



Environmental Resource Management

“restoring the past....preserving the future”



2014-2015
Student Handbook

The Pennsylvania State University
Environmental Resource Management Program
119 Agricultural Administration Building
University Park, PA 16802
agsci.psu.edu/erm

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INTRODUCTION

Welcome to the Environmental Resource Management (ERM) major at the Pennsylvania State University! This hand book is designed to give you an overview of the ERM program, as well as to serve as a guideline for students in the major. This book describes the structure of the major, the program's B.S. graduation requirements, and the diverse job opportunities that await graduates of the program. Also included in this handbook are a program check-sheet, a comprehensive recommended course scheduling sheet, and a complete list of prescribed courses for the major.

When you enter the ERM program, you will be assigned an academic advisor. Your academic advisor will help you plan your courses and serve as your source of information about the major, the curriculum, or any other questions you may have regarding the program and the University.

For more information about our program, please contact either:

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University Park, PA 16802
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Or, visit our website: <http://aqsci.psu.edu/erm>

WHAT IS ERM?

The ERM major is an inter-disciplinary environmental science major designed for students who want to use problem-solving, decision-making, and communication skills to address environmental and resource management issues. For 43 years, the ERM program has been preparing students to successfully and creatively analyze, manage, and protect the environmental resources of Pennsylvania, the nation, and the world. If you are interested in environmental protection, conservation, sustainability, managing natural resources, and experiencing both field and lab-based learning, then the ERM program is for you!

The ERM major offers a flexible, comprehensive curriculum that provides students with a solid background in the sciences. The program educates its students in fundamental environmental subjects including air, water & soils. The ERM major also educates its students in the management aspect of environmental science, which includes courses in both economics and law.

In addition to taking science based courses, students in the major specialize in one or several focus areas tailored to their own interest. These focus areas range from environmental engineering, to environmental economics, to water resources and most everything in between! Having one or several focus areas incorporated into the student's academic program enhances the student's marketability and knowledge base upon graduation.

WHERE ARE THE JOBS?

There are many employers in both the private and public sectors specifically looking for graduates with environmental science degrees because of the breadth and depth in environmental training. The Environmental Resource Management major prepares students to enter into several different environmental fields upon graduation. Students in the major can enter into private environmental consulting, the public, private or non-profit sector, or into one of the many government agencies that hire environmental professionals. As a graduate of the program, you can look forward to a variety of exciting career opportunities, including, but not limited to; ecosystem restoration, contaminated site remediation, soil, air and water quality improvement, and addressing other environmentally-related issues. Some examples of companies and organizations that have hired ERM graduates in the past include the Environmental Protection Agency (EPA), the Department of Conservation and Natural Resources (DCNR), County Conservation Districts, the Chesapeake Bay Foundation, the Department of Environmental Protection (DEP), and more!

To supplement the versatile science degree, ERM students can enhance their marketability in the environmental arena by carefully selecting appropriate courses to qualify for Professional Certifications. In addition to educational requirements, most professional certifications have experience requirements—a few years of "practice" and skill development on the job are needed to qualify for the actual "professional" title. ERM students can easily obtain certifications to become professionals in training in a variety of areas. Some examples of certifications in the environmental field include Professional Wetland Scientist (PWS), Certified Professional Soil Scientist (CPSS), Certified Hazardous Materials Manager (CHMM) and more! See your advisor for more information about certifications.

PLANNING YOUR ACADEMIC PROGRAM

Students can choose from three options within the ERM major: Environmental Science, Soil Science, and Water Science. Students are responsible for developing and implementing their academic plan in conjunction with an ERM advisor. Your advisor can be an invaluable resource, mentor and friend. Students are encouraged to meet with an ERM advisor on a regular basis (at least once a semester). E-mail is the most effective method for arranging an appointment or for getting a question answered by your advisor. Contact them well in advance of registration and other deadlines.

Students should also take an active role in planning their course work in order to meet all requirements and to graduate in a timely manner. Keep track of your progress by reviewing your Degree Audit on eLion: <https://elion.psu.edu/> and updating your ERM checksheet (page 9, 10, or 11, depending on your option) each semester.

CHOOSING YOUR SPECIALIZATION OR MINOR

All options within the ERM major require that each student develop a specialization relevant to the environment. This can be achieved by completing a University minor or by completing 12-18 credits of courses in a specialization of the student's choice. A University minor will be noted on your transcript; a specialization will not. Your advisor and/or other faculty members can be very helpful in making your decision about a minor or courses in your specialization. Your ERM advisor serves as the person in charge of specializations, some minors require faculty/advisor approval as well. Your advisor is your first point of contact when selecting a specialization or minor to complement your major.

UNIVERSITY MINORS

Approved University minors are a combined grouping of courses in a topical area and usually consist of 18-21 credits. There are a variety of environmental minors at Penn State that are relevant to ERM students. The requirements for each minor are defined in the Baccalaureate Degree Programs Bulletin (<http://bulletins.psu.edu/undergrad/programs/minors/>). Be sure that you are aware of the specific prerequisites for the minor early in your academic career. In some cases, a course selection for an official University minor is also listed as a prescribed ERM course (see ERM checksheet). When this "overlap" occurs, the course may be counted for both the minor and the prescribed ERM course. However, students must still satisfy the specialization requirement for the ERM major, and 12 of the 18 credits in the specialization requirement must be courses taken at the 300-400 level. Thus, minors that include prescribed ERM courses provide the opportunity for additional specialized course work, independent study, or internships, usually without increasing the number of credits needed to graduate from the major.

Listed below are some appropriate minors, but keep in mind that this list is not all-inclusive. If you are interested in a specific minor or specialization that is not mentioned, please consult with your ERM advisor.

SELECTED MINORS

Agronomy	Forest Ecosystem Management
Biology	Geographic Information Sciences
Climatology	Geography
Earth Systems	Geosciences
Energy, Business and Finance	Geographic Information Sciences
Energy, Environmental & Mineral Economics	International Agriculture
Engineering Entrepreneurship	Plant Pathology
Entomology	Sustainability Leadership
Environ. & Renewable Resource Economics	Watersheds and Water Resources
Entrepreneurship and Innovation	Wildlife & Fisheries Science
Environmental Engineering	
Environmental Soil Science	

SPECIALIZATIONS

The following specializations and courses are intended to be illustrative. Tailor selections to your interests and career goals. It is appropriate to consider courses that are not on the list. Remember to gain your advisor's counsel and approval before taking courses in your chosen specialization.

Each student must schedule 12 credits of 300-400 level courses as part of the 18-credit specialization. A combined total of 6 credits of ERM 495 (Internship) and/or ERM 496 (Independent Study) can be applied to the specialization. Check the latest Baccalaureate Degree Programs Bulletin for course restrictions and prerequisites.

AIR POLLUTION/AIR QUALITY

ERM	430 Air Pollution Impacts Terrestrial Ecosystems	METEO	122 Atmospheric Environment
	440 Chemistry of the Environment		
F SC	430 Air Pollution to Combustion Sources		497A Air Quality Forecasting (3)
ME	430 Fundamentals of Air Pollution		
	405 Indoor Air Quality		

BIOLOGY-ECOLOGY

BIOL	407 Plant Anatomy		
	412 Evolution of Infectious Diseases	ERM	450 Wetland Conservation
	414 Taxonomy of Seed Plants	FOR	203 Field Dendrology
	415 Ecotoxicology		308 Forest Ecology
	417 Invertebrate Zoology	FOR/WFS	430 Conservation Biology
	419 Ecol. & Environ. Problem Solving		408 Mammalogy
	427 Evolution		422 Ecology of Fishes
	428 Population Genetics		446 Wildlife & Fisheries Population Dynamics
	429 Animal Behavior		447W Wildlife Management
	441 Plant Physiology		452 Ichthyology
	446 Physiological Ecology		453 Ichthyology Lab
	448 Ecology of Plant Reproduction	MICRB	201 Introductory Microbiology
	450W Experimental Field Biology		202 Introductory Microbiology Lab
	463 General Ecology		400 Intro. Environmental Microbiology
		SOILS	412W Soil Ecology

