

# MASTER OF SCIENCE IN ENVIRONMENTAL SCIENCE

## Program Director

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## Program Description

The Environmental Science program offers a multidisciplinary, interdepartmental graduate program leading to a Master of Science degree. The program office is housed in Moser Hall and is administered by the Department of Physics, Astronomy, Geology and Environmental Sciences. This program is intended for individuals who have undergraduate degrees in Environmental Science/science, other natural or social sciences, engineering, or health professions. It is designed to meet the needs of students and working professionals preparing for supervisory roles in environmental science (research and management), with emphasis on a risk-based approach to the solving of environmental problems. The curriculum requires students to broaden their knowledge with core courses in Environmental Science, to deepen their expertise with elective courses, and to demonstrate their abilities to prepare a scholarly thesis. This degree will benefit students who are planning careers with regulatory agencies, regulatory compliance and management, research facilities, and consulting firms providing state-of-the-art assessment, management, and remediation.

## Admission Requirements

A cumulative undergraduate minimum grade point average of 2.7 (on a 4.0 scale) is required for admission.

GRE not required

Bachelor's degree in Environmental Science or related field

## Graduate Faculty

**Isam E. Amin**, Ph.D., Professor

Ground water contamination and remediation; characterization and remediation of Mahoning River banks; sediment transport in rivers and streams; intra-state water conflicts

**Felicia P. Armstrong**, Ph.D., Professor

Environmental chemistry of soils; water quality; ecotoxicology; soil remediation

**Thomas Jordan**

Environmental geophysics; archaeo-geophysics; hydro-geophysics; exploration; geophysics and hydrogeology

**Colleen McLean**, Ph.D., Associate Professor

Aqueous and environmental geochemistry; paleolimnology; biogeochemistry

**Ian J. Renne**, Ph.D., Associate Professor

Plant community ecology; invasive species; community structure; allelopathic systems; avian ecology

**Bradley A. Shellito**, Ph.D., Professor

Applications of geospatial technology (Geographic Information Science, remote sensing, global positioning systems, and 3D Modeling)

**Josef B. Simeonsson**, Ph.D., Professor

Analytical atomic and molecular spectroscopy; trace and ultratrace analysis; laser induced fluorescence spectroscopy; laser ionization spectroscopy; Raman spectroscopy; environmental analysis

## Degree Requirements

Changes Forthcoming

Environmental Science program requires courses that are designed to provide breadth in environmental science and understanding of environmental issues and regulations. Each student admitted to the program will meet with the coordinator to choose initial coursework and meet graduate faculty. It is highly recommended that new students enroll in ENST 6995 Introduction to Environmental Science Research. Each graduate student is required to select a thesis committee with the recommendation of his or her thesis advisor within the first year of full-time graduate study.

All students in the Environmental Science graduate program must have their course schedules approved by their thesis advisors every semester. A proposed course of study must be approved by the thesis committee. The course of study will be based on the student's area of specialization, background, and career interests.

The thesis committee will consist of three to five faculty members in appropriate fields of expertise and one non-faculty professional. The non-faculty member must qualify for appointment as an adjunct graduate faculty member at YSU. Research proposals and proposed course of study must be completed and approved by the thesis committee by the end of the second semester of full-time graduate study.

The thesis shall advance knowledge in environmental science and be applicable to the solving of environmental problems. The thesis requirement includes a formal document and a draft article in journal format suitable for publication submittal. A draft of the thesis must be reviewed by the thesis advisor then submitted to the thesis committee two weeks before the thesis defense. The thesis defense will comprise an oral presentation before the thesis committee for final thesis approval.

