

UNIVERSITY OF TEXAS RIO GRANDE VALLEY
Agricultural, Environmental, and Sustainability Sciences (MS)
Program Requirements

Required Core Courses	4
EEMS 6100: Systems Science and Applications Seminar	1
EEMS 6300: Ecosystem Management and Social-Ecological Resiliency	3
 Required Electives	 6
<i>Students must take two of the three courses listed. The third, if taken, will count as a Restricted Elective - Group 1</i>	
EEMS 6305: Advanced Sustainable Agriculture	3
EEMS 6350: Novel Ecosystems and Built Environments	3
ENVR 6320: Environmental Policy	3
 Restricted Electives – Group 1	 8-20
EEMS 5360: Soil Science and Conservation	3
EEMS 5365: Integrated Pest Management	3
EEMS 6199: Systems Science Issues and Applications Seminar	1
EEMS 6310: Coastal and Deltaic Processes	3
EEMS 6320: Biogeochemistry	3
EEMS 6330: Hydrologic Systems	3
EEMS 6355: Environmental Geophysics I	3
EEMS 6360: Food Science	3
EEMS 6365: Nanotechnologies for Food and Agriculture	3
EEMS 6385: Graduate Research (<i>No more than 6 hours can be counted towards the thesis track</i>)	3
EEMS 6390: Graduate Internship	3
EEMS 6391: Supervised Teaching	3
ENVR 5301: Conservation of Natural Resources	3
ENVR 5350: Environmental Planning and Permitting	3
ENVR 6350: Environmental Management	3
ENVR 6450: Environmental Management	4
GEOL 5401: Geographic Information Systems	3
BIOL 5340: Statistical Ecology	3
BIOL 6305: Biometry	3
BIOL 6429: Advanced Agroecology	3
POLI 6301: Urban Sustainability	3
<i>All 'Advanced Topics' courses in ENVR, GEOL, or MARS are included</i>	
 Restricted Electives – Group 2	 0-12
<i>Approval from the Graduate Advisory Committee (GAC) is required to take the courses listed Below. Courses not on this list may be counted with the approval of the GAC or Program Coordinator.</i>	
ANTH 6314: Environmental Anthropology	3
BIOL 5340: Statistical Ecology	3

BIOL 5342: Restoration Ecology	3
BIOL 5344: Advanced Mammalogy	3
BIOL 5346: Advanced Aquatic Entomology	3
BIOL 5388: Advanced Global Change Ecology	3
BIOL 5403: Advanced Remote Sensing Technology	4
BIOL 5404: Advanced Ichthyology	4
BIOL 5405: Advanced Plant Physiology	4
BIOL 5407: Plant Ecology	4
BIOL 5408: Advanced Plant Pathology	4
BIOL 5409: Advanced Herpetology	4
BIOL 5412: Advanced Ornithology	4
BIOL 5422: Conservation Biology	4
BIOL 5424: Advanced Microbial Ecology	4
BIOL 5426: Advanced Marine Ecology	4
BIOL 5427: Coastal Ecology	4
BIOL 5452: Advanced Marine Zoology	4
BIOL 6303: Advanced Ecology	3
BIOL 6308: Plant-Microbe Interactions	3
BIOL 6321: Applied Microbiology	3
BIOL 6404: Fish Ecology	4
BIOL 6412: Subtropical Ornithology	4
BIOL 6420: Plant Biochemistry and Molecular Biology	4
CHEM 6302: Environmental Chemistry	3
ENGR 6301: Water Resources and Disaster Management	3
MARS 5410: Marine Plant Science	4
SOCI 6306: Resources, Society and Environment	3
Capstone Requirement	6
Thesis	
EEMS 7300: Thesis I	3
EEMS 7301: Thesis II	3
Thesis Defense	
Non-Thesis	
EEMS 6386: Non-Thesis Research	3
EEMS 6390: Graduate Internship	3
Total graduate hours for degree:	36

Course Descriptions:

EEMS 5360: Soil Science and Conservation [3-0]
This course will introduce the critical importance of soils in sustaining life on land and in maintaining food production capabilities. An overview of basic soil science concepts will be followed by an introduction of ecological principles that define below ground ecosystem functioning. We will also explore soil degrading processes, and approaches for restoring and conserving soils. **Prerequisite:** Graduate Standing.

