BIOLOGY

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Master of Science in Environmental Systems Analysis and Management

GOALS AND OBJECTIVES
Graduates of this Professional Science Master’s program will be well versed in the technical and professional skills required to work in today’s technologically-oriented, quantitative, communication-intensive, teamwork-driven world. A unique feature of the program will be employment of a case study/problem solving approach to instruction that will incorporate close teamwork. In addition, quantitative reasoning is embedded throughout the program, fostering the type of practical applied mathematics skills that professionals in the environmental field require to succeed. Graduates will receive extensive training in the use of modern analytical instrumentation and digital field data collection equipment in our newly renovated and equipped teaching and research laboratories.

The Environmental Systems Analysis and Management program will prepare its graduates to:

• Understand the complex interactions between and among the living and non-living components of the environment that influence the sustainability and health of the earth’s environment.

• Understand the myriad ways that human activity affects the environment and the essential resources functional ecosystems provide to sustain human society.

• Be competent in modern environmental analysis and assessment methodology (Geographic Information Systems, Analytical Instrumentation, Digital Data Collection, Survey Methods, etc.)

• Be competent in essential professional skills required to succeed in today’s job market, including oral and written communication, teamwork and problem solving, and the fundamentals of business management.

ADMISSION REQUIREMENTS
Individuals who hold a bachelor’s degree with a 3.0 GPA or higher (on a 4.0 scale) from a regionally accredited college or university will be considered for admission to the ESAM program. Students should have a degree in a natural science such as Biology, Chemistry, Physics, or Environmental Science, but it is not required.

Minimum prerequisite courses for admission to the ESAM program include:

• 1 year each of major’s level General Biology and General Chemistry

• 1 semester of Organic Chemistry

• 1 semester of Pre-calculus

• 1 semester of Elementary Statistics

Applicants are required to submit:

• Official transcripts from all undergraduate institutions attended.

• One page written personal statement describing career goals, interests and qualifications for the program

• Two letters of recommendation

• Professional résumé

• Official GRE test score report preferred

REQUIRED COURSEWORK (27 CREDITS)
The ESAM Core (18 Credits)

ESM 501 Principles of Environmental Science and Ecosystem Management I

ESM 502 Principles of Environmental Science and Ecosystem Management II
The program is designed to be completed in two years of full-time study, but may be completed over a longer period (typically 4 years) for students on part-time status. In addition, undergraduate students majoring in biology or chemistry are able to apply for admission to the program in their junior year and begin taking graduate courses during their senior year while at the same time completing a Bachelor of Science degree. This 4 plus 1 option allows completion of a combined Bachelor and Master's of Science in 5 years. If you would like more information on this accelerated track, please contact the program director. Completion of this combined degree in 5 years requires summer coursework and careful planning is essential to meet all program requirements.

Course Descriptions

**ESM 501 Principles of Environmental Systems Analysis and Management I**
3 CH
This first course of a yearlong in-depth investigation into our environment will focus on the scientific principles that underlay the concept of sustainable environmental systems. Learning to think about the environment with an emphasis on sustainability will lead us to pollution and waste prevention instead of only focusing on clean up and disposal. Future environmental scientists must focus on preservation of ecosystems rather than a few select species, environmental restoration, conservation of resources, and the stabilization of our world's human population.

**ESM 502 Principles of Environmental Science and Ecosystem Management II**
3 CH
This second course of our yearlong in-depth study of our environment will concentrate students' efforts on sustaining environmental quality. We will explore multiple types of air, water and terrestrial pollution and the effects of pollution on human and environmental health. The focus of the course will be case studies and problem based learning exercises centered on examples of environmental degradation. The final section of the course concentrates on analysis of the economics and politics of the environment and the concept of sustainability.

**ESM 503 GIS for Environmental Analysis**
3 CH
This course focuses on the GIS principles, methods, and techniques that are particularly relevant to and useful for problem solving in environmental analysis and management. Specifically this course has four major components: an overview of selected GIS principles including data models, scale and spatial sampling, and spatial autocorrelation; a review of the major
techniques or issues for environmental data acquisition and integration; an introduction to environmental analysis and modeling techniques; and a discussion of several applied areas of environmental modeling techniques as related to landscape ecology, hydrology, natural hazards, natural resources management, and environmental planning.

**ESM 504 Hydrology**  
4 CH  
This course acquaints students with the basic concepts of environmental geology with an emphasis on fundamental concepts and methods in the study of hydrology and water resources. This course focuses application of the principles of geology and hydrology to environmental characterization and problem solving.

**ESM 505 Field Methods and Analysis**  
4 CH  
The analysis of an ecosystem requires an appreciation of ecological principles, and an understanding of the physical processes and biological components that influence a community. Students will learn and practice basic techniques in environmental biotic sampling and analysis in both terrestrial and aquatic environments. The course emphasizes sampling of vegetation, vertebrates and invertebrates, as well as management and analyses of data gathered in the field. Extensive field work will be conducted in the Housatonic River watershed and adjacent Long Island Sound. Due to the nature of New England’s seasons students enrolling in the course will be required to participate in intensive field work experiences during the late summer between year 1 and 2 of the program.