CLIMATE CHANGE & GLOBAL WARMING

EARTH	002 Earth System	GEOG	412W Climatic Change and Variability
	103 Earth Future-Predicting Climate Change		430 Human Use of Environment
GEOG	030 Geog. Sustainability-Human/Environ		438W Human Dimensions of Global Warming
	110 Climates of the World	GEOSC	320 Geology of Climate Change
	310W Intro to Global Climatic Systems	STS	201 Climate Change, Energy & Biodiversity
FOR	201 Global Change and Ecosystems		

ENERGY & SOCIETY

EGEE	101 Energy & the Environment 102 Energy Conservation for Environmental Protection 120 Oil: International Evolution 401 Energy in a Changing World 438 Sustainable Energy Options	ENNEC	100 Minerals and Resources 484W Energy Economics 490 Applied Financial & Invest. Analysis
EMS	101 Resource Wars 301 Global Finance for Earth Energy & Mat. Indus. 420 Energy and Modern Society	MNG	400 Mining & Our Environment 445 Env. Concerns in Mining Industry
		MIN E	415 Mgmt. in Mineral Ind. for Env., Legal, Health & Safety Prob.
		S T S	201 Climate Change, Energy & Biodiversity 420 Energy & Modern Society 471 Radiation, Reactors & Society

ENVIRONMENTAL HEALTH AND TOXICOLOGY; INDUSTRIAL HYGIENE

BMB	433 Molecular & Cellular Toxicology	I H S	400 Prin. of Industrial Health & Safety
BIOL	415 Ecotoxicology		430 Ind. Health-Safety Program Mgmt.
C E	471 Environmental Sanitation		445 Ind. Hygiene & Toxicology
CHEM	402 Environmental Chemistry		450 Environmental Health & Safety
E R M	431 Environmental Toxicology		490 Industrial Health & Safety Seminar
H P A	410 Princ. of Public Health Admin. 440 Princ. of Epidemiology 445 Health Economics	L I R	444 Occupational Health
GEOSC	498 Hazardous Waste Operations & Emergency Response	MICRB	201 Introductory Microbiology 202 Introductory Microbiology Lab
FD SC	407 Food Toxins		400 Intro. Environmental Microbiology 401 Microbial Physiol. & Structure
		S T S	471 Radiation, Reactors & Society

RESOURCE ECONOMICS AND POLICY*

CED	450 Internat. Dev., Renewable Res., & the Environment	CED	431W Econ. Analysis of Environ.
AGECO	134 Sustainable Ag. Science & Policy	PHIL	118 Intro. to Environ. Philosophy 403 Environmental Ethics
ECON	302 Intermed. Microecon. Analysis 304 Intermed. Macroecon. Analysis 428 Environmental Economics	PL SC	001 Intro. to Amer. National Govt. 002 American Public Policy 003 Intro. to Comparative Politics
ENNEC	100 Intro. to Energy & Earth Sciences Econ. 482 Econ. of Minerals in the Environ. 484W Energy Economics 491 Mineral Policy Analysis		135 Politics of the Ecological Crisis 417 Amer. Local Govt. & Admin. 419 Bureaucracy & Public Policy
CED	429 Natural Resource Economics	CED	427W Society and Natural Resources
		SOC	447 Environment, Energy & Society

* Note: The Environmental and Renewable Resource Economics (E RRE) minor is also available and includes many courses on this list.

Please see the specific minor requirements online at http://www.psu.edu/bulletins/bluebook/major/e_rremin.htm

SOIL RESOURCES*

B E	477 Land Waste Disposal	SOILS	404 Urban Soils
FOR	470 Watershed Management		405 Hydropedology
GEOSC	452 Intro. to Hydrogeology		412W Soil Ecology
E R M	433 Trans. of Pollutants in Soils		416 Soil Genesis, Classification & Mapping
	440 Chemistry of the Environment		
	450 Wetland Conservation		418 Nutrient Management in Ag. Systems
SOILS	102 Intro. Soil Science Lab		419 Soil Environmental Chemistry
	401 Soil Comp. & Phys. Properties		420 Remediation of Contaminated Soils
	402 Soil Nutrient Behavior & Mgmt.		422 Nat. Res. Conserv. & Comm. Sustainability
	403 Soil Morphology Practicum		450 Environmental Geo. Inf. Systems (GIS)

* Note: The Environmental Soil Sciences (ESOIL) minor is also available and includes many courses on this list. Please see the specific minor requirements online at <http://www.psu.edu/bulletins/bluebook/major/esoilmin.htm>

WASTE MANAGEMENT

B E	477 Land Waste Disposal	SOILS	418 Nutrient Mgmt in Ag. Systems
C E	476 Solid and Hazardous Wastes		420 Remediation of Cont. Soils
ERM	430 Air Pollut. Impacts to Terrestrial Ecosystems	MIN E	415 Mgmt In the Mining Industry for Environmental, Legal, Health & Safety Problems
	433 Transformation of Pollutants in Soils		

WATER RESOURCES*

BIOL	417 Invertebrate Zoology	GEOG	362 Image Analysis
	450W Experimental Field Biology		431 Water Resources
C E	361 Engineering Hydrology	GEOSC	412 Water Resources Geochemistry
	471 Environmental Sanitation		419 Organic Geochemistry of Natural Waters and Sediments
	472W Env. Eng. Capstone Design		452 Introduction to Hydrogeology
	473 Water Quality Management	MNG	400 Mining and Our Environment
	475 Water Quality Chemistry		444 Groundwater in Mining
ENT	425 Freshwater Entomology		445 Environ Concerns in the Mining Ind.
ERM	435 Limnology		
	440 Chemistry of the Environment	SOILS	422 Nat. Res. Conserv. & Comm. Sustainability
	450 Wetland Conservation	W F S	410 General Fishery Science
FOR	470 Watershed Management		422 Ecology of Fishes
	471 Watershed Management Lab.		452 Ichthyology
GEOEE	408 Contaminant Hydrology		453 Ichthyology Laboratory

* Note: The Watersheds & Water Resources (WWR) minor is also available and includes many courses on this list. Please see the specific minor requirements online at http://www.psu.edu/bulletins/bluebook/major/w_w_r.htm

ENVIRONMENTAL EDUCATION

A concurrent B.S. degree program combines the Environmental Science Option in Agricultural and Extension Education with the ERM major and can provide teaching certification (Grades K-12) in environmental education and general science. The Agricultural and Extension Education requirements are in the Baccalaureate Degree Program Bulletin. Concurrent degrees with teaching certification can be earned with approximately one additional year of course work.

Student: _____
 PSU ID: _____
 Advisor: _____

The Pennsylvania State University
ENVIRONMENTAL RESOURCE MANAGEMENT
Environmental Science Option
 121 Credits Required

Specialization/Minor: _____
 Program Year: _____
 Expected Graduation Date: _____

REQUIREMENTS FOR THE MAJOR

Course	Cr.	Grade	Sem.	Course	Cr.	Grade	Sem.
Prescribed Courses (82/84 credits)				Supporting Courses (24 credits)			
Freshman Seminar (AG 150S)	(1-3)	_____	_____	<u>Communications/Entrepreneurship/</u>			
AG BM 200 or MGMT 215 or ERM 402	(3)	_____	_____	<u>Leadership selection</u> (select 1)	(3)	_____	_____
ASM 327*	(3)	_____	_____	AEE 360/440, CAS 211/213/214W/215			
BIOL 110 GN*	(4)	_____	_____	250/352, CIVCM 211, ERM 499, MGMT 215			
BIOL 220W GN	(4)	_____	_____	<u>Ecology</u> (select 1)	(3)	_____	_____
CAS 100 GWS	(3)	_____	_____	BIOL 415/436/444/446/448/450W/463/482,			
CED 201	(3)	_____	_____	ENT 420/425, ERM 430/431/435/450, HORT 445			
CHEM 110* GN	(3)	_____	_____	SOILS 412W, WFS 422/430/446			
CHEM 111* GN	(1)	_____	_____	<u>Specialization/ Minor</u> (<i>Consult w/ advisor; 18 cr.</i>)			
CHEM 112 GN	(3)	_____	_____	_____			
CHEM 202	(3)	_____	_____	_____			
ECON 102 or AG BM 101 GS	(3)	_____	_____	_____			
ENGL 015 GWS	(3)	_____	_____	_____			
ENGL 202C GWS	(3)	_____	_____	_____			
ERM 151*	(1)	_____	_____	_____			
ERM 300*	(3)	_____	_____	_____			
ERM 411	(3)	_____	_____	_____			
ERM 412*	(3)	_____	_____	_____			
ERM 413W*	(3)	_____	_____	_____			
ERM 43__	(3)	_____	_____	_____			
ERM 43__	(3)	_____	_____	_____			
GEOG 160 GS	(3)	_____	_____	Electives			
GEOG 303 or 001	(3)	_____	_____	_____			
MATH 110 or 140 GQ	(4)	_____	_____	_____			
MATH 111 or 141 GQ	(2/4)	_____	_____	_____			
PHYS 211 or 250 GN	(4)	_____	_____	_____			
SOILS 101* GN	(3)	_____	_____	_____			
SOILS 102	(1)	_____	_____	_____			
STAT 200 or 240 or 250 GQ	(3-4)	_____	_____	_____			