EEMS 5360: Integrated Pest Management [3-0]
This course provides a fundamental understanding of the theory and practice of modern integrated pest management strategies, and will cover a wide variety of pest types (e.g. insects, plants, fungi, nematodes) and methodologies (e.g. biological control, pesticides, hormone disruption, sterile insect techniques), with a focus on biological control strategies for insect pests in agricultural and natural systems. Students will attain proficiency in developing integrated pest management plans and in executing biological control measures targeting several local pest species. **Prerequisite:** Graduate Standing.

EEMS 6100: Systems Science Issues and Applications Seminar [1-0]
Discussion and analysis of active areas of research in the areas of Earth, Environmental, and Marine Sciences. **Prerequisite:** Graduate Standing.

EEMS 6199: Systems Science Issues and Applications Seminar [1-0]
This course will include discussion of marine ecosystems and processes with a focus on the marine environment of South Texas. Not open to students with previous credit for MARS/BIOL 4426. **Prerequisite:** Graduate Standing.

EEMS 6300: Ecosystem Management and Social-Ecological Resiliency [3-0]
This course seeks to provide students with an understanding of key concepts related to natural resource and ecosystem management, including socio-ecological systems, collaborative network theory, ecosystem service valuation, as well as the diversity of private stakeholders and government institutions involved in the decision making process. **Prerequisite:** Graduate Standing.

EEMS 6305: Advanced Sustainable Agriculture [3-0]
This course provides an overview of the sustainability of food production at multiple levels: farm, community, region, nation and global. Students will examine ecological, socio-economic, and cultural implications of food systems, and discuss how these may change in response to different agricultural or environmental policies. Students will gain understanding of environmental problems caused by conventional agriculture, and challenges posed by sustainable agriculture in light of global climate change, desertification, and water scarcity. **Prerequisite:** Graduate Standing.

EEMS 6310: Coastal and Deltaic Processes [3-0]
This course provides a comprehensive study of the physical and geological processes controlling the morphology of coastal environments. Beach, estuarine, deltaic, lagoonal, barrier island and shelf processes and environments are examined in detail. **Prerequisite:** Graduate Standing.

EEMS 6320: Biogeochemistry [3-0]
This course provides a comprehensive study of the cycling and interactions of elements essential to life throughout the Earth system including the influence of biological, geological, and chemical processes. **Prerequisite:** Graduate Standing.

EEMS 6330: Hydrologic Systems [3-0]
This course provides a comprehensive study of advanced quantitative treatment of surface water and groundwater hydrology, focusing on analysis of observed hydrologic and hydroclimatic variability, and their interpretation in terms of the underlying biological, geological, and chemical processes. **Prerequisite:** Graduate Standing.

EEMS 6350: Novel Ecosystems and Built Environments [3-0]

This course provides an overview of novel ecosystems and built environments. It covers how changes in climate, species distributions, and human land use interact to shape ecosystem structure and function in novel ways. Students will gain understanding of the opportunities and challenges novel ecosystems and built environments pose for ecological and economic sustainability. **Prerequisite:** Graduate Standing.

EEMS 6355: Environmental Geophysics I [3-0]

Geophysical methods have become an increasingly valuable tool for application within a variety of agroecosystems. This course studies the theory and practical applications of three geophysical methods applied to Agricultural geophysics, which are resistivity, electromagnetic induction, and ground penetrating radar. The fundamentals applications covered in this course apply not only to Agricultural Geophysics but also to a broader set of environmental investigations. **Prerequisite:** Graduate Standing.

EEMS 6360: Food Science [3-0]

This course provides a foundation in hard science while integrating evidence-based practice with analysis of worldwide food sustainability. Students will develop the ability to apply technical skills and critical analysis to real-world issues of food safety, food sustainability, and ecologically sound practices of consumption and agriculture. It includes culturally specific discussions of food preparation and consumption, as well as an overview of the historical and ecological significance of each food group covered. It also presents a thorough review of food preparation, food science, and technology. The course will gently push students to contextualize key food science concepts within a larger ecological and historical framework. **Prerequisite:** Graduate Standing.

EEMS 6365: Nanotechnologies for Food and Agriculture [3-0]

This course provides students with challenging issues in food and agriculture and nanotechnology is one of the exciting new fields of research to address many of the pressing needs in the food and agriculture sectors. It is divided into three parts: Part I incorporates emerging nanotechnologies, Part II deals with nanotechnologies used in detection, delivery, and treatment, Part III addresses the toxicity issues and acceptance of this technology by public. It is also intended to provide a step stone to students for establishing collaborations, formulating strategies, and spawning new ideas and approaches that will help resolve some of the most vexing challenges facing food and agriculture in a growing world. **Prerequisite:** Graduate Standing.

