

Earth and Environmental Sciences

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The department of earth and environmental sciences is housed in the Randall Environmental Center, located on 145 acres of preserved natural area of the Upland campus. The environmental science program offers students the opportunity to enhance their liberal arts education with a cluster of specialized courses designed to provide the knowledge, skills and conscience necessary for environmental decision-making for stewardship and service in a complex world. Courses focusing on practical problem-solving methodologies add depth, utility and perspective to a variety of fields of study. The department offers opportunities for applied study in international settings, and a summer field course in the Black Hills of South Dakota. Student research is strongly encouraged and has been supported by external funding.

The department offers a bachelor of science degree in environmental science and coordinates three integrated majors: chemistry–environmental science (see listing under chemistry department), mathematics–environmental science (see listing under mathematics department) and environmental engineering (see listing under physics department). These majors provide excellent preparation for graduate education or job placement in a wide variety of career fields in environmental science. In addition to preparation for the Graduate Record Exams (GRE), these programs also serve as excellent preparation for the LSAT (law school entrance exam) and GMAT (MBA entrance exam).

Students in a wide range of majors outside the department may choose to develop a variety of practical scientific skills and explore the concepts of environmental stewardship by selecting one of three minors in the department: environmental science, environmental studies, and environmental law and policy.

In addition to the programs described below, a master of environmental science degree is offered. Qualified Taylor University students may participate in an accelerated 4+1 option, thus earning both the bachelor and master degrees in five years. Visit <http://www.taylor.edu/mes>, contact the MES program director, or call the department of earth and environmental sciences for more information.

Environmental Science (BS)

The bachelor of science degree with a major in environmental science requires 67-71 hours.

Major Requirements

BIO 304	4	Field Natural History of the Black Hills
ENS 204	4	Principles of Ecology
ENS 231	4	Introduction to Environmental Science
ENS 383	4	Environmental Ethics
ENS 402	4	Environmental Law and Policy
ENS 393	2	Practicum
MAT 210	4	Introductory Statistics
POS 331	3	Public Policy

Select one of the following chemistry course combinations:

CHE 201	4	General Chemistry I
CHE 202	4	General Chemistry II
or		
CHE 211	4	College Chemistry I
CHE 212	4	College Chemistry II

Biology Requirements

Select one of the following courses:

BIO 101	4	Principles of Cell Biology
BIO 103	3	Introductory Plant Biology
BIO 104	3	Introductory Animal Biology

Select two of the following courses:

BIO 301	4	Taxonomy of Vascular Plants
BIO 307	4	Vertebrate Natural History
BIO 441	4	Environmental Physiology
BIO 471	4	Microbiology and Immunology
ENS 475	4	Systems Ecology

Earth and Physical Science Requirements

ENS 241	4	Physical Geology
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Select two of the following courses:

ENS 355	4	Geospatial Analysis
ENS 361	4	Geomorphology
ENS 362	4	Hydrogeology
ENS 363	4	Applied Geology and Environmental Planning
ENS 364	4	Water Resources and Appropriate Technology
[†] CHE 320	3	Environmental Chemistry

and

[†] CHE 320L	1	Environmental Chemistry Lab
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[†]CHE 320 & 320L count as one course.

Electives

Select one of the following options:

Option 1 (Biology)

Select two courses not previously used from the following:

BIO 101	4	Principles of Cell Biology
BIO 103	3	Introductory Plant Biology
BIO 104	3	Introductory Animal Biology
BIO 244	4	Human Anatomy and Physiology I
BIO 245	4	Human Anatomy and Physiology II
BIO 301	4	Taxonomy of Vascular Plants
BIO 307	4	Vertebrate Natural History
BIO 331	4	Comparative Anatomy
BIO 452	4	Animal Physiology
BIO 471	4	Microbiology and Immunology
ENS 475	4	Systems Ecology

Option 2 (Earth and Physical Science)

Select two courses not previously used from the following:

ENS 340	4	Global Ecology/Global Issues
ENS 341	4	Earth Materials
ENS 355	4	Geospatial Analysis
ENS 361	4	Geomorphology
ENS 362	4	Hydrogeology
ENS 363	4	Applied Geology and Environmental Planning
ENS 364	4	Water Resources and Appropriate Technology

Environmental Science Minor

The minor in environmental science requires 19-20 hours and is designed for students in science majors; minor not open to environmental science majors. Students who desire entry into the Master of Environmental Science program should also take ENS 204, MAT 210, and CHE 201 and 202 or CHE 211 and 212.

Minor Requirements

Select one course from the following:

ENS 200	3	Environment and Society
ENS 231	4	Introduction to Environmental Science

Select one course from the following:

ENS 383	4	Environmental Ethics
ENS 402	4	Environmental Law and Policy

Select 12 hours from:

ENS 204	4	Principles of Ecology
ENS 241	4	Physical Geology
ENS 340	4	Global Ecology/Global Issues
ENS 341	4	Earth Materials
ENS 355	4	Geospatial Analysis
ENS 361	4	Geomorphology
ENS 362	4	Hydrogeology
ENS 363	4	Applied Geology and Environmental Planning
ENS 364	4	Water Resources and Appropriate Technology
ENS 475	4	Systems Ecology
BIO 304	4	Field Natural History of the Black Hills
CHE 320	3	Environmental Chemistry
and		
CHE 320L	1	Environmental Chemistry Lab

Appropriate course substitutions may be made with permission of the department chair.