*C-required

GENERAL EDUCATION

Course	Cr.	Grade	Sem.
Skills (15 credits)			
<u>Communications</u> (GWS 9 credits)			
[satisfied by 9 credits from ENGL 015 or 030, ENGL 202C and CAS 100 in prescribed courses]			
<u>Quantification</u> (GQ 6 credits)			
[satisfied by 6 credits from MATH 110 or 140 and MATH 111 or 141 in Prescribed Courses]			
Knowledge Domain (30 credits)			
<u>Natural Sciences</u> (GN 9 credits)			
[satisfied by 9 credits from BIOL 110, BIOL 220W, CHEM 110, CHEM 111, CHEM 112, and PHYS 211/250 in Prescribed Courses]			
<u>Arts</u> (GA 6 credits)			
	(3)	_____	_____
	(3)	_____	_____
<u>Humanities</u> (GH 6 credits)			
	(3)	_____	_____
	(3)	_____	_____
<u>Social & Behavioral Sciences</u> (GS 6 cr)			
[satisfied by 6 credits from ECON 102 or AG BM 101 and GEOG 160 in Prescribed Courses]			
<u>Health & Physical Activity</u> (GHA 3 cr)			
		_____	_____
		_____	_____
US Cultures and International Cultures Requirement			
(3 credits US and 3 credits IL Required)			
[can be satisfied by GA/US, GA/IL, GH/US or GH/IL]			
	(US)	_____	_____
	(ILS)	_____	_____

Student: _____
 PSU ID: _____
 Advisor: _____

The Pennsylvania State University
ENVIRONMENTAL RESOURCE MANAGEMENT
Soil Science Option
 121 Credits Required

Specialization/Minor: _____
 Program Year: _____
 Expected Graduation Date: _____

REQUIREMENTS FOR THE MAJOR

Course	Cr.	Grade	Sem.	Course	Cr.	Grade	Sem.
Prescribed Courses (78/83 credits)				Supporting Courses (20-25 credits)			
Freshman Seminar (AG 150S)	(1-3)	_____	_____	<u>Specialization/ Minor</u> (Consult w/ advisor; 18 cr.)			
AGRO 28/HORT 101/FOR				_____	_____	_____	_____
203/TURF 235 or BIOL220W	(3/4)	_____	_____	_____	_____	_____	_____
ASM 327*	(3)	_____	_____	_____	_____	_____	_____
BIOL 127/110 GN	(3/4)	_____	_____	_____	_____	_____	_____
CAS 100 GWS	(3)	_____	_____	_____	_____	_____	_____
CHEM 110* GN	(3)	_____	_____	_____	_____	_____	_____
CHEM 111* GN	(1)	_____	_____	_____	_____	_____	_____
CHEM 112 GN	(3)	_____	_____	_____	_____	_____	_____
CHEM 202	(3)	_____	_____	_____	_____	_____	_____
ECON 102/AG BM 101 GS	(3)	_____	_____	_____	_____	_____	_____
ENGL 015 GWS	(3)	_____	_____	<u>Electives</u> (2-7 credits)			
ENGL 202C GWS	(3)	_____	_____	_____	_____	_____	_____
ERM 151*	(1)	_____	_____	_____	_____	_____	_____
ERM 300*	(3)	_____	_____	_____	_____	_____	_____
ERM 411	(3)	_____	_____	_____	_____	_____	_____
GEOSC 001 or 020	(3)	_____	_____	_____	_____	_____	_____
MATH 110 or 140 GQ	(4)	_____	_____	_____	_____	_____	_____
PHYS 211or 250 GN	(4)	_____	_____	_____	_____	_____	_____
SOILS 101* GN	(3)	_____	_____	_____	_____	_____	_____
SOILS 102	(1)	_____	_____	_____	_____	_____	_____
SOILS 403	(2)	_____	_____	_____	_____	_____	_____
SOILS 412W	(3)	_____	_____	_____	_____	_____	_____
SOILS 416*	(4)	_____	_____	_____	_____	_____	_____
SOILS 450	(3)	_____	_____	_____	_____	_____	_____
SOILS 401/405 or GEOSC 452	(3)	_____	_____	_____	_____	_____	_____
SOILS 402/419/420 or				_____	_____	_____	_____
ERM 433 or ERM 440	(3)	_____	_____	_____	_____	_____	_____
SOILS 404/ERM 444/FOR 475	(3)	_____	_____	_____	_____	_____	_____
STAT 200/240/250 GQ	(3-4)	_____	_____	_____	_____	_____	_____

*C-required

GENERAL EDUCATION

Course	Cr.	Grade	Sem.
Skills (15 credits)			
<u>Communications</u> (GWS 9 credits) [satisfied by 9 credits from ENGL 015 or 030, ENGL 202C and CAS 100 in prescribed courses]			
<u>Quantification</u> (GQ 6 credits) [satisfied by 6 credits from MATH 110 or 140 and STAT 200/240/250 in Prescribed Courses]			
Knowledge Domain (30 credits)			
<u>Natural Sciences</u> (GN 9 credits) [satisfied by 9 credits from BIOL 110 or 127, CHEM 110, CHEM 111, CHEM 112, and PHYS 211//250 in Prescribed Courses]			
<u>Arts</u> (GA 6 credits)			
_____	(3)	_____	_____
_____	(3)	_____	_____
<u>Humanities</u> (GH 6 credits)			
_____	(3)	_____	_____
_____	(3)	_____	_____
<u>Social & Behavioral Sciences</u> (GS 6 cr) [satisfied by 3 credits from ECON 102/AG BM 101]			
_____	(3)	_____	_____
<u>Health & Physical Activity</u> (GHA 3 cr)			
_____	_____	_____	_____
_____	_____	_____	_____
US Cultures and International Cultures Requirement (3 credits US and 3 credits IL Required) [can be satisfied by GA/US, GA/IL, GH/US or GH/IL]			
_____	(US)	_____	_____
_____	(IL)	_____	_____

Name: _____
 PSU ID: _____
 Advisor: _____

The Pennsylvania State University
ENVIRONMENTAL RESOURCE MANAGEMENT
Water Science Option
 121 Credits Required

Specialization/Minor: _____
 Program Year: _____
 Expected Graduation Date: _____

REQUIREMENTS FOR THE MAJOR

Course	Cr.	Grade	Sem.	Course	Cr.	Grade	Sem.
Prescribed Courses (90/96 credits)				Supporting Courses (15 credits)			
Freshman Seminar (AG 150S)	(1-3)	_____	_____	Communications/Entrepreneurship			
ASM 327*	(3)	_____	_____	Leadership selection (select 1)	(3)	_____	_____
BIOL 110 GN*	(4)	_____	_____	AEE 360/ 440, CAS 211/213/214W			
BIOL 220W GN	(4)	_____	_____	/215/250/352, CIVCM 211, ERM 499,			
CAS 100 GWS	(3)	_____	_____	Or MGMT 215			
CED 201	(3)	_____	_____				
CHEM 110* GN	(3)	_____	_____	<u>Specialization/ Minor (Consult w/ advisor; 12 cr.)</u>			
CHEM 111* GN	(1)	_____	_____	_____			
CHEM 112 GN	(3)	_____	_____	_____			
CHEM 202	(3)	_____	_____	_____			
ECON 102 or AG BM 101 GS	(3)	_____	_____	_____			
ENGL 015 GWS	(3)	_____	_____				
ENGL 202C GWS	(3)	_____	_____				
ERM 151*	(1)	_____	_____				
ERM 300*	(3)	_____	_____				
ERM/ASM 309	(3)	_____	_____				
ERM 411	(3)	_____	_____				
ERM 412*	(3)	_____	_____				
ERM 413W*	(3)	_____	_____				
ERM 435	(3)	_____	_____				
ERM 447	(3)	_____	_____				
ERM 450	(3)	_____	_____				
FOR 470	(3)	_____	_____				
GEOG 160 GS	(3)	_____	_____				
GEOSC 452, SOILS 401 or 405	(3)	_____	_____				
MATH 110 or 140 GQ	(4)	_____	_____				
MATH 111 or 141 GQ	(2/4)	_____	_____				
PHYS 211 or 250 GN	(4)	_____	_____				
SOILS 101* GN	(3)	_____	_____				
SOILS 102	(1)	_____	_____				
STAT 200/240/250 GQ	(3-4)	_____	_____				
ENT 425, ERM 440, FOR 303/ 403, CE 370, or WFS 410/422	(3)	_____	_____				