COURSE	TITLE	S.H.
<b>Required Courses</b>		
ENST 6900	Advanced Environmental Studies	3
BIOL 5853	Biometry	3
Select two of the following:		6
ENST 5800	Environmental Impact Assessment	
ENST 5830	Toxicology and Risk Assessment	
ENST 5860	Environmental Regulations	
ENST 6901	Sources of Contamination	
ENST 6920	Environmental Compliance	
ENST 6921	Industry/Institutional Management for the Environmental Professional	
ENST 6931	Ecological Risk Assessment	
<b>Electives</b>		
Select an additional 15 semester hours. Elective courses can come from Environmental Science, Geology, Biology, Civil/Environmental Engineering, Geography, Chemistry or other disciplines recommended by the graduate committee.		15
Note: Additional ENST courses may be taken as electives.		
ENST 6995	Introduction to Environmental Science Research (recommended)	
ENST 5810	Environmental Safety (recommended)	
<b>Thesis</b>		
ENST 6990	Thesis	6
<b>Total Semester Hours</b>		<b>33</b>

All graduate students in Environmental Science are required to successfully pass a graduate exam during the second year of their graduate program. Currently the Environmental Professional Intern (EPI) exam is being utilized. This exam covers topics in environmental science with respect to chemistry, biology, regulations, analysis, and other environmental issues.

No more than nine (9) semester hours from the 5800 level (swing course) may be counted towards the Master of Science degree. (Note: More courses at the 5800 level can be taken, but only 9 s.h. count towards the 27 s.h. required for the Master's degree). Additional background courses (undergraduate or graduate) may be required as prerequisites for some of the graduate courses.

Credits earned for the Graduate Certificate in Environmental Studies may be applied to the Master of Science degree to the extent allowed by the College of Graduate Studies (normally nine semester hours). Students in the certificate program, who intend to pursue the Master's degree, must apply to and meet all the requirements for the Environmental Science Master of Science program.

## Learning Outcomes

Communicate effectively using the language, concepts, and models of environmental science in written, visual, and numerical formats.

Properly apply the scientific method to research an environmental problem and formulate conclusions.

Demonstrate ability to apply appropriate field-and laboratory-based methods (of acquiring, quantitatively and qualitatively analyzing and interpreting environmental data and information).

Apply environmental science research as demonstrated by the successful completion of the comprehensive exam and a Master's thesis.

## Graduate Courses

### ENST 5810 Environmental Safety 3 s.h.

The proper use of environmental monitoring instruments and personal protective gear. Participation in a series of realistic, hands-on simulation exercises that address a variety of waste clean-up situations. Topics include chemical and physical hazards of chemical compounds and toxicology and adverse effects of chemical exposure. Class meets three hours per week. Successful completion of the course earns OSHA Hazwoper 40 hour training certificate.

**Prereq.:** ENST 2600, equivalent experience or permission of instructor.

### ENST 5820 Sustainability, Climate Change, and Society 3 s.h.

This course explores environmental, economic, and social aspects of sustainable development, with an emphasis on economy and society. Through topics such as water, food, and climate change, we examine the role of humans and institutions in sustainable development and possibilities for reconfiguring relationships between our institutions and the natural world.

**Prereq.:** junior, senior or graduate level standing.

### ENST 5830 Toxicology and Risk Assessment 3 s.h.

A study of environmental toxicology of chemicals, primarily anthropogenic pollutants, and their effect on humans and ecosystems. Includes transportation of pollutants in the environment, biochemical reactions, toxicity testing methods, and dose-response assessment. Continues with an introduction in the process of estimating risk and the perception of those risks including how risk is used to set environmental standards.

**Prereq.:** ENST 1516 and 9 sh >3700 in ENST, CHEM, BIOL, GEOL or CEEN, junior, senior or graduate standing.

**Gen Ed:** Capstone.

### ENST 5860 Environmental Regulations 3 s.h.

An examination of federal and state regulations that relate to cleanup of abandoned waste sites, management of waste from current waste generators, development of new hazardous products and chemicals, safety and health issues, and control of pollution into air and water.

**Prereq.:** ENST 2600 or equivalent.

### ENST 6900 Advanced Environmental Studies 3 s.h.

A study of the principles and issues of environmental science, health, technology, and affairs. Topics will include contaminant chemistry; terrestrial and aquatic ecology; risks to human health; waste management; conservation; and sustainable development, energy, and pollution. Local, regional, and global issues will be studied.

### ENST 6901 Sources of Contamination 3 s.h.

A study of the sources and fate and transport of air, water, and soil contaminants that have potential to adversely affect human health and the environment. Topics will include measurement of environmental parameters, data collection and reporting, interpretation of results, compliance issues, and economic implications.