Environmental Law and Policy Minor

The minor in environmental law and policy requires 17-19 hours and is especially appropriate for students with majors in political science and those pursuing careers in law; minor not open to environmental science majors.

Minor Requirements

ENS 383	4	Environmental Ethics
ENS 402	4	Environmental Law and Policy
POS 331	3	Public Policy

Select one course from the following:

ENS 200	3	Environment and Society
ENS 231	4	Introduction to Environmental Science (recommended)

Select one course from the following:

GEO 240	3	Introduction to Geology
ENS 241	4	Physical Geology

Environmental Studies Minor

This minor in environmental studies requires 17-19 hours and is especially appropriate for students with majors in business, communication arts, humanities, or social sciences. It should be of particular interest for students pursuing a semester abroad.

Minor Requirements

ENS 383	4	Environmental Ethics
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Select one course from the following:

ENS 200	3	Environment and Society
ENS 231	4	Introduction to Environmental Science (recommended)

Select one course from the following:

GEO 240	3	Introduction to Geology
ENS 241	4	Physical Geology

Select 7-8 hours from:

ENS 204	4	Principles of Ecology
ENS 304	4	Global Ecology/Global Issues
ENS 341	4	Earth Materials
ENS 355	4	Geospatial Analysis
ENS 361	4	Geomorphology
ENS 362	4	Hydrogeology
ENS 363	4	Applied Geology and Environmental Planning
ENS 364	4	Water Resources and Appropriate Technology
ENS 402	4	Environmental Law and Policy
ENS 475	4	Systems Ecology
ECO 315	3	Environmental and Natural Resource Economics

Appropriate course substitutions may be made with permission of the chair of the department.

Environmental Science Courses

ENS 170

1-4 hours

Selected Topics

A course offered on a subject of interest but not listed as a regular course offering. *May count toward the departmental major and general education requirements.*

ENS 200

3 hours

Environment and Society

Introduction to ecological principles and human impacts on the environment. Issues studied include population dynamics, natural resources, pollution problems, and environmental ethics. Lab exercises focus on experimental ecology and the basic techniques used to describe and measure environmental quality. *Meets the general education life science requirement. Environmental science majors should elect ENS 231 rather than ENS 200.*

ENS 201

4 hours

Introduction to Geology in the Field

Introduction to earth's materials, processes, and history as discovered through field observations of minerals, rocks, fossils, strata, caves, rivers, canyons, and mountains. Emphasis is placed on field experiences and observations, complemented by study of maps, laboratory work, and discussions. *Offered during summer at the Black Hills Science Station near Rapid City, South Dakota.*

ENS 204

4 hours

Principles of Ecology

A majors core course: An introduction to the relationships existing between organisms and their environment. Lectures focus on the structural and functional aspects of populations, communities, and ecosystems in the context of the major North American biomes. Three hours lecture and two hours laboratory per week. *Does not normally satisfy general education science requirement. Prerequisite: Three hours of BIO or ENS or permission of the instructor.*

ENS 231

4 hours

Introduction to Environmental Science

An introduction to environmental science, including a discussion of ecological principles and their application, energy systems, pollution problems, environmental policy and decision making, and the scientific and ethical implications of human impacts on the environment. Lab exercises focus on experimental ecology and the basic techniques used to describe and measure environmental quality. This course serves three functions: (1) it is the entry level course for environmental science majors; (2) it may be taken for general education lab science credit; and (3) biology majors may count it as a 200-level biology course when calculating course hour requirements in biology. Three hours of lecture and two hours of lab per week. *Meets the general education life science requirement.*

ENS 241

4 hours

Physical Geology

A general introduction to the earth's internal and external physical, dynamic systems. Topics include occurrence and formation of minerals and rocks, processes that shape the earth's surface, and the internal structure and dynamics that lead to plate tectonics and crustal deformation. Special emphasis is placed on the environmental aspects of humans' interaction with the earth. Three hours of lecture and two hours of lab per week. *Meets general education earth science requirement.*

ENS 242

4 hours

Geology of Indiana

An introduction to the concepts of physical and historical geology in the context of Indiana. Topics include rocks, fossils, structure, landforms, and earth and environmental resources of the state. Offered during summer session and includes a required field trip to several regions of Indiana for field observation and collection of mineral, rock, and fossil specimens. *Meets general education earth science requirement.*

ENS 270

1-4 hours

Selected Topics

A course offered on a subject of interest but not listed as a regular course offering. *May count toward the departmental major and general education requirements.*

ENS 340

4 hours

Global Ecology/Global Issues

An introduction to the analysis of complex issues. Global actors, their values and policies, and the potential futures they create are investigated in the context of issues such as economic development, energy, food, and population. Global interdependence is stressed. The academic perspective is interdisciplinary, and the geographic focus is non-North American. Three hours of lecture and two hour discussion section per week. *Prerequisite: ENS 200 or 231.*

