



# **ECOLOGY AND ENVIRONMENTAL SCIENCES PROGRAM**

## **Bachelor of Science Curriculum Handbook**



**Fall 2019**

**<http://umaine.edu/ees-undergraduate/>**

# 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 nine requirement areas outlined in this curriculum guide. They are:

1. Ecology and Environmental Sciences (15 cr.)
2. Biological and Ecological Sciences (7 cr.)
3. Social Sciences (6 cr.)
4. Physical and Chemical Sciences (16 cr.)
5. Quantitative and Information Skills (6-7 cr.)
6. Communication Skills (9 cr.)
7. General Education: All students at the University of Maine are required to meet General Education requirements to assure a strong foundation in the liberal arts and sciences. Many of the GenEd requirements are met by the EES curriculum. Human Values and Social Context requirement (HVSC) (18 cr., 9 of which are met by core and concentration courses) is one category of six that students are required to fulfill in order to graduate. Work with your advisor and use the EES Gen Ed Requirements Worksheet to make sure that you fulfill the requirements. Visit <http://studentrecords.umaine.edu/academics/general-education-requirements/> for more details.
8. Concentrations (25-42 cr.)
9. Free Electives (variable depending on concentration and choice of core courses; some concentrations require basic science prerequisites which are counted as 'free elective' credits).

Total Credit Hours: 120

## **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.

## **Program Requirements**

*Students must earn a minimum of 120 credits in order to graduate.*

### **1. Ecology and Environmental Sciences (15 credits)**

All students in the program take the core courses, beginning with EES 117. The capstone experience for majors is accomplished by the completion of EES 489. Students should not take the capstone course until fall of their senior year. Honors students meet the requirement for EES 489 and EES 490 through satisfactory completion of their Honors Directed Study and Thesis (HON 498/499). A minimum grade of C is required for EES 489.

EES 100	Human Population and the Global Environment (PE) <sup>1</sup> (3cr.) [S,A]
EES 117	Introduction to Environmental Sciences (2 cr.) [F,A]
EES 217	Field Research Experience in EES (0-2 cr.) [F,SUM, A] <sup>2</sup>
EES 390	Junior Seminar (3 cr.) [S,A]
EES 489	Capstone (4 cr.) (must be taken Senior year) [F,A]
PHI 232	Environmental Ethics (3 cr.) <sup>3</sup> [B,A]
	<b>OR</b> ECO 381 Principles of Sustainable Dev. (3 cr.) [F,A]

### **2. Biological and Ecological Sciences (7credits)<sup>4</sup>**

BIO 100	Basic Biology (4 cr.) [F,A]
WLE 200	Ecology (3 cr.) [F,A]
	<b>OR</b> SMS 300 Marine Ecology (3 cr.) [F,A] <sup>5</sup>
	<b>OR</b> BIO 319 General Ecology (3 cr.) [S,A]

### **3. Social Sciences (6 credits)**

EES 324	Environmental Law and Policy (3 cr.) (PE) [F,A]
	<b>OR</b> SFR 446 Forest Resources Policy (3 cr.) [S,A] <sup>6</sup>
	<b>OR</b> SMS 230 Intro to Marine Policy (3 cr.) [F,A] <sup>7</sup>

---

<sup>1</sup> Course Key: Semester F: Fall, S: Spring, B: Both. Year E: Even, O: Odd, A: All, V: Variable Years. GenEd: SCI: Social Context and Institutions, PE: Population & Environment,

<sup>2</sup> EES 217 is required for students that matriculate Fall 2015 or later.

<sup>3</sup> Completion of PHI 232 or ECO 381 meets the General Education Ethics requirement.

<sup>4</sup> Some concentrations require BIO 200. Please see concentration requirements. Students should also be aware that BIO 200 is a prerequisite for many upper level science electives.

<sup>5</sup> Students in the Ecosystems Ecology Marine Ecosystems Concentration must take SMS 300.

<sup>6</sup> Only students in the Ecosystems Ecology Concentration- Forest Ecosystems Option take SFR 446.

