

# ENVIRONMENTAL SCIENCE

## Department of Environmental Science

**Chairperson:** George P. Cobb

**Graduate Program Director:** Cole W. Matson

The Department of Environmental Science offers three degree options:

1. Master of Science in environmental science for students with a Bachelor of Science degree
2. Master of Environmental Studies for students with a Bachelor of Arts degree
3. Master of Environmental Studies, non-thesis option for students with a Bachelor of Arts degree
4. Doctor of Philosophy in environmental science

Bachelor of Arts majors in a science discipline may petition for the Master of Science in environmental science.

The Environmental Science department welcomes graduate student candidates with diverse academic backgrounds. Students from majors such as anthropology, aviation science, biology, chemistry, engineering, geography, science education, and policy are encouraged to apply. The department has developed a graduate core course sequence open to students with graduate standing in all environmental fields.

Code	Title	Hours
ENV 5342	Ecological Risk Assessment	3
ENV 5303	Environmental Chemical Analysis	3
ENV 5368	Integrated Energy Resource Systems	3
ENV 5379	Ecosystem Management	3

The program offers advanced courses in specialized areas such as water resources, natural resource management, environmental toxicology, and environmental chemistry. Under the direction of a major advisor, graduate students may either focus their course work in a specific area, such as water quality, or they may pursue courses that provide a broad background in environmental issues. Graduate students may also take courses offered in other departments, such as Biology, Chemistry, and Geology, if the courses are appropriate to environmental science or studies and the graduate student's professional goals.

Financial assistance is available for departmental graduate students in the form of teaching assistantships, research assistantships, and scholarships. Loans and other types of aid are available through the Student Financial Aid Office.

Students selecting a thesis option may conduct research in the Waco area, outside the region or internationally. Environmental Science graduate students have conducted research in Asia, Europe, and Central America. Departmental laboratory facilities provide instrumentation and computer support in geographic information systems, computer modeling, water quality analysis, air quality monitoring, and biofuels production. The program engages in field research in a variety of ecosystems, including riparian corridors, reservoirs, grasslands, wetlands, temperate forests, tropical forests, and coastal barrier islands. Current faculty research interests include the social impacts of ecotourism, human dimensions of climate change, wastewater management, water quality, ecotoxicology, improved production of biofuels, conservation of biodiversity, and the ethics of natural resource communities.

Thesis options are appropriate for students interested in research and academic careers, research interest, those pursuing a terminal degree, or those planning careers that require extensive preparation of environmental documentation or plans. A non-thesis option with a required practicum is available for the Master of Environmental Studies (M.E.S.) degree. The semester-long practicum may be either paid or volunteer and must be under a professional supervisor. The non-thesis option is appropriate for students seeking employment in K-12 education, management in environmental organizations, or similar fields. The non-thesis option is not recommended for students planning to pursue a terminal degree, such as a Ph.D.

## Objective

The objective of all four degree programs is to train technically competent individuals to assess problems involving environmental issues, to design workable plans, to undertake or direct planned actions toward environmental problem solving, and to work in interdisciplinary teams.

## Admission

For admission to the graduate program, candidates must:

1. Meet the general requirements set forth by the Graduate School.
  2. Demonstrate an academic background that is adequate to undertake the course of study that has been defined as the candidate's major area of interest.
  3. Present a GPA from undergraduate disciplines that is predictive of success in this program and that supports the candidate's graduate area of interest.
- Environmental Science, M.S. (<https://catalog.baylor.edu/graduate-school/curriculum-departments-institutes-instruction/college-arts-sciences/environmental-science/environmental-science-ms/>)
  - Master of Environmental Studies, M.E.S. (<https://catalog.baylor.edu/graduate-school/curriculum-departments-institutes-instruction/college-arts-sciences/environmental-science/master-environmental-studies-mes/>)
  - Environmental Science, Ph.D. (<https://catalog.baylor.edu/graduate-school/curriculum-departments-institutes-instruction/college-arts-sciences/environmental-science/environmental-science-phd/>)

## Environmental Science (ENV)

### ENV 4302 Team Problem Solving in Environmental Studies (3)

Students will contribute the skills of their specializations to analyze and to suggest a solution to a current environmental problem. May be repeated once with a change of content.

### ENV 4304 Aquatic Chemistry (3)

Pre-requisite(s): ENV 3387 or consent of instructor

Concepts and issues in aquatic chemistry, including chemical equilibria of natural waters and anthropogenic impacts. Required field trips.

