

**The University of Maine**

**Ecology and Environmental Sciences Program  
Bachelor of Science Degree**

**Curriculum Handbook**

**September 2009**

**[www.umaine.edu/nrc/](http://www.umaine.edu/nrc/)**

## Ecology and Environmental Science Curriculum

### Program Curriculum Outline

The curriculum for the degree of Bachelor of Science in Ecology and Environmental Sciences (EES) is structured around eight requirement areas outlined in this curriculum guide. They are:

1. Ecology and Environmental Sciences Core
2. Biological and Ecological Sciences
3. Physical and Chemical Sciences
4. Quantitative and Information Skills
5. Communication Skills
6. General Education -- Thematic Minor in Human Values and Social Context
7. Concentration
8. Free Electives

In the sections below, the requirements and elective choices in these various areas are displayed. Courses are shown in the semesters they are typically offered. By completion of the program requirements as shown below, EES students automatically complete all General Education requirements established by the faculty of the University of Maine.

### Program Learning Outcomes and Assessment

Learning outcomes goals for the program reflect the needs of employers and feedback received from previous graduates. Upon graduation, EES students should be able to:

- Effectively apply basic principles of the natural and social sciences to current issues of natural resources and the environment;
- Understand and appropriately use the vocabularies of the natural and social sciences relevant to issues of natural resources and the environment;
- Write and speak clearly about technical issues related to their concentration of study in the EES program;
- Work collaboratively with other professionals in the disciplines of the major to address significant policy issues in natural resources and the environment;
- Choose and apply appropriate quantitative tools necessary to analyze significant issues related to their concentration of study in the EES program;
- Evaluate sources of technical information for credibility and relevance for addressing significant issues related to their concentration of study in the EES program;
- Identify significant ethical issues in natural resources and the environment and be able to address these issues in an informed and thoughtful manner.

Assessment of program effectiveness at meeting these learning outcomes will be done in three ways:

1. Primary assessment will be done through student performance in the two capstone courses. Between these two courses all of the outcome goals can be assessed.
2. A formal survey of students at graduation will be developed as a secondary assessment tool.

3. Ongoing informal assessment will be accomplished by continuation of a period newsletter to program graduates which will continue to provide data on career success of graduates and feedback about program strengths and weaknesses.

## **Program Requirements**

### **I. Ecology and Environmental Sciences Core (10 credits):**

All students in the program take the core courses, beginning with EES 100. The capstone experience for majors is accomplished by the completion of EES 400 and EES 489. Students should not take the capstone courses until their last two semesters. Honors students meet the requirement for EES 400 through satisfactory completion of their Honors Directed Study and Thesis (HON 498/499). A minimum grade of C is required for EES 400 and EES 489.

- NFA 117 -- Issues and Opportunities (1 cr.) (waived for transfer students)
- EES 100 -- Human Population and the Global Environment (3 cr.)
- EES 400 -- Senior Paper in Ecology & Environmental Sciences (3 cr.)
- EES 489 -- Critical Issues in Ecology & Environmental Science Policy (3 cr.)

### **II. Biological and Ecological Sciences (15 credits):**

Every student in the program is required to complete a core of courses designed to establish basic competency in biology and ecology.

- BIO 100 -- Basic Biology (4 cr.)
- BIO 200 -- Biology of Organisms (4 cr.)
- BIO 205 -- Field Natural History of Maine (4 cr.)
- BIO 319 -- General Ecology (3 cr.) or WLE 200 -- Ecology (3 cr.)

### **III. Physical and Chemical Sciences (16 credits):**

Likewise, competency in physical and chemical sciences is essential to understanding environmental and resource issues. All students are required to complete foundation courses in this area as well.

- CHY 121/123 -- Introduction to Chemistry (4 cr.)
- CHY 122/124 -- Molecular Basis of Chemical Change (4 cr.)
- ERS 101 -- Introduction to Geology (4 cr.) or ERS 102 -- Environmental Geology of Maine (4 cr.)
- PSE 140/141 -- Soil Science and lab (4 cr.)

### **IV. Quantitative and Information Skills (10 credits):**

The analytical tools used in environmental quality and resource management require quantitative competency and the ability to manage and evaluate information. The minimum math requirement for the program is Pre-calculus. Some concentrations in the program require one or two semesters of Calculus, which is indicated in the concentration descriptions below.

- MAT 122 -- Pre-Calculus (4 cr.) or MAT 126 -- Calculus I (4 cr.)
- MAT 232 -- Principles of Statistical Inference (3 cr.)
- LBR 200 -- Information Literacy (3 cr.)

**V. Communication Skills** (9 credits):

Effective written and oral communication is a requirement of virtually all careers pursued by program graduates. These base communications courses, combined with the Senior Paper in the capstone, assure that students have the skills they need in this area. Students must earn a grade of C or better in English Composition. Honors students meet their English Composition requirement by completing the first-year Honors sequence with a minimum grade of C.

- ENG 101 -- College Composition (3 cr.)
- ENG 317 -- Business and Technical Writing (3 cr.) or ENG 212 Persuasive and Analytical Writing (3 cr.)
- CMJ 103 -- Fundamentals of Public Communication (3 cr.)

**VI. Thematic Minor in Human Values and Social Context** (18 credits):

As part of the General Education requirements of the University of Maine, all undergraduates must complete a thematic minor in human values and social context. (Additional general education requirements are met automatically by students when they meet other requirements of the Ecology and Environmental Sciences curriculum.) Some of the thematic minor area requirements are met by electives from an approved list, while others are met by completing specific courses required by the program. A single course may not be used to meet two different requirements of the thematic minor. Likewise, courses used to meet thematic minor requirements may not be used also to meet concentration requirements.