<sup>7</sup> Only students in the Ecosystems Ecology Concentration – Marine Ecosystems Option take SMS 230.

SFR 220 Environment and Society (3 cr.) (WCT) [F,A] <sup>8</sup>  
**OR** ECO 180 Citizens, Energy, and Sust. (3 cr.) [F,A] (SCI)

#### 4. Physical and Chemical Sciences (16 credits)

CHY 121/123 Introduction to Chemistry (4 cr.) [B,A] **AND**  
CHY 122/124 Molecular Basis of Chemical Change (4 cr.) [S,A]  
**OR** PHY 111 (4 cr.)

ERS 101 Introduction to Geology (4 cr.) [B,A]  
**OR** ERS 102 Environmental Geology of Maine (4 cr.) [B,A]  
**OR** ERS 108/SMS 108 Beaches and Coasts (3 cr.) [S,A] <sup>9</sup>

EES 140/141 Soil Science (4 cr.) [S,A]

#### 5. Quantitative and Information Skills (6-7 credits)

*Note: A minimum of 3 additional math credits are required. Please see concentrations for specific math requirements.*

STS 232 Principles of Statistical Inference (3 cr.) [B,A]  
**OR** WLE 220 Introduction to Statistical Ecology (4 cr.) [S,A]  
**OR** SFR 205 Forest Measurements and Statistics (3 cr.) [S,A]  
<sup>10</sup>

SFR 400 Applied Geographic Information Systems (4 cr.) [S,A] <sup>11</sup>  
**OR** ERS 230 Earth & Climate Science Geomatics (4 cr.) [F,A]

#### 6. Communication Skills (9 credits)

Students must earn a grade of C or better in College 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.) [B,A]  
ENG 317 Business and Technical Writing (3 cr.) [B,A]  
**OR** ENG 315 Research Writing in the Disciplines (3 cr.) [B,A]

SFR 222 Environmental Communication Skills (3 cr.) [S,A] (SCI) <sup>12</sup>  
**OR** CMJ 103 Fund. of Public Communication (3 cr.) [B,A]  
**OR** CMJ 107 Communication & the Environment (3 cr.) [F,A]

#### 7. General Education

*General Education requirements for mathematics literacy, science and writing competency, a capstone experience, and ethics are met by the EES curriculum as outlined above. In addition, students must complete coursework in the following areas:*

---

<sup>8</sup> Students in the Ecosystems Ecology Concentration Forest Ecosystems Option take SFR 220.

<sup>9</sup> Only students in the Ecosystem Ecology Marine Ecosystems Option take ERS 108/SMS 108.

<sup>10</sup> Only Students in the Ecosystem Ecology Forest Ecology Option take SFR 205.

<sup>11</sup> Students in the Ecosystem Ecology Forest Ecology Option must take SFR 400.

<sup>12</sup> Students in the Ecosystem Ecology Forest Ecology Option must take SFR 222.

### **Human Values and Social Context (18 credits)**

As part of the General Education requirements of the University of Maine, all undergraduates must complete the Human Values and Social Context (HVSC) requirement. Students must take at least three credits from each of five sub-categories. SCI and PE are met within the EES core requirements. Each student must complete electives in the remaining sub-categories (below) from an approved list:

**<https://studentrecords.umaine.edu/files/2012/02/Courses-that-Satisfy-Gen-Ed-Requirements.pdf>**

Depending on course choices, some sub-categories may also be met within the EES requirements (Social Context and Institutions, Western Cultural Traditions, Cultural Diversity and International Perspectives). The Artistic and Creative Expression sub-category is never covered by EES requirements, so students must satisfy this requirement via an additional elective.

- Western Cultural Tradition (WCT) (3 cr.)
- Cultural Diversity and International Perspectives (CDI) (3 cr.)
- Artistic and Creative Expression (ACE) (3 cr.)

Completion of the Civilizations Sequence (HON 111, 112, 211, & 212) will satisfy all areas of the Human Values and Social Contexts (HVSC) general education requirement for 16 of the 18 required credits and the ethics requirement.