### ENV 4307 Environmental Law (3)

Cross-listed as PSC 4307

Pre-requisite(s): Upper-level standing or consent of instructor

Fundamentals of environmental protection laws in the United States, including the evolution of environmental law in the areas of case law, common law, and administrative law. Topics include air and water quality, toxic and hazardous substances, endangered species, and wetlands and coastal management issues.

**ENV 4308 Air Quality Regulation (3)**

Reviews history and policy of United States, transboundary, and global air pollution and resulting environmental regulations.

**ENV 4310 World Food Problems (3)**

Cross-listed as ANT 4311

Pre-requisite(s): Upper-level standing

A seminar approach with emphasis on the various causes of malnutrition including the ecological basis for food production, the impact of economics and politics on food production and distribution, and the consequences of malnutrition.

**ENV 4318 Heavy Metals & Global Public Health (3)**

Pre-requisite(s): BIO 1305 or BIO 1405, BIO 1306 or BIO 1406, CHE 1301, and CHE 1302, and upper level standing

Examines the impacts of natural and anthropogenic sources of metals on human health and the relationship between natural geological factors and health in humans and animals in the context of geographic significance and public health responses.

**ENV 4322 Climate Anthropology (3)**

Cross-listed as ANT 4321

See ANT 4321 for course information.

**ENV 4323 The Environment and Economic Analysis (3)**

Cross-listed as AVS 4323, ECO 4323

Pre-requisite(s): ECO 1305 or 2306; and upper-level standing

Economic analysis in description, analysis, and policy formulation of environmental problems such as natural resource development, ecology, energy needs, noise, water, and air pollution. Economic tools used will include social welfare analysis, externalities, and benefit cost analysis.

**ENV 4325 Human Health Risk Assessment (3)**

Pre-requisite(s): ENV 3314 or concurrent enrollment in ENV 3314; or consent of instructor

Concepts, data sources, and methodologies used in the field of human risk assessment, including environmental hazard identification, dose-response assessment, exposure assessment, risk characterization, and risk communication. Required project utilizing professional risk assessment software.

**ENV 4327 Human Catastrophe and Cultural Response (3)**

Cross-listed as ANT 4327

See ANT 4327 for course information.

**ENV 4330 Urban Political Processes (3)**

Cross-listed as PSC 4330

See PSC 4330 for course information.

**ENV 4333 Coastal Zone Management (3)**

Pre-requisite(s): Upper-level standing

Strategies for managing beaches, deltas, barrier islands and coastal seas, including issues in flood and storm risk, pollution mitigation, recreational development and fisheries exploitation.

**ENV 4335 Applied Environmental Impact Analysis (3)**

Government regulations and increased citizen awareness relationship to the impact of plans and projects on the environment. The course includes an examination of major environmental legislation and its impact on decision making in the public sector. Legislative Acts pertinent to the development of Environmental Impact Analysis are studied.

**ENV 4340 Environmental Archaeology (3)**

Cross-listed as ANT 4340, ARC 4340

See ANT 4340 for course information.

**ENV 4344 Fundamentals of Toxicology (3)**

Cross-listed as BIO 4344

Pre-requisite(s): CHE 1301, 1302, 3331, BIO 1305, 1306, and 3322; or consent of instructor

Basic concepts of toxicology, including historical perspectives, the disposition and metabolism of toxic substances, pharmacokinetics, target organ toxicity, non-organ directed toxicity, toxic agents, industrial toxicology, forensic toxicology, environmental toxicology, toxicity testing techniques, and risk assessment.

**ENV 4345 Water Management (3)**

Cross-listed as GEO 4345

Interdisciplinary field of water management. Scientific, technical, institutional, economic, legal, and political aspects of water management.

**ENV 4351 Futuristics (3)**

Cross-listed as ANT 4351

See ANT 4351 for course information.

**ENV 4355 Principles of Renewable Resource Management (3)**

Theory, principles, and management of renewable resources to meet human needs. Field trips to management activities will be included.

**ENV 4362 Applied Anthropology (3)**

Cross-listed as ANT 4362

See ANT 4362 for course information.

**ENV 4365 The Environment and Energy (3)**

Pre-requisite(s): ENV 1301 and upper-level standing

Fundamental concepts of energy: the nature of energy flows and storage, potential and kinetic energy, energy loss and reversible and irreversible processes. Renewable and non-renewable energy sources and the impact of energy consumption on problems of societal sustainability.

