ENVIRONMENTAL SCIENCE

The Master of Science in Environmental Science (MSES) is a two-year program designed for students who wish to pursue graduate study on a full or part-time basis so they can balance professional and personal goals. Courses are primarily held in the evening and occasionally on Saturdays. Graduate students in the Department of Natural Sciences are talented and often have significant professional experience. Graduate faculty are highly qualified and experienced, and the educational culture is one in which learning, teaching, and research are emphasized. Pursuing a graduate degree in Environmental Science at UM-Dearborn will result in substantial growth in knowledge, skills, and long-term career potential.

We stress personalized, individual attention to graduate student education and research. The program provides a choice between emphasizing the environmental aspects of biology, chemistry, or geology, or a more broadly focused approach involving courses in each of the above fields. Faculty and students are engaged in the research of many environmental issues.

Research Facilities

The Department of Natural Sciences (https://umdearborn.edu/casl/departments/natural-sciences/) offers graduate students extensive access to research equipment and space, including labs for preparation and chemical analysis of environmental, biological and geological samples. Environmental chambers are available for experiments requiring precisely controlled environments for experimental study of both plants and animals. With NSF assistance, we have acquired a scanning electron microscope in collaboration with the College of Engineering and an inductively coupled plasma spectrometer (ICP).

A focal point for the environmental programs on the Dearborn campus is the Environmental Interpretive Center (https://umdearborn.edu/environmental-interpretive-center/) that opened in May, 2001. It is the gateway to a 300- acre environmental study area featuring many natural habitats, including a mature beech-maple forest, floodplain forest, an upland mesic forest, meadows, an 8-acre lake, and the Rouge River on its western border.

The Geospatial Analysis and Mapping (https://umdearborn.edu/casl/life-casl/labs-learning-centers/geospatial-analysis-and-mapping-laboratory/) (GAM) Lab (located in Social Sciences Building, 1170) is a state-of-the-art computer lab used to teach Geographic Information Systems (GIS), remote sensing, spatial analyses, geospatial data management, and cartographic principles. The GAM Lab is equipped with 22 high-end networked workstations, instructional support technology and an array of special purpose peripherals and software (e.g., ArcGIS, Erdas Imagine, large format printers and laser printers, large map scanner, GPS units, iPads, etc.).

Admission and Prerequisites

The MSES Program anticipates the applicant has a foundation and experience in basic science and math akin to the University of Michigan-Dearborn's Environmental Sciences (https://catalog.umd.umich.edu/undergraduate/college-arts-sciences-letters/environmental-science/), Geological Sciences, or Environmental Studies programs (Regular admit). Applicants outside of traditional Natural Sciences degrees are strongly encouraged to speak with the MSES Chair (MSES Director, Associate Professor of Biology, John Abramyan: abramyan@umich.edu) for additional information pertinent to their application for admission (Conditional Admit).

Each applicant should submit the following:

1. Official transcripts from all universities attended.
2. A convincing statement of purpose that clearly describes career goals and specific reasons for pursuing the MSES program, including any potential research collaborations with faculty.
3. Three letters of recommendation, of which at least two must be from professors that are familiar with applicant's academic performance.
4. Students whose native language is not English are required to satisfy the English Language Requirements for Admission, which can be found in Graduate (https://catalog.umd.umich.edu/graduate/graduate-admissions/)Admissions.

See Application instructions (https://umdearborn.edu/admissions-aid/graduate-admissions/how-apply/) for additional information.

For more information, visit the MSES website or call 313-583-6321.

Degree Requirements

The MSES degree requires 30 semester hours of graduate coursework that can be satisfied by one of three options:

- Plan A. Thesis Option 24 credit hours (15 credit hours core, 9 credit hours electives 500 level or above) plus ESCI 699. A thesis will be based on original research. (Preferred by the environmental consulting industry)
- Plan B. Project Option 27 credit hours (15 credit hours core, 12 credit hours electives 500 level or above) plus ESCI 698. A project will be based on library/field/laboratory research or classroom exercises demonstrating analysis and interpretation of scientific data.
- Plan C. Coursework Option 30 credit hours (15 credit hours core, 15 credit hours electives 500 level or above) (Not recommended for students interested in doctoral degrees).