ENS 341

4 hours

Earth Materials

Basic principles of mineralogy and petrology, with emphasis placed on description, identification, classification, and interpretation of rock-forming minerals and the igneous, sedimentary, and metamorphic rocks they comprise. Also includes origin and occurrence of earth materials and their uses in economic and environmental contexts. Lab emphasizes observation of hand specimens and some thin-sections. Three hours of lecture and the equivalent of two hours of lab per week, including field trips to selected locations throughout the state. *Prerequisite: ENS 241 or permission from the instructor.*

ENS 355

4 hours

Geospatial Analysis

An introduction to methods of collection, management and analysis of geospatial data. Topics include basic map properties, preparation and interpretation of thematic and topographic maps, analysis of aerial photographs, surveying by traditional and global positioning systems (GPS) techniques, and acquisition of remotely-sensed satellite data. Special emphasis is placed on methods and applications of geographic information systems (GIS) in geospatial analysis. *Prerequisite: ENS 200, 231, or 241.*

ENS 360

1-4 hours

Independent Study

An individualized, directed study involving a specified topic.

ENS 361

4 hours

Geomorphology

An applied approach to the study of earth surface processes and the landforms they produce. Topics include processes and landforms associated with weathering, mass wasting, rivers, karst, tectonics, glaciers, shorelines, and wind. Emphasis placed on environmental and land-use applications. Field and lab assignments include qualitative descriptions and quantitative measurements from fieldwork, topographic and geologic maps, and aerial photographs. Three hours of lecture and three hours of lab per week. *Prerequisite: ENS 241 or permission from the instructor.*

ENS 362

4 hours

Hydrogeology

Basic processes and measurement of the hydrologic cycle, including precipitation, evaporation, surface runoff, stream flow, soil moisture, and groundwater. Emphasis placed on groundwater, including aquifer characteristics, principles of flow, conceptual models of regional flow, geology of occurrence, well hydraulics, chemistry and quality, detection of pollutants, contaminant transport and remediation, and resource development. Three hours of lecture and three hours of lab per week. *Prerequisites: ENS 241 or permission from the instructor.*

ENS 363

4 hours

Applied Geology and Environmental Planning

The application of principles from surficial geology and hydrology in the recognition, assessment, and mapping of environmental geo-hazards in the context of environmental planning. Topics include hazards and land-use analysis of soils, slopes, floods, groundwater, coasts, and tectonic activities. Three hours of lecture and three hours of lab per week. *Prerequisite: ENS 241 or permission from the instructor.*

ENS 364

4 hours

Water Resources and Appropriate Technology

Concepts and practices of water resource development and appropriate technology in the context of environmental resources in a developing country. Students participate in a service-learning project of design and implementation of water resource related appropriate technology (such as well-drilling, water quality protection, hygiene training, and sanitation system design) as part of a holistic ministry toward transformational development. Students develop a perspective on the role of appropriate technology in the responsibility of individuals in cross-cultural service, in issues of cross-cultural communication and interactions, and in God's purposes in missions and the worldwide church. *Prerequisite: IAS 120.*

ENS 370 **1-4 hours**
Selected Topics
A course offered on a subject of interest but not listed as a regular course offering. *May count toward the departmental major and general education requirements.*

ENS 383 **4 hours**
Environmental Ethics
An in-depth discussion of the ethical implications of major environmental problems, such as world population and food supply, inequities in land and resource distribution, animal rights, materialism and personal life styles, and exploitation vs. stewardship of the environment. Three hours of lecture and a discussion section per week. *Prerequisite: Junior/senior ENS majors or permission from the instructor.*

ENS 393 **1-4 hours**
Practicum
Supervised learning involving a first-hand field experience or a project. Generally, one hour of credit is awarded for a minimum of 40 hours of practicum experience. *Offered primarily during summer.*

ENS 402 **4 hours**
Environmental Law and Policy
Lectures introduce the major elements of U.S. environmental law: NEPA, EIS, CAA, CWA, RCRA, CERCLA, TSCA, FIFRA and CRTK. The administrative process, cost/benefit analysis and the role of litigation in enforcement are also discussed. Presentation techniques and debate skills are introduced. Three hours of lecture and a discussion section per week. *Prerequisite: Senior environmental science majors and minors or permission from the instructor.*

ENS 450 **1-4 hours**
Directed Research
Investigative learning involving closely directed research and the use of such facilities as the library or laboratory.

ENS 475 **4 hours**
Systems Ecology
The principles of systems theory are introduced in an integrated study of the development, dynamics, and disruption of natural ecosystems. Theoretical, analytical, and experimental aspects of ecosystems are explored. Students are introduced to the use of microcomputers as a tool in ecosystem modeling. *Prerequisites: ENS 204 and one course in college-level mathematics or computer science.*

ENS 480 **1-4 hours**
Seminar
A limited-enrollment course designed especially for upper-class majors with emphasis on directed readings and discussion.

ENS 490 **1-2 hours**
Honors
Individualized study or research of an advanced topic within a student's major. Open to students with at least a 3.00 GPA in the major field.

Notes