Environmental Sciences

Chair, Department of Earth and Environmental Sciences
• Charles "Tom" Foster Jr.

Coordinators, Environmental Sciences
• E. Arthur Bettis III, Andrew A. Forbes

Undergraduate major: environmental sciences (B.A., B.S.)
Undergraduate minor: environmental sciences
Faculty: http://clas.uiowa.edu/envsci/people
Web site: http://clas.uiowa.edu/envsci/

The Environmental Sciences Program provides rigorous interdisciplinary training in the scientific study of the environment. It promotes an understanding of the earth as a complex network of interacting organic and inorganic systems. The program's undergraduate curricula reflect the diversity in the broad field of environmental sciences and draw upon the College of Liberal Arts and Sciences' disciplinary strengths, giving students the opportunity to develop particular areas of expertise.

Hands-on field experience is a crucial component of the program. Students are strongly encouraged to engage in research and study abroad.

The Department of Earth and Environmental Sciences is the administrative home for the Environmental Sciences Program.

Undergraduate Programs of Study

• Major in environmental sciences (Bachelor of Arts, Bachelor of Science)
• Minor in environmental sciences

Bachelor of Science

The Bachelor of Science with a major in environmental sciences requires a minimum of 120 s.h., including 81-85 s.h. of work for the major. Students must maintain a g.p.a. of at least 2.00 in all courses for the major and in all UI courses for the major. They also must complete the College of Liberal Arts and Sciences General Education Program; some courses required for the major in environmental sciences may be used to satisfy General Education Program requirements.

Bachelor of Science students majoring in environmental sciences must complete requirements in three areas: the science and mathematics foundation, the environmental sciences foundation, and one of four environmental sciences tracks. Each student is assigned an advisor who specializes in his or her track.

The science and mathematics foundation develops fundamental skills and comprehension in biology, chemistry, geology, mathematics, and statistics. The environmental sciences foundation includes an introductory course in environmental science and additional courses that focus on remote sensing techniques, design and use of geographic information technologies, the geomorphic and environmental processes that shape the earth's surface, and ecological factors that influence the distribution and abundance of organisms.

Each of the program's four tracks focuses on areas of specialization within environmental sciences:

- biosciences (green) track—biological systems and ecological approaches;
- chemical sciences (yellow) track—environmental systems and chemistry;
- geosciences (brown) track—earth materials and surficial geologic processes; and
- hydrosciences (blue) track—hydrogeology and hydrogeologic systems, and water chemistry.

The tracks aim to prepare scientists who can tackle problems that require particular areas of expertise, and to help students develop the skills needed for future employment or graduate study.

The environmental sciences major for the Bachelor of Science requires the following course work.

SCIENCE AND MATHEMATICS FOUNDATION

Students must complete at least 31 s.h. of course work for the science and mathematics foundation, as follows.

All of these:

- BIOL:1411-BIOL:1412 Foundations of Biology - Diversity of Form and Function 8 s.h.
- CHEM:1110 & CHEM:1120 Principles of Chemistry I-II 8 s.h.
- EES:1050 Introduction to Geology 4 s.h.
- MATH:1850 & MATH:1860 Calculus I-II 8 s.h.

One of these:

- CHEM:2021 Basic Measurements 3 s.h.
- STAT:2020 Probability and Statistics for the Engineering and Physical Sciences 3 s.h.
- STAT:3510 Biostatistics 3 s.h.
- STAT:4200 Statistical Methods and Computing 3 s.h.

ENVIRONMENTAL SCIENCES FOUNDATION

Students must complete at least 18-19 s.h. of course work for the environmental sciences foundation, as follows.

All of these:

- ENVS:1080 Introduction to Environmental Science 4 s.h.
- ENVS:2673 Ecology 3 s.h.
- ENVS:3000 Environmental Sciences Seminar (taken twice) 2 s.h.
- ENVS:3020 Earth Surface Processes 3 s.h.
- GEOG:1050 Foundations of GIS 3 s.h.

One of these:

- ENVS:3100 Introduction to Applied Remote Sensing 4 s.h.
- GEOG:3500 Introduction to Environmental Remote Sensing 3 s.h.

Tracks for the Bachelor of Science

Bachelor of Science students majoring in environmental sciences must choose one of the following four tracks. Each track includes required general sciences courses,
track foundation courses, field study courses, and elective courses.

