

Environmental Science

Interdisciplinary Major or Minor (<http://catalog.uwgb.edu/archive/2014-2015/undergraduate/planning/interdisciplinary-majors-minors>)
(Bachelor of Science)

Professors – Gregory J. Davis, Michael L. Draney, Heidi S. Fencil, Kevin J. Fermanich, Robert W. Howe, Tian-You Hu, John F. Katers (chair), Patricia A. Terry, Michael E. Zorn

Associate Professors – Atife Caglar, Franklin Chen, Mathew Dornbush, Woo Jeon, John Luczaj, John M. Lyon, Michael McIntire, Steven Meyer, Amy T. Wolf, Julie M. Wondergem

Assistant Professors – Ryan Currier, Jorge Estevez, Patrick Forsythe, Lisa Grubisha, Jeremy Intemann, Megan Olson Hunt

Lecturers – Theresa E. Adsit, Gary A. Fewless, Mary Guy, James Meyer, Nydia Villanueva

The Environmental Science major prepares students to analyze, understand, and solve environmental problems.

The program of study in the Environmental Science major is interdisciplinary, emphasizing an integrated approach to knowledge in the field. Because the study of environmental problems requires a sound understanding of scientific principles, the Environmental Science major is grounded in the natural sciences and mathematics. The curriculum includes a social science component, enabling students to gain an understanding of environmental economic and policy issues. Field experiences, internships and practicums are emphasized.

This major helps to develop the following skills and abilities: 1) formulate and interpret models that describe environmental processes; 2) facility with laboratory and field instrumentation, software for statistical analysis and modeling, taxonomic keys, and other practical skills; 3) design and implement research strategies and procedures to collect, organize, evaluate, and interpret data that characterize environmental systems; 4) characterize and analyze human impacts on the environment; 5) design and evaluate strategies, technologies and methods for remediation of degraded environments; 6) design and evaluate strategies for sustainable management of environmental systems; and 7) access and manage data resources applicable to environmental processes and management.

This major is designed for students who are seriously interested in environmental concerns and studies. Students who plan to pursue this major should emphasize science and mathematics in their course work. Courses in biology, chemistry, geoscience, physics, and mathematics provide the needed background.

While many universities are just beginning to recognize the need for environmental science programs, UW-Green Bay has over 40 years of teaching and research experience in the field. Its program was one of the first in the nation. The interdisciplinary focus allows students to have a diverse education. They receive hands-on and practical learning experiences in both laboratory and field. A significant number of graduates of this major gain entry-level positions in the environmental science field. About one-third of these positions are in the public sector, and two-thirds are in the private sector in industries, business, and engineering consulting firms. Numerous graduates have successfully completed master's and doctoral degrees.

Faculty members are actively addressing environmental problems and their solutions at the regional, national and international levels. This activity keeps them up to date on current trends and topics in the field. They provide opportunities for undergraduates to become involved in their research projects, where students can gain valuable knowledge and experience. Faculty members are highly involved in the students' education, both inside and outside of the classroom.

Environmental Science students have access to modern computer facilities which are continually upgraded. Computing software resources emphasizing geographic information systems (GIS) and mathematical modeling and statistical analysis tools also are available. In addition to general-access computer laboratories, students can also use a science-dedicated computer laboratory.

Students wishing to gain hands-on field experiences have access to the Cofrin Center for Biodiversity which includes the 290-acre Cofrin Memorial Arboretum on campus, several natural areas in the region, the University Herbarium, and the Richter Museum of Natural History. The latter two facilities have recently moved to a new and expanded space. A variety of equipment is available for environmental measurements and monitoring.

Laboratory instrumentation enhances student opportunities to perform chemical analyses which are important in environmental monitoring. Such instrumentation includes mass spectrometers, infrared and UV-visible spectrophotometers, nuclear magnetic resonance spectrometers, gas chromatographs, ion chromatographs, and high-performance liquid chromatographs. In addition to opportunities to monitor air and surface-water quality, students also have the opportunity to monitor ground water; three wells have been drilled on campus specifically for that purpose.

As industries recognize their responsibility to help create and maintain a sustainable environment, often achieving efficiencies in the process, they create positions dealing with waste management, pollution reduction, and other environmental responsibilities. Many UW-Green Bay Environmental Science graduates find employment in these industries or go on to advanced study in environmental science or other scientific disciplines.

