ENVIROMENTAL RESOURCE MANAGEMENT (ERM)

ERM 150S: ERM First Year Engagement
1 Credits

This First Year Engagement course is for first-year students intending to major in Environmental Resource Management at University Park campus. First year DUS students may also enroll. Students will explore environmental science, natural resource, and sustainability issues and research methodologies through literature review, library searches, field studies, critical thinking exercises, and exposure to Penn State faculty. Students will also be introduced to the breadth of University resources at their disposal.

First-Year Seminar

ERM 151: Careers and Issues in Environmental Resource Management
1 Credits

ERM 151 introduces students to the environmental sciences and resource management field early in their academic experience. The course is the first prescribed ERM course for students in the Environmental Resource Management major, and is also designed for non-majors (e.g. DUS students) interested in exploring career paths in the environmental sciences. Weekly presentations are made by ERM graduates, Penn State faculty, and upper-level students. Course objectives include discussion of topical issues in environmental sciences and resource management, familiarization with environmental career opportunities for graduates, providing feedback to enhance students’ Penn State experience, enhancement of critical thinking and communication skills, and creating an opportunity to address student questions about the ERM program. Weekly writing assignments are designed to enhance the learning process and require students to reflect on the day’s speaker and the issues of importance to them. A service learning and seminar assignment are also required to familiarize new students to engagement opportunities outside the classroom. Students also develop a draft and final Personal and Professional Development Plan throughout the semester, which is designed to facilitate the establishment and refinement of career goals and objectives, and to be an action plan for their remaining Penn State experience.

ERM 197: Special Topics
1-9 Credits/Maximum of 9

Formal courses given infrequently to explore, in depth, a comparatively narrow subject which may be topical or of special interest.

ERM 199: Foreign Studies
1-12 Credits/Maximum of 12

Courses offered in foreign countries by individual or group instruction.

International Cultures (IL)

ERM 210: Environmental Factors and Their Effect on Your Food Supply
3 Credits

An exploration of how urban environmental problems influence our ability to obtain food and natural resources. ERM 210E R M 210 Environmental Factors and Their Effects on Your Food Supply (3) (GN)(BA) This course meets the Bachelor of Arts degree requirements. Environmental Factors and Their Effect on Your Food Supply will study links between environmental issues and the agricultural systems from an urban perspective. Insects, one the most diverse groups of organisms, will be used to provide examples of human impact on ecosystem structure and function. Differences between sustainable and non-sustainable systems, along with efforts to create sustainable human systems, will be explored. This course looks at the Earth as a single ecosystem composed of interacting biological, chemical and physical systems. The social and economic dimensions of issues will be discussed. We will focus on how non-human systems interact with each other and with the human population. The course focus will be on the principles and concepts from biology, chemistry, geology and physics. Specific topics treated within the context of this interdisciplinary course include but are not limited to: human response to (insecticide use) and influence on (reduction in diversity) insects, the unique and life-giving properties of water, nutrient cycles, energy flows, species diversity, the dose-response relationship, risk assessment and perception, global climate change, and conservation of energy and matter. We will also be learning about how the use of the scientific method an interdisciplinary setting. Scientific situations found in everyday life will be used to explore and practice how to ask questions, gather data, and reach conclusions. Evaluation of student performance will be based upon critical thinking exercises, class discussion, short in-class writing assignments, and examinations. The critical thinking exercises will be assessed by written material submitted by the student. The written material will include the steps undertaken in the exploration (methods), the observations made (results) and description of what was learned (conclusions). These explorations will help students learn to solve problems and think critically using information they have discovered. The explorations will require students to supplement their observations with information found on the Web and in the Library. Students will be required to participate in class discussions using CourseTalk. Contributions will be evaluated for content and quality. Short, in-class, written student feedback will be collected frequently to determine the level of understanding and attendance. Two midterm evaluations and a comprehensive final will be given. These exams will consist of higher-order thinking questions requiring the student to synthesize information to solve problems. Self-quizzes will accompany each unit to help the student determine when they understand the concepts being learned. Environmental Factors and Their Effect on Your Food Supply is an introductory level, general education science course without prerequisites. This course is not a prerequisite for any other course. An introductory level course in sustainable environmental systems will provide a useful context for future course work. Recitation sections will be used to increase the student’s understanding of concepts discussed during lecture. Computer exercises develop specifically for this course, the textbookCD-ROM, and data found on the Web will be used to aid students in their understanding of course concepts. The course will be offered annually in the spring. Expected enrollment is 100 students.