- Western Cultural Tradition (3 cr.):  
Elective from approved list
- Social Context and Institutions (6 cr.):  
POS 100 -- American Government and  
ECO 120 -- Principles of Microeconomics
- Cultural Diversity and International Perspectives (3 cr.):  
Elective from approved list <http://studentrecords.umaine.edu/pdf/GenEds.pdf>
- Artistic and Creative Expression (3 cr.):  
Elective from approved list <http://studentrecords.umaine.edu/pdf/GenEds.pdf>
- Ethics (3 cr.):  
PSE 121 -- Human Societies, Soil, & Water: The Unbreakable Link or  
PHI 232 -- Environmental Ethics (3 cr.) or  
ECO 381 -- Principles of Sustainable Development

Students in the Honors College automatically meet the university's general education requirement with the four-course Honors sequence (HON 111, 112, 211, & 212). In addition to those four courses, EES majors in the Honors College are required to complete the following three courses:

- ECO 120 – Principles of Microeconomics
- POS 100 -- American Government
- PSE 121 -- Human Societies, Soil, & Water: The Unbreakable Link or  
     PHI 232 -- Environmental Ethics (3 cr.) or  
     REP 381 -- Principles of Sustainable Development

## **VII. Program Concentrations:**

In addition to the core requirements that establish the basic foundation, each student must complete one concentration of study in the program. At a minimum, a concentration will entail 21 credits of course work with at least 15 credits being 300 or 400 level (Junior or Senior) courses. Students must earn a minimum grade of C in all courses that are included in the concentration. Students work with an academic advisor to choose the combination of concentration courses that best meets the student's academic goals. Substitutions may be made for courses in the approved lists below with approval of the student's academic advisor. For well-qualified Seniors, graduate courses may also be used with the approval of the advisor and the course instructor.

Some concentrations have courses that you must take as part of the concentration while others have required pre-requisite courses that you must take in place of free electives.

The developed concentrations may not meet the needs and aspirations of an individual student. In those cases, the student may develop an individualized concentration. See detailed guidelines below.

### **Concentration 1: Ecology**

Building on the core courses in biological and ecological sciences, students in this concentration develop a deeper understanding of natural processes and ecological interactions. This concentration reflects the tremendous depth of faculty resources in ecology at the University of Maine. This concentration is designed to prepare students for both advanced study and professional work in ecology. This concentration meets the requirements for an undergraduate degree in ecology recommended by the Ecological Society of America. See their web site at: [www.esa.org](http://www.esa.org).

*Required preparatory courses (taken in lieu of free electives):*

- MAT 126 -- Calculus I (4 cr.)
- PHY 111 -- General Physics I or PHY 121--Physics for Engineers and Physical Scientists I (4 cr.)
- PHY 112 -- General Physics II or PHY 122--Physics for Engineers and Physical Scientists II (4 cr.)
- CHY 251/253 -- Organic Chemistry I (5 cr.) or BMB 221/221 Organic Chemistry (4 cr.)
- CHY 252/254 -- Organic Chemistry II (5 cr.)

*Concentration Electives:*

Normally Offered Fall Semesters

- BIO 326 --General Entomology (4 cr.)
- BIO 329/331 -- Vertebrate Biology (4 cr.)
- BIO 342 -- Plants in Our World (3 cr.)
- BIO 353 -- Invertebrate Zoology (4 cr.)

- BIO 377 -- Animal Physiology (3 cr.)
- BIO 430 -- Ecology and Systematics of Aquatic Insects (4 cr.)
- BIO 432 -- Biology of Fungi (4 cr.)
- BIO 447 -- Experimental Aquatic Ecology (4 cr.)
- BIO 452/453 -- Plant Physiology (4 cr.)
- BIO 463 -- River Ecology (4 cr.)
- BIO 468 -- Limnology (3 cr.)
- BIO 469 -- Field Limnology (1 cr.)
- FES 407 -- Forest Ecology (3 cr.)
- INT 482 -- Pesticides and the Environment (3 cr.)
- PSE 403 -- Weed Ecology and Management (3 cr.)
- PSE 442 -- Pedology: The Science of Soil Morphology, Genesis and Classification (3 cr.)
- PSE 444 -- Field Soil Morphology and Classification Techniques (1 cr.)
- PSE 457 -- Plant Pathology (4 cr.)
- WLE 323 -- Introduction to Conservation Biology (3 cr.)
- WLE 423 -- Wetland Ecology and Conservation (4 cr.)

#### Normally Offered Spring Semesters

- BIO 310 -- Plant Biology (4 cr.)
- BIO 433 -- Mammalogy (4 cr.)
- BIO 434 -- Avian Biology and Ecology (4 cr.)
- BIO 448 -- Insect Pest Ecology and Management (3 cr.)
- BIO 455 -- Biological Invasions (3 cr.)
- BIO 461 -- Insect Biology, Taxonomy, and Systematics (4 cr.)
- BIO 464 -- Taxonomy of Vascular Plants (4 cr.)
- BIO 476 -- Paleoecology (4 cr.)
- EES 350 -- Principles of Environmental Science (3 cr.)
- INT 475 -- Field Studies in Ecology (3 cr.)
- PSE 469 -- Soil Microbiology (4 cr.)
- SMS 373 -- Algae in the Ecosystem: Phytoplankton and Seaweed (4 cr.)