### **8. 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. Courses taken as part of the core curriculum cannot be counted towards concentration requirements. For example, if a student chooses SFR 220 to meet the EES Social Science core requirement, that course cannot be counted towards the Sustainability, Environmental Policy, and Natural Resource Management Concentration. 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.

**Some concentration courses may have required prerequisites which are not EES program requirements, but which must be completed before the concentration course is taken.**

Substitutions may be made for courses in the approved lists below with approval of the student's academic advisor and the undergraduate coordinator. For well-qualified seniors, graduate courses may also be used with the approval of the advisor and the course instructor.

### **ENVIRONMENTAL EARTH AND CLIMATE SCIENCES CONCENTRATION**

*The intent of the Environmental Earth and Climate Sciences concentration is to provide flexibility to pursue courses related to the environmental earth and climate sciences that meet individual student interests. When selecting courses that fulfill these electives,*

*please consider personal objectives and select courses that will further your individual goals (Where do you hope to work? Do you plan on attending graduate school?). Students interested in employment opportunities in different fields are advised to discuss course selections with faculty in those fields. Students must earn a C or higher in concentration courses.*

**Required Courses (15 credits)**

ERS 152	Earth's Changing Climate (3 cr.) [F]
ERS 201	Global Environmental Change (4 cr.) [S,A]
MAT 116	Introduction to Calculus (3 cr.)
or	
MAT 122	Pre-Calculus (4 cr.)
or	
MAT 126	Calculus I (4 cr.) [B,A]

**Concentration Electives (Must take 21 total credits, 15 of which are 300-400 level classes.)**

- Selected from the following disciplines: ERS, PSE, WLE, BIO, SMS, SFR, ECO, EES, MAT, PHY, CHY
- At least 12 of these elective credits must be ERS courses.
- At least 3 of these elective credits must be taken outside of ERS.
- Required core and concentration courses may not be used to also fulfill concentration elective courses.
- Concentration electives must be at the 200 level or higher with the exception of MAT 126/127, PHY 111/112/121/122, and CHY 121/123/122/124. At least 15 of these 21 course credits must be filled by courses at the 300 or higher level.
- Students interested in environmental geology careers are strongly encouraged to complete courses in hydrology (e.g. ERS 350, ERS 480), geochemistry (e.g. ERS 312, ERS 521), and surficial processes (e.g. ERS 361, ERS 441) to acquire skills relevant for a career in environmental geosciences. Students interested in pursuing post-graduate studies are advised to take a full year of calculus, chemistry and/or physics (depending on their career goals).

**Sample tracks within this concentration:**

**Environmental Earth Science**

ERS 312	Geochemistry (3 cr.)
ERS 315	Principles of Sedimentology & Stratigraphy (4 cr.)
ERS 319	Geohazards and Humans (3 cr.)
ERS 330	Earth Materials (4 cr.)
ERS 350	Fresh Water Flow (3 cr.) [S,E]
ERS 361	Principles of Geomorphology (3 cr.)
ERS 401	Paleoceanography (3 cr.)
ERS 408	Coastal Processes and Coastal Zone Management (3 cr.)
ERS 420	Computer Scripting for Data Analysis (3 cr.)

PSE 442	Pedology The Science of Soil Morphology, Genesis & Classification (3 cr.) [F,E]
PSE 469	Soil Microbiology (3 cr.) [S,O]

### **Climate Science**

ERS 240	The Atmosphere (4 cr.)
ERS 312	Geochemistry (4 cr.)
ERS 315	Principles of Sedimentology & Stratigraphy (4 cr.)
ERS 323	Extreme Weather (3 cr.)
ERS 330	Earth Materials (4 cr.)
ERS 401	Paleoceanography (3 cr.)
ERS 420	Computer Scripting for Data Analysis (3 cr.)
ERS 441	Glaciers and Our Landscape (3 cr.)
ERS 444	Introduction to Glaciology (4 cr.)
ERS 425	How to Build a Habitable Planet (3 cr.)
ANT 311	Geography of Climate Change (3 cr.)
BIO 476	Paleoecology (4 cr.)
EES 312	Energy, Law and the Environment (3 cr.)
SMS 402	Oceans and Climate Change (3 cr.)