***C-required**

Last Updated 06/2014

GENERAL EDUCATION

Course	Cr.	Grade	Sem.
Skills (15 credits)			
<u>Communications</u> (GWS 9 credits) [satisfied by 9 credits from ENGL 015 or 030, ENGL 202C and CAS 100 in prescribed courses]			
<u>Quantification</u> (GQ 6 credits) [satisfied by 6 credits from MATH 110 or 140 and MATH 111 or 141 in Prescribed Courses]			
Knowledge Domain (30 credits)			
<u>Natural Sciences</u> (GN 9 credits) [satisfied by 9 credits from BIOL 110, BIOL 220W, CHEM 110, CHEM 111, CHEM 112, and PHYS 211/250 in Prescribed Courses]			
<u>Arts</u> (GA 6 credits)			
_____	(3)	_____	_____
_____	(3)	_____	_____
<u>Humanities</u> (GH 6 credits)			
_____	(3)	_____	_____
_____	(3)	_____	_____
<u>Social & Behavioral Sciences</u> (GS 6 cr) [satisfied by 6 credits from ECON 102 or AG BM 101 and GEOG 160 in Prescribed Courses]			
<u>Health & Physical Activity</u> (GHA 3 cr)			
_____		_____	_____
_____		_____	_____
US Cultures and International Cultures Requirement (3 credits US and 3 credits IL Required) [can be satisfied by GA/US, GA/IL, GH/US or GH/IL]			
_____	(US)	_____	_____
_____	(IL)	_____	_____

**Recommended Academic Plan ERM - Environmental Science Option
Beginning at the University Park Campus**

Semester 1 (FALL)	Credits	Semester 2 (SPRING)	Credits
CHEM 110 (GN)	3	CHEM 112 (GN)	3
ECON 102 or AG BM 101 (GS)	3	ENGL 015 or 030 (GWS)	3
MATH 110 or 140* (GQ)	4	MATH 111 or 141* (GQ)	2-4
AG 150S (First-Year Seminar)	2	CAS 100 (GWS)	3
ERM 151	1	Arts or Humanities (GA/GH)	3
Arts or Humanities (GA/GH)	3		
Total Credits:	16	Total Credits:	14-16
Semester 3	Credits	Semester 4	Credits
BIOL 110 (GN) (fall only)	4	STAT 200, 240 or 250	3-4
CHEM 111 (GN)	1	BIOL 220W (GN) (spring only)	4
CHEM 202 (GN)	3	PHYS 211 or 250* (GN)	4
SOILS 101 (GN)	3	GEOG 160 (GS)	3
SOILS 102	1	Health and Physical Activity (GHA)	1.5
Arts or Humanities (GA/GH)	3		
Total Credits:	15	Total Credits:	15.5-16.5
Semester 5	Credits	Semester 6	Credits
AG BM 200 or MGMT 215 or ERM 402	3	ENGL 202C (GWS)	3
ERM 411 (fall only)	3	CED 201 (spring only)	3
ASM 327 (fall only)	3	ERM 300	3
GEOSC 303 (fall only) or GEOSC 001	3	Specialization/Minor Courses ³	6
Arts or Humanities (GA/GH)	3	Health and Physical Activity (GHA)	1.5
Total Credits:	15	Total Credits:	16.5
Semester 7	Credits	Semester 8	Credits
Ecology Selection ¹	3	Communications/Entrepreneurship/Leadership Selection ²	3
ERM 412	3	ERM 413W (spring only)	3
ERM 4XX	3	ERM 4XX	3
Specialization/Minor Courses ³	6	Specialization/Minor Courses ³	6
Total Credits:	15	Total Credits:	15

Program Notes:

¹ Choose one from: BIOL 415/436/444/446/448/450W/463/482, ENT 420/425, ERM 430/431/435/450, HORT 445, SOILS 412W, WFS 422/430/446

² Choose one from: AEE 360, 440, CAS 211/213/214W/215/250/352, CIVCM 211, ERM 499, MGMT 215

³ Select from approved list. Students must consult with their ERM adviser when making these selections

Academic Advising Notes:* For those students with non-engineering interests (specialization areas like soils, water resources, wildlife, biology, ecology, environmental policy) should take MATH 110, MATH 111, and PHYS 250. For those students interested in obtaining the Environmental Engineering minor, MATH 140, MATH 141, and PHYS 211 are required. Most ERM students take MATH 110, 111, and PHYS 250 and specialize in areas pertaining to natural resource conservation.

**Recommended Academic Plan for ERM - Environmental Science Option
Beginning at a Commonwealth Campus**

Semester 1 (FALL)	Credits	Semester 2 (SPRING)	Credits
CHEM 110 (GN)	3	CHEM 112 (GN)	3
CHEM 111 (GN)	1	ENGL 015 or 030 (GWS)	3
ECON 102 or AG BM 101 (GS)	3	MATH 111 or 141* (GQ)	2-4
MATH 110 or 140* (GQ)	4	CAS 100 (GWS)	3
Arts or Humanities (GA/GH)	3	Arts or Humanities (GA/GH)	3
First-Year Seminar ⁺	1-3		
Total Credits:	15-17	Total Credits:	14-16
Semester 3	Credits	Semester 4	Credits
BIOL 110 (GN)	4	BIOL 220W (GN) (spring only)	4
CHEM 202 (GN)	3	PHYS 211 or 250* (GN)	4
STAT 200 , 240 or 250	3-4	ENGL 202C (GWS)	3
Arts or Humanities (GA/GH)	3	Arts or Humanities (GA/GH)	3
Health and Physical Activity (GHA)	1.5	Health and Physical Activity (GHA)	1.5
Total Credits:	14.5-15.5	Total Credits:	15.5
Semester 5	Credits	Semester 6	Credits
ERM 151 (fall only)	1	AG BM 200 or MGMT 215 or ERM 402	3
SOILS 101 (GN)	3	CED 201 (spring only)	3
SOILS 102	1	ERM 300	3
ERM 411 (fall only)	3	Specialization/Minor Courses ³	6
ASM 327 (fall only)	3		
GEOSC 303 (fall only) or GEOSC 001	3		
GEOG 160 (GS)	3		
Total Credits:	17	Total Credits:	15
Semester 7	Credits	Semester 8	Credits
Ecology Selection ¹	3	Communications/Entrepreneurship/Leadership Selection ²	3
ERM 412	3	ERM 413W (spring only)	3
ERM 4XX	3	ERM 4XX	3
Specialization/Minor Courses ³	6	Specialization/Minor Courses ³	6
Total Credits:	15	Total Credits:	15

Program Notes: ¹ Choose one from: BIOL 415/436/444/446/448/450W/463/482, ENT 420/425 ERM 430/431/435/450, HORT 445, SOILS 412W, WFS 422/430/446

² Choose one from: AEE 360, 440, CAS 211/213/214W/215/250/352, CIVCM 211, ERM 499, MGMT 215 ³ Select from approved list. Students must consult with their ERM adviser when making these selections. **Academic Advising Notes:*** For those students with non-engineering interests (specialization areas like soils, water resources, wildlife, biology, ecology, environmental policy) should take MATH 110, MATH 111, and PHYS 250. For those students interested in obtaining the Environmental Engineering minor, MATH 140, MATH 141, and PHYS 211 are required. Most ERM students take MATH 110, 111, and PHYS 250 and specialize in areas pertaining to natural resource conservation. +For campuses that do not require a first-year seminar and offer an alternative first-year engagement plan, this first-year seminar requirement will be waived. A student must, however, still meet the minimum number of credits required for graduation (121) from this major which may require the student to take an additional elective.

