

# Environmental Science and Sustainability

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## School

School of Science, Engineering and Technology (<http://www.stmarytx.edu/set/>)

## School Dean

Teresa Beam, Ph.D. ([tbeam@stmarytx.edu](mailto:tbeam@stmarytx.edu))

## Department

Environmental Sciences and Sustainability (<https://www.stmarytx.edu/academics/department/environmental-science-sustainability/>)

## Department Chair

Evelynn Mitchell, Ph.D. ([emitchell1@stmarytx.edu](mailto:emitchell1@stmarytx.edu))

Environmental Science and Sustainability are multidisciplinary fields based on the nature of the complex environmental problems that need to be resolved. This department aims to give students a foundation of scientific knowledge, sustainable practices and professional skills that will enable them to assess a variety of environmental and sustainability issues, and propose potential solutions.

The St. Mary's Environmental Science degrees were designed to meet the demands of an ever increasing global population which brings about urbanization issues and the depletion of natural resources. Our degree plans allow the student to choose their electives based on their interest in a variety of fields, including geology, ecology, teacher education and sustainability.

- **Bachelor of Arts in Environmental Science** provides a solid education in understanding environmental systems, analyzing environmental data and communicating the conclusions to stakeholders. This degree prepares students for a wide variety of job opportunities in multiple environmental sectors.
- **Bachelor of Science in Environmental Science** requires a higher achievement of mathematics with the completion of Calculus I and II, and is recommended for students intending to pursue graduate studies in any scientific or engineering discipline.
- **Bachelor of Arts in Environmental Science with Teaching Certification** provides students with our core education in environmental systems while also preparing the student for classroom experience and certification as a 4-8 grade science teacher.

The program offers small class sizes and introduces students to research within our courses, providing field experience and developing skills to apply to independent research projects. Students in the program are encouraged to pursue research through a variety of on campus programs:

- Summer Undergraduate Research Fellowship (SURF)
- The Louis Stokes Alliance for Minority Participation (NSF-LSAMP)
- The McNair Scholars Program
- The NIH U-RISE Program
- B.A. in Environmental Science (<https://catalog.stmarytx.edu/undergraduate/majors-programs/science-engineering-technology/environmental-science-sustainability/env-sci-ba/>)
- B.A. in Environmental Science (Teacher Certification) (<https://catalog.stmarytx.edu/undergraduate/majors-programs/science-engineering-technology/environmental-science-sustainability/env-sci-ba-tc/>)
- B.S. in Environmental Science (<https://catalog.stmarytx.edu/undergraduate/majors-programs/science-engineering-technology/environmental-science-sustainability/env-sci-bs/>)
- Energy Science and Policy (<https://catalog.stmarytx.edu/undergraduate/majors-programs/science-engineering-technology/environmental-science-sustainability/minor-energy-sci-policy/>)
- Energy Science and Technology (<https://catalog.stmarytx.edu/undergraduate/majors-programs/science-engineering-technology/environmental-science-sustainability/minor-energy-sci-tech/>)
- Environmental Science (<https://catalog.stmarytx.edu/undergraduate/majors-programs/science-engineering-technology/environmental-science-sustainability/minor-env-science/>)
- Geology (<https://catalog.stmarytx.edu/undergraduate/majors-programs/science-engineering-technology/environmental-science-sustainability/minor-geology/>)

**All courses serving as prerequisites in the School of Science, Engineering and Technology must be completed with a “C” or better in order to advance to the next sequenced course.**

**ES 1100. General Geology Laboratory. 1 Semester Hour.**

Laboratory study of earth materials (minerals and rocks), introduction to maps, historical geology (fossils), and plate tectonics. (3 hours per week) (Fall) Additional fee associated with this course. See fee schedule for details at <https://www.stmarytx.edu/admission/financial-aid/tuition/>.

**ES 1173. Environmental Science Lab. 1 Semester Hour.**

Laboratory study of ecological footprints and the effects humans have on the environment. May include some field studies. This lab will be required for all students working on a major or minor in Environmental Science and by all Engineering Science majors working to fulfill an environmental science concentration. (Spring).

**ES 1300. General Geology. 3 Semester Hours.**

A survey course covering the physical aspects of geology (minerals, rocks, Earth systems, plate tectonics) and the geological history of the Earth and development of life (fossils). Field trip required. (Fall and Spring) Additional fee associated with this course. See fee schedule for details at <https://www.stmarytx.edu/admission/financial-aid/tuition/>.