### **ECOSYSTEM ECOLOGY**

1. ECOSYSTEM ECOLOGY
2. ECOSYSTEM ECOLOGY – Aquatics and Wetlands Systems Option
3. ECOSYSTEM ECOLOGY – Forest Ecosystems Option
4. ECOSYSTEM ECOLOGY – Marine Ecosystems Option

*There are four focus options within the Ecosystem Ecology concentration (see 1- 4 above). Building on the core courses in biological and ecological sciences, students in these concentrations study in depth natural processes and ecological interactions. They reflect the tremendous depth of faculty resources in ecology at the University of Maine and are designed to prepare students for both advanced study and professional work in ecology. Students in the EES Ecosystem Ecology Concentration may choose a generalist option with elective course selections representing a broad array of ecosystems or a focused option on a specific ecosystem of interest to the student.*

#### **Required courses (11-12 credits)**

MAT 116	Introduction to Calculus (3 cr.)
	<b>OR</b>
MAT 122	Pre-Calculus (4 cr.) [B,A]
	<b>OR</b>
MAT 126	Calculus (4 cr.) [B,A]
	<b>OR</b>
BIO 200	Biology of Organisms (4 cr.) [S,A]
	<b>OR</b> SMS 201 <sup>13</sup> Biology of Marine Organisms (3 cr.) [F,A] <b>AND</b>

<sup>13</sup> Only students in the Ecosystems Ecology Marine Ecosystems Option take SMS 201/203.

SMS 203 Intro. to Integrative Marine Science (1 cr.) [S,A]

BIO 205 Field Natural History of Maine (4 cr.) [F,A]

**Concentration Electives (23-26 credits, 15 of which must be 300-400 level courses)**

**Ecosystems (8-11 credits)**

BIO 463 River Ecology (4 cr.) [F,E]  
BIO 468 Lake Ecology (3 cr.) [F,O]  
EES 475 Field Studies in Ecology (3 cr.) [S,A]  
SFR 407 Forest Ecology (3 cr.) [F,A]  
SFR 408 Silviculture (3 cr.) [F,A]  
SFR 409 Forest Ecology and Silviculture Lab (2 cr.) [F,A]  
SFR 508 The Industrial Spruce-Fir Ecosystem (Seniors Only) (4 cr.) [F,E]  
SMS 100 Introduction to Ocean Science (3 cr.) [F,A]  
SMS 352 Semester-by-the-sea: Marine Ecology (4 cr.)  
SMS 354 Thinking About the Ocean: A Question-based Approach to Learning Marine Sciences (3 cr.)  
SMS 402 Oceans and Climate Change (3 cr.) [S,A]  
WLE 423 Wetland Ecology and Conservation (4 cr.) [F,E]

- Students following the Forest Ecosystems option must take SFR 407, 408, and 409 to fulfill their Ecosystems requirement.
- Students following the Aquatic and Wetland Sciences option must take BIO 463, BIO 468, and WLE 423 to fulfill their Ecosystems requirement.
- Students following the Marine Ecosystems option must take SMS 100 and SMS 402 and one additional course from this list.

**Organismal Ecology (3-4 credits)**

BIO 430 Ecology and Systematics of Aquatic Insects (4 cr.) [F,O]  
BIO 433 Mammalogy (4 cr.) [S,E]  
BIO 434 Avian Biology and Ecology (4 cr.) [S,O]  
BIO 455 Biological Invasions (3 cr.) [S,A]  
PSE 403 Weed Ecology and Management (3 cr.) [F,O]  
SFR 439 Plant Anatomy: Structure and Function (3 cr.) [S,A]  
SFR 522 Physiological Ecology of Plants (Seniors only) (3 cr.) [S,E]  
SMS 308 Conservation and Ecology of Marine Mammals (3 cr.) [S,A]  
SMS 322 Biology of Marine Vertebrates Credits: 3 [V]  
SMS 373 Marine and Freshwater Algae (4 cr.) [S,A]  
SMS 422 Biology of Fishes (3 cr.) [F,E]  
SMS 480 Semester-by-the-Sea: Biology of Marine Invertebrates (4 cr.) [F,A]  
WLE 340/341 Freshwater Fisheries Ecology and Management (4 cr.) [F,O]

