Ecosystem Management and Forestry

The Ecosystem Management and Forestry major is replacing the Forestry and Natural Resources major in the College of Natural Resources.

Bachelor of Science (BS)

Ecosystem Management and Forestry (EMF) focuses on the conservation and restoration of the earth's natural resources through hands-on study of the ecology, stewardship, and management of forest, woodland, and grassland ecosystems.

The program offers two specializations to choose from, and if the student chooses a specialization in Forestry, they can qualify to take the Registered Professional Forester's licensing exam in California.

- The Forestry specialization provides students with the ecological, quantitative, and social foundation to be the managers and leaders in the management of forests and forest resources. The Forestry specialization is accredited by the Society of American Foresters and provides four years of qualifying education or professional experience for licensing as a professional forester in California. The goals of the Forestry specialization are very closely associated with the educational requirements of the forestry profession and prepare our students for a variety of careers in forestry or closely related natural resource fields.

- The Natural Resource Management specialization provides students with greater flexibility to explore subjects in ecology, physical environment, monitoring and measurement, and management and policy. Students can choose to concentrate their studies in water management, ecology, climates change or design their own concentration based on interest.

Students in the program, regardless of concentration, have ample opportunity to acquire interdisciplinary skills in the ecology, stewardship, and management of ecosystems such as forests, woodlands, and grasslands. Within the program, students can choose to emphasize topics such as wildlife biology, water policy, fire science, ecosystem restoration, environmental justice, remote sensing and GIS, and rural sociology.

EMF graduates are well-prepared for graduate school and careers in environmental consulting, public agencies, non-profit conservation organizations, and private companies. Students also have the option of preparing for professional careers in forestry, wildlife, and range management.

Admission to the Major

Advice on admission for freshmen and transfer students can be found on the CNR Admissions Guide (http://guide.berkeley.edu/undergraduate/colleges-schools/natural-resources/admissiontext) page or the CNR Prospective Student website (https://nature.berkeley.edu/prospective-students). Freshman students may apply directly to the major, or they may select the College of Natural Resource's undeclared option and declare the major by the end of their fourth semester. Transfer students may apply directly to the major through the UC application.

Information for current Berkeley students who would like to declare the major after admission, including information on a change of major or change of college, please see chapter 6 of the College of Natural Resources Undergraduate Student Handbook (https://nature.berkeley.edu/handbook). (https://nature.berkeley.edu/handbook)

Honors Program

Students with a GPA of 3.6 or higher may enroll in the College of Natural Resources honors program (H196) once they have reached upper division standing. To fulfill the program requirements, students design, conduct, and report on an individual research project working with a faculty sponsor. For further information about registration for the honors symposium and the honors requirements, please see the College of Natural Resources website (http://nature.berkeley.edu/site/honors_program.php).

Minor Program

A minor in Forestry is available for students who are interested in learning about forestry and renewable resource management as an adjunct to their chosen fields. Students in many diverse majors such as business administration, integrative biology, and civil engineering may find this minor complementary to their professional career goals. For information regarding how to declare the minor, please contact the department.

Other Majors and Minors Offered by the Department of Environmental Science, Policy, and Management:

Conservation and Resource Studies (http://guide.berkeley.edu/undergraduate/degree-programs/conservation-resource-studies) (Major and Minor)

Environmental Sciences (http://guide.berkeley.edu/undergraduate/degree-programs/environmental-sciences) (Major only)

Molecular Environmental Biology (http://guide.berkeley.edu/undergraduate/degree-programs/molecular-environmental-biology) (Major only)

Society and Environment (http://guide.berkeley.edu/undergraduate/degree-programs/society-environment) (Major only)

Students in this major choose a specialization in Forestry or Natural Resource Management. The specific requirements for each specialization is outlined below. In addition to the University, campus, and college requirements, listed on the College Requirements tab, students must fulfill the below requirements specific to their major program.