#### **Concentration 2: Environmental Sciences**

Many opportunities exist for students in environmental consulting and research support that require more intensive training in quantitative skills, organic chemistry, and physics. The concentration in environmental sciences is designed to prepare students for these opportunities.

*Required preparatory courses (taken in lieu of free electives):*

- MAT 126 -- Calculus I (4 cr.)
- MAT 127 -- Calculus II (4 cr.)
- PHY 111 -- General Physics I or PHY 121--Physics for Engineers and Physical Scientists I (4 cr.)
- PHY 112 -- General Physics II or PHY 122--Physics for Engineers and Physical Scientists II (4 cr.)
- CHY 251/253 -- Organic Chemistry I (5 cr.)
- CHY 252/254 -- Organic Chemistry II (5 cr.)

*Concentration Electives:*

Normally Offered Fall Semesters

- CIE 231 -- Fundamentals of Environmental Engineering (3 cr.)
- INT 482 -- Pesticides and the Environment (3 cr.)
- ISE 201 -- Principles of Geographic Information Systems (3 cr.)
- FES 407 -- Forest Ecology (3 cr.)
- PSE 413 -- Wetland Delineation and Mapping (4 cr.)
- PSE 442 -- Pedology: The Science of Soil Morphology, Genesis and Classification (3 cr.)
- PSE 444 -- Field Soil Morphology and Classification Techniques (1 cr.)
- WLE 323 -- Introduction to Conservation Biology (3 cr.)

Normally Offered Spring Semesters

- CIE 431 -- Pollutant Fate and Transport (4 cr.)
- EES 200 -- Introduction to Safety and Environmental Management (3 cr.)
- EES 350 -- Principles of Environmental Science (3 cr.)
- FTY 206 -- Photogrammetry and Remote Sensing (3 cr.)
- FTY 457 -- Forest Watershed Management (3 cr.)
- PSE 440 -- Environmental Soil Chemistry and Plant Nutrition (3 cr.)
- PSE 469 -- Soil Microbiology (4 cr.)

**Concentration 3: Soil and Water Sciences**

This concentration builds on the physical and chemical science courses in the core and develops particular strengths for students in understanding the various properties of soils and water, the impacts of humans on soil and water, and the relationship of these resources to the biological world. Students interested in professional accreditation as a soil scientist in the State of Maine and elsewhere can attain the necessary academic credentials in this concentration through careful selection of courses with the help of an academic advisor. Calculus is recommended, but not required, for this concentration.

*Concentration Electives:*

Normally Offered Fall Semesters

- BIO 463 -- River Ecology (4 cr.)
- BIO 468 -- Limnology (3 cr.)
- BIO 469 -- Field Limnology (1 cr.)
- CIE 231 -- Fundamentals of Environmental Engineering (3 cr.)
- EES 324 -- Environmental Protection Law and Policy (3 cr.)
- ISE 201 -- Principles of Geographic Information Systems (3 cr.)
- PSE 403 -- Weed Ecology and Management (3 cr.)
- PSE 413 -- Wetland Delineation and Mapping (4 cr.)
- PSE 442 -- Pedology: The Science of Soil Morphology, Genesis and Classification (3 cr.)
- PSE 444 -- Field Soil Morphology and Classification Techniques (1 cr.)
- WLE 423 -- Wetland Ecology and Conservation (4 cr.)

Normally Offered Spring Semesters

- EES 200 -- Introduction to Safety and Environmental Management (3 cr.)
- EES 350 -- Principles of Environmental Science (3 cr.)
- FTY 206 -- Photogrammetry and Remote Sensing (3 cr.)
- FTY 457 -- Forest Watershed Management (3 cr.)
- FTY 480 -- Applied Geographic Information Systems (3 cr.)
- PSE 344 -- Soil and Water Quality: Human Impacts on the Environment (3 cr.)
- PSE 469 -- Soil Microbiology (4 cr.)

#### **Concentration 4: Wetland and Aquatic Ecology**

Wetlands and other aquatic systems are some of the most biological productive ecosystems on the planet. They are also most vulnerable to human disturbance since they often are encroached upon by economic and social development. Understanding of these systems is deepened in this concentration, which builds on the core courses in biological and ecological sciences.

*Required Concentration Courses:*

- BIO 463 -- River Ecology (4 cr.)
- BIO 468 -- Limnology (3 cr.)
- BIO 469 -- Field Limnology (1 cr.)
- WLE 423 -- Wetland Ecology and Conservation (4 cr.)

*Concentration Electives:*

Normally Offered Fall Semesters

- BIO 430 -- Ecology and Systematics of Aquatic Insects (4 cr.)
- BIO 447 -- Experimental Aquatic Ecology (4 cr.)
- EES 324 -- Environmental Protection Law and Policy (3 cr.)
- PSE 413 -- Wetland Delineation and Mapping (4 cr.)
- SMS 211 -- Introduction to Aquaculture (3 cr.)
- WLE 429 -- Freshwater Fisheries Ecology and Management (3 cr.)

Normally Offered Spring Semesters

- FTY 457 -- Forest Watershed Management (3 cr.)
- FTY 480 -- Applied Geographic Information Systems (3 cr.)
- SMS 373 -- Algae in the Ecosystem: Phytoplankton and Seaweed (4 cr.)
- SMS 422 -- Biology of Fishes (3 cr.)

#### **Concentration 5: Resource and Environmental Policy**

Students interested in pursuing the policy implications of natural resource use and environmental quality will find this concentration most appropriate. It provides preparation for law school, other graduate studies in policy, and positions in state and federal agencies.