- Students following the Forest Ecosystems option must take SFR 439.
- Students following the Aquatic and Wetland Sciences option choose from SMS 422, SMS 373, WLE 340/341 or BIO 430.
- Students following the Marine Ecosystems option choose from SMS 422, SMS 373, INT 308, SMS 322 or SMS 480.



### **Genetics and Evolution (3 credits)**

BIO 350	Concepts and Applications of Genetics (3 cr.) [S,A]
BIO 465	Evolution (3 cr.) [S,A]
SMS 425	Applied Population Genetics (3 cr.) [S,A]

- Students following the Marine Ecosystems option take SMS 425.

### **Additional electives (6 credits)**

*Choose additional courses from the three areas above or from the list below.*

BIO 310	Plant Biology (4 cr.) [S,A]
BIO 326	General Entomology (4 cr.) [F,A]
BIO 329/331	Vertebrate Biology (4 cr.) [F,A]
BIO 342	Plants in Our World (3 cr.) [F,A]
BIO 353	Invertebrate Zoology (4 cr.) [F,A]
BIO 354	Animal Behavior (3 cr.) [S,A]
BIO 432	Biology of Fungi (4 cr.) [F,O]
BIO 452	Plant Physiology (3 cr.) [F,A]
BIO 464	Taxonomy of Vascular Plants (4 cr.) [F,A]
BIO 476	Paleoecology (4 cr.) [S,E]
PSE 440	Environmental Soil Chemistry and Plant Nutrition [S,E]
PSE 442	Pedology (3 cr.) [F,E]
PSE 444	Field Soil Morphology and Classification Techniques (1 cr.) [F,E]
PSE 457	Plant Pathology (4 cr.) [F,A]
PSE 469	Soil Microbiology (3 cr.) [S,O]
SFR 107	Forest Vegetation (4 cr.) [F,A]
SFR 406	Image Interpretation and Forest Mapping (3 cr.) [S,A]
SFR 409	Forest Ecology and Silviculture Lab (2 cr.) [F,A]
SFR 410	Forest Regeneration (3 cr.) [S,E]
SFR 439	Plant Anatomy: Structure and Function (3 cr.) [S,A]
SFR 457	Tree Pests and Disease (3 cr.) [F,A]
SFR 458	Tree Pests and Disease Lab (1 cr.) [F,A]
SFR 520	Development and Growth of Plants (3 cr.) [F,E]
SMS 321	Intro to Fisheries Science (3 cr.) [S,A]
SMS 350	Undergraduate Seminar (1-3 cr.) [F,A]
SMS 482	Semester-by-the-Sea: Human Impacts (3 cr.) [F,A]
SMS 485	Comparative Animal Physiology (3 cr.) [V]
SMS 491	Problems in Marine Science (1-99 cr.) [B,A]
SMS 497	Independent Study in Marine Science [B,A]
WLE 323	Introduction to Conservation Biology (3 cr.) [F,A]

- Students following the Forest Ecosystems option take either SFR 107 or BIO 464 plus an additional elective.