General Guidelines

1. All courses taken to fulfill the major requirements below must be taken for graded credit, other than courses listed which are offered on a Pass/No Pass basis only. Other exceptions to this requirement are noted as applicable.

2. A minimum cumulative grade point average (GPA) of 2.0 is required.

3. A minimum GPA of 2.0 in upper division major requirements is required.

4. At least 15 of the 36 required upper division units must be taken in the College of Natural Resources (except for students majoring in Environmental Economics and Policy; please see the EEP major adviser for further information).

5. A maximum of 16 units of independent study (courses numbered 97, 98, 99, 197, 198, and 199) may count toward graduation, with a maximum of 4 units of independent study per semester.
6. No more than 1/3 of the total units attempted at UC Berkeley may be taken Pass/Not Pass. This includes units in the Education Abroad Program and UC Intercampus Visitor or Exchange Programs.

7. A maximum of 4 units of physical education courses will count toward graduation.

For information regarding residency requirements and unit requirements, please see the College Requirements tab.

Requirements for all Ecosystem Management and Forestry Majors

Lower division courses

Chemistry (pick one)
CHEM 1A  General Chemistry
& 1AL  and General Chemistry Laboratory
CHEM 3A  Chemical Structure and Reactivity
& 3AL  and Organic Chemistry Laboratory

Biology
BIOLOGY 1B  General Biology Lecture and Laboratory [4]

Calculus (A-B series required)
MATH 16A  Analytic Geometry and Calculus
& MATH 16B  and Analytic Geometry and Calculus
MATH 1A  Calculus
& MATH 1B  and Calculus
MATH 10A  Methods of Mathematics: Calculus, Statistics, and Combinatorics
& MATH 10B  and Methods of Mathematics: Calculus, Statistics, and Combinatorics

Statistics
STAT 20  Introduction to Probability and Statistics [4]
or STAT 21  Introductory Probability and Statistics for Business

Economics
ENVECON C1  Introduction to Environmental Economics and Policy [4]
or ECON 1  Introduction to Economics

Physical Science
GEOG 40  Introduction to Earth System Science [4]
or EPS 50  The Planet Earth
or GEOG N1  Global Environmental Change

GIS
ESPM 72  Introduction to Geographic Information Systems [3]
(offered every other year)
or ESPM C1 GIS and Environmental Spatial Data Analysis

ESPM Core Requirements
ESPM Environmental Sciences Core: Select one from the following:
ESPM 2  The Biosphere [3]
ESPM 6  Environmental Biology [3]
ESPM C10  Environmental Issues [4]
ESPM 15  Introduction to Environmental Sciences [3]

ESPM Social Sciences Core: Select on from the following:
ESPM C11  Americans and the Global Forest [4]
ESPM C12  Introduction to Environmental Studies [4]
ESPM C22AC  Fire: Past, Present and Future Interactions with the People and Ecosystems of California [4]

Forestry Specialization Requirements
The Forestry specialization provides students with the ecological, quantitative, and social foundation to be the managers and leaders in the management of forests and forest resources. The Forestry specialization is accredited by the Society of American Foresters and provides four years of qualifying education or professional experience for licensing as a professional forester in California. The goals of the Forestry specialization are very closely associated with the educational requirements of the forestry profession and prepare our students for a variety of careers in forestry or closely related natural resource fields.

Forestry Field Program
ESPM 105A  Sierra Nevada Ecology [4]
ESPM 105B  Forest Measurements [1]
ESPM 105C  Silviculture and Utilization [3]
ESPM 105D  Forest Management and Assessment [3]

Forestry Required Courses
ESPM 102B  Natural Resource Sampling
& 102BL  and Laboratory in Natural Resource Sampling
ESPM 102D  Climate and Energy Policy [4]
or ESPM 60  Environmental Policy, Administration, and Law
ESPM 134  Fire, Insects, and Diseases in Forest Ecosystems [3]
ESPM 182  Forest Operations Management [3] (offered every other year)

Forestry Elective
(Select two)
ESPM 120  Science of Soils [3]
ESPM 121  Development and Classification of Soils [3]
ESPM C129  Biometeorology [3]
LD ARCH 110  Ecological Analysis [3]
LD ARCH C188  Geographic Information Systems [4]

Natural Resource Management Specialization Requirements
The Natural Resource Management specialization provides students with greater flexibility to explore subjects in ecology, physical environment, monitoring and measurement, and management and policy. Students can choose to concentrate their studies in water management, ecology, climates change or design their own concentration based on interest.