**ENV 4369 Seminar in Anthropology (3)**

Cross-listed as ANT 4369

See ANT 4369 for course information.

**ENV 4371 Wetlands (3)**

Cross-listed as GEO 4371

See GEO 4371 for course information.

**ENV 4374 Global Soil Systems (3)**

Cross-listed as GEO 4373

See GEO 4373 for course information.

**ENV 4375 Natural Landscape Evaluation and Planning (3)**

Cross-listed as GEO 4375

See GEO 4375 for course information.

**ENV 4377 Advanced Studies in Wilderness, Parks, and Nature Reserves (3)**

Pre-requisite(s): ENV 3306 or consent of instructor

Topics in the management of national or state parks, nature reserves or wilderness areas, such as recreational impacts, disturbance ecology, or environmental interpretation. May be conducted as an off-campus field seminar.

**ENV 4380 Restoration Ecology (3)**

Cross-listed as BIO 4381

Pre-requisite(s): ENV 2307 and 3306, or BIO 3303 or consent of instructor

Principles and practices for restoring natural systems that have been degraded or destroyed. Emphasis on re-establishment of soils, plants, and animals in terrestrial and aquatic environments. Legislative, political, industrial, and regulatory perspectives considered.

**ENV 4386 Remote Sensing (3)**

Cross-listed as AVS 4386, BIO 4386, GEO 4386, GEOG 4386  
See GEO 4386 for course information.

**ENV 4389 American Environmental History (3)**

Cross-listed as HIS 4388  
See HIS 4388 for course information.

**ENV 4397 Tropical Environments: Ecology and Sustainable Management (3)**

Pre-requisite(s): Consent of instructor and upper-level standing  
Off-campus field course exploring tropical ecosystems, such as rainforests and coral reefs. Investigation of past impacts of human cultures, and of sustainable practices for future environmental management. Topics may include agriculture, forestry, aquatic resources, energy production, and ecotourism.

**ENV 4450 Applied Forest Ecology (4)**

Pre-requisite(s): ENV 1301 or BIO 1306  
Ecological analysis of forest and woodland structure, energy and nutrient cycling, population dynamics and response to disturbance. Application of concepts to sustainable forest management.

**ENV 4485 Introduction to Geographic Information Systems (4)**

Cross-listed as AVS 4485, GEO 4485  
See GEO 4485 for course information.

**ENV 4487 Advanced GIS Analysis (4)**

Cross-listed as AVS 4487, ENV 4388, GEO 4487  
Principles and techniques for geospatial data collection, manipulation, modeling, visualization, and analysis. Emphasis is placed on current raster modeling techniques, spatial statistical analysis methods, and using GIS as a predictive tool for environmental research.

**ENV 4680 Field School in Cultural Anthropology (6)**

Cross-listed as ANT 4680  
See ANT 4680 for course information.

**ENV 4V13 Special Topics in Field and Laboratory Methodologies (1-3)**

Pre-requisite(s): Upper-level standing or consent of instructor  
A field experience centered on a region, ecosystem type, or environmental issue. Incorporates system-specific sampling methodologies. Requires off-campus field trips. May be repeated up to a total of three credit hours when content differs.

**ENV 4V50 Problems (1-3)**

Advanced interdisciplinary study of the environment. Subject and hours credit mutually agreed upon by student and directing professor(s) prior to registration. May be repeated for a maximum total credit of three semester hours.

**ENV 5102 Current Advances in Environmental Science (1)**

This seminar course includes applications of scientific inquiry to environmental science and development of policies that influence the quality of the environment. Graduate students attend seminars and engage the speaker on a weekly basis.

**ENV 5155 Advanced In-Situ Instrumentation Techniques (1)**

Cross-listed as PHY 5155  
See PHY 5155 for course information.

**ENV 5188 Advanced Laboratory Methods in Life Sciences (1)**

Co-requisite(s): ENV 5288  
Advanced Laboratory Methods in Life Sciences is a course for the advanced life sciences student. Course content explores biochemical and genetic techniques via classroom lectures and discussion as well as active demonstration/participation in the laboratory. Students learn principles and techniques used to evaluate a variety of endpoints across several disciplines.

**ENV 5199 Non-Thesis Degree Completion (1)**

To fulfill requirements for non-thesis master's students who need to complete final degree requirements other than coursework during their last semester. This may include such things as a comprehensive examination, oral examination, or foreign language requirement. Students are required to be registered during the semester they graduate.