*Required Concentration Courses:*

- ECO 377 -- Introduction to Natural Resource Economics and Policy (3 cr.)
- EES 324 -- Environmental Protection Law and Policy (3 cr.)

*Concentration Electives:*

Normally Offered Fall Semesters

- ECO 341 -- Waste Management (3 cr.)
- ECO 371 -- Public Finance and Fiscal Policy (3 cr.)
- ECO 473 -- Economic and Policy Application of GIS (3 cr.)
- ECO 477 -- Economics of Environmental and Resource Management (3 cr.)
- GEO 201 -- Introduction to Human Geography (3 cr.)
- INT 482 -- Pesticides and the Environment (3 cr.)
- PAA 220 -- Introduction to Public Policy (3 cr.)
- POS 352 -- American Public Opinion (3 cr.)
- PSE 413 -- Wetland Delineation and Mapping (4 cr.)
- WLE 323 -- Introduction to Conservation Biology (3 cr.)

Normally Offered Spring Semesters

- ECO 372 -- State and Local Government Finance (3 cr.)
- ECO 479 -- Land Use Planning (3 cr.)
- EES 200 -- Introduction to Safety and Environmental Management (3 cr.)
- EES 424 -- Environmental Assessment and Management Techniques (3 cr.)
- FTY 349 -- Principles of Forest Management (3 cr.)
- FTY 446 -- Forest Resources Policy (3 cr.)
- HTY 479 -- U.S. Environmental History (3 cr.)
- PAA 327 -- Environmental Policy, Management, and Regulation (3 cr.)
- PAA 340 -- Public Financial Management (3 cr.)
- PHI 232 -- Environmental Ethics (3 cr.)

**Concentration 6: Land Use Planning**

One of the uses of an EES degree is involvement in local, state, or federal land use planning activities. This includes work for government agencies or for consulting firms in support of the planning process. This concentration develops skills students will need to be effective in the planning arena.

*Required Concentration Courses:*

- ECO 479 -- Land Use Planning (3 cr.)
- ECO 473 -- Economic and Policy Application of GIS (3 cr.)

*Concentration Electives:*

Normally Offered Fall Semesters

- EES 324 -- Environmental Protection Law and Policy (3 cr.)

- FTY 208 -- Forest Surveying and Mapping (3 cr.)
- ISE 201 -- Principles of Geographic Information Systems (3 cr.)
- PAA 220 -- Introduction to Public Policy
- PAA 370 -- Local Government Administration (3 cr.)
- PSE 413 -- Wetland Delineation and Mapping (4 cr.)
- PSE 442 -- Pedology: The Science of Soil Morphology, Genesis and Classification (3 cr.)
- PSE 444 -- Field Soil Morphology and Classification Techniques (1 cr.)

Normally Offered Spring Semester

- ECO 477 -- Economics of Environmental and Resource Management (3 cr.)
- EES 200 -- Introduction to Safety and Environmental Management (3 cr.)
- REP 424 -- Environmental Assessment and Management Techniques (3 cr.)
- FTY 206 -- Photogrammetry and Remote Sensing (3 cr.)
- FTY 349 -- Principles of Forest Management (3 cr.)
- FTY 480 -- Applied Geographic Information Systems (3 cr.)

### **Concentration 7: Natural History**

Building on the core courses in biological and ecological sciences, students in this concentration develop an understanding in natural history. There is a rich array of field courses offered, particularly in the fall semester.

*Concentration Electives:*

Normally Offered Fall Semesters

- BIO 326 -- General Entomology (4 cr.)
- BIO 329/331 -- Vertebrate Biology (4 cr.)
- BIO 342 -- Plants and Our World (3 cr.)
- BIO 353 -- Invertebrate Zoology (4 cr.)
- BIO 430 -- Ecology and Systematics of Aquatic Insects (4 cr.)
- BIO 432 -- Biology of Fungi (4 cr.)
- BIO 447 -- Experimental Aquatic Ecology (4 cr.)
- BIO 448 -- Insect Pest Ecology and Management (3 cr.)
- BIO 463 -- River Ecology (4 cr.)
- BIO 468 -- Limnology (3 cr.)
- BIO 469 -- Field Limnology (1 cr.)
- FES 407 -- Forest Ecology (3 cr.)
- INT 482 -- Pesticides and the Environment (3 cr.)
- PSE 442 -- Pedology: The Science of Soil Morphology, Genesis and Classification (3 cr.)
- PSE 444 -- Field Soil Morphology and Classification Techniques (1 cr.)
- PSE 457 -- Plant Pathology (4 cr.)
- WLE 323 -- Introduction to Conservation Biology (3 cr.)
- WLE 423 -- Wetland Ecology and Conservation (4 cr.)

Normally Offered Spring Semesters

- BIO 310 -- Plant Biology (4 cr.)
- BIO 433 -- Mammalogy (4 cr.)

- BIO 434 -- Avian Biology and Ecology (4 cr.)
- BIO 455 -- Biological Invasions (3 cr.)
- BIO 461 -- Insect Biology, Taxonomy, and Systematics (4 cr.)
- BIO 464 -- Taxonomy of Vascular Plants (4 cr.)
- BIO 476 -- Paleoecology (4 cr.)
- INT 475 -- Field Studies in Ecology (3 cr.)
- PSE 469 -- Soil Microbiology (4 cr.)
- SMS 373 -- Algae in the Ecosystem: Phytoplankton and Seaweed (4 cr.)

### **Concentration 8: Entomology**

Insects play vital roles in both managed and natural ecosystems. The entomology concentration is designed for those students who wish to focus their interest in ecology in this particular area. Calculus is recommended, but not required, for this concentration.