### ENST 6905 Teaching Methods in Geology and Environmental Science 2 s.h.

A required course for all Department of Geological and Environmental Sciences graduate teaching assistants. This course will provide guidance and instruction in teaching introductory laboratories in the department.

### ENST 6910 Environmental Management Systems Standards (ISO 14001) 1 s.h.

Introduction to establishing a program to set internal industrial standards to identify, measure, and control the environmental impact of their activities, products, and services, including environmental policy, communication, legal requirements, training, documentation, and emergency preparedness.

### ENST 6920 Environmental Compliance 3 s.h.

Regulatory compliance concerning operations of environmental and health and safety departments. RCRA permitting (NPDES and air emissions), landfilling, Right to Know, waste generation, storage, shipping (manifests and placarding), disposal of wastes, MSDS, OSHA regulations, safe work practices, hiring consultants (technical and legal), writing requests for proposals, and documenting and report writing.

**Prereq.:** ENST 5860, ENST 6900, or equivalent.

### ENST 6921 Industry/Institutional Management for the Environmental Professional 3 s.h.

A comprehensive background in management principles and operations relating to the environmental professions. Topics include budgeting, staffing, scheduling, leadership, and quality assurance/control. The student will learn to write, evaluate, and implement technical and cost proposals for contracts and grants, scopes of work, operations plans, sampling and analysis plans, health and safety plans, job descriptions, resumes, statements of qualifications, mission statements, meeting agendas (for professionals and the general public), and other written and oral communications (reports, memoranda, memoranda of understanding, policy briefs, press releases, fact sheets, requests for information).

**Prereq.:** ENST 6900 or equivalent.

### ENST 6930 Risk Management 3 s.h.

Using the principles of risk assessment, the student will learn to manage existing environmental risks in the workplace. Topics will include workplace health hazards; product liability; toxic tort claims; cleaning strategies for risk reduction such as brownfield redevelopment, voluntary action programs, alternative, and regulatory actions. Economic importance, resource allocation, technical feasibility, and public opinion will be discussed.

**Prereq.:** ENST 6900 and ENST 5830 or equivalent.

### ENST 6931 Ecological Risk Assessment 3 s.h.

The student will examine environmental risks to nonhuman populations. Topics will include the study of measurements of adverse effects due to one or more stressors by examining population communities and ecosystems. Also, the class will study the following issues: threatened and endangered species, wetlands, endocrine disruption, multiple stressors, sediment and soil toxicity, conservative screening versus site-specific studies, and natural resource damage claims.

**Prereq.:** ENST 6900 and ENST 5830 or equivalent.

**ENST 6990 Thesis 1-6 s.h.**

Hours arranged. Applicable to master's degree in environmental studies. Research selected and supervised by departmental advisor and approved by graduate faculty of environmental studies program and graduate dean. May be repeated.

**ENST 6995 Introduction to Environmental Science Research 2 s.h.**

This course introduces the student to the fundamental and practical aspects of research, especially as they apply to environmental sciences. The course emphasizes research methodologies and ethics, how to review the literature, how to write a research proposal, and how research results are presented. The course will include presentations of the faculty research interests.

**Prereq.:** graduate standing or permission of instructor.

**ENST 6999 Special Topics in Environmental Science 1-3 s.h.**

Environmental science topics selected by faculty from fields of current research interest or of special emphasis. May be repeated with a different topic up to a total of six semester hours.

**Prereq.:** Permission of director.

**ENST 6999G Special Topics in Environmental Science Environmental Geophysics 1-3 s.h.**

Environmental science topics selected by faculty from fields of current research interest or of special emphasis. May be repeated with a different topic up to a total of six semester hours.

**Prereq.:** Permission of director.

**ENST 6999J Special Topics in Environmental Science Hydrogeology 1-3 s.h.**

Environmental science topics selected by faculty from fields of current research interest or of special emphasis. May be repeated with a different topic up to a total of six semester hours.

**Prereq.:** Permission of director.