**ES 1303. Geology of Earth Resources. 3 Semester Hours.**

Explores the nature, origin, distribution, use, conservation and future availability of valuable earth materials such as minerals, rocks, soils and water. Earth materials and activities will be used in class where appropriate. (field trip required) (Fall; Even year) Additional fee associated with this course. See fee schedule for details at <https://www.stmarytx.edu/admission/financial-aid/tuition/>.

**ES 1305. Physical Geography. 3 Semester Hours.**

A survey course which considers the entire world in terms of location, mapping, time zones, weather and climate, soils and vegetation, land forms, surface processes, and oceanography. (Spring).

**ES 1342. Oceanography. 3 Semester Hours.**

A broad-based introductory course on every facet of ocean study: biologic, geologic, hydrologic, physical and chemical. (Saturday field trip) Prerequisite: ES 1300 or other natural science. (All courses serving as prerequisites in the School of Science, Engineering and Technology must be completed with a "C" or better in order to advance to the next sequenced course.).

**ES 1373. Introductory Environmental Science. 3 Semester Hours.**

Investigation of man's relationship to the earth; earth resources and conservation, pollution problems, geological hazards (earthquakes, volcanoes, landslides). Designed to benefit students majoring in any field. Field trip required. (Fall, Spring, and Summer) Additional fee associated with this course. See fee schedule for details at <https://www.stmarytx.edu/admission/financial-aid/tuition/>.

**ES 2120. General Ecology Lab. 1 Semester Hour.**

An examination of the theoretical and experimental aspects of the relationship between the biological and physical environments (organisms, food, space, and time) at the individual, population, community, and ecosystem levels. An examination of the theoretical and experimental aspects of the relationship between the biological and physical environments (organisms, food, space, and time) at the individual, population, community, and ecosystem levels. (Fall; Even Year).

**ES 2150. Environmental Geology Lab. 1 Semester Hour.**

Laboratory study of environmental hazards Analytical data will be utilized to study the frequency and magnitude of past hazards. The lab shows how studying past events this can help a society prepare for future hazard events. Materials include analysis of earthquakes, volcanic eruptions, hurricanes, floods and other geological and weather processes. (Spring) Pre-requisites ES 1300 or with permission of the instructor.

**ES 2300. Global Change. 3 Semester Hours.**

The main objective of this course will be to provide students with a perspective of the geological history of the earth, and the natural changes the planet has endured. Learning about the history of environmental changes and events such as species extinctions and causes will give students a background to understand how recent environmental changes compare the past changes on the planet. (Fall only) Prerequisites: ES 1300 and ES 1373. (All courses serving as prerequisites in the School of Science, Engineering and Technology must be completed with a "C" or better in order to advance to the next sequenced course.).

**ES 2320. General Ecology. 3 Semester Hours.**

The main objective of this course will be to will learn about the fundamentals of ecology by studying the hierarchy of life, adaptations, population ecology and community ecology. Prerequisites: ES 1373 and ES 1173. Concurrent enrollment in MT 2303 recommended. (All courses serving as prerequisites in the School of Science, Engineering and Technology must be completed with a "C" or better in order to advance to the next sequenced course.) Field Trip required (Fall; Even Year).

**ES 2325. Energy Resources and the Environment. 3 Semester Hours.**

This course will help students understand and appreciate the importance of geology in controlling the nature, origins, and distribution of energy resources. Students will also examine economic and political factors that influence both the present and future development of these resources, as well as the associated potential environmental impacts. Alternative energy resources such as solar, wind, geothermal, biofuels, and hydropower will also be discussed. Key concepts are reinforced by giving students hands on experience through classroom demonstrations and projects using case studies and materials from the extensive collections of the Department of Physics and Environmental Sciences. Field Trip. (Spring) Prerequisites: ES1300 or with permission of the instructor. (All courses serving as prerequisites in the School of Science, Engineering and Technology must be completed with a "C" or better in order to advance to the next sequenced course.) Additional fee associated with this course. See fee schedule for details at <https://www.stmarytx.edu/admission/financial-aid/tuition/>.