**BIOSCIENCES (GREEN) TRACK**
The environmental biosciences track provides the essential skills for entry-level positions that require a good knowledge of biotic systems and the ability to inventory biologic resources. The track's aim is to produce scientists who are capable of tackling environmental problems in which links and interactions with life sciences are crucial and in which a substantial knowledge of biological/ecological sciences is required. The track also provides a strong foundation for graduate or professional training in disciplines such as ecology, wildlife management, and natural resource management.

Students must complete at least 32 s.h. of environmental biosciences track course work, including one field study course.

**Biosciences Track: General Sciences**
This course:
CHEM:2210 Organic Chemistry I 3 s.h.
Students are encouraged to take at least one semester of physics.

**Biosciences Track: Foundation**
Both of these:
BIOL:2512 Fundamental Genetics 4 s.h.
BIOL:3172 Evolution 4 s.h.
At least 7 s.h. from these:
BIOL:2346 Vertebrate Zoology 4 s.h.
EES:3070 Marine Ecosystems and Conservation 3 s.h.
EES:3220 Evolution of the Vertebrates 3 s.h.
EES:4440 Phylogenetics and Biodiversity 3 s.h.
EES:4700 Evolution of Ecosystems 3 s.h.
GEOG:2374 Biogeography 3 s.h.
GEOG:2950 Environmental Conservation 3 s.h.
IALL:3105 Plant Taxonomy 4 s.h.
IALL:3115 Field Mycology 4 s.h.
IALL:3117 Ecology and Systematics of Diatoms 4 s.h.

Other Iowa Lakeside Laboratory courses (prefix IALL) may be approved in consultation with an environmental sciences advisor.

**Biosciences Track: Field Study**
One of these:
IALL:3103 Aquatic Ecology 4 s.h.
IALL:3105 Plant Taxonomy 4 s.h.
IALL:3109 Ecology and Systematics of Algae 4 s.h.
IALL:3115 Field Mycology 4 s.h.
IALL:3117 Ecology and Systematics of Diatoms 4 s.h.
IALL:3122 Prairie Ecology 4 s.h.
IALL:3126 Ornithology 4 s.h.
IALL:3160 Restoration Ecology 4 s.h.
IALL:3163 Conservation Biology 4 s.h.

**Biosciences Track: Electives**
Biosciences track students must complete at least 10 s.h. of elective course work, with at least 6 s.h. from the following lists. They may include an additional field study course to satisfy 4 s.h. of the elective requirement (see "Biosciences Track: Field Study" above).

BIOL:3244 Animal Behavior 3,5 s.h.
BIOL:3343 Animal Physiology 3 s.h.
BIOL:3663 Plant Response to the Environment 3 s.h.
BIOL:3676 Evolution Lab 4 s.h.
BIOL:3994 Introduction to Research 2-3 s.h.
BIOL:4273 Population Genetics and Molecular Evolution 3 s.h.
BIOL:4999 Honors Investigations arr.
CEE:2150 Natural Environmental Systems 3-4 s.h.
CEE:5154 Environmental Microbiology 3 s.h.
CHEM:3110 Analytical Chemistry I 3 s.h.
CHEM:3120 Analytical Chemistry II 3 s.h.
EES:3080 Introduction to Oceanography 2 s.h.
EES:3210 Principles of Paleontology 3 s.h.
GEOG:2310 Introduction to Climatology 3 s.h.
GEOG:3310 Landscape Ecology 3 s.h.
GEOG:3320 Wetlands: Function, Geography, and Management 3 s.h.
GEOG:3350 Urban Ecology 3 s.h.
STAT:6513 Intermediate Statistical Methods 4 s.h.

May include one of these policy courses:
ECON:3625 Environmental and Natural Resource Economics 3 s.h.
EES:1115 Energy and Society: History and Science of Oil ISSUES 3 s.h.
GEOG:1070 Contemporary Environmental Issues 3 s.h.
GEOG:3340 Ecosystem Services: Human Dependence on Natural Systems 3 s.h.
GEOG:3750 Environmental Quality: Science, Technology, and Policy 3 s.h.
GEOG:3780 U.S. Energy Policy in Global Context 3 s.h.
GEOG:4750 Environmental Impact Analysis 4 s.h.