The non-thesis M.S. program has an emphasis on coursework, while the thesis-based/project-based degree has an emphasis on both coursework and original research. Thesis-based M.S. students will experience the excitement of performing guided research.

A cumulative grade point average of *B* or better is required. For more information, visit the MSES website.

Specific Course Requirement

Code	Title	Credit Hours
Core Courses		
BIOL 500	Graduate Seminar in Natural Sciences	3
NSCI 505	Research Design	3
Any one of the following 500-Level BIOL or MICR courses:		3
BIOL 508	Invasive Species Ecology	
BIOL 519	Behavior and Evolution	
BIOL 522	Conservation Biology	
BIOL 524	Integrative and Comparative Zoology	
BIOL 545	Restoration Ecology	
BIOL 552	Med & Env Toxicology	
BIOL 556	Behavioral Ecology	

MICR 505	Environmental and Public Health Microbiology	
Any one of the following 500-Level CHEM courses:		3
CHEM 535	Green Chemistry	
CHEM 548	Environmental Chemistry	
Any one of the following 500-Level ESCI or GEOL courses:		3
ESCI 510	Future Cities Live	
ESCI 574	Watershed Analysis	
ESCI 577	Environmental Field Methods	
ESCI 578	Field Geology	
ESCI 585	Spatial Analysis and GIS	
ESCI 595	Topics in Environmentl Science	
GEOL 550	Glacial Geology	
Electives		
Select fifteen credit hours from the list below:		15
Department of Natural Sciences:		
BIOL 508	Invasive Species Ecology	
BIOL 519	Behavior and Evolution	
BIOL 522	Conservation Biology	
BIOL 524	Integrative and Comparative Zoology	
BIOL 545	Restoration Ecology	
BIOL 552	Med & Env Toxicology	
BIOL 556	Behavioral Ecology	
CHEM 535	Green Chemistry	
CHEM 548	Environmental Chemistry	
ENST 574	Environmental Education	
ESCI 510	Future Cities Live	
ESCI 574	Watershed Analysis	
ESCI 577	Environmental Field Methods	
ESCI 578	Field Geology	
ESCI 585	Spatial Analysis and GIS	
ESCI 595	Topics in Environmentl Science	
ESCI 597	Off-Campus Independent Study	
ESCI 599	On-Campus Independent Study	
ESCI 698	MSES Master's Project	
ESCI 699	MSES Master's Thesis	
GEOL 550	Glacial Geology	
MICR 505	Environmental and Public Health Microbiology	
Other Departments:		
STAT 530	Applied Regression Analysis	
STAT 545	Reliability & Survival Analys	
STAT 555	Environmental Statistics	
Total Credit Hours		**30**

Three Options for a MSES Degree

- **Plan A. Thesis Option** 24 credit hours (15 credit hours core, 9 credit hours electives 500 level or above) **plus** 6 credits ESCI 699. A thesis will be based on original research, and is supervised by an advisor and committee. This is preferred by the environmental consulting industry and doctoral programs.
- **Plan B. Project Option** 27 credit hours (15 credit hours core, 12 credit hours electives 500 level or above) **plus** ESCI 698. A project will be based on library/field/laboratory research, and is supervised by an advisor.
- **Plan C. Coursework Option** 30 credit hours (15 credit hours core, 15 credit hours electives 500 level or above). This is not recommended for students interested in pursuing a doctoral degree.

Learning Goals

(1) Conceptual knowledge. Understanding the underlying concepts and principles associated with environmental aspects of biology, chemistry and geology

- Ability to understand and apply underlying concepts and principles associated with the environmental aspects of biology
- Ability to understand and apply underlying concepts and principles associated with the environmental aspects of chemistry
- Ability to understand and apply underlying concepts and principles associated with the environmental aspects of geology

(2) Communication skills. Ability to acquire, present, and develop scientific ideas

- Ability to read, understand and use scientific information related to environmental issues
- Ability to effectively communicate scientific information orally
- Ability to effectively communicate scientific information in writing

(3) Critical thinking and cognitive skills.