Bachelor of Arts: Natural Sciences
General Education: Natural Sciences (GN)
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**Prerequisites:** 3 credits in BIOL and CHEM 111 and (MATH 110 or MATH 140) Concurrents: (PHYS 250 or PHYS 211)

**Prerequisite:** AG BM 101 or ECON 102 or ECON 104 and 7th semester standing

Cross-listed with: BRS 402

Cross-listed: ASM 309
perform tasks they may be asked to perform during their environmental careers: preparing permit applications, public comment documents, writing permit conditions, and challenging and defending final agency decisions.

**Prerequisite:** ECON 102 or AG BM101; and prerequisite or concurrent: ERM 151, CED 152, or EBM 200

ERM 412: Resource Systems Analysis

3 Credits

ERM 412 is a course in problem solving, as it relates to environmental and resource related issues. The course covers a variety of problems within an environmental context, including mass balance, steady-state, dynamic, and statistical problems. Students will gain experience in making assumptions and testing those assumptions in the application of biological, chemical, and physical principles to problem solving. The course is designed to develop experience in quantitative problem solving using spreadsheets, modeling tools, and computer-based statistical analysis.

**Prerequisites:** (MATH 111 or MATH 141) and (STAT 200 or STAT 240 or STAT 250) Concurrent Courses: ERM 300

ERM 413W: Case Studies in Ecosystem Management

3 Credits

Application of biological, physical, and social science principles to ecosystem management problems; introduction to environmental impact analysis and review.

**Prerequisite:** ERM 300 and ERM 412

Writing Across the Curriculum

ERM 426: Nutrient Management Specialist Preparation

1 Credits

Students in the College of Agricultural Sciences may wish to have professional certifications and licenses related to their anticipated area of employment. This course will assist students as they prepare for certification to write nutrient management plans for agricultural production and livestock operations. Professionals in the field will provide study materials and guide students as they study and prepare to complete the certification process. This course and successful completion of certification will make the student more employable than students that have not obtained this professional certificate. Upon completion of this course, students can take the licensing exam for Nutrient Management Specialist Certification offered by the Pennsylvania Department of Environmental Protection and Pennsylvania Department of Agriculture.

**Prerequisite:** SOILS 101 and SOILS 102.

ERM 430: Air Pollution Impacts to Terrestrial Ecosystems

3 Credits

This course introduces student to air pollutant sources, transport, meteorology, and temporal and spatial trends of pollution dispersion and deposition. An overview is presented of the direct and indirect effects of air pollutants on terrestrial ecosystems with an emphasis on plant life. The effects of ozone, sulfur dioxide, nitrogen oxides, particulate matter, halogens, and combined pollutants leading to acidic atmospheric depositions are presented. Emphasis is placed on air pollutants as plant pathogens leading to symptoms and eventual long-term accumulative effects to entire ecosystems. Methods of diagnostics, factors affecting plant response, ecosystem decline and resiliency, pest interactions, assessment of loss and cost/benefit analysis leading to abatement follows. Final parts of the course include perspectives of public awareness, development of National Ambient Air Quality Standards, compliance prevention of significant deterioration, and the Clean Air Act reforms of 1990.

**Prerequisites:** (BIOL 110 or FOR 308) and 5th Semester standing or higher

Cross-listed with: PPEM 430

ERM 431: Environmental Toxicology

3 Credits

Effects of pollutants on animal health at the chemical, physical, and cellular level.

**Prerequisite:** BIOL 110, CHEM 110, CHEM 112

Cross-listed with: VBSC 431

ERM 433: Transformation of Pollutants in Soils

3 Credits

The course provides the chemical and biological basis for understanding, predicting and controlling the fate of pollutants added to the soil. The material falls distinctly into two major sections: Section I discusses the fundamental concepts of soil science as they relate to the fate of pollutants in soil systems. Section II provides specific coverage of important classes of soil pollutants. The environmental impacts associated with soil enrichment of these pollutant groups are discussed. Primary emphasis is given to pollutants having adverse effects on human health via water and the food supply, namely, trace elements, trace organic contaminants, pathogens, and radionuclides. The major plant nutrients, nitrogen and phosphorus, warrant coverage because of their potential negative impacts on aquatic systems. Salts can harm soil productivity and structure and thus represent a third distinct pollutant category.