**CHEMICAL SCIENCES (YELLOW) TRACK**
The environmental chemical sciences track provides the essential skills for entry-level positions that require a basic understanding of chemical principles and a working knowledge of basic chemical concepts as applied in the environment. The track's aim is to produce scientists who are capable of tackling environmental problems in which chemical and molecular processes play an important role. The track also provides a strong foundation for graduate or professional training in environmental chemistry.

Students must complete at least 35 s.h. of environmental chemical sciences track course work.

**Chemical Sciences Track: General Sciences**
One of these sequences:
PHYS:1511-PHYS:1512 College Physics I-II 8 s.h.
PHYS:1611-PHYS:1612 Introductory Physics I-II 8 s.h.

**Chemical Sciences Track: Foundation**
This sequence:
CHEM:3110 & CHEM:3120 Analytical Chemistry I-II  
6 s.h.

One of these sequences:
CHEM:2210 & CHEM:2220 Organic Chemistry I-II  
6 s.h.
CHEM:2230 & CHEM:2240 Organic Chemistry for Majors - Organic Chemistry II for Majors

One of these:
CHEM:4431 Physical Chemistry I  
3 s.h.
CHEM:4432 Physical Chemistry II  
3 s.h.

**Chemical Sciences Track: Lab and Field Study**

Both of these:
CHEM:2410 Organic Chemistry Laboratory  
3 s.h.
CHEM:3430 Analytical Measurements  
3 s.h.

**Chemical Sciences Track: Electives**

Chemical sciences track students must complete at least 6 s.h. of elective courses chosen from the following lists. Students may petition the chemistry department's environmental sciences advisor to use appropriate Department of Chemistry courses numbered 3000 and above as electives.

BIOC:3110 Biochemistry  
3 s.h.
CEE:4153 Environmental Chemistry Laboratory  
3 s.h.
CEE:4158 Solid and Hazardous Wastes  
3 s.h.
CEE:5152 Environmental Chemistry I  
3 s.h.
CHEM:3250 Inorganic Chemistry  
2 s.h.
CHEM:3994 Undergraduate Research  
1-4 s.h.
CHEM:4873 Atmospheric and Environmental Chemistry  
3 s.h.
EES:4490 Elements of Geochemistry  
3 s.h.
EES:4520 Isotope Geochemistry  
3 s.h.
ENVS:3110 Chemical Evolution of the Oceans  
3 s.h.
GEOG:2310 Introduction to Climatology  
3 s.h.
GEOG:2950 Environmental Conservation  
3 s.h.

May include one of these:
CHEM:4431 Physical Chemistry I (if not taken as a foundation course)  
3 s.h.
CHEM:4432 Physical Chemistry II (if not taken as a foundation course)  
3 s.h.

May include one of these policy courses:
ECON:3625 Environmental and Natural Resource Economics  
3 s.h.
EES:1115 Energy and Society: History and Science of Oil  
3 s.h.
GEOG:1070 Contemporary Environmental Issues  
3 s.h.
GEOG:2930 Water Resources  
3 s.h.
GEOG:3340 Ecosystem Services: Human Dependence on Natural Systems  
3 s.h.
GEOG:3750 Environmental Quality: Science, Technology, and Policy  
3 s.h.
GEOG:3780 U.S. Energy Policy in Global Context  
3 s.h.
GEOG:4750 Environmental Impact Analysis  
4 s.h.

**GEOSCIENCES (BROWN) TRACK**

The environmental geosciences track provides the essential skills for entry-level positions that require a basic understanding of geologic principles and a working knowledge of basic geologic concepts applied in the environmental industry. The track's aim is to produce scientists who are capable of tackling environmental problems in which earth materials and surficial geologic processes are of primary importance. The track also lays a strong foundation for graduate study in environmental geology, engineering geology, and natural hazards assessment.

Students must complete at least 35 s.h. of environmental geosciences track course work.

**Geosciences Track: General Sciences**

This course:

PHYS:1400 Basic Physics  
4 s.h.

Students are strongly encouraged to take additional course work in physics.

**Geosciences Track: Foundation**

All of these:
EES:2410 Mineralogy  
4 s.h.
EES:3300 Sedimentary Geology  
4 s.h.
EES:3360 Soil Genesis and Geomorphology  
3 s.h.
EES:3500 Igneous and Metamorphic Petrology  
4 s.h.
EES:3840 Structural Geology  
4 s.h.
EES:4790 Engineering Geology  
3 s.h.