**Recommended Academic Plan for ERM - Soil Science Option
Beginning at the University Park Campus**

Semester 1 (FALL)	Credits	Semester 2 (SPRING)	Credits
CHEM 110 (GN)	3	CHEM 112 (GN)	3
ECON 102 or AG BM 101 (GS)	3	ENGL 015 or 030 (GWS)	3
MATH 110 or 140* (GQ)	4	SOILS 101 (GN)	3
AG 150S (First-Year Seminar)	2	SOILS 102	1
ERM 151 (fall only)	1	CAS 100 (GWS)	3
Arts or Humanities (GA/GH)	3	Arts or Humanities (GA/GH)	3
Total Credits:	16	Total Credits:	16
Semester 3	Credits	Semester 4	Credits
BIOL 110 or 127 (GN)	3-4	PHYS 211 or 250* (GN)	4
CHEM 111 (GN)	1	GEOSC 020 (GN) or 001	3
CHEM 202 (GN)	3	STAT 200 , 240 or 250	3-4
AGRO 028 , HORT 101 , TURF 235 , BIOL 220W or FOR 203	3-4	Social and Behavioral Sciences (GS)	3
Arts or Humanities (GA/GH)	3		
Total Credits:	13-15	Total Credits:	13-14
Semester 5	Credits	Semester 6	Credits
SOILS 412W (fall only)	3	ENGL 202C (GWS)	3
ERM 411 (fall only)	3	SOILS 402 , 420 , ERM 433 , or ERM 440	3
ASM 327 (fall only)	3	SOILS 401 , 405 or GEOSC 452	3
SOILS 403 (fall only)	2	ERM 300	3
Specialization/Minor ¹	3	Specialization/Minor ¹	3
Health and Physical Activity (GHA)	1.5		
Total Credits:	15.5	Total Credits:	15
Semester 7	Credits	Semester 8	Credits
SOILS 416 (fall only)	4	SOILS 404 , ERM 444 , or FOR 475	3
SOILS 450 (fall only)	3	Specialization/Minor ¹	3
Specialization/Minor ¹	3	Arts or Humanities (GA/GH)	3
Specialization/Minor ¹	3	Elective ¹	2-7
Specialization/Minor ¹	3	Health and Physical Activity (GHA)	1.5
Total Credits:	16	Total Credits:	12.5-17.5

Program Notes: ¹Select from approved list. Students must consult with their adviser when making these selections. **Academic Advising Notes:** * For those students interested in obtaining the Environmental Engineering minor, MATH 140, MATH 141, and PHYS 211 are required. Students with a non-engineering minor or specialization area (e.g. agronomy, wildlife, biology, ecology) may take MATH 110, and PHYS 250 (MATH 111/141 not required for Soil Science Option of the major).

**Recommended Academic Plan ERM - Soil Science Option
Beginning at a Commonwealth Campuses**

Semester 1 (FALL)	Credits	Semester 2 (SPRING)	Credits
CHEM 110 (GN)	3	CHEM 112 (GN)	3
ECON 102 or AG BM 101 (GS)	3	ENGL 015 or 030 (GWS)	3
MATH 110 or 140* (GQ)	4	CAS 100 (GWS)	3
First-Year Seminar ⁺	1-3	GEOSC 020 (GN) or 001	3
Arts or Humanities (GA/GH)	3	Arts or Humanities (GA/GH)	3
Total Credits:	14-16	Total Credits:	15
Semester 3	Credits	Semester 4	Credits
BIOL 110 or 127 (GN)	3-4	PHYS 211 or 250* (GN)	4
CHEM 111 (GN)	1	ENGL 202C (GWS)	3
CHEM 202 (GN)	3	Social and Behavioral Sciences (GS)	3
STAT 200 , 240 or 250	3-4	Arts or Humanities (GA/GH)	3
Arts or Humanities (GA/GH)	3	Health and Physical Activity (GHA)	1.5
Health and Physical Activity (GHA)	1.5		
Total Credits:	14.5-16.5	Total Credits:	14.5
Semester 5	Credits	Semester 6	Credits
SOILS 101 (GN)	3	SOILS 402 , 420 , ERM 433 , or ERM 440	3
SOILS 102	1	SOILS 401 , 405 or GEOSC 452	3
SOILS 412W (fall only)	3	ERM 300	3
ERM 411 (fall only)	3	Specialization/Minor ¹	3
ASM 327 (fall only)	3	AGRO 28/HORT 101/TURF 235/BIOL 220W or FOR 203	3-4
ERM 151 (fall only)	1		
SOILS 403 (fall only)	2		
Total Credits:	16	Total Credits:	15-16
Semester 7	Credits	Semester 8	Credits
SOILS 416 (fall only)	4	SOILS 404 , ERM 444 , or FOR 475	3
SOILS 450 (fall only)	3	Specialization/Minor ¹	6
Specialization/Minor ¹	9	Arts or Humanities (GA/GH)	3
		Elective ¹	2-7
Total Credits:	16	Total Credits:	14-19

Program Notes: ¹ Select from approved list. Students must consult with their adviser when making these selections. **Academic Advising Notes:** * For those students interested in obtaining the Environmental Engineering minor, MATH 140, MATH 141, and PHYS 211 are required. Students with a non-engineering minor or specialization area (e.g. agronomy, wildlife, biology, ecology) may take MATH 110, and PHYS 250 (MATH 111/141 not required for Soil Science Option of the major).⁺For campuses that do not require a first-year seminar and offer an alternative first-year engagement plan, this first-year seminar requirement will be waived. A student must, however, still meet the minimum number of credits required for graduation from this major which may require the student to take an additional elective.

**Recommended Academic Plan for ERM - Water Science Option
Beginning at the University Park Campus**

Semester 1 (FALL)	Credits	Semester 2 (SPRING)	Credits
CHEM 110 (GN)	3	CHEM 112 (GN)	3
ECON 102 or AG BM 101 (GS)	3	ENGL 015 or 030 (GWS)	3
MATH 110 or 140* (GQ)	4	MATH 111 or 141* (GQ)	2-4
AG 150S (First-Year Seminar)	2	CAS 100 (GWS)	3
ERM 151	1	Arts or Humanities (GA/GH)	3
Arts or Humanities (GA/GH)	3		
Total Credits:	16	Total Credits:	14-16
Semester 3	Credits	Semester 4	Credits
BIOL 110 (GN)	4	STAT 200, 240 or 250	3-4
CHEM 111 (GN)	1	BIOL 220W (GN) (spring only)	4
CHEM 202 (GN)	3	PHYS 211 or 250 (GN)	4
SOILS 101 (GN)	3	GEOG 160 (GS)	3
SOILS 102	1	Health and Physical Activity (GHA)	1.5
Health and Physical Activity (GHA)	1.5		
Arts or Humanities (GA/GH)	3		
Total Credits:	16.5	Total Credits:	15.5-16.5
Semester 5	Credits	Semester 6	Credits
ERM/ASM 309 (fall only)	3	ENGL 202C (GWS)	3
ERM 411 (fall only)	3	CED 201 (spring only)	3
ASM 327 (fall only)	3	ERM 300 (spring only)	3
ERM 435 (fall only)	3	Specialization/Minor Courses ²	6
Arts or Humanities (GA/GH)	3		
Total Credits:	15	Total Credits:	15
Semester 7	Credits	Semester 8	Credits
Communications/Entrepreneurship/Leadership Selection ²	3	ERM 412	3
ERM 450 (fall only)	3	ERM 413W (spring only)	3
ERM 447 (fall only)	3	FOR 470 (spring only)	3
GEOSC 452 or SOILS 401 or SOILS 405 (fall only)	3	Specialization/Minor Courses ²	6
WFS 410, WFS 422 or C E 370(3), E R M 440(3), ENT 425(3), FOR 303(3), FOR 403(3) (Sem: 5-8)	3		
Total Credits:	15	Total Credits:	15

Program Notes: ¹ Choose one from: AEE 360, 440, CAS 211/213/214W/215/250/352, CIVCM 211, ERM 499, MGMT 215 ² Select from approved list. Students must consult with their ERM adviser when making these selections. **Academic Advising Notes:** * For those students with non-engineering interests (specialization areas like soils, water resources, wildlife, biology, ecology, environmental policy) should take MATH 110, MATH 111, and PHYS 250. For those students interested in obtaining the Environmental Engineering minor, MATH 140, MATH 141, and PHYS 211 are required. Most ERM students take MATH 110, 111, and PHYSICS 250 and specialize in areas pertaining to natural resource conservation.