**ENV 5288 Concepts for Advanced Laboratory Methods in Life Sciences (2)**

Co-requisite(s): ENV 5188  
Concepts for Advanced Laboratory Methods in Life Sciences is a course for the advanced life sciences student. It explores laboratory methods via classroom lectures and discussion as well as active demonstration/participation in the laboratory. Students learn principles and techniques used to evaluate a variety of endpoints across several disciplines.

**ENV 5300 Integrative Seminar in Environmental Studies (3)**

An in-depth interdisciplinary examination of environmental practices in six areas: the ecosphere, human ecosystems, principles and practices in areas such as the ecosphere, human ecosystems, natural resources and pollution, environment and society, methodology, and emerging themes.

**ENV 5301 Global Health and Environmental Aspects of Disaster Risk Reduction (3)**

Pre-requisite(s): Graduate standing or permission of instructor  
This course studies the global health and environmental concepts of disaster response and risk reduction. Lectures and discussions explore the practical aspects of recent disasters, disease outbreaks, and environmental incidents and the methods, strategies, and tools that could be used to mitigate future disasters.

**ENV 5302 Foundations of Environmental Health Science (3)**

Cross-listed as HED 5302, PUBH 5302  
Overview of current topics in environmental health, including environmental toxicology and disease, food security and safety, risk assessment, air and water quality, waste management, emerging contaminants and diseases, public health concepts of emergency preparedness, environmental regulation, and mitigation of environmental risks.

**ENV 5303 Environmental Chemical Analysis (3)**

Pre-requisite(s): ENV 3387 or CHE 3331; or consent of instructor  
Analytic chemistry techniques used in environmental science including sampling, wet chemistry, chromatography, and spectroscopic methods.

**ENV 5310 Agricultural Ecology (3)**

Ecological basis for food production in both temperate and tropical countries with emphasis on understanding the nature of the vulnerability of agriculture to environmental disturbance and on possible mechanisms to improve the stability and sustained productivity of improve the stability and sustained productivity of agricultural systems.

**ENV 5311 Advanced World Food Problems (3)**

Cross-listed as ANT 5310  
See ANT 5310 for course information.

**ENV 5315 Research Design and Methods (3)**

Pre-requisite(s): Senior or graduate standing; or consent of instructor  
Research design and methods. Students produce a comprehensive research proposal in their major field(s) of study and submit for funding to appropriate agency or foundation.

**ENV 5321 Energy Economics (3)**

Cross-listed as ECO 5321

See ECO 5321 for course information.

**ENV 5323 Research Design and Research Methods (3)**

Cross-listed as PSC 5323

See PSC 5323 for course information.

**ENV 5325 Advanced Methods for Human Health Risk Assessment and Analysis (3)**

Pre-requisite(s): Successful completion of ENV 4325, graduate standing, or approval by the instructor

This course introduces students to advanced concepts, data sources, and methodologies used in the field of human health risk assessment and provides them with an understanding of current issues in environmental sciences. Students conduct a quantitative risk assessment, which is demonstrated in the final project that includes a risk management proposal with uncertainty/sensitivity analysis.

**ENV 5330 Conservation Biology (3)**

Cross-listed as BIO 5330

See BIO 5330 for course information.

**ENV 5342 Ecological Risk Assessment (3)**

Pre-requisite(s): Graduate standing or consent of instructor

A thorough treatment of assessment procedures for quantifying hazardous effects of chemicals on the environment. Topics will include but are not limited to components of risk assessment paradigm, ecological risk assessment for contaminated sites, the precautionary principle, and other contemporary risk assessment issues.

**ENV 5350 The Environment and Third World Development (3)**

This course introduces students to the field of environmental issues and Third World development with emphasis on sustainable development and ensured environmental security.

**ENV 5360 Biological Invasions: Ecology and Management (3)**

Cross-listed as BIO 5360

See BIO 5360 for course information.

**ENV 5368 Integrated Energy Resource Systems (3)**

Cross-listed as AVS 5368

A seminar approach which examines various examples of integrated energy systems combining different renewable and conventional resources.

**ENV 5370 Advanced Environmental Toxicology and Chemistry (3)**

Pre-requisite(s): Two semesters each of university-level chemistry and biology or consent of instructor

Advanced principles of environmental toxicology, environmental fate of pollutants, and risk assessment. The course will focus on contemporary topics and methodology.