## **NATURAL HISTORY AND ENVIRONMENTAL STUDIES**

*Natural history is a broad term involving the interest in and study of diverse aspects of the natural sciences (e.g., botany, zoology, geology, chemistry), historical geography, anthropology (human development and history within an ecological framework), and*

*conservation. Environmental studies is an academic field that focuses on human interactions with the environment. This interdisciplinary concentration places more focus on the social sciences related to human-environment relationships and may include topics in ethics, policy, sociology, and philosophy as well as environmental sciences. Students will have familiarity with the diversity of life in all its forms to provide the foundation for a broadly trained naturalist. Building on the core courses in biological, ecological, and social sciences, students in this will be prepared for professional work in environmental non-government organizations, consulting firms, state and federal agencies, environmental education, as well as graduate study.*

**Required Courses (22-24 cr.)**

MAT 116	Introduction to Calculus (3 cr.)
	<b>OR</b>
MAT 122	Pre-Calculus (4 cr.) [B,A]
	<b>OR</b> M
MAT 126	Calculus (4 cr.) [B,A]
BIO 200	Biology of Organisms (4 cr.) [S,A]
BIO 205	Field Natural History of Maine (4 cr.) [F,A]
BIO 326	General Entomology (4 cr.) [F,A]
	<b>OR</b> BIO 353 Invert. Zoology (4 cr.) [F,A]
BIO 329/331	Vertebrate Biology (4 cr.) [F,A]
BIO 464	Taxonomy of Vascular Plants (4 cr.) [F,A]
	<b>OR</b> SFR 107 Forest Vegetation (3 cr.) [F,A]

**Concentration Electives (18 required credits, 15 of which need to be 300 or 400 level classes.)**

**Protists, Fungi, and Microbes (3-4 credits)**

BIO 432	Biology of Fungi (4 cr.) [F,O]
BMB 300	General Microbiology (3 cr.) [F,A]
PSE 469	Soil Microbiology (3 cr.) [S,O]
PSE 457	Plant Pathology (4 cr.) [F,A]
SMS 373	Marine and Freshwater Algae (4 cr.) [S,A]

**Animal diversity (6-8 credits)**

BIO 354	Animal Behavior (3 cr.) [S,A]
BIO 433	Mammalogy (4 cr.) [S,E]
BIO 434	Avian Biology and Ecology (4 cr.) [S,O]
SMS 321	Introduction to Fisheries Science (3 cr.) [S,A]
SMS 322	Biology of Marine Vertebrates (3 cr.) [F,E]
SMS 422	Biology of Fishes (3 cr.) [F,A]
WLE 340/341	Freshwater Fisheries Ecology and Management (4 cr.) [F,O]

**Ecosystem diversity (3-4 credits)**

BIO 463	River Ecology (4 cr.) [F,O]
BIO 468	Lake Ecology (3 cr.) [F,O]
EES 475	Field Studies in Ecology (3 cr.) [S,A]

SFR 407	Forest Ecology (3 cr.) [F,A]
SFR 508	The Industrial Spruce-Fir Ecosystem (4 cr.) [F,E]
WLE 423	Wetland Ecology and Conservation (4 cr.) [F,E]

### **Environmental Humanities (6-8 credits)**

ANT 270	Environmental Justice Movements in the United States (3 cr.) [F,A]
ANT 410	Human Dimensions of Climate Change (3 cr.) [F,A]
ANT 431	Folklore, the Environment, and Public Policy (3 cr.) [S,V]
ANT 464	Ecological Anthropology (3 cr.)(writing intensive) [F,V]
ANT 475	Environmental Archaeology (3 cr.) [F,O]
ENG 238	Nature and Literature (3 cr.) [S,V]
HTY 210	History of Maine (3 cr.) [V]
HTY 211	Maine and the Sea (3 cr.) [V]
HTY 212	Geography of Maine (3 cr.)
HTY 479	U.S. Environmental History (3 cr.) [V]
MES 301	Rachel Carson, Maine, and the Environment (3 cr.) [S,A]
SFR 479	Environmental Attitudes and Behaviors (3 cr.) [S,E]
SFR 452	Environmental Interpretation (3 cr.) [F,O]
WGS 230	Women, Health and the Environment (3 cr.) [B,A] (pre-req of WGS 101 can be waived)

## **SOIL AND WATER SCIENCE**

*Students in this concentration will study soil biogeochemical and hydrologic processes in depth. Their understanding and skills will be useful in addressing many societal challenges, including climate and land use change, environmental protection, ecosystem services, food security, and energy production in a range of employment settings. In addition, this concentration prepares students for advanced study in related areas.*