- Ability to apply scientific method to evaluate environmental problems and propose solution
- Ability to use and apply knowledge and understanding of essential facts, concepts, principles and theories relating to environmental science
- Ability to evaluate information from a range of sources and to engage with some of the current developments in environmental science, including applications and the philosophical and ethical issues involved
- Ability to perform statistical and quantitative analyses

(4) Practical and/or professional skills

- Ability to conduct practical and investigative work in a responsible, safe and ethical manner, and be aware of risk assessment and relevant health and safety regulations
- Ability to initiate, design, conduct and report on investigations, which may involve primary or secondary data
- Ability to obtain, record, collate and analyze data derived from laboratory and/or field investigations, and interpret and report their significance in the light of underlying theory, practical issues and relevant information from other sources

ESCI 504 Field Studies in Env Science 2 Credit Hours
A systematic analysis of the environment. This course will focus on the analysis of the Rouge River Watershed as an ecological unit. The student will make intensive analyses of the river water and the surrounding land surface at selected sites. The results will provide a composite of the water quality and land use of the various tributaries. Emphasis will be placed on proper sampling and testing techniques, field and lab safety procedures, aquatic chemistry, biological organisms as indicators of pollution, and the role of wastewater dumping on the watershed.

ESCI 510 Future Cities Live 1 to 4 Credit Hours
This field course explores sustainability and resilience in cities around the world. It follows a multi-disciplinary approach by integrating urban-related concepts from history, sociology, ecology, geography, architecture, and planning. It also explores how seriously cities take their "going green" initiatives. Target cities might vary from year to year to include U.S. and foreign cities. The course may be repeated for credit when destination varies. There is a mandatory pre-departure meeting; trip length varies depending on offered credits. (OC). (OC).
Restriction(s):
Can enroll if Class is Graduate

ESCI 525 Soil in the Environment 3 Credit Hours
The study of soil in the environment, including its formation, classification, physical attributes and engineering properties with an emphasis on soil-water statics and dynamics, chemical attributes and processes. Students are expected to have background knowledge of physical geology. The course will include field trips and field work, including the collection of soil samples from the Universities natural area. The course will also include a laboratory component in which students will perform a variety of test, e.g. bulk density, engineering properties on the soil samples collected. the course will typically be team taught. (S, AY)
Prerequisite(s): GEOL 118
Restriction(s):
Can enroll if Level is Rackham or Graduate
Can enroll if College is Engineering and Computer Science or Education, Health, and Human Services or Business or Arts, Sciences, and Letters

ESCI 551 Glacial Geology 3 Credit Hours
The study of landforms and sediments created by glaciers both past and present. The glacial activities of the past 2 million years will be emphasized, particularly the evolution of landforms common to the upper Midwest. The influence of glacial deposits on development, construction methods, planning and environmental protection will also be discussed. (AY).
Prerequisite(s): GEOL 118 and GEOL 218
Restriction(s):
Can enroll if Class is Graduate

ESCI 572 Environmental Communications 3 Credit Hours
Preparation and presentation of both oral and written technical abstracts and reports, including environmental newsletters, thesis, and media releases. Professional scientists must be able to effectively communicate ideas and concepts to other scientists and to the general public. This course will provide the foundations in learning how to communicate ideas effectively and succinctly. (F, YR)
Restriction(s):
Can enroll if Class is Senior or Graduate
Can enroll if College is Arts, Sciences, and Letters

ESCI 574 Watershed Analysis 3 Credit Hours
An interdisciplinary study of watersheds, the most commonly used bio-regional unit. The course integrates the analysis of many factors which contribute to the character of watersheds, including bedrock and surficial geology, surface and groundwater hydrology, social history, land use history, water quality analysis, biological diversity, laws and regulations, management models, drinking water and wastewater systems, best management practices, and educational programs. The Rouge River watershed will serve as the primary case study.
Restriction(s):
Can enroll if Class is Graduate