**Geosciences Track: Field Study**

One of these:
CEE:4103 Water Quality  
3 s.h.
EES:2831 Geologic Field Methods  
3 s.h.
EES:4680 Field Methods in Hydrologic Science  
3 s.h.
GEOG:4010 Field Methods in Physical Geography  
3 s.h.

**Geosciences Track: Electives**

Geosciences track students must complete at least 6 s.h. of elective courses chosen from the following lists.

CEE:2150 Natural Environmental Systems  
3 s.h.
CEE:4158 Solid and Hazardous Wastes  
3 s.h.
EES:1290 Energy and the Environment  
3 s.h.
EES:1400 Natural Disasters  
3 s.h.
EES:3080 Introduction to Oceanography  
2 s.h.
EES:3190 Directed Study  
arr.
EES:3300 Sedimentary Geology  
4 s.h.
EES:3380 Fluvial Geomorphology  
3 s.h.
EES:3390 Integrated Watershed Analysis  
3 s.h.
EES:3770 Global Stratigraphy  
3 s.h.
EES:4490 Elements of Geochemistry  
3 s.h.
EES:4520 Isotope Geochemistry  
3 s.h.
EES:4630 Hydrogeology  
3 s.h.
EES:4720 Glacial and Pleistocene Geology  
3 s.h.
EES:4800 Solid Earth Geophysics  
3 s.h.
EES:4870 Applied Geostatistics  
3 s.h.
EES:5380 Process Geomorphology Seminar  
1-3 s.h.
EES:5820 Tectonics  
3 s.h.
ENVS:3110 Chemical Evolution of the Oceans 3 s.h.
GEOG:2310 Introduction to Climatology 3 s.h.
GEOG:2950 Environmental Conservation 3 s.h.

May include one of these policy courses:
ENVS:1115 Energy and Society: History and Science of Oil 3 s.h.
ECON:3625 Environmental and Natural Resource Economics 3 s.h.
GEOG:1070 Contemporary Environmental Issues 3 s.h.
GEOG:3340 Ecosystem Services: Human Dependence on Natural Systems 3 s.h.
GEOG:3750 Environmental Quality: Science, Technology, and Policy 3 s.h.
GEOG:3760 Hazards and Society 3 s.h.
GEOG:3780 U.S. Energy Policy in Global Context 3 s.h.
GEOG:4750 Environmental Impact Analysis 4 s.h.

HYDROSCIENCES (BLUE) TRACK

The environmental hydrosciences track provides the essential skills for entry-level positions that require a basic understanding of geologic principles and a working knowledge of hydrogeology and hydrogeochemistry. The track’s aim is to produce scientists who are capable of tackling environmental problems that emphasize hydrogeologic systems and for which substantial knowledge of hydrogeology and water chemistry are essential. The track also lays a strong foundation for graduate education in hydrogeology, hydrology, geochemistry, and aqueous chemistry.

Students must complete at least 34 s.h. of environmental hydrosciences track course work.

Hydrosciences Track: General Sciences
This sequence:
PHYS:1511-PHYS:1512 College Physics I-II 8 s.h.

Hydrosciences Track: Foundation
Both of these:
EES:4630 Hydrogeology 3 s.h.
EES:4790 Engineering Geology 3 s.h.
One of these:
EES:3380 Fluvial Geomorphology 3 s.h.
EES:3390 Integrated Watershed Analysis 3 s.h.
One of these:
CEE:5152 Environmental Chemistry I 3 s.h.
EES:4490 Elements of Geochemistry 3 s.h.

Hydrosciences Track: Field Study
This course:
EES:4680 Field Methods in Hydrologic Science 3 s.h.

