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/casl/centers-institutes/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 (http://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 (Professor Jacob Napieralski: jnapiera@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 (http://catalog.umd.umich.edu/graduate/graduate-admissions/) Admissions.

Application instructions can be found at: umdearborn.edu/gradapplynow

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) plus ESCI 699. A thesis will be based on original research. (Preferred by the environmental consulting industry)

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

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Core Courses</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BIOL 508</td>
<td>Invasive Species Ecology</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 548</td>
<td>Environmental Chemistry</td>
<td>3</td>
</tr>
<tr>
<td>ESCI 572</td>
<td>Environmental Communications</td>
<td>3</td>
</tr>
<tr>
<td>ESCI 574</td>
<td>Watershed Analysis</td>
<td>3</td>
</tr>
<tr>
<td>GEOL 550</td>
<td>Glacial Geology</td>
<td>3</td>
</tr>
<tr>
<td><strong>Electives</strong></td>
<td>15</td>
<td></td>
</tr>
</tbody>
</table>

Select fifteen credit hours from:

Department of Natural Sciences:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 519</td>
<td>Behavior and Evolution</td>
</tr>
<tr>
<td>BIOL 522</td>
<td>Conservation Biology</td>
</tr>
<tr>
<td>BIOL 524</td>
<td>Biology of Spiders</td>
</tr>
</tbody>
</table>
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.

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.

Environmental Science

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 545</td>
<td>Restoration Ecology</td>
<td></td>
</tr>
<tr>
<td>BIOL 552</td>
<td>Med &amp; Env Toxicology</td>
<td></td>
</tr>
<tr>
<td>BIOL 556</td>
<td>Behavioral Ecology</td>
<td></td>
</tr>
<tr>
<td>CHEM 535</td>
<td>Green Chemistry</td>
<td></td>
</tr>
<tr>
<td>ENST 574</td>
<td>Environmental Education</td>
<td></td>
</tr>
<tr>
<td>ESCI 585</td>
<td>Spatial Analysis and GIS</td>
<td></td>
</tr>
<tr>
<td>ESCI 595</td>
<td>Topics in Environmental Science</td>
<td></td>
</tr>
<tr>
<td>ESCI 597</td>
<td>Off-Campus Independent Study</td>
<td></td>
</tr>
<tr>
<td>ESCI 599</td>
<td>On-Campus Independent Study</td>
<td></td>
</tr>
<tr>
<td>ESCI 698</td>
<td>MSES Master’s Project</td>
<td></td>
</tr>
<tr>
<td>ESCI 699</td>
<td>MSES Master’s Thesis</td>
<td></td>
</tr>
<tr>
<td>GEOL 577</td>
<td>Environmental Field Methods</td>
<td></td>
</tr>
<tr>
<td>GEOL 578</td>
<td>Field Geology</td>
<td></td>
</tr>
<tr>
<td>MICR 505</td>
<td>Environmental and Public Health Microbiology</td>
<td></td>
</tr>
<tr>
<td>Other Departments:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>STAT 530</td>
<td>Applied Regression Analysis</td>
<td></td>
</tr>
<tr>
<td>STAT 545</td>
<td>Reliability &amp; Survival Analysis</td>
<td></td>
</tr>
<tr>
<td>STAT 555</td>
<td>Environmental Statistics</td>
<td></td>
</tr>
</tbody>
</table>

Total Credit Hours 30

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 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 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 Credit Hour
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 and trip length is typically one to two weeks in length. (YR). (YR).

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, W, S).

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 Environmental 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 Science  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.