*Required Concentration Course:*

- BIO 326 -- General Entomology (4 cr.)

*Concentration Electives:*

Normally Offered Fall Semesters

- BIO 353 -- Invertebrate Zoology (4 cr.)
- BIO 430 -- Ecology and Systematics of Aquatic Insects (4 cr.)
- BIO 448 -- Insect Pest Ecology and Management (3 cr.)
- BIO 462 -- Principles of Genetics (3 cr.)
- INT 482 -- Pesticides and the Environment (3 cr.)

Normally Offered Spring Semesters

- BIO 461 -- Insect Biology, Taxonomy, and Systematics (4 cr.)
- BIO 464 -- Taxonomy of Vascular Plants (4 cr.)
- INT 256 -- Tree Pests and Diseases (4 cr.)

### **Concentration 9: Natural Resource Management**

The management of natural resources in modern society requires a broad array of skills and understandings for students to succeed. This concentration is a combination of courses in biological, physical, and social sciences designed so that students will have broad training in preparation for careers in natural resource management or for graduate study.

*Required Concentration Course:*

- EES 200 -- Introduction to Safety and Environmental Management (3 cr.)

*Concentration Electives:*

Normally Offered Fall Semesters

- EES 324 -- Environmental Protection Law and Policy (3 cr.)
- FTY 208 -- Forest Surveying and Mapping (3 cr.)
- FTY 480 -- Applied Geographic Information Systems (3 cr.)
- ISE 201 -- Principles of Geographic Information Systems (3 cr.)
- PSE 413 -- Wetland Delineation and Mapping (4 cr.)
- ECO 341 -- Waste Management (3 cr.)
- ECO 473 -- Economic and Policy Applications of GIS (3 cr.)
- WLE 323 -- Introduction to Conservation Biology (3 cr.)

Normally Offered Spring Semesters

- ECO 479 -- Land Use Planning (3 cr.)
- EES 424 -- Environmental Assessment and Management Techniques (3 cr.)
- FTY 206 -- Photogrammetry and Remote Sensing (3 cr.)
- FTY 349 -- Principles of Forest Management (3 cr.)
- PAA 327 -- Environmental Policy, Management, and Regulation (3 cr.)
- PSE 344 -- Soil and Water Quality: Human Impacts on the Environment (3 cr.)
- PSE 469 -- Soil Microbiology (4 cr.)

### **Concentration 10: International Conservation**

Increasingly, conservation of natural resources and environmental quality transcends national borders. Conservationists and environmental professionals work in situations requiring sensitivities to cultural and political differences. The concentration in International Conservation is designed to give students skills needed to function effectively in diverse international environments.

*Required Courses for General Education (in lieu of electives in these categories):*

- Cultural Diversity -- ANT 102 -- Introduction to Anthropology -- Diversity of Cultures
- Western Cultural Traditions -- POS 120 -- Introduction to World Politics

*Required Preparatory Courses (taken in lieu of free electives):*

- Modern language -- 6 credits beyond the intermediate level for one modern language

*Required Concentration Course:*

- INT 475 -- Field Studies in Ecology (3 cr.)

*Concentration Electives:*

- ANT 250 -- Conservation Anthropology (3 cr.)
- BIO 434 -- Avian Biology and Ecology (4 cr.)
- BIO 455 -- Biological Invasions (3 cr.)
- BIO 462 -- Principles of Genetics (3 cr.)
- BIO 476 -- Paleoecology (4 cr.)
- EES 324 -- Environmental Protection Law and Policy (3 cr.)

- FTY 206 -- Photogrammetry and Remote Sensing (3 cr.)
- INT 308 -- Conservation and Ecology of Marine Mammals (3 cr.)
- ECO 477 -- Economic and Policy Applications of GIS (3 cr.)
- ECO 478 -- International Environmental Economics and Policy
- SMS 425 -- Applied Population Genetics (3 cr.)
- WLE 323 -- Introduction to Conservation Biology (3 cr.)
- WLE 410 -- Wildlife Population Dynamics and Conservation (3 cr.)
- WLE 445 -- Management of Endangered and Threatened Species (3 cr.)

### **Concentration 11: Individualized Concentration**

In some cases, the defined concentrations may not meet the interests or career aspirations of students in the program. Students may develop and pursue an individualized concentration of study.

Individualized concentrations must deal with some aspect of ecology and environmental sciences as broadly reflected in the degree program. Individualized concentrations may not be developed for areas where degrees are already being offered at the University of Maine. So, for example, while “wildlife” is clearly part of natural ecosystems, this would not be an appropriate organizing concept for an individualized concentration since a degree program in wildlife ecology already exists at the University of Maine. Generally, the course work that makes up an individualized concentration should be largely drawn from courses offered at the University of Maine.

A student wishing to pursue an individualized concentration should do so in conjunction with an advisor who is a faculty member participating in the EES program. The student should prepare a brief proposal for the concentration, including a narrative explaining the organizing concept for the concentration and proposed name. The courses that will be taken to constitute the concentration should also be included. Individualized concentrations must include 21 credit hours of course work, at least of 15 of which are at the 300 or 400 course level. An individualized concentration must be approved by the student’s academic advisor and a committee of the program faculty.

### **VIII. Free Electives (21 credits):**

With the exception of the concentrations in Ecology and in Environmental Sciences, there are 21 credit hours of free electives in the program. Since students may take any courses for which the University of Maine offers elective credits with these electives, there are a number of attractive options open to students. Some students have pursued a second concentration in the program, which is allowed as long as there is no “double counting” of any course to meet two different program requirements. Others increase the depth in the primary concentration by taking courses beyond the required 21 credits.