**Prerequisites:** CHEM 111, CHEM 112, SOILS 101

ERM 435: Limnology

3 Credits

Biogeochemistry and natural history of freshwater ecosystems. WFS (ERM) 435 Limnology (3) This course will define and describe major principles (physical, chemical, biological, and ecological) that govern the structure and function of freshwater ecosystems (ponds, lakes, and rivers). Current scientific literature will be critically reviewed and discussed in relation to comparative philosophy, methodology, and case studies that cover a range of topics in limnology. The objectives of ERM (WFS) 435 are to familiarize students with the major physical properties, chemical cycles, taxonomic groups of organisms, and ecological interactions that define and describe the natural function of aquatic ecosystems. The course will use case studies to illustrate and examine pertinent issues (e.g., excessive material loading, introduction to exotic species, habitat fragmentation, and climate change) that can alter the structure and function of aquatic ecosystems. Knowledge of these basic ecosystem principles will be applied towards formulating real-life resolutions to the issues identified in class, in order to better
manage aquatic resources (methods to reduce material loads, transport controls of exotic species, habitat restoration, and reduction of global gases). This course will be useful to both undergraduate and graduate students seeking degrees in Environmental Resource Management, Wildlife and Fisheries Science, Ecology, and other related subjects. At the undergraduate level, the course will serve as a 400-level selection in both the Environmental Resource Management and Wildlife and Fisheries Science degree programs. At the graduate level, the course will complement several Wildlife and Fisheries courses that form the complement of that degree program. Moreover, the course can satisfy the course requirement for ecosystems ecology in the inter-college Ecology graduate program and serve as a breadth course in Water Resources for graduate students in the Watershed Stewardship program.

**Prerequisite:** BIOL 110, BIOL 220W, CHEM 110

Cross-listed with: WFS 435

ERM 436: Limnological Methods

3 Credits

Application of current methodologies to evaluate the biological, chemical, and physical characteristics of aquatic ecosystems. ERM (WFS) 436 Limnological Methods (3) Limnological Methods will instruct students to apply state of the art analytical measurements in order to gain an understanding of how and why ecosystems support specific biodiversity and biogeochemical cycles. The course will help students define key ecological elements (e.g., ecosystem metabolism, resource limitation, predator-prey relations) in both qualitative and quantitative terms, thereby making them tangible, tractable, and readily understandable. The course will use an instructional rubric to integrate conceptual, analytical, and communicative exercises in order to instruct students about how to evaluate variation in natural ecosystems. This course provides experiential training in the scientific process (rubric), so students can learn by doing, thereby internalizing their knowledge. Course content is organized into three 5-week sections, each of which will emphasize one component of the biogeochemical cycle (physical, chemical, biological). In each section, students will carry out a focused group study designed to evaluate how a pertinent environmental perturbation can affect that component of the aquatic biogeochemical cycle. The course content in each five-week block will have students: 1) review the experimental design and hypothesis, 2) implement the experimental design in the field or laboratory, 3 and 4) process and analyze samples in the laboratory, and 5) make statistical and graphical evaluations of the experimental results relative to their hypothesis (in class) and present these findings in written form. Knowledge of these basic ecosystem principles will be applied towards formulating real-life solutions to the issues identified in class, in order to better manage aquatic ecosystems. This course will be useful to undergraduate students seeking degrees in Environmental Resource Management and Wildlife and Fisheries Science, as well as graduate students pursuing degrees in Ecology, Forest Science, Wildlife and Fisheries Science, Watershed Stewardship, and other related subjects. At the undergraduate level, the course will serve as a 400-level elective in Environmental Resource Management degree program, Wildlife and Fisheries Science degree program, and the inter-college Marine Science option. At the graduate level, the course will complement several Forest Science and Wildlife and Fisheries courses. Moreover, the course can also satisfy the requirements for the ecosystems ecology focus in the inter-college Ecology graduate program. Grades will be based on three research papers, and a final laboratory practical.