ESCI 577 Environmental Field Methods 1 to 4 Credit Hours
An intensive, off-campus field course that provides students an opportunity to observe and critically study different natural and human environments. Students learn how to collect data in a systematic way and formulate scientific inferences about environmental processes, products, and problems. Students also learn preparation techniques for conducting long days in the field under varying weather conditions and in challenging terrains. The course may be repeated for credit when destination varies. There is a mandatory pre-departure meeting; trip length varies depending on offered credits. (OC). (OC).
Restriction(s):
Can enroll if Class is Graduate

ESCI 578 Field Geology 3 Credit Hours
Introduction to geological field methods; detailed rock descriptions, how 3-dimensional structures are visualized, described, and how maps and cross sections are constructed from field data. (F, AY).
Restriction(s):
Can enroll if Class is Graduate

ESCI 585 Spatial Analysis and GIS 3 Credit Hours
Application of the principles of Spatial Analysis and the use of Geographic Information Systems as a research tool in Environmental Science. Emphasis will be placed on the use of commercially available software including: ESRI's ArcView GIS, Golden Software's Surfer and Adobe PhotoShop. Emphasis will also be placed on the use of the Michigan spatial data warehouse program and the Michigan geographic framework program for metadata specific to Michigan. (AY).
Restriction(s):
Can enroll if Class is Graduate

ESCI 595 Topics in Environmentl Science 3 Credit Hours
Problems or readings on specific topics or subjects in environmental science. (YR)
Restriction(s):
Can enroll if Class is Senior or Graduate
Can enroll if College is Arts, Sciences, and Letters

ESCI 595G Topics in Environmental Sci 3 Credit Hours
Topic: Soil in the Environment. A study of the textural and chemical classification of soil as well as the biologic, engineering and geologic aspects of soil science including applications to agriculture and agronomic science. The course will explore topics such as soil formation, soil-water statics and dynamics, soil-energy balances, soil fertility and plant nutrition, biodiversity, soil and water management, soil pollution and remediation.

ESCI 597 Off-Campus Independent Study 1 to 3 Credit Hours
Provides opportunity for qualified graduate students in the MSES program to pursue independent research under the direction of a graduate faculty member off campus. A written proposal describing the project (including the nature of the project itself, dates, where the project will be done and the faculty member supervising the project) must be approved by the MSES program director/committee before the student can register for the course. Project must be appropriate to the student's chosen track. It must be designed to produce a scholarly paper, papers, or other evidence(s) that reflect significant results from the course (F, W, S).
Restriction(s):
Can enroll if Class is Graduate

ESCI 599 On-Campus Independent Study 1 to 3 Credit Hours
Provides opportunity for qualified graduate students in the MSES program to pursue independent research under the direction of a graduate faculty member. A written proposal describing the project (including the nature of the project itself, dates, and the supervising faculty member) must be submitted to the Program Director/committee for approval before the student can register for the course. Project must be appropriate to the student's chosen track. It must be designed to produce a scholarly paper, papers, or other evidence(s) that reflect significant results from the course. (F, W, S).
Restriction(s):
Can enroll if Class is Graduate

ESCI 698 MSES Master's Project 3 Credit Hours
Intended for students who present a plan for a project using methods of intellectual exploration and analysis. Possible projects include gathering data through laboratory or field based studies, using interviews and survey instruments to gauge human responses. They should involve creative representations, writing, and other forms of interdisciplinary analysis. To be carried out under the general supervision of a member of the graduate faculty in Natural Sciences. Project plan must be approved by the MSES Program Director/committee before student registers for this course. (F, W, S).
Restriction(s):
Can enroll if Class is Graduate

ESCI 699 MSES Master's Thesis 1 to 6 Credit Hours
MSES students electing this thesis option in the last stage of the program will work under the general supervision of a member of the graduate faculty in Natural Sciences, but will plan and carry out the work independently. Prospectus and thesis plan must be approved by the MSES Program Director/committee before student registers for this course. (F, W, S).
Restriction(s):
Can enroll if Class is Graduate

*An asterisk denotes that a course may be taken concurrently.

Frequency of Offering

The following abbreviations are used to denote the frequency of offering: (F) fall term; (W) winter term; (S) summer term; (F, W) fall and winter terms; (YR) once a year; (AY) alternating years; (OC) offered occasionally