**Recommended Academic Plan for ERM - Water Science Option
Beginning at a Commonwealth Campus**

Semester 1 (FALL)	Credits	Semester 2 (SPRING)	Credits
CHEM 110 (GN)	3	CHEM 112 (GN)	3
CHEM 111 (GN)	1	ENGL 015 or 030 (GWS)	3
ECON 102 or AG BM 101 (GS)	3	MATH 111 or 141* (GQ)	2-4
MATH 110 or 140* (GQ)	4	CAS 100 (GWS)	3
Arts or Humanities (GA/GH)	3	Arts or Humanities (GA/GH)	3
First-Year Seminar*	1-3		
Total Credits:	15-17	Total Credits:	14-16
Semester 3	Credits	Semester 4	Credits
BIOL 110 (GN) (fall only)	4	BIOL 220W (GN)	4
CHEM 202 (GN)	3	PHYS 211 or 250* (GN)	4
STAT 200, 240 or 250	3-4	ENGL 202C (GWS)	3
Health and Physical Activity (GHA)	1.5	Health and Physical Activity (GHA)	1.5
Arts or Humanities (GA/GH)	3	Arts or Humanities (GA/GH)	3
Total Credits:	14.5-15.5	Total Credits:	15.5
Semester 5	Credits	Semester 6	Credits
ERM 151 (fall only)	1	CED 201 (spring only)	3
ERM/ASM 309 (fall only)	3	ERM 300 (spring only)	3
ERM 411 (fall only)	3	Specialization/Minor Courses ²	6
ASM 327 (fall only)	3	Arts or Humanities (GA/GH)	3
ERM 435 (fall only)	3		
SOILS 101 (GN)	3		
SOILS 102	1		
Total Credits:	17	Total Credits:	15
Semester 7	Credits	Semester 8	Credits
Communications/Entrepreneurship/Leadership Selection ²	3	ERM 412	3
ERM 450 (fall only)	3	ERM 413W (spring only)	3
ERM 447 (fall only)	3	FOR 470 (spring only)	3
GEOSC 452 or SOILS 405 (fall only)	3	Specialization/Minor Courses ²	6
WFS 410, WFS 422, or ERM 436 (fall only)	3		
Total Credits:	15	Total Credits:	15

Program Notes: ¹ Choose one from: AEE 360, 440, CAS 211/213/214W/215/250/352, CIVCM 211, ERM 499, MGMT 215 ² Select from approved list. Students must consult with their ERM adviser when making these selections. **Academic Advising Notes:** * For those students with non-engineering interests (specialization areas like soils, water resources, wildlife, biology, ecology, environmental policy) should take MATH 110, MATH 111, and PHYS 250. For those students interested in obtaining the Environmental Engineering minor, MATH 140, MATH 141, and PHYS 211 are required. Most ERM students take MATH 110, 111, and PHYSICS 250 and specialize in areas pertaining to natural resource conservation. *For campuses that do not require a first-year seminar and offer an alternative first-year engagement plan, this first-year seminar requirement will be waived. A student must, however, still meet the minimum number of credits required for graduation (121) from this major which may require the student to take an additional elective.

Course Descriptions in the ERM Curriculum

[AG 150S](#) **BE A MASTER STUDENT**(2) Students explore agricultural issues and research methodologies through literature review, library searches, field studies, and critical thinking. Prerequisite: first- or second-semester standing.

[AG BM 101](#) (GS) **ECONOMIC PRINCIPLES OF AGRIBUSINESS DECISION MAKING** (3) Introduction to economic principles and their application to real world examples of agribusiness management issues.

[AG BM 200](#) **INTRODUCTION TO AGRICULTURAL BUSINESS MANAGEMENT** (3) Application of management principles and processes to agricultural business firms in their planning and operating in domestic and international markets.

[AGRO 028](#) **PRINCIPLES OF CROP MANAGEMENT** (3) Biological and agronomic principles applied to production and management of major feed and forage crops of the northeastern United States.

[A S M 327](#) **SOIL AND WATER RESOURCE MANAGEMENT** (3) Soil and water management systems and practices including hydrology, surface drainage, open channels, and erosion, subsurface drainage, impoundments and irrigation. Prerequisite: [PHYS 250](#)

[BIOL 110](#) (GN) **BIOLOGY: BASIC CONCEPTS AND BIODIVERSITY** (4) A study of the evolution of the major groups of organisms including the fundamental concepts of biology.

[BIOL 127](#) (GN) **INTRODUCTION TO PLANT BIOLOGY** (3) Cellular structure and organization; physiological processes; classification; reproduction and development; relationship of plant groups. Students who have passed BIOL 240W may not schedule this course.

[BIOL 220W](#) (GN) **BIOLOGY: POPULATIONS AND COMMUNITIES** (4) A study of the structures and functions of organismic interactions from simple populations to complex ecosystems. (BIOL 220W, 230W, and 240W each carry only 1 credit of "writing"; all three courses must be taken to meet the writing requirement.) Prerequisite: BIOL 110

[CAS 100](#) (GWS) **EFFECTIVE SPEECH** (3) Introduction to speech communication: formal speaking, group discussion, analysis and evaluation of messages.

[C E D 201](#) (AG EC) **INTRODUCTORY ENVIRONMENTAL AND RESOURCE ECONOMICS** (3) Apply principles of economics to analyze environmental protection policies and natural resource use decision. Examine contemporary policy issues. Prerequisite: [AG BM 101](#) or [ECON 102](#)

[CHEM 110](#) (GN) **CHEMICAL PRINCIPLES I** (3) Effective Date: SU2007 Basic concepts and quantitative relations. Prerequisite: satisfactory performance on the Chemistry and Math FTCAP tests-- i.e., placement beyond the level of CHEM 101 and MATH 022; or [CHEM 101](#), and [MATH 022](#) or [MATH 041](#)

[CHEM 111](#) (GN) **EXPERIMENTAL CHEMISTRY I** (1) Effective Date: SU2007 Introduction to quantitative experimentation in chemistry. Prerequisite: or concurrent: [CHEM 110](#) or [CHEM 106](#)

[CHEM 112](#) (GN) **CHEMICAL PRINCIPLES II** (3) Effective Date: SU2007 Continuation of CHEM 110, including an introduction to the chemistry of the elements. Prerequisite: [CHEM 110](#) or [CHEM 106](#). Prerequisite or concurrent: [CHEM 111](#)

[CHEM 202](#) **FUNDAMENTALS OF ORGANIC CHEMISTRY I** (3) Effective Date: SU2007
Introduction to organic chemistry, with emphasis on the properties of organic compounds of biochemical importance. Because of duplication of subject matter, students may not receive credit for both CHEM 202 and CHEM 210. Prerequisite: [CHEM 101](#) or [CHEM 110](#) or [CHEM 106](#)

[ECON 102](#) (GS) **INTRODUCTORY MICROECONOMIC ANALYSIS AND POLICY** (3) Methods of economic analysis and their use; price determination; theory of the firm; distribution.

[ENGL 015](#) (GWS) **RHETORIC AND COMPOSITION** (3) Instruction and practice in writing expository prose that shows sensitivity to audience and purpose. Prerequisite: [ENGL 004](#) or satisfactory performance on the English proficiency examination.

[ENGL 202C](#) (GWS) **EFFECTIVE WRITING: TECHNICAL WRITING** (3) Writing for students in scientific and technical disciplines. (A student may take only one course for credit from ENGL 202A, 202B, 202C, and 202D.) Prerequisite: [ENGL 015](#) or [ENGL 030](#) ; fourth-semester standing.