**Prerequisite:** BIOL 110 and CHEM 110

Cross-listed with: WFS 435

ERM 440: Chemistry of the Environment: Air, Water, and Soil

3 Credits

A global perspective of the chemical principles, composition and processes that operate within and between air, water, and soil environments. ERM 440 Chemistry of the Environment: Air, Water, and Soil (3) This course provides a global perspective of the chemical principles, composition and processes that operate within and between air, water and soil environments. The course is designed to develop knowledge of chemistry fundamentals as applied to the principles and concepts used in environmental chemistry. Upon completion of this course, students will have an understanding of soil, water, and air chemical principles and their applications. Specifically designed for juniors and senior undergraduates, the course will link theoretical chemistry concepts to real-world environmental problems. Students will be evaluated on examinations, homework, and class participation.

**Prerequisite:** CHEM 110, CHEM 111, CHEM 112, CHEM 202 or CHEM 210

ERM 444: Environmental Biophysics

3 Credits

Analysis of the interaction of living organisms and their microenvironment by applying biophysical principles and engineering methods. ERM 444 Environmental Biophysics (3) This course trains students in the analysis of the interaction of living organisms and their microenvironment by applying biophysical principles and engineering methods. Students will learn to describe the physical environment surrounding the organism (wind, temperature, radiation, humidity) and to calculate biophysical responses of the organisms to these variables in terms of transfer of mass (liquid water, gases) and other processes. Practical examples and accompanying calculations are fundamental components of the course as the students learn to quantitatively explore the links between the environment and features of living organism such as the shape and color of leaves and canopies, the distribution of the rooting system, or the thickness of an animal fur. A laboratory section complements the lectures and introduces the students to basic techniques and equipment utilized in this discipline. This course can be helpful for students in the areas of plant and animal sciences, ecology, entomology, environmental sciences, and agricultural and environmental engineering.

**Prerequisite:** BIOL 110; MATH 110 or MATH 140; PHYS 250 or PHYS 211

ERM 447: Stream Restoration

3 Credits

Stream restoration will focus on understanding stream impairment by evaluating the stream channel, its floodplain, and the watershed supplying runoff to the stream. A wide variety of stream assessment tools will be introduced along with several stream classifications systems. Students will be introduced to the concepts of stream stability and evolution and how human activities and our infrastructure impact the health of a stream. Various restoration approaches designed to restore impaired stream reaches to stable channels will be introduced. Stream stability and the role of sediment transport in the context of pebble-count data will be introduced along with several sediment transport models. Stream biology, macro-invertebrates, the role of riparian buffers, and desirable plant populations will be introduced. The laboratory experiences
will focus on stream assessment tools and stream surveys needed for
the stream restoration design process. Students will be responsible for
assessing a stream and developing a preliminary design for restoring an
impaired local stream reach.

**Prerequisites:** ASM 327 or BE 307 or CE 360 or CE 370

ERM 448: Rural Road Ecology and Maintenance

3 Credits

Roads are ubiquitous throughout the landscape and this course is
intended for students who anticipate working in natural resource
management fields. This course provides students with the fundamental
understanding of the interaction of natural systems with unpaved and
low volume paved roads in order to economically maintain roadways with
minimum impact on the environment. The major focus area will be the
road/stream interface, including the fundamentals of hydrology, geology,
sols, and erosion processes as they pertain to roads and streams. It is
expected that the student will gain a practical understanding of rural road
maintenance in order to provide a foundation for real-world application.
Emphasis is placed on Environmentally Sensitive Maintenance (ESM)
practices for rural roads that are used throughout Pennsylvania. The goal
of ESM practices is to minimize the environmental impact of the existing
road network by maintaining proper road drainage in order to keep road
materials out of the adjacent streams and surrounding landscape. Upon
completion the student will be ESM certified under Pennsylvania’s Dirt,
Gravel and Low Volume Road Maintenance Program.

