energy and labor inputs.

Credit Hours: 3

Contact Hours: 3

ENV 542: Plant Prop. & Prod. Systems

This course provides an understanding of both traditional plant propagation and tissue culture as well as sustainable plant production systems. Plant propagation is a critical part of nursery and greenhouse management not only to reduce production costs but also to maximize the potential profit. Sustainable practices and production of horticultural crops is also examined to reduce water use, pollutants, energy, and labor inputs. Topics covered also include soil, plant nutrition, pest, and disease management that are essential for small scale farmers. Credit: 3 semester hours

Prerequisite: AFE 217 or consent of instructor

Credit Hours: 3

Contact Hours: 3

ENV 545: Molecular Tech Envir/Aqua Stud

This course examines how molecular biological approaches are used to address major issues in environmental biology. Lecture/laboratories examine how molecular methods can be applied to wildlife management, ecology, pollution control and remediation, and environmental health.

Prerequisite: BIO 111 or consent of instructor

Credit Hours: 3

Contact Hours: 3

ENV 550: Human Health/Environment

A comprehensive study of physical, chemical and biological factors that impact human diseases. Includes hands-on training in areas such as Occupational Safety, Health Implications of Environment, Food Safety, and advanced Molecular Biological techniques.

Credit Hours: 3

Contact Hours: 3

ENV 551: Livestock Production Practices

Explores ways in which animal management impacts the environment, and ways to utilize animal behavior to modify such impacts. Students will gain hands-on experience working with livestock to learn basic handling and management procedures.

Credit Hours: 3

Contact Hours: 3

ENV 555: Food Safety and Microbiology

This course is intended for those with theoretical and practical interest in the field of food sciences, especially those interested in a wide range of subjects and hands on/practical approaches in microbial food processes, general food safety, public health and epidemiology. Various aspects of food production, maintenance, supply chains, potential contaminations, introduction to food borne toxins and outbreaks of food borne infections, safe food handling and preparation techniques will be introduced to the students. Credit: 3 semester hours.

Prerequisite: BIO 111, CHE 101, and CHE 110

Credit Hours: 3

Contact Hours: 3

ENV 560: Agricultural & Environ. Policy

This course provides an introduction to issues in agricultural and environmental policy, with emphasis on environmental management strategies, environmental and human health risks such as toxicity, environmental issues in agriculture, and climate change.

Credit Hours: 3

Contact Hours: 3

ENV 565: Environmental Law

This course provides an introduction to major issues in the field of environmental law with particular emphasis on federal environmental law and the role of states in enforcement.

Credit Hours: 3

Contact Hours: 3

ENV 585: Special Topics in AFE

Intensive examination of an environmental science topic chosen by a faculty member in the Master of Science in Environmental Studies Program. Requires intensive reading and discussion, as well as writing at a graduate student level.

Credit Hours: 3

Contact Hours: 3

ENV 589: Remote Sensing of the Env.0

The course introduces fundamental principles of remote sensing applications for recording electromagnetic energy from the earth's surface for studying vegetation, soil, water, and urban infrastructure. Credit: 3 semester hours.

Prerequisite: Consent of instructor

Credit Hours: 3

Contact Hours: 3

ENV 595: Envir Sci/Bioremediation Tech

This course is intended for those with theoretical and practical interest in environmental issues and is designed to provide a wide range of subjects and practical work experience using standard methods, concepts and equipment in environmental science. The fate and transport of pollutants in the environment and their final destination, dilution, dispersion, adsorption, persistence, degradation, their adverse effects, and the route that the toxin in question takes in the environment will be discussed and possible solutions and remediation techniques will be presented.

Credit Hours: 3

Contact Hours: 3

ENV 596: Intern. in Environ. Science

Students find an internship(s) at the federal, state, or industries, national labs, and environmental organizations to earn hands-on field experience or to apply classroom knowledge to real-world situations. Topic areas may include but are not limited to conservation, pollution, environmental law and policy analysis, and ecosystem management. Such practical experience prepares students for professional jobs and helps students develop critical essential skills for careers in environment-related professional jobs or for the pursuit of advanced degrees.

Credit Hours: 3

Contact Hours: 3

ENV 600: MES Research

Laboratory or field research on approved thesis topic.

Credit Hours: 1-9

Contact Hours: 1-9

ENV 601: MES Thesis

Preparation of research based thesis on approved topic.

Credit Hours: 1-3

Contact Hours: 1

ENV 699: MES Capstone Research Proj

The independent research capstone project would be designed in collaboration with an interdisciplinary advisory committee of two or three selected KSU faculty/research members. This is a yearlong project which will serve as the culminating activity for the MES degree. Pass/Fail only. Must be repeated once for a total of 6 hours.

Credit Hours: 3-6

Contact Hours: 3-6