**ES 2330. Introduction to Sustainability. 3 Semester Hours.**

Humans rely on energy and natural resources from the Earth for every aspect of a modern, technological society. The idea of sustainability is to ensure that resources are identified and obtained in an environmentally sound manner that allows for fulfilling the social, economic and other requirements of present and future generations. This course will present students with an overview of the drivers for human resource needs, resource exploration and extraction, consumption, and waste disposal. Through a service learning component, the students will also be introduced to actions that enhance sustainability at the local, regional, and national level. (Required Field Trip, Fee). Prerequisites: ES 1300 and ES 1373 OR with permission of instructor. (All courses serving as prerequisites in the School of Science, Engineering and Technology must be completed with a "C" or better in order to advance to the next sequenced course.) (Fall; Odd Year) Additional fee associated with this course. See fee schedule for details at <https://www.stmarytx.edu/admission/financial-aid/tuition/>.

**ES 2345. Experimental Design. 3 Semester Hours.**

This class will be an applied statistics course that focuses on the design and analysis of experiments typical to research in environmental science. Students will learn the steps required to set up a sound experiment and then study the various methods used in single factor and multifactor analysis. Topics will include: ANOVAs, Confidence Intervals, the f-statistic, Pairwise Comparisons and Orthogonality. The course will require use of statistical software to analyze data sets. (Fall only) Prerequisite: MT 2303. (All courses serving as prerequisites in the School of Science, Engineering and Technology must be completed with a "C" or better in order to advance to the next sequenced course.) Lab Fee (Fall; Odd Year).

**ES 2350. Environmental Geology. 3 Semester Hours.**

Investigation of man's relationship to the earth; earth resources and conservation, pollution problems, geological hazards (earthquakes, volcanoes, landslides), energy resources. Causes to environmental problems will be studied as well as possible preventative measures. (Spring) Pre-requisites ES 1300 or with permission of the instructor.

**ES 3100. Environmental Science Seminar. 1 Semester Hour.**

Presentation and discussion of current research in the environmental sciences will be covered in this course. Career development aspects will also be covered. Students will be expected to take 3 semesters of this course to meet the requirements of the major. (Fall; Spring).

**ES 3103. Special Topics. 1 Semester Hour.**

Subject matter varies. Topic must be stated precisely on transcript, e.g., energy resources, petroleum geology, geophysics. May include lab and field work. Prerequisites: ES 1300 or permission of instructor. (All courses serving as prerequisites in the School of Science, Engineering and Technology must be completed with a "C" or better in order to advance to the next sequenced course.) (Fall, Spring, Summer).

**ES 3110. Environmental Science Seminar I. 1 Semester Hour.**

This course will cover career development skills, discussion of research in the environmental sciences, and a semester long project. The focus of student skills covered in this semester will be on writing personal statements, career planning, and completing applications for internships and future studies.(Fall).

**ES 3120. Environmental Science Seminar II. 1 Semester Hour.**

This course will cover career development skills, discussion of research in the environmental sciences, and a semester long project. The focus of student skills covered in this semester will be job search skills, resume writing and preparing for taking the GRE. (Spring).

**ES 3125. Earth Science Extravaganza. 1 Semester Hour.**

This course will allow students to utilize their knowledge in understanding their environment to teach the next generation. Students will design and present demonstrations about the environment for elementary age students. Up to 3 semesters of this course may be taken for elective credit. No prerequisites required.

**ES 3203. Special Topics. 2 Semester Hours.**

Subject matter varies. Topic must be stated precisely on transcript, e.g., energy resources, petroleum geology, geophysics. May include lab and field work. Prerequisites: ES 1300 or permission of instructor. (All courses serving as prerequisites in the School of Science, Engineering and Technology must be completed with a "C" or better in order to advance to the next sequenced course.)( Fall, Spring and Summer).

**ES 3301. Essential Elements of Life-Earth Sciences. 3 Semester Hours.**

Includes essential elements in the following areas: classification, morphology and evolutions of life forms; characteristics, processes and evolution of the earth's lithosphere, oceans and atmosphere: and characteristics and evolution of the solar system and universe. Emphasis on learning through inquiry and discovery. This course can only be taken with approval from the Education Department. No prerequisites. (Candidates for Teacher Certification only.).

**ES 3303. Special Topics. 3 Semester Hours.**

Subject matter varies. Topic must be stated precisely on transcript, e.g., energy resources, petroleum geology, geophysics. May include lab and field work. Prerequisites: ES 1300 or permission of instructor. (All courses serving as prerequisites in the School of Science, Engineering and Technology must be completed with a "C" or better in order to advance to the next sequenced course.) (Fall, Spring, Summer) Additional fee associated with this course. See fee schedule for details at <https://www.stmarytx.edu/admission/financial-aid/tuition/>.