EEMS 6385: Graduate Research

Faculty supervised research designed for students who are working on a research or the thesis project. A maximum of 6 SCH of Graduate Research will count toward the degree; subsequent enrollments will not count. **Prerequisite:** Graduate Standing.

EEMS 6386: Non-Thesis Research

Faculty supervised research designed for students who are working on an internship project. Students pursuing a Graduate Internship may perform research geared towards professional development, e.g., the generation of a relevant professional paper, or as preparation for an internship position.

Prerequisite: Graduate Standing.

EEMS 6390: Graduate Internship [3-3]
This course is an applied experience in an industrial, educational, private agency, or government facility. A maximum of 3 SCH of Graduate Internship will count toward the degree; subsequent enrollments will not count. **Prerequisite:** Graduate Standing.

EEMS 6391: Supervised Teaching [3-0]
This course is to prepare students for becoming be effective teaching assistants during their graduate careers and to prepare them for independent teaching and presentations. A maximum of 3 SCH of Supervised Teaching will count toward the degree; subsequent enrollments will not count. **Prerequisite:** Graduate Standing.

EEMS 7300: Thesis I [3-0]
This supervised research course will include design of an original research problem with a written proposal, collection and analysis of original data, and writing of a scientific report in acceptable publication format. A maximum of 3 SCH of Thesis I will count toward the degree; subsequent enrollments will not count. **Prerequisite:** Graduate Standing.

EEMS 7301: Thesis II [3-0]
This supervised research course will include design of an original research problem with a written proposal, collection and analysis of original data, and writing of a scientific report in acceptable publication format. A maximum of 3 SCH of Thesis II will count toward the degree: subsequent enrollments will not count. **Prerequisite:** Graduate Standing.

ENVR 5301: Conservation of Natural Resources [3-0]
An in depth review of the distribution of natural resources, with special emphasis on new solutions to problems of resource scarcity. Topics include: energy, water, air and food resources and other selected components of the lithosphere, hydrosphere, atmosphere and biosphere. Economic, demographic, and political issues are considered as they affect natural resources.

ENVR 5350: Environmental Planning and Permitting [3-0]
This course reviews concepts, approaches, and techniques to environmental planning and the necessary procedures to prepare local, state, and federal environmental permits under SEPA and NEPA guidelines. Students will become familiarized with the environmental permit planning, process, and application as applied to urban land and coastal development. The basics of environmental project management will be integrated into the permit assignments of this course. Students will gather information from local sites following mock proposed development scenarios to practice submitting permits to the EPA, ACOE, and USFWS in addition to other agencies. Skills and practice permits include, but are not limited to, site plan review, SWPPP, NPDES, MS4, CWA Section 401 and 404, and EIA. Students completing this class are encouraged to use their knowledge and skills to seek state or national certification in these areas.

ENVR 6350: Environmental Management [3-0]
This course provides an overview of environmental management of land and coastal areas with a focus on the protection of natural resources and human and ecological health. Students will learn how to implement management and protection options for land, water, coastal land, forestry and wildlife, and waste management. Management approaches to planning and reporting at the local, state, federal, and international levels are covered. This information is used by student teams to develop a management plan focusing one of the following environments: agricultural, rangeland, recreational and multiuse,

rural, urban, or coastal, and for which offers protection to environmental resources and allows for future planning.

ENVR 6450: Environmental Monitoring [3-0]

This course covers the field and laboratory testing and analysis techniques of environmental monitoring to meet state and federal guidelines. Monitoring areas include, but are not limited to, soils and sediments, water, and plants and animals. Field geological, water quality, and ecological census techniques are taught through hands-on, practical student learning. Students will also learn applicable laboratory skills and maintaining quality assurance through sampling handling, storage, and physical and chemical measurement techniques. Additionally, students are taught how methods of data gathering and sampling, analysis, and presentation can affect environmental interpretations.

GEOL 5401: Geographic Information Systems [3-0]

This course covers more advanced concepts and techniques of Geographic Information Systems (GIS). Concepts include: spatial analysis techniques for both vector and raster-based data models; examination of relational databases and database management systems; and hands-on use of ArcGIS software with an emphasis on the following extensions: Spatial Analyst, Network Analyst, 3-D Analyst, Geostatistical Analyst and Business Analyst in a laboratory setting and course project.

ANTH 6314: Environmental Anthropology [3-0]

An introduction to human/environmental interactions from various anthropological perspectives. History of anthropological approaches to the environment, emphasizing the mutual interconnectedness of people and nature. Survey of evolutionary models, cultural ecology, systems approaches, indigenous knowledge, ethno ecology, nature and the state, political ecology, eco-feminism, environmentalism, and environmental justice.