[E R M 151](#) **CAREERS AND ISSUES IN ENVIRONMENTAL RESOURCE MANAGEMENT** (1)
Career opportunities and topical issues in the environmental sciences.

[E R M 300](#) **BASIC PRINCIPLES AND CALCULATIONS IN ENVIRONMENTAL ANALYSIS** (3)
This course will teach basic problem solving skills while using examples taken from environmental media--air, water, and soil. Effective: Fall 2010
Prerequisite: 3 credits in BIOL; [CHEM 111](#); [MATH 110](#) or [MATH 140](#); [PHYS 250](#) or [PHYS 211](#)

[ER M 309](#) (A S M 309) **MEASUREMENT & MONITORING OF HYDROLOGIC SYSTEMS** (3)
Introduction to measurement and monitoring equipment/techniques commonly used in analyses and design of hydrologic systems. Prerequisite: [PHYS 211](#) or [PHYS 250](#), [CHEM 110](#)

[E R M 402](#) **Foundations of Sustainable Business** (3) Emphasis on understanding business strategies for enhancing sustainable operations, including issues related to the natural environment and corporate social responsibility.
Prerequisite: [AG BM 101](#) or [ECON 102](#) or [ECON 104](#)

[E R M 411](#) **LEGAL ASPECTS OF RESOURCE MANAGEMENT** (3) Legal systems and lawmaking processes; property rights in land, water, and wildlife resources; jurisdictional problems in planning resource use.
Prerequisite: [E R M 151](#)

[E R M 412](#) **RESOURCE SYSTEMS ANALYSIS** (3) The concept of systems; techniques of analysis, including input/output, mathematical programming, and simulation; application to resource systems. Prerequisite: [BIOL 220W](#) , [E R M 151](#) , [E R M 300](#) , and [STAT 240](#) ; [MATH 111](#) or [MATH 141](#)

[E R M 413W](#) **CASE STUDIES IN ECOSYSTEM MANAGEMENT** (3) Application of biological, physical, and social science principles to ecosystem management problems; introduction to environmental impact analysis and review. Prerequisite: [BIOL 220W](#) , [SOILS 101](#) . Prerequisite or concurrent: [E R M 412](#)

[E R M 430](#) (PPATH) **AIR POLLUTION IMPACTS TO TERRESTRIAL ECOSYSTEMS** (3)
Overview of the direct and indirect effects of air pollutants on terrestrial plants and ecosystems.
Prerequisite: [BIOL 220W](#) or [FOR 308](#)

[E R M 431](#) **ENVIRONMENTAL TOXICOLOGY** (3) Effects of pollutants on animal health at the chemical, physical, and cellular level. Prerequisite: [BIOL 110](#) , [CHEM 110](#) , [CHEM 112](#)

[E R M 433](#) **TRANSFORMATION OF POLLUTANTS IN SOILS** (3) Processes regulating fate and transport of metals, organics, nutrients, salts, pathogens, and radionuclides in soil systems. Prerequisite: [CHEM 111](#) , [CHEM 112](#) , [SOILS 101](#)

[E R M 435](#) (W F S) **LIMNOLOGY** (3) Biogeochemistry and natural history of freshwater ecosystems. Prerequisite: [BIOL 110](#) , [BIOL 220W](#) , [CHEM 110](#)

[E R M 440](#) **Chemistry of the Environment: Air, Water, and Soil** (3) A global perspective of the chemical principles, composition and processes that operate within and between air, water, and soil environments. Prerequisite: [CHEM 110](#), [CHEM 111](#), [CHEM 112](#); [CHEM 202](#) or [CHEM 210](#)

[E R M 444](#) **Environmental Biophysics** (3) Analysis of the interaction of living organisms and their microenvironment by applying biophysical principles and engineering methods. Prerequisite: [BIOL 110](#); [MATH 110](#) or [MATH 140](#); [PHYS 250](#) or [PHYS 211](#)

[E R M 447](#) **STREAM RESTORATION** (3) Stream restoration including fluvial geomorphology, stream classification, impairment, sediment transport, stable stream design, and watershed assessment. Prerequisite: [A S M 327](#) or [A B E 307](#) or [C E 361](#)

[E R M 450](#) (W F S) **WETLAND CONSERVATION** (3) Wetland types, classification, functions and values; hydrology, soils, and plants; introduction to wetland identification and delineation; wetland regulations. Prerequisite: [E R M 300](#) or [W F S 209](#)

[E R M 499](#) (IL) **Foreign Studies** (1-12) Supervised student activities on research projects identified on an individual or small-group basis.
Effective: Summer 2005

[FOR 203](#) **FIELD DENDROLOGY** (3) Field identification of native and introduced trees and shrubs by leaf, fruit, twig, and bark. Concurrent: [FOR 200W](#) or [W P 200W](#) and [W P 203](#)
ncurrent: [FOR 200W](#) or [W P 200W](#) and [W P 203](#)

[FOR 470](#) **WATERSHED MANAGEMENT** (3) Management of wild land watersheds for control of the amount and timing of water yield, water quality, erosion, and sedimentation. Prerequisite: 3 credits in Soils

[GEOG 160](#) (GS) **MAPPING OUR CHANGING WORLD** (3) Fundamental concepts of GIS, cartography, remote sensing, and GPS in the context of environmental and social problems.

[GEOSC 001](#) **PHYSICAL GEOLOGY** (3) Earth processes and their effects on the materials, structure, and morphology of the earth's crust. Practicum includes field work, study of rocks, minerals, dynamic models, and topographic maps.

[GEOSC 020](#) (GN) **PLANET EARTH** (3) Nontechnical presentation of earth processes, materials, and landscape. Practicum includes field trips, study of maps, rocks, and dynamic models, introduction to geologic experimentation.

[GEOSC 303](#) **INTRODUCTION TO ENVIRONMENTAL GEOLOGY** (3) Origin of earth and earth materials; natural resources, geologic barriers and hazards, and relationships to human use of the environment.

[GEOSC 452](#) **HYDROGEOLOGY** (3) Hydrologic cycle: occurrence, movement, quality, and quantity of groundwater; solute transport; quantitative hydrogeologic methods; role of water in geologic processes. This course has one or more required field trips for which a fee may be charged to the student. Prerequisite: [CHEM 112](#); [GEOSC 001](#), [GEOSC 020](#) or [GEOSC 071](#); [MATH 140](#) or [MATH 110](#)

[HORT 101](#) (GN) **HORTICULTURAL SCIENCE** (3) Introduction to horticulture with emphasis on plant domestication, morphology, classification, world food crops, commodities, gardens, propagation, and agrochemicals.

[MATH 110](#) (GQ) **TECHNIQUES OF CALCULUS I** (4) Functions, graphs, derivatives, integrals, techniques of differentiation and integration, exponentials, improper integrals, applications. Students may take only one course for credit from MATH 110, 140, 140A, and 140B. Prerequisite: [MATH 022](#) or satisfactory performance on the mathematics proficiency examination

[MATH 111](#) (GQ) **TECHNIQUES OF CALCULUS II** (2) Analytic geometry, partial differentiation, maxima and minima, differential equations. Prerequisite: [MATH 110](#)

[MATH 140](#) (GQ) **CALCULUS WITH ANALYTIC GEOMETRY I** (4) Functions, limits; analytic geometry; derivatives, differentials, applications; integrals, applications. Students may only take one course for credit from MATH 110, 140, 140A, 140B, and 140H. Prerequisite: [MATH 022](#) , [MATH 026](#) ; or [MATH 040](#) or [MATH 041](#) or satisfactory performance on the mathematics proficiency examination

[MATH 141](#) (GQ) **CALCULUS WITH ANALYTIC GEOMETRY II** (4) Derivatives, integrals, applications; sequences and series; analytic geometry; polar coordinates. Students may take only one course for credit from MATH 141, 141B, and 141H. Prerequisite: [MATH 140](#) , [MATH 140A](#) , [MATH 140B](#) , or [MATH 140H](#)

[PHYS 211](#) (GN) **GENERAL PHYSICS: MECHANICS** (4) Calculus-based study of the basic concepts of mechanics: motion, force, Newton's laws, energy, collisions, and rotation. Concurrent: [MATH 140](#)

[PHYS 250P](#) (GN) **INTRODUCTORY PHYSICS I** Selected topics in mechanics, heat, and sound. Prerequisite: [MATH 022](#) , [MATH 026](#) ; or [MATH 040](#) ; or [MATH 041](#) or satisfactory performance on the mathematics proficiency examination

[SOILS 101](#) (GN) **INTRODUCTION TO SOILS** (3) A study of soil characteristics and their relationship to land use, plant growth, environmental quality, and society/culture.