**ES 3310. Scientific and Technical Writing. 3 Semester Hours.**

The purpose of this course is to teach the fundamentals of effective scientific writing. This class will focus primarily on the process of writing and publishing scientific manuscripts but writing lab reports will also be addressed. Students will: improve their ability to efficiently access the scientific literature and write literature reviews; improve their technical and scientific writing skills; learn principal forms of scientific writing; learn how to write clear, concise and correct scientific prose; learn the details of manuscript preparation for scientific publication; learn how to reference scientific sources and write a bibliography; and learn how to perform peer reviews of scientific manuscripts and respond to editor comments. (Fall; Odd Year).

**ES 3320. Environmental Policy and Regulation. 3 Semester Hours.**

This course is designed to acquaint the student with numerous issues and perspectives confronting society and environmental scientists, and their influence on the development of environmental policy and regulation. This course is intended as a practical overview of environmental regulation, focusing on using case studies and examples to illustrate selected statutes and regulations that commonly shape the career of an environmental professional. Pre-requisites: ES 1373 or permission of the instructor. (All courses serving as prerequisites in the School of Science, Engineering and Technology must be completed with a "C" or better in order to advance to the next sequenced course.) (Spring; Odd Year).

**ES 3325. Geophysics. 3 Semester Hours.**

This course covers Physics of the Earth's Interior, where students learn about examining Earth structure, plate tectonics, and earthquakes. Students will also study methods of exploring the makeup of the Earth's surface using seismic surveys, electrical methods, magnetics, gravity and well logging. Field demonstrations will be a required part of the course, which may require some Saturday meetings. (Fall; Even Year) Additional fee associated with this course. See fee schedule for details at <https://www.stmarytx.edu/admission/financial-aid/tuition/>. Pre-requisites: MT 1303.

**ES 3330. Introduction to Geographic Information System. 3 Semester Hours.**

This course will teach the student the fundamentals of earth coordinate systems and collecting data with global positioning systems (GPS). Once the student is familiar with projection types and data collection systems they will begin using collected data to create maps with GIS technology, in order to better define and understand environmental problems. Map creation will also cover incorporating remotely sensed data, such as satellite imagery, showing how different layers of the mapping process can be used to display multiple maps in the GIS format, and examining ways the data can be interpreted using GIS software functions. (Spring; Odd Year) Pre-requisites: ES1300 and ES1373 or permission of the instructor (All courses serving as prerequisites in the School of Science, Engineering and Technology must be completed with a "C" or better in order to advance to the next sequenced course.) Additional fee associated with this course. See fee schedule for details at <https://www.stmarytx.edu/admission/financial-aid/tuition/>.

**ES 3335. Advanced Spatial Analysis. 3 Semester Hours.**

This elective course will cover advanced spatial analysis techniques, focusing on Geographic Information Systems (GIS) and remote sensing analysis. Unlike the introductory Information Technology course (ES 3330) which introduced students to GIS and remote sensing, this course will explore spatial analysis techniques such as cluster analysis, mapping distributions and density, and Model-building. The focus on remote sensing will explore land use/land cover change mapping and change mapping. Required Field Trip Fee. (Fall; Odd Year) Prerequisites: ES 3330 (All courses serving as prerequisites in the School of Science, Engineering and Technology must be completed with a "C" or better in order to advance to the next sequenced course.) Additional fee associated with this course. See fee schedule for details at <https://www.stmarytx.edu/admission/financial-aid/tuition/>.

**ES 3340. Physical Hydrogeology. 3 Semester Hours.**

This class will give students a firm understanding of the way that geology influences the water resources that exist in the world. Physical studies of geologic environments will examine the science required to study the quantity and movement within surface and ground water systems. Hands on experience will be provided through classroom demonstrations and projects. (Fall; Odd Year) Pre-requisites: ES1300, MT 1303 or with permission of the instructor. (All courses serving as prerequisites in the School of Science, Engineering and Technology must be completed with a "C" or better in order to advance to the next sequenced course.) Additional fee associated with this course. See fee schedule for details at <https://www.stmarytx.edu/admission/financial-aid/tuition/>.