BIOL 5340: Statistical Ecology [3-0]

The application, interpretation, and critique of statistical methods for analyzing arrays of species-by-samples data as arise in biological monitoring of environmental impacts and fundamental studies of community ecology. Topics include standard diversity indices, hierarchical clustering, multidimensional scaling, principal components analyses, analysis of similarities and selected advanced topics. This course will emphasize the use of statistical software packages and reporting of results. **Prerequisite:** Graduate standing and one course in Ecology or consent of constructor.

BIOL 5342: Restoration Ecology [3-0]

This course explores the relevance of ecological principles applicable to the recovery of degraded ecosystems. With an emphasis on the reestablishment of ecosystem functioning to facilitate recovery, topics discussed relate to the implementation and monitoring or restoration projects across systems and disturbances. **Prerequisite:** Graduate standing and one course in Ecology or consent of constructor.

BIOL 5344: Advanced Mammalogy [2-3]

A study of anatomy, evolution, distribution, systematics, ecology and physiology of mammals of North America. A research project is required. Critical review of current literature and studies of recent advances in Mammalogy are emphasized. Laboratory fee. **Prerequisite:** Graduate Standing.

BIOL 5346: Advanced Aquatic Entomology [3-0]
Aquatic insect identification, taxonomy, ecology and use in bioassessment of water quality. Lower Rio Grande regional fauna emphasized. Lecture, lab and field work. **Prerequisite:** Graduate standing. \$5 laboratory fee.

BIOL 5388: Advanced Global Change Ecology [3-0]
This course will cover different aspects of global change, a critical environmental problem caused by human activities (e.g., non-sustainable agricultural practices). This course will address lectures, discussion, and assignments related to topics such as habitat transformation, species extinctions, and spread of diseases, invasive species, global warming and the impact of these factors on conservation efforts. **Prerequisite:** Graduate Standing.

BIOL 5403: Advanced Remote Sensing Technology [4-0]
This course provides training in the use of electromagnetic radiation for monitoring environmental conditions and resources. Emphasis will be placed on the operation of various remote sensors, collection of analog and digital data, and use of computer software for image processing, interpretation and integration of imagery into geographic information systems. **Prerequisite:** Consent of instructor.

BIOL 5404: Advanced Ichthyology
A study of ecology, distribution, adaptations, physiology, systematics and evolution of freshwater and marine fishes, with an emphasis on local forms. Laboratories will stress identification and other practical applications of modern ichthyological techniques. Laboratory fee. **Prerequisite:** Graduate Standing.

BIOL 5405: Advanced Plant Physiology [3-3]
Physiology of plants, cell structure and function, nutrition, metabolism and factors influencing growth and development. **Prerequisite:** Graduate standing.

BIOL 5407: Plant Ecology [3-3]
This course will introduce students to the theoretical framework and current research in plant ecology. Plant ecology focuses on factors that influence the distribution and abundance of plants and their interactions with each other and their environment. Resource availability, seed dispersal, competition, herbivory, and disturbances all interact to influence plant survival and growth, and topics such as these are the focus of this class. We will also address timely issues relevant to current research in plant ecology such as exotic species invasions, global climate change, and human-driven changes to disturbance regimes. These topics will be discussed in relation to the primary scientific literature and other mainstream sources such as newspapers and magazines. **Prerequisite:** Graduate Standing.

BIOL 5408: Advanced Plant Pathology [3-3]
The causes, nature and control of plant diseases. Principles of plant disease development. Laboratory fee. **Prerequisite:** Graduate Standing.

BIOL 5409: Advanced Herpetology [3-3]
A study of the anatomy, evolution, distribution, systematics, ecology and physiology of amphibians and reptiles, primarily of North American species with special emphasis on local forms. **Prerequisites:** Graduate standing. Laboratory Fee.

BIOL 5412: Advanced Ornithology [3-3]
Studies in avian biology with emphasis on taxonomy, behavior and ecology. Cannot take for credit if have had BIOL 4412 or equivalent. Laboratory fee. **Prerequisite:** Graduate Standing.

BIOL 5422: Conservation Biology [3-3]
Focus on the controlled use and systematic protection of natural resources such as forests, soils, and water systems. Conservation integrates concepts of geography, climatology, geology, geomorphology, chemistry, and biology into one applied standing. **Prerequisite:** Graduate standing.