Choose One:

Choice A
• Either the Forestry Field program (ESPM 105A-D) or Biology and Geomorphology of Tropical Islands (ESPM C107) AND
• Three additional approved courses by and Ecosystem Management and Forestry Faculty

**Choice B**

Complete an approved six course resource concentration track or design your own six course concentration with EMF faculty approval with at least one elective from each of the following categories

**Natural Resource Management Choice B course list**

**Ecosystem Knowledge**

ESPM 108B  Environmental Change Genetics [3]
ESPM 111  Ecosystem Ecology [4]
ESPM 112  Microbial Ecology [3]
ESPM 113  Insect Ecology [3]
ESPM 114  Wildlife Ecology [3]
ESPM 115C  Fish Ecology [3]
ESPM 120  Science of Soils [3]
ESPM 121  Development and Classification of Soils [3]
ESPM C129  Biometeorology [3]
ESPM 131  Soil Microbial Ecology [3]
ESPM C180  Air Pollution [3]

**Ecosystem Measurement and Assessment**

ESPM 102B  Natural Resource Sampling and Laboratory in Natural Resource Sampling
ESPM 164  GIS and Environmental Science [3]
ESPM 173  Introduction to Ecological Data Analysis [3]
ESPM 174  Design and Analysis of Ecological Research [4]
LD ARCH 110  Ecological Analysis [3]

**Ecosystems Value and Policy**

ESPM 102D  Climate and Energy Policy [4]
ESPM 162A  Health, Medicine, Society and Environment [4]
ESPM 163AC  Environmental Justice: Race, Class, Equity, and the Environment [4]
ESPM 168  Political Ecology [4]
ESPM 169  International Environmental Politics [4]

**Ecosystem Management**

ESPM C104  Modeling and Management of Biological Resources [4]
ESPM 134  Fire, Insects, and Diseases in Forest Ecosystems [3]
ESPM 152  Global Change Biology [3]
ESPM 158  Biodiversity Conservation in Working Landscapes [4]
ESPM C167  Environmental Health and Development [4]
ESPM 181A  Fire Ecology [3]
ESPM 182  Forest Operations Management [3]

Possible concentrations in Natural Resource Management:

**Water & Watershed:** ESPM 120 Science of Soils, ESPM 164 GIS and Environmental Science, ESPM 182 Forest Operations Management, ESPM 102D Climate and Energy Policy, EPS 117 Geomorphology, CIV ENG 103 Introduction to Hydrology


**Management in Changing Climate:** ESPM 102D Climate and Energy Policy, ESPM C129 Biometeorology, ESPM 152 Global Change Biology, ESPM 173 Introduction to Ecological Data Analysis, ESPM 181A Fire Ecology, ENVECON C175 The Economics of Climate Change


Students who have a strong interest in an area of study outside their major often decide to complete a minor program. These programs have set requirements and are noted officially on the transcript in the memoranda section, but they are not noted on diplomas.

**General Guidelines**

1. All minors must be declared no later than one semester before a student’s Expected Graduation Term (EGT). If the semester before EGT is fall or spring, the deadline is the last day of RRR week. If the semester before EGT is summer, the deadline is the final Friday of Summer Sessions. To declare a minor, contact the department advisor for information on requirements, and the declaration process.