Other students use the free electives to pursue a minor in another field or a double major with another degree program. Popular minors include Education, for students interested in environmental education, and Journalism, for students who wish to become environmental writers. Other minors that students have pursued include Mathematics, Spanish, German, Sustainable Agriculture, Environmental Horticulture, Philosophy, Anthropology, and Public Management.

For student in the Honors College some Honors requirements will use free elective credits. A sample sequence for the Honors College option follows that for the EES program.

B.S. in Ecology and Environmental Sciences--Curriculum Check--Starting Fall 2009

Student: \_\_\_\_\_

	<u>Hours</u>	<u>Semester</u>
<b>I. EES Core (10)</b>		
EES 100--Human Population and Global Environment	3	_____
NFA 117--Issues and Opportunities in College	1	_____
EES 400--Senior Paper (Capstone)	3	_____
EES 489--Critical Issues in Policy (Capstone)	3	_____
Students must earn minimum grade of C in capstone courses		
<b>II. Biological and Ecological Sciences (15)</b>		
BIO 100--Basic Biology	4	_____
BIO 200--Biology of Organisms	4	_____
BIO 205--Field Natural History of Maine	4	_____
BIO 319 or WLE 200--General Ecology	3	_____
<b>III. Physical and Chemical Sciences (16)</b>		
CHY 121/123--Intro to Chemistry	4	_____
CHY 122/124--Molecular Basis of Chemical Change	4	_____
ERS 101--Introduction to Geology or ERS 102	4	_____
PSE 140/141--Soil Science	4	_____
<b>IV. Quantitative Skills (10)</b>		
LBR 200--Information Literacy	3	_____
MAT 122--Pre-calculus or Mat 126 Calculus	4	_____
MAT 232--Statistics	3	_____
<b>V. Communications Skills (9)</b>		
ENG 101--College Composition _____	3	_____
CMJ 103--Public Communication	3	_____
ENG 317--Technical Writing	3	_____
<b>VI. Human Values and Social Context (18)</b>		
POS 100--American Government	3	_____
ECO 120--Principles Microeconomics	3	_____
Ethics--PSE 121 or PHI 232 or ECO 381	3	_____
Creative Expression _____	3	_____
Cultural Diversity _____	3	_____
Western Cultural Traditions _____	3	_____
<b>VII. Concentration (21) Students must earn a minimum of C- in Concentration Courses</b>		
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
<b>VIII. Free Electives (21)</b>		
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

B.S. Ecology and Environmental Sciences--Sample Program Sequence

<u>Fall</u>	<u>Credits</u>	<u>Spring</u>	<u>Credits</u>
<b><u>First Year</u></b>			
BIO 100	4	BIO 200	4
Basic Biology		Biology of Organisms	
ENG 101	3	ECO 120	3
English Composition		Microeconomics	
EES 100	3	PSE 140/141	4
Population & the Environment		Soil Science	

MAT 122 (or MAT 126) 4  
 Pre-Calculus  
 NFA 117 1  
 Issues and Opportunities in College  
 Semester Credits 15

ERS 101 (or ERS 102) 4  
 Introduction to Geology  
 Semester Credits 15

Sophomore Year

CHY 121/123 4  
 Introduction to Chemistry  
 BIO 205 4  
 Field Natural History of Maine  
 CMJ 103 3  
 Public Communication  
 LBR 200 3  
 Information Literacy  
 Semester Credits 14

CHY 122/124 4  
 Molecular Basis of Chem. Change  
 BIO 319 3  
 General Ecology  
 MAT 232 3  
 Principles of Statistical Inf.  
 Ethics course 3  
 Concentration Course 3  
 Semester Credits 16

Junior Year

ENG 317 3  
 Technical Writing  
 Concentration courses, Thematic  
 Minor Electives & Free  
 Electives  
 Semester Credits 15-17

Concentration courses, Thematic  
 Minor Electives, & Free  
 Electives  
 Semester Credits 15-17

Senior Year

EES 489 3  
 Critical Issues In Policy  
 Concentration courses, Thematic  
 Minor Electives & Free  
 Electives  
 Semester Credits 15-17

EES 400 3  
 Senior Paper  
 Concentration courses, Thematic  
 Minor Electives & Free  
 Electives  
 Semester Credits 15-17

B.S. in Ecology and Environmental Sciences--Curriculum Check -- Honors College Option - Starting Fall 2009

Student: \_\_\_\_\_

	<u>Hours</u>	<u>Semester</u>
<b>I. EES Core (10)</b>		
EES 100--Human Population & Global Environment	3	_____
NFA 117--Issues and Opportunities in College	1	_____
HON 499--Honors Thesis (Capstone)	3	_____
EES 489--Critical Issues in Policy (Capstone)	3	_____
Students must earn minimum grade of C in capstone courses		
<b>II. Biological and Ecological Sciences (15)</b>		
BIO 100--Basic Biology	4	_____
BIO 200--Biology of Organisms	4	_____
BIO 205--Field Natural History of Maine	4	_____
BIO 319 or WLE 200--General Ecology	3	_____
<b>III. Physical and Chemical Sciences (16)</b>		
CHY 121/123--Intro to Chemistry	4	_____
CHY 122/124--Molecular Basis of Chemical Change	4	_____
ERS 101--Introduction to Geology or ERS 102	4	_____
PSE 140/141--Soil Science	4	_____
<b>IV. Quantitative Skills (10)</b>		
LBR 200--Information Literacy	3	_____
MAT 122--Pre-calculus or Mat 126 Calculus	4	_____
MAT 232--Statistics	3	_____
<b>V. Communications Skills (10)</b>		
HON 111--Honors Seminar	4	_____
CMJ 103--Public Communication	3	_____
ENG 317--Technical Writing	3	_____
<b>VI. Human Values and Social Context (21)</b>		
POS 100--American Government	3	_____
ECO 120--Principles Microeconomics	3	_____
Ethics--PSE 121 or PHI 232 or REP 381	3	_____
HON 112--Honors Seminar (Western)	4	_____
HON 211--Honors Seminar (creative)	4	_____
HON 212--Honors Seminar (diversity)	4	_____
<b>VII. Concentration (21) Students must earn a minimum of C- in Concentration Courses</b>		
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
<b>VIII. Free Electives (21)</b>		
HON 3xx--Honors Tutorial _____	3	_____
HON 498--Thesis Research _____	3	_____
HON 180 _____	1	_____
Electives _____	_____	_____
_____	_____	_____
_____	_____	_____