**ENV 5373 Advanced Environmental Biotechnology (3)**

Pre-requisite(s): Two semesters each of university-level chemistry and biology; or consent of instructor

Special applications of biotechnology in the areas of degradation and remediation of environmental contaminants; environmental implications of genetic engineering.

**ENV 5376 Advanced Urban and Regional Comprehensive Environmental Planning (3)**

Seminar which examines the application of the principles and practices of comprehensive planning at the urban and regional levels emphasizing the implications of the natural environmental characteristics of an area while addressing the social, economic, and physical environmental needs of a community.

**ENV 5377 Landscape Ecology (3)**

Cross-listed as BIO 5377

See BIO 5377 for course information.

**ENV 5379 Ecosystem Management (3)**

Pre-requisite(s): Graduate standing or permission of instructor

A seminar in the application of ecological principles to the management of terrestrial, freshwater and marine communities and ecosystems.

An overview for students from all environmental specialties with an emphasis on case histories.

**ENV 5387 Advanced Environmental Chemistry (3)**

Pre-requisite(s): Four semesters of university-level chemistry; or consent of instructor

Sources and implications of chemical pollution, cost/benefit analyses, chemical implications of alternative energy sources, waste minimization, recycling, and decontamination considerations.

**ENV 5391 Measurement Methods and Data Analysis for Air Pollution Research (3)**

Cross-listed as AVS 5391

Pre-requisite(s): CHE 1301 and 1302; or AVS 4320 and 4330; or consent of instructor

Measurement methods, such as spectroscopy, and statistical analysis used to characterize the chemical and physical properties of air to determine pollution levels and air quality.

**ENV 5393 Atmospheric Chemistry and Physics (3)**

Cross-listed as AVS 5393

Pre-requisite(s): CHE 1301 and 1302; or AVS 4320 and 4330; or consent of instructor

Chemistry and physics of the troposphere and stratosphere, including photochemistry, chemical kinetics, aerosol formation, micrometeorology, atmospheric modeling, and other advanced topics.

**ENV 5404 Wetland Ecology and Management (4)**

Cross-listed as BIO 5404

See BIO 5404 for course information.

**ENV 5405 Stream Ecology (4)**

Cross-listed as BIO 5405

See BIO 5405 for course information.

**ENV 5413 Advanced Ecological Data Analysis (4)**

Cross-listed as BIO 5413

See BIO 5413 for course information.

**ENV 5430 Mathematical Modeling of Environmental Quality Systems (4)**

Pre-requisite(s): MTH 1321 and 1322 or consent of the instructor

This course introduces the process principles that govern contaminant transport and transformations in multimedia outdoor environments.

The course covers application of fate and transport models to evaluate pollutant interactions with the biosphere, particularly in the context of human exposure modeling and health risk assessment.

**ENV 5440 Advanced Statistics for Environmental Scientists (4)**

Pre-requisite(s): MTH 1321 and 1322 or consent of instructor

This course provides students with basic principles of statistics and helps students apply statistics to analyze data and interpret results from the perspective of environmental scientists. The course first introduces basic concepts and then focuses on applications to various examples in environmental sciences.

**ENV 5V52 Special Topics in Environmental Analysis (1-12)**

The course may be repeated depending on the combination of semester hours up to a maximum of twelve semester hours.

**ENV 5V90 Graduate Environmental Practicum (1-3)**

Pre-requisite(s): Consent of instructor

A practicum supervised by an environmental professional. May be salaried or volunteer. Requires one hundred fifty to one hundred sixty hours of work per semester hour. Students are required to complete three hours of ENV 5V90 for their degree requirements.

**ENV 5V98 Graduate Research (1-15)**

Pre-requisite(s): Graduate standing

Required of all graduate students. For research credit associated with graduate research. Credit will be given for the amount of work done. May be repeated for credit through 45 hours.

**ENV 5V99 Research for Master's Thesis (1-6)**

The course is required to be repeated depending on the combination of semester hours up to a minimum of six semester hours.

**ENV 6V98 Dissertation Proposal and Prospectus Research (1-12)**

Pre-requisite(s): Graduate standing

For research credit, once coursework is completed, and prior to admission to candidacy for an advanced degree. May be repeated for credit up to 6 hours.

**ENV 6V99 Dissertation (1-9)**

Research, data analysis, writing, and oral defense of an approved doctoral dissertation on a research topic in Environmental Science. Student must have been Admitted to Candidacy before registering for dissertation hours.