**ES 3360. Wildlife Research and Management Techniques. 3 Semester Hours.**

The purpose of this course is to introduce students to the techniques wildlife professionals use to manage both wildlife populations and wildlife habitat. This is an active learning course in the sense that the class spends as much time as possible outside the classroom, in the field, working with wildlife professionals. Required Field Trip, Fee. (Fall; Even Year) Prerequisites: ES 1373, ES 1173, and ES 2320 or permission from the instructor. (All courses serving as prerequisites in the School of Science, Engineering and Technology must be completed with a "C" or better in order to advance to the next sequenced course.) Additional fee associated with this course. See fee schedule for details at <https://www.stmarytx.edu/admission/financial-aid/tuition/>.

**ES 3365. Conservation Biology. 3 Semester Hours.**

This course is designed to introduce students to conservation biology, a multidisciplinary field of study that focuses on the patterns of and the processes that contribute to biological diversity. Formed in response to the global loss in biodiversity, conservation biology is a value-laden, crisis discipline that not only studies biodiversity, but importantly identifies strategies to reduce or prevent further loss of it. In this course, we review the ethical foundations of conservation biology, discuss the scientific evidence that illustrates recent rapid loss of biological diversity at multiple spatial and temporal scales, identify and elaborate on the causative factors of biodiversity loss, and discuss various strategies for conserving biodiversity. Conservation biology is multidisciplinary in scope, and therefore we will discuss topics in fields of study that include wildlife management, restoration ecology, economics, ethics, geology, evolution, philosophy, phylogeny, taxonomy, genetics, behavioral ecology, population ecology, disease, sociology, sustainable living, and human dimensions. (Spring; Even Year) Prerequisites: ES 1373, ES 1173, and ES 2320 or permission from the instructor. (All courses serving as prerequisites in the School of Science, Engineering and Technology must be completed with a "C" or better in order to advance to the next sequenced course.) Required Field Trip; Additional fee associated with this course. See fee schedule for details at <https://www.stmarytx.edu/admission/financial-aid/tuition/>.

**ES 3400. Environmental Geochemistry. 4 Semester Hours.**

The principal objective for this course is to provide students with an understanding of the importance of chemistry in determining the quality of our environment. Students will learn about natural geochemical processes that occur in Earth's water, air, and soil systems, and explore how human activity can affect geochemical cycles in the environment. Fundamental concepts will be reinforced using examples at both a local and a global scale. Course content is largely based on applied geochemistry, with supporting content in theoretical geochemistry. (Spring; Even Year) Pre-requisites: ES1300, ES 1373, and CH 1401, or with permission of the instructor. ES 3400L must be taken concurrently. (All courses serving as prerequisites in the School of Science, Engineering and Technology must be completed with a "C" or better in order to advance to the next sequenced course.) Required Field Trip; Lab fee.

**ES 4300. Environmental Science Internship. 3 Semester Hours.**

This course will allow students to gain course credit for internship work performed with a supervisor outside the St. Mary's University Environmental Science program. Students are expected to complete all work required by their supervisor in a timely manner and will provide a report and presentation on their experience to their academic advisor to gain credit. (Fall only) Permission of academic advisor is required. (Fall, Spring, Summer).

**ES 4325. Pollution Analysis and Remediation. 3 Semester Hours.**

In a practical sense, pollution can be considered to be the presence of something where it shouldn't otherwise be. Pollution control efforts have historically focused on remediation – cleaning up pollution after the fact, but more recent efforts have focused on designing prevention and control measures to stop pollution before it happens. This course will present students with an overview of different types of pollution, with discussion of hazard/risk assessment, pollution regulation, and remediation technologies to minimize potential effects of pollution. (Required Field Trip, Fee). Prerequisites: Undergraduate level ES 1300 Minimum Grade of D AND Undergraduate level ES 1373 Minimum Grade of D AND Undergraduate level ES2300 Minimum Grade of D, OR with permission of instructor.

**ES 4400. Field Based Environmental Chemistry. 4 Semester Hours.**

Environmental Chemistry is a project-based course during which students apply environmental science and chemistry concepts to the analysis of a natural environment. The course is focused on the analysis of soil and water chemistry at a field site in San Antonio. Students will design and implement sampling plans based on best practices. Field measurements will be performed on site. Samples will be analyzed in the laboratory using major chemical instrumentation. An emphasis will be placed on quality control and assurance in the design of the laboratory analysis. Students will prepare the results of their analysis in written and oral forms. Prerequisites: Undergraduate level ES 1300 Minimum Grade of C, OR CH1402 OR ES3400 Minimum Grade of C, OR with permission of instructor. (Field Trip, Fee). Spring , Odd Years.