### **Required Courses (11-16 credits)**

MAT 116	Introduction to Calculus (3 cr.)
	<b>OR</b>
MAT 122	Pre-Calculus (4 cr.) [B,A]
	<b>OR</b>
MAT 126	Calculus (4 cr.) [B,A <sup>14</sup> ]
BIO 200	Biology of Organisms (4 cr.) [S,A]
BIO 205	Field Natural History of Maine (4 cr.) [F,A]

### **Recommended Course**

MAT 127	Calculus II (4 cr.) [B,A]
---------	---------------------------

### **Electives (21 credits, 15 of which need to be 300 or 400 level courses.)**

#### **Soil and Earth Science (9 credits)**

ERS 312	Geochemistry (3 cr.) [S,A]
ERS 315	Principles of Sedimentology and Stratigraphy (4 cr.) [F,A]
ERS 330	Mineralogy (4 cr.) [S,E]

<sup>14</sup> MAT 126 is recommended, but not required, for this concentration.

PSE 320	Soil Organic Matter Management (3 cr.) [F,E]
PSE 440	Environmental Soil Chemistry and Plant Nutrition (3 cr.) [S,E]
PSE 469	Soil Microbiology (3 cr.) [S,O]

### **Water Science and Hydrology (6 credits)**

BIO 468	Lake Ecology (3 cr.) [F,O]
CIE 331	Fundamentals of Environmental Engineering (3 cr.) [F,A]
CIE 431	Pollutant Fate and Transport (4 cr.) [V]
ERS 350	Fresh-Water Flow (3 cr.) [S,E]

### **Additional Electives (6 credits)**

*Choose additional courses from the areas above or from the list below.*

ERS 200	Earth Systems (4 cr.) [F,A]
ERS 201	Global Environmental Change (4 cr.) [S,A]
ERS 369	Energy Resources and Climate Change (3 cr.) [F,E]
ERS 420	Computer Scripting for Data Analysis (3 cr.) [F,O]
ERS 441	Glaciers and Our Landscape (3 cr.) [F,E]
SFR 208	Geomatics, Coordinate Geometry, and GPS (4 cr.) [F,A]
SFR 406	Remote Sensing Image Interpretation and Forest Mapping (3 cr.) [S,A]
WLE 423	Wetland Ecology and Conservation (4 cr.) [F,E]

## **SUSTAINABILITY, ENVIRONMENTAL POLICY, AND NATURAL RESOURCE MANAGEMENT**

*Building on the core courses in biological, ecological, and social sciences, students in this concentration study in depth interactions between human and natural systems. This concentration reflects the tremendous depth of faculty resources in anthropology, environmental economics, environmental policy, natural resource management, human ecology, human dimensions of natural resource management, and sustainability science at the University of Maine. This concentration is designed to prepare students for both advanced study and professional work in sustainability science, environmental policy, and natural resource management.*

### **Recommended General Education courses**

ANT 102	Diversity of Cultures (3 cr.) [S,A] [CDI, SCI]
ECO 381	Sustainable Development (3 cr.) [F,A] [PE] <sup>15</sup>
POS 100	American Government (3 cr.) [B,A] [SCI]
POS 120	Introduction to World Politics (3 cr.) [B,A] [CDI, WCT]

### **Required Courses (9-10 credits)**

MAT 116	Introduction to Calculus (3 cr.)
	<b>OR</b>
MAT 122	Pre-Calculus (4 cr.) [B,A]
	<b>OR</b>
MAT 126	Calculus (4 cr.) [B,A]

---

<sup>15</sup> Students following the Sustainability Concentration can take ECO 381 to satisfy their ethics requirement OR a concentration elective, but the course cannot satisfy both requirements.