The following list represents some careers that have been pursued by Environmental Science graduates: agricultural scientist, botanist, ecologist, forest ranger, oceanographer, agricultural technician, engineering technician, forester, air and water quality manager, environmental analyst, park ranger, air pollution analyst, environmental consultant, environmental educator, geologist, project manager, environmental engineer, geophysicist, biologist, hazardous waste manager, hydrologist, environmental lawyer, chemical technician, soil conservation technician, chemist, management consultant,

teacher, meteorologist, urban and regional planner, civil engineer, environmental planner, microbiologist/wastewater plant operator, natural resource specialist, wildlife manager, conservationist, zoologist.

Students may study abroad or at other campuses in the United States through UW-Green Bay's participation in international exchange programs and National Student Exchange. Travel courses are another option for obtaining academic credits and completing requirements. For more information, contact the Office of International Education at (920) 465-2190 or see <http://www.uwgb.edu/international/> .

- Environmental Science Major (<http://catalog.uwgb.edu/archive/2014-2015/undergraduate/programs/environmental-science/major>)
- Environmental Science Minor (<http://catalog.uwgb.edu/archive/2014-2015/undergraduate/programs/environmental-science/minor>)

Courses

ENV SCI 101. Introduction to Becoming a Scientist. 1 Credit.

Learn about the challenges and rewards of a science major. Acquire essential professional skills using electronic databases and spread sheets that are needed by science majors. Learn about current science and the culture of scientists.

P: Fr or So status only.

Fall and Spring.

ENV SCI 102. Introduction to Environmental Sciences. 3 Credits.

Examines the interrelationships between people and their biophysical environment, including the atmosphere, water, rocks and soil, and other living organisms. The scientific analysis of nature and the social and political issues of natural resource use.

Fall and Spring.

ENV SCI 141. Astronomy. 3 Credits.

A study of the solar system, stars, galaxies and universe.

Fall and Spring.

ENV SCI 198. First Year Seminar. 3 Credits.

Reserved for New Incoming Freshman.

ENV SCI 207. Laboratory Safety. 1 Credit.

This course examines safety within the science laboratory with emphasis on practical application. Topics include current safety regulations, identification of hazards, chemical labeling and storage, waste management, personal protective equipment, ventilation, spill response, and biosafety.

P: Biology 202 or 203 or Chem 108, 211 or 212 or Hum Biol 204 or conc enr.

Fall and Spring.

ENV SCI 260. Energy and Society. 3 Credits.

The issues relating energy and society rather than energy technology per se: global energy flows; sources of energy; energy-related problems, policy and conservation; energy growth; future scenarios.

Fall and Spring.

ENV SCI 299. Travel Course. 1-4 Credits.

Travel courses are conducted to various parts of the world and are led by one or more faculty members. May be repeated to different locations.

P: cons of instr & prior trip arr & financial deposit.

ENV SCI 301. Radioactivity: Past, Present, and Future. 3 Credits.

Radioactive isotopes play a significant role in many aspects of the natural and human environments. People are affected throughout their lives by natural and anthropogenic isotopes at local, national, and global scales. From radon in houses and radium in local drinking water supplies to fallout from Chernobyl, humans are directly impacted through health, economic, and technological pathways.

REC: HS chemistry or earth science, or Geosci 102 with at least a C grade

Fall Only.

ENV SCI 302. Principles of Ecology. 4 Credits.

Ecological principles governing interactions of plants and animals in their physical and biotic environments. Focuses on organisms and their environment, populations, communities, ecosystems, and global dimensions.

P: Math 104 with at least a C grade or Math Placement of Math 202 or greater; Math 260 with at least a C grade and Biology 203 with at least a C grade .

Fall and Spring.

ENV SCI 303. Environmental Sustainability. 3 Credits.

Principles of environmental sustainability rooted in interdisciplinary and systems perspectives; sustainability of our natural resource system; natural chemical, physical and biological systems which affect and influence sustainable practices; politics and economics of environmental sustainability.

P: None; REC: Env Sci 102

Fall and Spring.

ENV SCI 305. Environmental Systems. 4 Credits.

Physical and chemical aspects of natural environmental processes. The movement, transformation, and fate of materials and contaminants.

P: Chem 212 with at least a C grade and Geosci 202 with at least a C grade and Math 104 with at least a C grade and Biology 202 with at least a C grade.

Fall Only.

ENV SCI 318. Pollution Control. 3 Credits.

Government regulations, manufacturing processes, waste minimization, pollution prevention methods and pollution control techniques of major industries.

P: Chem 212 with at least a C grade.

Fall Only.

ENV SCI 320. The Soil Environment. 4 Credits.

The physical, chemical and biological properties and principals of soils; formation, classification and distribution of major soil orders; function and management of soils in natural, agricultural and urban environments. Includes field and laboratory experiences.

P: Chem 108 with at least a C grade or 212 with at least a C grade; REC: Geosci 202.

Fall Only.