[SOILS 102](#) **INTRODUCTORY SOIL SCIENCE LAB** (1) Laboratory exercise and field trips designed to develop student competency in soil description, analysis, and assessment. Prerequisite: [SOILS 101](#) Concurrent: [SOILS 101](#)

[SOILS 401](#) **SOIL COMPOSITION AND PHYSICAL PROPERTIES** (3) Advanced study of mineralogical and physical properties of soils which affect soil-plant-water relationships. Prerequisite: [SOILS 101](#)

[SOILS 402](#) **SOIL NUTRIENT BEHAVIOR AND MANAGEMENT** (3) Chemical and biological behavior of soil nutrients; management for plant availability and fate in the environment. Laboratory emphasizes soil testing and soil-plant relationships. Prerequisite: [CHEM 112](#), [SOILS 101](#)

[SOILS 403](#) **SOIL MORPHOLOGY PRACTICUM** (2 per semester/maximum of 4) Students develop field skills to describe soil morphology, classify soils, and make land use interpretations. Effective: Spring 2011. Prerequisite: [SOILS 101](#) or equivalent

[SOILS 404](#) **Urban Soils** (3) This course introduces the student to natural and human-influenced soils. Prerequisite: [SOILS 101](#)

[SOILS 405](#) (GEO SC 405) **HYDROPEDOLOGY** (3) Soil and water interactions across scales, integrated studies of landscape- soil-water relationships, fundamental processes of water flow and chemical transport. Prerequisite: SOILS 101

[SOILS 412W](#) **SOIL ECOLOGY** (3) Introduction to soil organisms; includes interactions between organisms, their processes, and metabolism with a major focus on microorganisms.

[SOILS 416](#) **SOIL GENESIS AND CLASSIFICATION** (3) Pedological evolution, classification, and world distribution of soils. Prerequisite: [SOILS 101](#)

[SOILS 418](#) (AGECO 418, AN SC 418) **Nutrient Management in Agricultural Systems** (3) Comprehensive review of nutrient flow in animal agricultural systems, environmental regulations, and environmental stewardship practices.

[SOILS 420](#) **REMEDICATION OF CONTAMINATED SOILS** (3) Basic principles and technical aspects of remediation of contaminated soils. Prerequisite: [CHEM 112](#) consultation with the course instructor.

[SOILS 450](#) **ENVIRONMENTAL GEOGRAPHIC INFORMATION SYSTEMS** (3) Use of geographic information systems (GIS) and digital spatial databases to characterize landscapes for environmental assessment and management. Prerequisite: [SOILS 101](#)

[STAT 200](#) (GQ) **ELEMENTARY STATISTICS** (4) Descriptive statistics, frequency distributions, probability, binomial and normal distributions, statistical inference, linear regression, and correlation. Prerequisite: 2 units in algebra

[STAT 240](#) (GQ) **INTRODUCTION TO BIOMETRY** (3) Statistical analysis, sampling, and experimentation in the agricultural sciences; data collection, descriptive statistics, statistical inference, regression, one factor AOV, probability. Students may take only one course from STAT 200, 220, 240, 250 for credit. Prerequisite: 3 credits in mathematics

[STAT 250](#) (GQ) **INTRODUCTION TO BIOSTATISTICS** (3) Statistical analysis and interpretation of data in the biological sciences; probability; distributions; statistical inference for one- and two-sample problems. Prerequisite: 3 credits in mathematics

[TURF 235](#) **THE TURFGRASS** (3) Characterization of the primary plant species used for sports, lawn and utility turf; includes turfgrass morphology, environmental adaptation, and cultural requirements.

[W F S 410](#) **GENERAL FISHERY SCIENCE** (3) Introduction to the study, management, and uses of fish populations; methods of investigation, culture, and harvest of fishes. Prerequisite: [BIOL 210](#) or [W F S 209](#)

[W F S 422](#) **ECOLOGY OF FISHES** (3) Role of fishes in aquatic communities and general ecosystems. Environmental factors influencing fish as individuals, populations, and communities. Prerequisite: [BIOL 220W](#) or [W F S 209](#)

SUPPORTING AND OTHER COURSES

COMMUNICATIONS/ENTREPRENEURSHIP/LEADERSHIP SELECTION: (3) Choose from AEE 360, 440; CAS 211, 213, 214W, 215, 250 or 352; CIVCM 211; ERM 499; MGMT 215

ECOLOGY SELECTION: (3) Choose from: BIOL 415, 436, 444, 446, 448, 450W, 463, 482; ENT 420, 425; ERM 430, 435, 450; HORT 445; SOILS 412W; WFS 422, 430, 446

ERM 495* INTERNSHIP (1-12) A SUPERVISED PRACTICUM IN THE ENVIRONMENTAL FIELD. TO BE OFFERED ONLY FOR SA/UN GRADING. Prerequisite: PRIOR APPROVAL OF ASSIGNMENT BY INSTRUCTOR.

ERM 496* INDEPENDENT STUDIES (1-18)

SPECIALIZATION OR MINOR (18 CREDITS MINIMUM)

*ERM students may apply up to 6 credits of ERM 495 and/or ERM 496 toward their 18 credit specialization area.

ERM Faculty and Courses Taught in the ERM Program:

Douglas Beegle, Distinguished Professor of Agronomy
SOILS 402-Soil Nutrient Behavior and Management

Katya Bazilevskaya, Research Associate
ERM 440-Chemistry of the Environment: Air, Water and Soil

Elizabeth Boyer, Associate Professor of Water Resources
FOR 470-Watershed Management

Robin C. Brandt, Lecturer in Biological Engineering
ERM 300-Basic Principles & Calculations in Environmental Analysis

Larry Brannaka, Adjunct Assistant Professor
ERM 447-Streambank Restoration

Mary Ann Bruns, Associate Professor of Soil Microbiology
SOILS 412W-Soil Ecology

Rick Day, Associate Professor of Soil Science and Environmental Information Systems
SOILS 450-Environmental Geographic Information Systems

Dennis R. Decoteau, Professor of Horticulture
ERM 430-Air Pollution Impacts to Terrestrial Ecosystems

Patrick Drohan, Assistant Professor of Pedology
SOILS 403 -Soil Morphology Practicum, SOILS 404- Urban Soils; SOILS 416- Soil Genesis, Classification, and Mapping

Herschel A. Elliott, Professor of Biological Engineering
ERM 433-Transformation of Pollutants in Soils

Heather Gall, Assistant Professor of Agricultural & Biological Engineering
ERM/ASM 309- Measurement and Monitoring of Hydrologic Systems

Jason Kaye, Associate Professor of Soil Biogeochemistry
ERM 413W-Case Studies in Ecosystem Management, ERM 496-Independent Research

Sridhar Komarneni, Distinguished Professor of Clay Mineralogy
SOILS 420-Remediation of Contaminated Soils

Henry Lin, Associate Professor of Hydropedology/Soil Hydrology
SOILS 405-Hydropedology

Nancy Ostiguy, Associate Professor of Entomology
ERM 210-Environmental Factors and Their Effect on Your Food Supply

Jeffrey M. Peters, Distinguished Professor of Environmental Toxicology
ERM 431-Environmental Toxicology

Matthew B. Royer, Director, Ag and the Environment Center/PSU Cooperative Extension
ERM 411-Legal Aspects of Resource Management

Robert D. Shannon, Associate Professor of Biological Engineering
ERM 151-Careers and Issues in ERM, ERM 412-Resource Systems Analysis, ERM 450-Wetland Conservation

Rick Stehouwer, Professor of Environmental Soil Science
SOILS 101-Introduction to Soil Science, SOILS 102-Introductory Soil Science Laboratory

George Vahoviak, Adjunct Professor
ERM 435 - Limnology

Jack Watson, Professor of Soil Science
SOILS 401-Soil Composition and Physical Properties