Hydrosciences Track: Electives
Hydrosciences track students must complete at least 11 s.h. of elective courses chosen from the following lists.
CEE:2150 Natural Environmental Systems 3 s.h.
CEE:3371 Principles of Hydraulics and Hydrology 3 s.h.
CEE:4103 Water Quality 3 s.h.
CEE:4153 Environmental Chemistry 3 s.h.
CEE:4378 Hydrometeorology 3 s.h.
CEE:5152 Environmental Chemistry I 3 s.h.
CEE:5154 Environmental Microbiology 3 s.h.
EES:3080 Introduction to Oceanography 2 s.h.
EES:3190 Directed Study arr.
EES:3300 Sedimentary Geology 4 s.h.
EES:4660 Groundwater Modeling 3 s.h.
EES:4800 Solid Earth Geophysics 3 s.h.
EES:4870 Applied Geostatistics 3 s.h.
ENVS:3110 Chemical Evolution of the Oceans 3 s.h.
GEOG:2310 Introduction to Climatology 3 s.h.
GEOG:2950 Environmental Conservation 3 s.h.
GEOG:3320 Wetlands: Function, Geography, and Management 3 s.h.
GEOG:3380 U.S. Energy Policy in Global Context 3 s.h.
GEOG:4750 Environmental Impact Analysis 4 s.h.

Bachelor of Arts

The Bachelor of Arts with a major in environmental sciences requires a minimum of 120 s.h., including a minimum of 60 s.h. of work for the major. Students must maintain a g.p.a. of at least 2.00 in all courses for the major and in all UI courses for the major. They also must complete the College of Liberal Arts and Sciences General Education Program; some courses required for the major in environmental sciences may be used to satisfy General Education Program requirements.

Bachelor of Arts students majoring in environmental sciences complete requirements in four areas: the science and mathematics foundation, the environmental sciences foundation, environmental sciences field study, and environmental sciences track courses.

The science and mathematics foundation develops fundamental skills and comprehension in biology, chemistry, geology, mathematics, and statistics. The environmental sciences foundation includes an introductory course in environmental science and additional courses that focus on the geomorphic and environmental processes that shape the Earth’s surface, the ecological factors that influence the distribution and abundance of organisms, and a choice of one course that
deals with remote sensing techniques or with the use of geographic information technologies. The environmental sciences field study gives students hands-on experience with methods of analysis and interpretation of natural systems/organisms.

Each of the program's four tracks focuses on areas of specialization within environmental sciences:

- biosciences (green) track—biological systems and ecological approaches;
- chemical sciences (yellow) track—environmental systems and chemistry;
- geosciences (brown) track—earth materials and surficial geologic processes; and
- hydrosciences (blue) track—hydrogeology and hydrogeologic systems, and water chemistry.

Students select one course from each of three of the four tracks in order to develop breadth of understanding and skill in these areas.

The environmental sciences major for the Bachelor of Arts requires the following course work.

**SCIENCE AND MATHEMATICS FOUNDATION**

Students must complete at least 31 s.h. of course work for the sciences and mathematics foundation, as follows.

**All of these:**

- BIOL:1411-BIOL:1412 Foundations of Biology - Diversity of Form and Function 8 s.h.
- CHEM:1110 Principles of Chemistry I 4 s.h.
- CHEM:1120 Principles of Chemistry II 4 s.h.
- EES:1050 Introduction to Geology 4 s.h.

First semester math and calculus—one of these:

- MATH:1440 Mathematics for the Biological Sciences 4 s.h.
- MATH:1850 Calculus I 4 s.h.

Second semester math and calculus—one of these:

- MATH:1460 Calculus for the Biological Sciences 4 s.h.
- MATH:1860 Calculus II 4 s.h.

One semester of statistics—one of these:

- CHEM:2021 Basic Measurements 3 s.h.
- STAT:2020 Probability and Statistics for the Engineering and Physical Sciences 3 s.h.
- STAT:3510 Biostatistics 3 s.h.
- STAT:4200 Statistical Methods and Computing 3 s.h.

**ENVIRONMENTAL SCIENCES FOUNDATION**

Students must complete at least 17-19 s.h. of course work for the environmental sciences foundation, as follows.

**All of these:**

- ENVS:3100 Introduction to Applied Remote Sensing 4 s.h.
- GEOG:1070 Contemporary Environmental Issues 3 s.h.
- GEOG:2910 The Global Economy 3 s.h.
- GEOG:2930 Water Resources 3 s.h.
- GEOG:2950 Environmental Conservation 3 s.h.
- GEOG:3350 Urban Ecology 3 s.h.
- GEOG:3750 Environmental Quality: Science, Technology, and Policy 3 s.h.
- GEOG:3760 Hazards and Society 3 s.h.
- GEOG:3780 U.S. Energy Policy in Global Context 3 s.h.
- GEOG:3910 Geographic Perspectives on Development 3 s.h.
- GEOG:4750 Environmental Impact Analysis 4 s.h.
- GEOG:4770 Environmental Justice 3 s.h.