ECO 120	Introduction to Microeconomics (3 cr.) [B,A]
ECO 377	Introduction to Natural Resource Economics and Policy (3 cr.) [F,A]

**Concentration Electives (18 credits, 15 of which must be 300-400 level courses.)**  
*Must take a minimum of one or two courses in each of these three areas (Economics, Social, and Resource Management/Policy/Ecology).*

**Economics (3 credit minimum)**

EES 312	Energy, Law and the Environment (3 cr.) [S,A]
ECO 405	Sustainable Energy Economics and Policy (3 cr.) [S,A]
ECO 450	International Environmental Economics and Policy (3 cr.) [F,E]
ECO 371	Public Finance and Fiscal Policy (3 cr.) [F,O]
SFR 444	Forest Resources Economics (3 cr.) [S,A]

**Social (3 credit minimum)**

ANT 225	Climate Change, Societies and Cultures (3 cr.) [S,O]
ANT 250	Conservation Anthropology (3 cr.) [F,V]
ANT 270	Environmental Justice Movements in the United States (3 cr.) [F,A]
ANT 410	Human Dimensions of Climate Change (3 cr.) [F,A]
ANT 464	Ecological Anthropology (3 cr.) [F,V]
EES 312	Energy, Law and the Environment (3 cr.) [S,A]
ECO 381	Sustainable Development (3 cr.) [F,A] [PE]
HTY 479	U.S. Environmental History (3 cr.) [V]
SFR 220	Environment and Society (3 cr.) [S,A]
SFR 479	Environmental Attitudes and Behaviors (3 cr.) [S,E]
WGS 230	Women, Health & the Environment (3 cr.) [B,A] (pre-req can be waived)

**Resource Management/Policy/Ecology (6 credit minimum)**

BIO 455	Biological Invasions (3 cr.) [S,O]
CIE 431	Pollutant Fate and Transport (3 cr.) [V]
CIE 439	Solid Waste and Air Pollution (3 cr.) [S, V]
EES 312	Energy, Law and the Environment (3 cr.) [S,E]
EES 475	Field Studies in Ecology (3 cr.) [S,A]
POS 203	American State and Local Government (3 cr.) [S,A]
POS 282	Introduction to American Law (3 cr.)
PSE 105	Principles of Sustainable Agriculture (3 cr.) [F,A]
PSE 312	Sustainable Food Systems: Challenges and Opportunities (3 cr.) [F,E]
PSE 320	Soil Organic Matter Management (3 cr.) [F,E]
PSE 403	Weed Ecology and Management (3 cr.) [F,O]
SFR 208	Geomatics, GPS, and Coordinate Geometry (4 cr) [F,A]
SFR 215	Introduction to Forest Bioproducts and Bioenergy (3 cr.) [S,A]
SFR 226	Park Systems of the World (3 cr.) [F,A]
SFR 349	Applied Forest Ecology and Silviculture (3 cr.) [F,A]
SFR 406	Remote Sensing Image Interpretation and Forest Mapping (3 cr.) [S,A]
SFR 446	Forest Resources Policy (3 cr.) [S,A]
SMS 230	Introduction to Marine Policy and Fisheries Management (3 cr.) [F,A]
WLE 230	Introduction to Wildlife Conservation (3 cr.) [S,A]
WLE 323	Introduction to Conservation Biology (3 cr.) [F,A]
WLE 445	Management of Endangered and Threatened Species (3 cr.) [S,O]

WLE 461  
WLE 470

Human Dimensions of Fisheries & Wildlife Conservation (3 cr.)  
Wildlife Policy and Administration (3 cr.) [F,A]

## **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 15 of which are at the 300 or 400 course level. An individualized concentration must be approved by the student’s academic advisor, the Undergraduate Coordinator, and the Director.*

# **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?)
3. Were your expectations met? If different, how were they different?)
4. 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.
5. Describe the relationship(s) you saw between your academic major and the activities you performed.
6. Identify strengths and weaknesses you have discovered in yourself as a result of this experience.
7. Identify a problem area faced by your employer that came to your attention during the placement.
8. Consider how this experience confirmed or modified your ideas and plans for a career.
9. Develop suggestions you would make to another cooperative education student considering this specific field placement.
10. 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.