**Prerequisites:** MATH 22 and MATH 26; or MATH 41; or MATH 110 or
MATH 140 Concurrent Courses:ASM 327 or BE 307 or CE 335 or CE 370
or FOR 308 or FOR 470

ERM 449: Sustainable Water Management: Economics and Policy

3 Credits

Water resource management is of fundamental importance to human
societies and natural ecosystems. Yet, despite millennia of human
experience in managing water resources, water shortages and water
quality degradation harmful to the health and prosperity of people and
to ecosystems are common, and stresses on water are expected to
increase globally in coming years. Growing populations and incomes are
increasing the demand for scarce water while creating new stresses on
water quality. Climate change and changes in land use and land cover
that accompany population growth and climate change are affecting
water supplies and water quality. Addressing existing and emerging
water problems requires understanding the underlying causes, and
the development and implementation of remedies that are effective,
efficient, resilient, fair. This is a multi-disciplinary problem. This course
introduces students to the methods and contributions of economics
as a behavioral and decision science to the task. Topics include water
supply costs, water demands, ecosystem services and values provided by
water, efficiency and fairness in water use, water rights institutions,
water markets, water pricing, effluent taxes, pollution permit trading, and
methods of water project and policy evaluation.

**Prerequisites:** ( MATH 22 or MATH 110 or MATH 140 ) and ( AGBM 101 or
ECON 102 ) Recommended Preparation: CED 201 or EBF 200

ERM 450: Wetland Conservation

3 Credits

Wetland types, classification, functions and values; hydrology, soils, and
plants; introduction to wetland identification and delineation; wetland
regulations. E R M ( W F S ) 450 Wetland Conservation ( 3 ) Wetlands
are unique ecosystems, differing in many ways from both terrestrial
and aquatic environments. They provide recognized values and functions
to society, although these values and functions remain difficult to
quantify. The study of wetlands is interdisciplinary, requiring background
knowledge in science, management and policy disciplines. This course
will explore the variety of wetland types and functions, and emphasize
the diverse hydrological, biological, chemical, and physical interactions
that occur within wetlands. Because wetlands are recognized as valuable
assets in the landscape, issues surrounding wetland management and
regulation have taken on increased importance; we will address these
issues as well. Topics will also include the restoration of degraded
wetlands and wetland creation, along with the construction of wetlands
for pollution abatement. Students will become familiar with different
wetland types and how they are classified, and will develop skills in
understanding the interactions between wetland hydrology, hydric soils
and hydrophytic vegetation. They will also develop an understanding
of important national and state policies and regulations pertaining to
wetlands and their protection and delineation. Classroom assessment
will be based on three cumulative exams, homework assignments, and
a final project. The course will fulfill 3 credits of electives or technical
selections in the Wildlife and Fisheries Science major. Other students
university-wide may be interested in the course, and the intention is to
develop a course that is accessible to a wide variety of traditional and
non-traditional students. For proper instruction, a technology classroom
with computer projection equipment will be required. E R M 450 will be
offered each fall semester. Enrollment will be limited to 60-80 students.

**Prerequisite:** E R M300 or W F S209

Cross-listed with: WFS 450

ERM 494: Undergraduate Research in Environmental Science

1-6 Credits/Maximum of 6

Supervised student activities on research projects identified on an
individual or small group basis.

**Prerequisite:** permission of the Environmental Resource Management
program

ERM 494H: Honors Thesis

1-6 Credits/Maximum of 6

Independent study directed by a faculty supervisor that culminates in the
production of an ERM honors thesis.

**Prerequisite:** Junior or senior status in the Schreyer Honors College and
permission of the ERM honors advisor

Honors

ERM 495: Internship

1-12 Credits/Maximum of 12

A supervised practicum in the environmental field. To be offered only for
SA/UN grading.

**Prerequisite:** prior approval of assignment by instructor
Full-Time Equivalent Course

ERM 496: Independent Studies
1-18 Credits/Maximum of 18

Creative projects, including research and design, which are supervised on an individual basis and which fall outside the scope of formal courses.

ERM 497: Special Topics
1-9 Credits/Maximum of 9

Formal courses given infrequently to explore, in depth, a comparatively narrow subject which may be topical or of special interest.

ERM 499: Foreign Studies
1-12 Credits/Maximum of 12

Courses offered with a component in foreign countries, by individual or group instruction.

International Cultures (IL)