**ENVIRONMENTAL SCIENCES FIELD STUDY**

Students must complete at least one field study course (at least 3 s.h.) from the following list.

- CEE:4103 Water Quality 3 s.h.
- EES:2831 Geologic Field Methods 3 s.h.
- EES:4680 Field Methods in Hydrologic Science 3 s.h.
- GEOG:4010 Field Methods in Physical Geography 3 s.h.
- IALL:3103 Aquatic Ecology 4 s.h.
- IALL:3105 Plant Taxonomy 4 s.h.
- IALL:3117 Ecology and Systematics of Diatoms 4 s.h.
- IALL:3126 Ornithology 4 s.h.
- IALL:3163 Conservation Biology 4 s.h.

**ENVIRONMENTAL SCIENCES TRACK COURSES**

Students must complete 9-12 s.h. (three courses), choosing one course from each of three of the following four lists of environmental sciences track courses.

**Biosciences (Green) Track**

- BIOL:2346 Vertebrate Zoology 4 s.h.
- EES:3070 Marine Ecosystems and Conservation 3 s.h.
- EES:3220 Evolution of the Vertebrates 3 s.h.
- EES:4700 Evolution of Ecosystems 3 s.h.
- EES:4710 Evolution of Plants 3 s.h.
- GEOG:2374 Biogeography 3 s.h.
- IALL:3105 Plant Taxonomy 4 s.h.
- IALL:3117 Ecology and Systematics of Diatoms 4 s.h.
Chemical Sciences (Yellow) Track
BIOC:3110 Biochemistry 3 s.h.
CEE:5152 Environmental Chemistry I 3 s.h.
CHEM:2210 Organic Chemistry I 3 s.h.
CHEM:3110 Analytical Chemistry I 3 s.h.
CHEM:4431 Physical Chemistry I 3 s.h.

Geosciences (Brown) Track
ENVS:1115 Energy and Society: History and Science of Oil 3 s.h.
ENVS:3110 Chemical Evolution of the Oceans 3 s.h.
EES:1290 Energy and the Environment 3 s.h.
EES:1400 Natural Disasters 3 s.h.
EES:2410 Mineralogy 4 s.h.
EES:3300 Sedimentary Geology 4 s.h.
EES:3360 Soil Genesis and Geomorphology 3 s.h.
EES:3380 Fluvioglacial Geomorphology 3 s.h.
EES:3390 Integrated Watershed Analysis 3 s.h.
EES:3840 Structural Geology 4 s.h.
EES:4490 Elements of Geochemistry 3 s.h.
EES:4520 Isotope Geochemistry 3 s.h.
EES:4720 Glacial and Pleistocene Geology 3 s.h.
EES:4790 Engineering Geology 3 s.h.
EES:4800 Solid Earth Geophysics 3 s.h.

Hydrosciences (Blue) Track
CEE:2150 Natural Environmental Systems 3-4 s.h.
CEE:3371 Principles of Hydraulics and Hydrology 3 s.h.
CEE:4103 Water Quality 3 s.h.
CEE:5152 Environmental Chemistry I 3 s.h.
EES:3300 Sedimentary Geology 4 s.h.
EES:3390 Integrated Watershed Analysis 3 s.h.
EES:4490 Elements of Geochemistry 3 s.h.
EES:4630 Hydrogeology 3 s.h.
EES:4790 Engineering Geology 3 s.h.
ENVS:3110 Chemical Evolution of the Oceans 3 s.h.
GEOG:3320 Wetlands: Function, Geography, and Management 3 s.h.

B.A. or B.S. with Teacher Licensure

Environmental sciences majors interested in earning licensure to teach in elementary and/or secondary schools must complete the College of Education’s Teacher Education Program (TEP) in addition to the requirements for the major and all requirements for graduation. The TEP requires several College of Education courses and student teaching. Contact the Office of Education Services for details.

Students must satisfy all degree requirements and complete Teacher Education Program licensure before degree conferral.

Students with a strong interest in science teaching may complete a major offered by the Science Education Program. Students choose one of five emphases—biology, chemistry, earth science, physics, or all-science—and earn a Bachelor of Science degree. They may apply for admission to the Teacher Education Program. See Science Education in the Catalog.