=====

B.S. Ecology and Environmental Sciences--Honors College Option

<u>Fall</u>	<u>Credits</u>	<u>Spring</u>	<u>Credits</u>
<b>First Year</b>			
BIO 100	4	BIO 200	4
Basic Biology		Biology of Organisms	
HON 111	4	ECO 120	3
Honors Seminar		Microeconomics	
EES 100	3	PSE 140/141	4

Human Population & Environment  
 MAT 122 (or MAT 126) 4  
 Pre-Calculus  
 NFA 117 1  
 Issues and Opportunities in College

Semester Credits 16

Soil Science  
 HON 112  
 Honors Seminar 4

Semester Credits 15

Sophomore Year

CHY 121/123 4  
 Introduction to Chemistry  
 BIO 205 4  
 Field Natural History of Maine  
 HON 211 4  
 Honors Seminar  
 LBR 200 3  
 Information Literacy

Semester Credits 15

CHY 122/124 4  
 Molecular Basis of Chem. Change  
 BIO 319 3  
 General Ecology  
 HON 212 4  
 Honors Seminar  
 ERS 101 4  
 Intro to Geology

Semester Credits 15

Junior Year

HON 3xx 3  
 Honors Tutorial  
 ENG 317 3  
 Technical Writing  
 POS 100 3  
 American Government  
 Concentration courses 6-8

Semester Credits 15-17

CMJ 103 3  
 Public Communication  
 MAT 232 3  
 Statistics  
 PSE 121 or PHI 232 or ECO 381 3  
 Ethics Course  
 Concentration courses 6-8

Semester Credits 15-17

Senior Year

EES 489 3  
 Critical Issues In Policy  
 HON 498 3  
 Honors Research  
 Concentration Course 3-4  
 Concentration Course 3-4

Semester Credits 12-14

HON 499 3  
 Honors Thesis  
 Concentration Course 3-4  
 Electives 9

Semester Credits 15-16

**COOPERATIVE EDUCATION PROGRAM GUIDELINES  
(EES 396 FIELD EXPERIENCE)  
ECOLOGY AND ENVIRONMENTAL SCIENCES**

**Purpose of the Program**

The cooperative education/field experience program is designed to provide a work-study experience in the various professional employment settings of interest to students majoring in Ecology and Environmental Sciences. This program will:

- Enable students to explore occupations in which they have an interest.
- Provide students with the opportunity to apply theoretical principles developed in the classroom in a practical environment.
- Enable students to develop an appreciation of the relationship between formal education and job success, thereby increasing their self-confidence, maturity, and sense of responsibility.
- Improve job placement for program graduates.
- Provide students with a combination of work experience and income earning opportunity.

**Procedure**

Eligibility Requirements

All interested junior or senior students in good standing (not on academic probation) majoring in Ecology and Environmental Sciences are eligible to apply. Most often students in the program will identify employers and petition for inclusion of a specific job-opportunity as a cooperative education/field experience placement. Employers may also identify prospective work experiences for which they are seeking students to participate. The program faculty will screen applicants for these opportunities, but the final selection will be at the discretion of the cooperating employer.

Expectations of Employer

The participants in the cooperative education/field experience program will be provided an opportunity to interview potential intern participants. If the employer chooses to participate in the program, it is expected to provide a variety of work experiences for the student. The off-campus experience normally will provide the student with a broad overview of the operational and material functions of the firm or agency with which the student is serving.

Specifically cooperating employers will be expected to:

- Participate in the development of the student's plan of work.
- Provide a general schedule of activities, experiences, and responsibilities planned for the student.
- Identify the person who will be responsible for supervising the student and providing evaluations.
- Complete an interim evaluation of the student's work mid-way through the experience. The evaluation should be reviewed with the student and returned to the University supervisor.
- Provide a final evaluation of the student's work during the last week of the experience. The evaluation should be reviewed with the student and returned to the University supervisor.
- Make recommendations to the Ecology and Environmental Sciences Program for general improvements in the cooperative education/field experience program.

## Expectations of the Student

Students are expected to take primary responsibility for the success of their own cooperative education/field experience placement. Among other tasks, students should:

- Prepare a draft plan of work for the prospective experience that outlines objectives and activities.
- Finalize the plan of work based on the comments of the employer and University supervisor.
- Maintain a daily journal of activities during the experience.
- Make periodic, typically weekly, reports to the University supervisor.
- Prepare a comprehensive final report (Appendix A).
- Comply with responsibilities outlined in the Appendix B.