**ESM 506 Environmental Sampling and Analysis**  
4 CH  
Students will be exposed to Environmental Protection Agency’s (EPA) Quality Assurance & Quality Control (QA/QC) plans and will have hands on laboratory experience in analyzing environmental samples for organic and inorganic contaminants using EPA test protocols and major environmental instruments such as Gas Chromatography/Mass Spectrometry (GC/MS), Inductively Coupled Plasma Spectroscopy (ICP) and Atomic Absorption (AA). The course will concentrate on analyzing samples collected from the Housatonic River watershed and adjacent Long Island Sound.

**ESM 507 Environmental Toxicology**  
4 CH  
This course will provide an overview of the major environmental pollutants and their sources, along with the mechanisms and effects of toxicity and potential remediation techniques. Abiotic and biotic factors affecting bioavailability will also be discussed. We will consider the impacts of pollutants at the organismal, population, community, and ecosystem levels.

**ESM 511 Soils & Land Management**  
3 CH  
This course examines changes in soil properties and behavior caused by short- and long-term stresses from anthropogenic activities and environmental forces. The soil biological community will be studied with an emphasis on improving land management practices.

**ESM 543 Restoration Ecology**  
3 CH  
Ecological restoration is an intentional activity that initiates or accelerates the recovery of an ecosystem with respect to its health, integrity and sustainability. Restoration ecology is the study of how to return an impaired or degraded ecosystem to a close approximation of its remaining natural potential, as defined by such indices as ecologic habitat, water quality, biodiversity, functionality, dynamic stability, etc. This course examines the scientific basis of restoration programs in the U.S.
and worldwide through consideration of interdisciplinary theories and practices. Specifically we will focus on restoration needs and goals, restoration approaches for various ecosystems, restoration planning and implementation, and the uncertainty and sustainability of restoration designs. Students will be exposed to a variety of restoration concepts through lectures, seminars, and independent projects. Finally students will actively participate in ongoing restoration projects in the Housatonic River watershed.

**ESM 553 Ecosystem Ecology**  
4 CH  
Students will explore the interactions of organisms and their physical environment as an integrated system by focusing on one particular ecosystem. The model system utilized in this course will be the Housatonic Watershed. The faculty and students of the Environmental Systems Analysis and Management program will become participating members of the Housatonic Watershed Project organized by the federal Environmental Protection Agency and run locally by numerous non-profit and state organizations in Massachusetts, New York, and Connecticut. The students will be immersed in a thorough examination of the use, abuse, and management of this watershed through the prism of ecosystem science.

**ESM 563 Hazardous Waste Management**  
3 CH  
This course covers topics associated with the management of hazardous waste. The topic selection emphasizes: pollution prevention within industry; waste minimization; recovery, reuse, and recycling, treatment technologies; and site remediation. The basics of hazardous waste regulation are also addressed.

**ESM 561 Environmental Chemistry**  
3 CH  
The course explores chemical aspects of the human environment and sources, reactions, transport, effects and fates of chemical species in water, soil and living environments and effects of technology thereon.

**ESM 573 Environmental Policy**  
3 CH  
This course is designed to provide an intensive introduction to the study of environmental policy. Development of environmental policy in the United States and the increasing globalization of environmental politics are considered. It explores the role of key policy actors in environmental policy formation and implementation. In addition, the course provides an overview and assessment of key U.S. and international environmental policy issues such as air and water pollution, waste management, energy, and population growth. Emphasis is placed on analyzing domestic and international case studies in environmental justice. The relations among science, politics, and policy are taught via case histories that include endangered species, air pollution, water quality, protected area management, facility planning, and hazardous site restoration.

**ESM 599 Special Topics in Environmental Systems Analysis and Management**  
1–3 CH  
Regular offerings of one and two credit courses on topics of current interest will be regularly scheduled. Topics will depend on faculty expertise and student interest. The course will be taught in a seminar format.

**ESM 690 Environmental Research Project**  
3–6 CH  
A research project will be designed in consultation with a faculty advisor that addresses a real-world environmental questions or issue. The projects will typically address a topic of concern to industry, non-profit environmental organizations, or local, state, or federal government agencies. Team research projects that address related components of significant
environmental issues are encouraged. Detailed professional project reports will be prepared and defended in a public presentation. Accumulation of between three and six credits in ESAM 599 is required for completion of the ESAM program. Students will typically enroll in ESAM 690 in either or both of the two semesters of their second year of study to accumulate the required three to six credits.

**WGB 521 Fundamentals of Management**

3 CH

Examines and analyzes principles of planning, organizing, leading and controlling the activities of business, government and other organizations in a globally competitive environment. Focus is not only on developing students' knowledge of these areas, but also on developing their business skills, especially in the areas of analysis and written and oral communication.

**WGB 612 Leading and Influencing with Integrity**

3 CH

Leaders and managers at all levels in organizations must influence others to enable achievement of the organization's objectives. Leading and influencing with integrity requires understanding of one's self, other people, the situational and cultural context, as well as both current and future impacts of actions taken. Through course learning experiences students develop individual and organizational strategies to influence others, shape culture, manage change, negotiate, and facilitate employee engagement and performance so organizations can contribute to society in ways that are effective, responsible and sustainable.