Joint B.A./M.A.T. with Science Education Subprogram

B.A. students majoring in environmental sciences who are interested in pursuing a graduate degree in teaching may apply to the joint Bachelor of Arts/Master of Arts in Teaching program offered by the College of Liberal Arts and Sciences and the College of Education. Designed for undergraduates majoring in biology, chemistry, environmental sciences, or physics, the joint program enables students to earn a B.A. and an M.A.T. in five years by beginning to earn graduate credit during their fourth year of undergraduate study and by counting up to 18 s.h. of qualifying credit toward both degrees. For more information, see “Joint B.A./M.A.T. Science Education” in the Teaching and Learning (College of Education) section of the Catalog. Interested students should consult an advisor.

Four-Year Graduation Plan

The Four-Year Graduation Plan is not available for the environmental sciences major. Students work with their advisors on individual graduation plans.

Honors in the Major

Students majoring in environmental sciences have the opportunity to graduate with honors in the major. Honors study in environmental sciences provides students with opportunities to engage in independent research under the guidance of a faculty sponsor chosen from affiliated faculty of the Environmental Sciences Program; the program draws faculty members from the Departments of Anthropology, Biology, Chemistry, Civil and Environmental Engineering, Earth and Environmental Sciences, and Geographical and Sustainability Sciences. Honors students learn how to write the results of their research in the format of a scientific paper, and they have the experience of formally presenting their research as either a short seminar or a poster.

Environmental sciences honors students must be members of the University of Iowa Honors Program, which requires students to maintain a cumulative University of Iowa g.p.a. of at least 3.33 and to fulfill other requirements; visit Honors at Iowa to learn about the University’s honors program.

To graduate with honors in environmental sciences, students must fulfill the following requirements:

- complete a B.S. or B.A. with a major in environmental sciences with a g.p.a. of at least 3.33 in all work for the major;
- submit a research proposal to the honors director within two months of the beginning of the semester in which the research is initiated;
- complete a minimum of 6 s.h. of honors research taken over two semesters in BIOL:4999 Honors Investigations, CHEM:3994 Undergraduate Research, EES:3190 Directed Study, or GEOG:3992 Undergraduate Research, depending on the departmental affiliation of the faculty sponsor;
- prepare a thesis presenting the research in the format of a scientific paper with abstract, introduction,
methods, results, discussion, and conclusions; the thesis must include a title page and an abstract formatted according to the specifications of the honors program and must be submitted to the honors director at least one week before the honors program deadline for submission; and present either a short seminar or a poster about the research at a professional meeting and/or at the University of Iowa.

Beginning in their sophomore or junior year, students should identify potential faculty sponsors by conducting a web-based survey of the research interests of the program’s affiliated faculty. The student should contact potential sponsors to determine who would be willing to sponsor an honors student and what research projects the student might undertake. Students who choose a sponsor whose faculty appointment is not in the College of Liberal Arts and Sciences must choose a cosponsor who does have a faculty appointment in CLAS.

After the student has identified a sponsor and the two have agreed on a project, the sponsor guides the student in the preparation of a research proposal that identifies the background, goals, methods, and significance of the research project. The proposal serves as the foundation of the honors thesis, which the student prepares under the sponsor’s supervision upon completion of the research. Once the thesis is nearing completion or is completed, the student presents a short seminar or a poster detailing the purpose of the research.

For examples of honors projects in environmental sciences, see Undergraduate Program/Honors Projects on the Environmental Sciences Program web site.

**Minor**

The minor in environmental sciences requires a minimum of 16 s.h. in University of Iowa environmental sciences course work. Students must maintain a g.p.a. of at least 2.00 in all courses for the minor and in all UI courses for the minor. Course work in the minor may not be taken pass/nonpass. The following courses are required.

- **ENVS:1080 Introduction to Environmental Science**
  - 3-4 s.h.
  - Biological and physical character of the Earth; interaction of humans with the environment, including impacts on ecosystems, climate, natural processes, resources; alternative options, including sustainability, waste management, energy, land reform. GE: Natural Sciences without Lab; Natural Sciences with Lab. Same as EES:1080.

- **ENVS:1090 Introduction to Environmental Sciences Laboratory**
  - 1 s.h.
  - Laboratory component of EES:1080. Requirements: completion of 3 s.h. in EES:1080 or ENVS:1080; or 3 s.h. of transfer equivalent. GE: Natural Sciences Lab only. Same as EES:1090.