BIOL 5424: Advanced Microbial Ecology
An introduction to the diversity of microbes found in nature. Emphasis is placed on the ecological significance of bacterial communities found in terrestrial, aquatic and extreme environments, as well as their metabolic activities, interactions and survival strategies. Microbial bioremediation and biogeochemistry are also addressed. **Prerequisite:** Graduate Standing.

BIOL 5426: Advanced Marine Ecology
This course will include discussion of marine ecosystems and processes with a focus on the marine environment of South Texas. **Prerequisite:** BIOL 3409.

BIOL 5427: Coastal Ecology [3-3]
This course examines the major nearshore habitats and communities of the western Gulf of Mexico including: beaches, sand dunes, estuaries, salt marshes, mud flats, sea grass meadows and rocky shores. Emphasis is placed on directed, field-oriented, individual research projects. **Prerequisite:** Graduate standing and one course in general ecology or zoology or consent of the instructor.

BIOL 5452: Advanced Marine Zoology [3-3]
Structural, physiological and ecological relationships of common marine animals, stressing invertebrates of coastal waters. **Prerequisite:** BIOL 3414 recommended. Laboratory fee.

BIOL 6303: Advanced Ecology [3-3]
Utilization of modern techniques to analyze interrelationships between plants, animals and the environment. Terrestrial and freshwater environments will be considered. Laboratory fee. **Prerequisite:** Graduate Standing.

BIOL 6305: Biometry [3-0]
Statistical analysis and principles as applied to biological problems. **Recommended Prerequisite:** Undergraduate statistics course. Laboratory fee.

BIOL 6308: Plant-Microbe Interactions [3-0]
The course will cover advanced plant pathology topics and several others not covered in BIOL 4408/5408. The graduate student will become familiar with the concepts underlying the interactions of microbes and plants across a continuum of symbioses. Modern ideas from very recent scientific literature concerning the molecular nature of plant pathogenicity and resistance will be emphasized. **Prerequisites:** BIOL 4408 or BIOL 5408; BIOL 3401, BIOL 3412, BIOL 3413 or BIOL 3415; consent of instructor.

BIOL 6321: Applied Microbiology [3-0]

This course is primarily associated with the commercial exploitation of microorganisms, and involves processes and products that are of major economic, environmental and medical importance to humankind. Aspects of industrial microbiology such as production of valuable microbial products via fermentation processes will be emphasized. Key aspects of microbial physiology to elucidate the versatility of microorganisms for their diverse metabolic activities and products will be included in the course. **Prerequisite:** BIOL 3401. \$4 laboratory fee.

BIOL 6404: Fish Ecology [4-3]

Interactions of fishes especially teleosts, with their physical and biotic environment. The lab emphasizes fieldwork and includes an individual student project. **Prerequisite:** Graduate standing.

BIOL 6412: Subtropical Ornithology [3-3]

Ecology, history, behavior and conservation of subtropical bird communities, focusing on breeding birds of the Lower Rio Grande Valley. Students will perform field studies of birds and several field trips will be held. Laboratory fee. **Prerequisites:** Graduate standing. BIOL 4412 or BIOL 5412 recommended.

BIOL 6420: Plant Biochemistry and Molecular Biology [3-3]

The lecture portion of this course will present the unique biological aspects of plants in the context of their biochemistry, physiology and cellular and molecular biology. The laboratory portion of this course will teach students the unique lab techniques involved in the study of plant biochemistry and molecular biology. **Prerequisite:** Graduate standing and one of the following courses: BIOL 3401 OR BIOL 3406 OR BIOL 3412 OR BIOL 3413 OR BIOL 3415 OR BIOL 4417.

BIOL 6429: Advanced Agroecology [3-3]

Ecological concepts and principles are applied to the design and management of sustainable agroecosystems. Alternatives for agriculture are discussed in terms of ecosystem structure and function. A weekly three-hour lab is required, with lab fees charged. **Prerequisite:** Graduate Standing.

CHEM 6302: Environmental Chemistry [3-0]

Environmental chemistry will provide the students with enhanced understanding of the different aspects of environmental chemistry, including aquatic chemistry and aqueous based natural reactions as well as the effects of anthropogenic activity on the environment. **Prerequisite:** Acceptance into Chemistry Graduate Program or instructor's permission.

MARS 5410: Marine Plant Science [4-0]

The common local marine flora including the microscopic and algal forms and aquatic angiosperms. Not open to students with previous credit for MARS/BIOL 4410. Laboratory fee. **Prerequisite:** Graduate Standing.