ENV SCI 323. Pollution Prevention. 3 Credits.

Emphasizes principles of pollution prevention and environmentally conscious products, processes and manufacturing systems. Also addresses post-use product disposal, life cycle analysis, and pollution prevention economics.

P: Env Sci 318 with at least a C grade.

Spring Odd.

ENV SCI 325. Regional Climatology. 3 Credits.

The elements, controls, and classification of climates; the distribution of climate types over the earth; world patterns of climate.

P: Geosci 222 with at least a C grade or Geog 222 with at least a C grade; REC: Geosci 202.

Fall Only.

ENV SCI 330. Hydrology. 3 Credits.

Qualitative study of the principal elements of the water cycle, including precipitation, runoff, infiltration, evapotranspiration and ground water; applications to water resource projects such as low flow augmentation, flow reregulation, irrigation, public and industrial water supply and flood control.

P: Geosci 202 with at least a C grade.

Fall Only.

ENV SCI 335. Water and Waste Water Treatment. 3 Credits.

Water and waste water treatment systems, including both sewage and potable water treatment plants and their associated collection and distribution systems. Study of the unit operations, physical, chemical and biological, used in both systems.

P: Geosci 202 with at least a C grade or Chem 211 with at least a C grade or Biology 202 with at least a C grade.

Spring.

ENV SCI 336. Environmental Statistics. 2 Credits.

The course will give hands on experience in the management and analysis of environmental data using advanced statistical software. Students will handle environmental data and apply relevant statistical tools to summarize the data, do tests of hypotheses concerning population means, variances, and proportions, and fit regression models for continuous and binary response variables.

P: Math 260

Fall and Spring.

ENV SCI 337. Environmental GIS. 2 Credits.

This is a project based course where students conduct geospatial data manipulation, analysis and management with a suite of GIS software tools and web-based GIS interfaces. Students will learn about a range of applications of remotely sensed and other geospatial data to natural science problems.

Through the course project, students will create a functional GIS to study or model an environmental phenomena or problem.

P: Pu En Af 250 REC: Geosci 202

Fall and Spring.

ENV SCI 338. Environmental Modeling. 2 Credits.

Creation and analysis of mathematical models describing environmental systems. How and where mathematical models are used in real life environmental applications. Students will create models and use them to analyze and interpret systems.

P: Math 104, 202 or 203

Fall and Spring.

ENV SCI 339. Scientific Writing. 2 Credits.

This course focuses on key elements of scientific writing, including grammar, attention to audience, and building a logical argument. Students will develop their writing skills through mock grant applications, reports, and journal articles.

Spring.

ENV SCI 370. Emergence of Western Technology. 3 Credits.

History of the shift in the technological balance of power from 16th century China, India and the Islamic world to western Europe and later to North America.

P: Chem 108 or 211 or Geosci 102 or 202 or 222 or Env Sci 102 or 141 or Geog 222 or Physics 141 or 103 or 180 or 201 and Hum Stud 101 or 201 all courses require at least a C grade.

Fall Odd.

ENV SCI 401. Stream Ecology. 4 Credits.

The goal of this course is to develop a profound understanding of the abiotic and biotic processes responsible for shaping the ecosystem in running waters. Focus will be on ecological processes, but nutrient dynamics and fluid mechanics are also important issues as well as the fauna associated to the streambed, mainly macro invertebrates and their ecological role. Theory will be combined with hands on experience providing the student with a tool to manage a stream based on ecological principles.

P: Biology 203

Fall Even.

ENV SCI 403. Limnology. 4 Credits.

Limnology is a broad sub-discipline of ecology that is the study of the structural and functional interrelationships of organisms of inland waters as they are affected by their dynamic physical, chemical and biotic environments. In this course, we will examine the dominant organizing principles and the current conceptual advances in the field of limnology focusing on lakes.

P: Biology 203

Fall Odd.

ENV SCI 415. Solar and Alternate Energy Systems. 3 Credits.

Study of alternate energy systems which may be the important energy sources in the future, such as solar, wind, biomass, fusion, ocean thermal, fuel cells and magneto hydrodynamics.

P: Physics 104 with at least a C grade or 202 with at least a C grade.

Spring Even.

ENV SCI 421. Soils and Geology of Wisconsin Field Trip. 1-3 Credits.

Intensive three-day field study tour of the properties, origins and uses of major soils and landscapes of Wisconsin, with follow-up discussions. Cost of tour bus, guidebook, meals and lodging borne by student.

P: Geosci 202 with at least a C grade.

Fall Odd.

ENV SCI 425. Global Climate Change. 3 Credits.