- **ENVS:2673 Ecology**
  - 3-4 s.h.
  - Adaptations of organisms to their physical and biological environments; organism-environment interactions; population biology; interactions between species; ecology of communities, ecosystems; human impact on ecosystems. Prerequisites: BIOL:1411 and BIOL:1412 and (MATH:1460 or MATH:1550 or MATH:1850). Recommendations: a basic statistics course. Same as BIOL:2673.

**Courses**

**Lower-Level Undergraduate**

- **ENVS:1080 Introduction to Environmental Science**
  - 3-4 s.h.
  - Biological and physical character of the Earth; interaction of humans with the environment, including impacts on ecosystems, climate, natural processes, resources; alternative options, including sustainability, waste management, energy, land reform. GE: Natural Sciences without Lab; Natural Sciences with Lab. Same as EES:1080.

- **ENVS:1090 Introduction to Environmental Sciences Laboratory**
  - 1 s.h.
  - Laboratory component of EES:1080. Requirements: completion of 3 s.h. in EES:1080 or ENVS:1080; or 3 s.h. of transfer equivalent. GE: Natural Sciences Lab only. Same as EES:1090.

- **ENVS:1115 Energy and Society: History and Science of Oil**
  - 3 s.h.
  - History, politics, and science of oil and oil industry. GE: Historical Perspectives. Same as EES:1115, GEOG:1115, HIST:1115.

- **ENVS:2673 Ecology**
  - 3-4 s.h.
  - Adaptations of organisms to their physical and biological environments; organism-environment interactions; population biology; interactions between species; ecology of communities, ecosystems; human impact on ecosystems. Prerequisites: BIOL:1411 and BIOL:1412 and (MATH:1460 or MATH:1550 or MATH:1850). Recommendations: a basic statistics course. Same as BIOL:2673.

**Upper-Level Undergraduate and Graduate**

- **ENVS:3000 Environmental Sciences Seminar**
  - 0-1 s.h.
  - Role of sciences in environmental issues and problems; progression from observation to evaluation to design of better questions and experiments. Requirements: environmental sciences major.
**ENVS:3020 Earth Surface Processes** 3 s.h.
Basic geomorphic and environmental processes that shape the earth's surface; emphasis on erosion, transport, deposition by land mass movement (creep, landslides, earth flow), fluid agents (wind, water, ice); methods used to study these processes. Prerequisites: EES:1050 or EES:1080 or ENVS:1080 or GEOG:1020. Same as GEOG:3020, EES:3020.

**ENVS:3095 Field Ecology** 4 s.h.
Analysis and interpretation of patterns and underlying physical and biotic basis for regional and local distributions of plants and animals of eastern Iowa; field observation, sampling, and laboratory analysis; conduction of several field research projects requiring collection, statistical analysis, and interpretation of data in short reports; field-oriented course. Prerequisites: BIOL:1411. Recommendations: advanced undergraduate standing or graduate standing in ecology, environmental sciences, or geoscience.

**ENVS:3100 Introduction to Applied Remote Sensing** 4 s.h.
Remote sensing of the earth's surface from aircraft, satellites; aerial photograph interpretation; remote sensing systems, methods, data analysis using electromagnetic spectrum and digital processing techniques, including visible, infrared, microwave radiation; remote sensing applied to geologic and environmental problems. Prerequisites: EES:1030 or EES:1050 or EES:1080. Same as EES:3100.

**ENVS:3110 Chemical Evolution of the Oceans** 3 s.h.
Investigation of various physico-chemical states oceans have assumed over the past four billion years of Earth history; use of isotope geochemistry as a proxy for ancient ocean conditions; focus on integrated Earth system science, paleoceanographic and paleoclimate modeling, role of chemical stratigraphy in deciphering past climate states of ocean-atmosphere system; relationship between chemical changes in ocean/atmosphere and biological systems of the Earth. Same as EES:3110.

**ENVS:4700 Evolution of Ecosystems** 3 s.h.
Evolutionary history of terrestrial and marine ecosystems; ecological processes from population to ecosystem levels; community assembly, trophic levels, networks, biodiversity dynamics; practical aspects of paleoecological data collection, statistical analysis, modeling. Requirements: two courses in geoscience, biology, environmental sciences, anthropology, or geography. Same as EES:4700.