## Responsibilities of the Ecology and Environmental Sciences Program

The Ecology and Environmental Sciences Program will be responsible for program supervision with a faculty member designated as cooperative education/field experience program coordinator. If the student's proposed study warrants, the coordinator will establish an ad hoc committee that will normally include the student's advisor and one other faculty member. The program supervisor will regularly contact each student by telephone or email and normally make at least one on-the-job visit during the off-campus work period.

## Evaluation Procedure

Following the completion of the experience, the student and coordinator will discuss the benefits derived, suggested changes, and overall value of the experience to the student. Reports prepared on the work-study experiences and the program should also include assessments of the program. Employers are encouraged to evaluate the overall effectiveness of the cooperative education/field experience program.

## Academic Credit

Academic credit will be awarded for cooperative education/field experience work on the basis of a maximum eight credits for each semester of full-time experience. Grading will be on a pass-fail basis. A maximum of 16 credits from all such experiences will be allowed.

An ad hoc committee of the Ecology and Environmental Sciences faculty would determine the standards for credit, amount of credit to be given and the qualification of a particular proposal for a co-op work experience. The following factors will be considered:

- Nature of the work experience.
- Length of the work experience.
- Academic value of the experience in relationship to the student's major

## **COOPERATIVE EDUCATION FINAL REPORT OUTLINE**

### Items to be included in your final report (8 -- 10 pages)

1. Describe your field placement. (Name, location, principal product, organization, key contact person, etc.)
2. Describe purpose/objectives. (Initially, what did you expect to receive from the experience? Were your expectations met? If different, how were they different?)
3. Summarize the experience as it related to your plan of work, including:

- Activities in the plan of work that were completed.
  - Activities in the plan of work that were not completed.
  - Activities not in the plan of work that were completed.
4. Describe the relationship(s) you saw between your academic major and the activities you performed.
  5. Identify strengths and weaknesses you have discovered in yourself as a result of this experience.
  6. Identify a problem area faced by your employer that came to your attention during the placement.
  7. Consider how this experience confirmed or modified your ideas and plans for a career.
  8. Develop suggestions you would make to another cooperative education student considering this specific field placement.
  9. Include any final thoughts or recommendations.

#### **RESPONSIBILITIES OF STUDENTS PARTICIPATING IN THE COOPERATIVE EDUCATION/FIELD EXPERIENCE PROGRAMS**

1. Students are expected to meet the performance standards and learning objectives set by the program and the field supervisor once arrangements for an active learning situation have been completed.
2. Students must comply with all federal, State, and local employment regulations when applicable.
3. Any employment difficulties or misunderstandings need to be reported immediately by the student involved to the faculty cooperative education/field experience advisor. This faculty person will try to work through these concerns with you and your field supervisor.
4. Students are expected not to quit without prior consultation with their faculty cooperative education/field experience advisor who will negotiate any needed arrangements with the field supervisor.
5. Prolonged illnesses keeping one away from the job more than five consecutive calendar days should be reported to your faculty advisor.
6. Students have no special time-off privileges. Any requests for time off for such things as job interviews, emergency home situations, and the like must be cleared through one's employer.
7. Students who are involuntarily terminated or laid off from their field placements need to notify their faculty cooperative education/field experience advisor immediately.
8. Students are responsible for costs of room, board, travel, and personal expenses during the field placement period.
9. Students are expected to conduct themselves in a professional manner.

## Faculty of Ecology and Environmental Sciences Program

### School of Biology and Ecology

- Andrei Alyokhin, Assistant Professor of Applied Entomology
- Seanna Annis, Assistant Professor of Mycology
- Christopher Campbell, Professor of Plant Systematics
- Christopher Cronan, Professor of Botany and Ecology
- Francis Drummond, Professor of Insect Ecology and Entomology
- William Glanz, Associate Professor of Zoology
- Eleanor Groden, Associate Professor of Entomology and School Director
- Rebecca Holberton, Associate Professor of Biological Sciences
- George Jacobson, Professor of Botany and Quaternary Studies
- Michael Kinnison, Assistant Professor of Biological Sciences
- Christa Schwintzer, Professor of Botany
- Jasmine Saros, Associate Professor of Paleoecology & Biological Sciences
- Kevin Simon, Assistant Professor of Biological Sciences
- Stephen Woods, Associate Professor of Entomology

### School of Forestry

- Michael Greenwood, Ruth Hutchins Professor of Forest Physiology
- Richard Jagels, Professor of Forest Biology
- G. Bruce Wiersma, Professor of Forest Resources
- Robert Lilieholm, Associate Professor of Forest Resources

### Department of Plant, Soil and Environmental Sciences

- M. Susan Erich, Professor of Plant, Soil and Environmental Sciences
- Ivan Fernandez, Professor of Plant, Soil and Environmental Sciences
- David Lambert, Associate Professor of Plant, Soil and Environmental Sciences
- Tsutomu Ohno, Professor of Soil Chemistry

### School of Economics

- Mark Anderson, Senior Instructor of Resource Economics and Policy
- Kathleen Bell, Associate Professor of Resource Economics and Policy
- George Criner, Professor of Resource Economics and Policy and School Director
- Todd Gabe, Associate Professor of Resource Economics and Policy
- Alan Kezis, Professor of Agricultural and Resource Economics
- Stephen Reiling, Professor of Agricultural and Resource Economics
- Mario Teisl, Professor of Resource Economics and Policy
- Sharon Tisher, Instructor in Resource Economics and Policy

### Department of Wildlife Ecology

- Aram Calhoun, Associate Professor of Wetland Ecology
- Malcolm Hunter, Professor & Libra Professor of Conservation Biology