Examines changes in global climate with emphasis on the processes by which climate change occurs. Focuses on the recent changes in the concentration of atmospheric greenhouse gases and their impact on the earth's global energy budget. Examines the potential environmental impact of a changed climate.

P: Geosci 222 with at least a C grade, Geog 222 with at least a C grade or Env Sci 102 with at least a C grade.

ENV SCI 432. Hydrogeology. 3 Credits.

Introduction to the geological and physical principles governing ground water flow. Description of aquifer properties, chemical processes, equation of flow, well hydraulics, and environmental concerns.

P: Geosci 202 with at least a C grade; REC: Env Sci 330 with at least a C grade; Math 202.

Spring.

ENV SCI 434. Environmental Chemistry. 3 Credits.

Physical, chemical, and biological processes affecting the composition of air and water. Chemical reactions in polluted, and unpolluted environments; dispersal processes and methods of control for various pollutants.

P: Chem 311 with at least a C grade and 300 with at least a C grade; or Chem 311 with at least a C grade and 302 with at least a C grade and 303 with at least a C grade.

Fall Only.

ENV SCI 435. Environmental Chemistry Laboratory. 1 Credit.

Basic measurement techniques used by environmental scientists to evaluate air and water quality; field methods, continuous monitoring techniques, and in-laboratory analysis techniques. Experiments demonstrate reaction kinetics, stoichiometry, thermodynamics instrumentation, and wet chemical methods.

P: Chem 434 with at least a C grade or conc enr, or Env Sci 434 or conc enr, or Chem 311; and Env Sci 207 or conc enr of Hum Biol 207 or conc enr.

Fall Only.

ENV SCI 460. Resource Management Strategy. 3 Credits.

Application of the principles of systems analysis to the sustainable use of material and energy resources. Emphasis on use of analytical tools of economics (e.g. costs-benefit, cost-effectiveness, and risk-benefit analysis) and the process of public policy making and implementation.

REC: background in econ and conservation.

Fall and Spring.

ENV SCI 467. Capstone in Environmental Science. 4 Credits.

A project-based course in which students address a practical application of scientific and mathematics skills in the environmental sciences. Topics vary.
 P: Env Sci 302 with at least a C grade or 305 with at least a C grade, and Math 260 with at least a C grade. REC: Env Sci 302 and 305
 Fall Only.

ENV SCI 469. Conservation Biology. 4 Credits.

Overview of the major issues and ecological principles underlying the field of conservation of biology, including patterns and measurement of biological diversity from genetic to community scales.

P: Env Sci 302 with at least a C grade or consent of instructor
 Fall Only.

ENV SCI 478. Honors in the Major. 3 Credits.

P: min 3.50 all cses req for major and min gpa 3.75 all UL cses req for major. (F,S)

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Fall and Spring.

ENV SCI 491. Senior Thesis/Research in Environmental Science. 3-4 Credits.

A project-based capstone experience where individual students address a specific aspect of the environmental sciences through the use of scientific and mathematical skills.

P: Env Sci 302 with at least a C grade or 305 with at least a C grade; Math 260 with at least a C grade; instr consent. REC: Env Sci 302 and 305.

Fall and Spring.

ENV SCI 492. Practicum in Environmental Science. 1-4 Credits.

A project-based course in which students address a practical application of scientific and mathematics skills in the environmental sciences. Topics vary.

P: Env Sci 302 with at least a C grade or 305 with at least a C grade, and Math 260 with at least a C grade. REC: Env Sci 302 and 305

Fall and Spring.

ENV SCI 497. Internship. 1-12 Credits.

Supervised practical experience in an organization or activity appropriate to a student's career and educational interests. Internships are supervised by faculty members and require periodic student/faculty meetings. All internships must be taken P-NC.

P: jr st and gpa > or = 2.75 and completion of 3 UL cses in maj or min.

Fall and Spring.

ENV SCI 498. Independent Study. 1-4 Credits.

Independent study is offered on an individual basis at the student's request and consists of a program of learning activities planned in consultation with a faculty member. A student wishing to study or conduct research in an area not represented in available scheduled courses should develop a preliminary proposal and seek the sponsorship of a faculty member. The student's advisor can direct him or her to instructors with appropriate interests. A written report or equivalent is required for evaluation, and a short title describing the program must be sent early in the semester to the registrar for entry on the student's transcript.

P: fr or so st with cum gpa > or = 2.50; or jr or sr st with cum gpa > or = 2.00.

Fall and Spring.

ENV SCI 499. Travel Course. 1-6 Credits.

Travel courses are conducted to various parts of the world and are led by one or more faculty members. May be repeated to different locations.

P: cons of instr & prior trip arr & financial deposit.