2. All courses taken to fulfill the minor requirements below must be taken for graded credit.

3. A minimum grade point average (GPA) of 2.0 is required for courses used to fulfill the minor requirements.

4. No more than one course may be used to simultaneously fulfill requirements for a student’s major and minor programs.

**Completing the Forestry and Natural Resources Minor Program**

• Students must complete at least five courses taken from the predetermined list below. No substitutions will be permitted.
• No more than one lower division course for the minor
• The courses taken must total at least 12 semester units.

**Requirements**

**Core courses:**

At least one core course required for the minor

ESPM 105D  Forest Management and Assessment [3]
ESPM 182  Forest Operations Management [3]
with a Forestry concentration from UC Berkeley, they will have the basic knowledge and skills to assess and manage forest resources.

The Natural Resource Management concentration trains students how to solve ecosystem problems that require interdisciplinary skills. Students can choose to emphasize such topics as wildlife biology, water policy, fire science, ecosystem restoration, environmental justice, remote sensing, and GIS, or rural sociology. Students who graduate the EMF major with an NRM concentration are well-positioned to tackle current environmental challenges (climate change, fire, sudden oak death, exurban development, drought, and novel ecosystems) while working in industry, government or environmental organizations.

Learning Goals for the Major

Forestry Concentration

Knowledge and skills are based on the four major subject areas required by the Society of American Foresters. These four subject areas and the basic competencies expected of students are as follows.

1. Ecology and Biology

   • Competencies must be documented as an:

     • Understanding of taxonomy and ability to identify forest species, their distribution, and associated habitat requirements.

     • Understanding of soil properties and processes, hydrology, water quality, and watershed functions.

     • Understanding of ecological concepts and principles including the structure and function of ecosystems, plant and animal communities, competition, diversity, population dynamics, succession, disturbance, and nutrient cycling.

     • Ability to make ecosystem, forest, and stand assessments.

     • Understanding of plant and animal physiology and the effects of climate, fire, pollutants, moisture, nutrients, genetics, insects and diseases on ecosystem health and productivity.

2. Measurement of Forest and Natural Resources

   • Competencies must be documented as an:

     • Ability to identify and measure land areas and conduct spatial analysis.

     • Ability to design and implement comprehensive inventories that meet specific objectives using appropriate sampling methods and units of measurement.

     • Ability to analyze inventory data and project ecosystem conditions.

3. Management of Forest and Natural Resources

   • Competencies must be documented as an:

     • Ability to develop and apply silvicultural and restoration prescriptions appropriate to management objectives including methods of establishing and influencing the composition, growth, and quality of forests and wildlands and understand the impacts of those prescriptions.
• Ability to analyze the economic, environmental, and social consequences of resource management strategies and decisions.

• Ability to develop management plans with specific multiple objectives and constraints.

• Understanding of the valuation procedures, market forces, processing systems, transportation and harvesting activities that translate human demands for timber-based and other consumable natural resource products into the availability of those products.

• Understanding of the valuation procedures, market, and non-market forces that avail humans the opportunities to enjoy non-consumptive products and services of forests and wildlands.

• Understanding of the administration, ownership, and organization of forest and resource management enterprises.

4. Resource Policy, Economics, and Administration

• Competencies must be documented as an:

  • Understanding of resource policy and the processes by which it is developed.

  • Understanding of how federal, state, and local laws and regulations govern the practice of forestry and resource management.

  • Understanding of professional ethics and recognition of the responsibility to adhere to ethical standards in decision-making on behalf of clients and the public.

  • Ability to understand the integration of technical, financial, human resources, and legal aspects of public and private enterprises.

Natural Resource Management Concentration

Knowledge and skills are based on the four major subject areas required by the Society of American Foresters. These four subject areas and the basic competencies expected of students are as follows:

1. Fundamental Knowledge of Ecosystem Components and Ecosystem Functioning

• Competencies must be documented as an:

  • Knowledge of the elements of botany, zoology, entomology, plant pathology, plant physiology, and genetics essential to an understanding of higher-order ecological processes.

  • An understanding of taxonomy and systematics and an ability to identify dominant and/or ecologically significant components of the flora and fauna of ecosystems at regional to continental scales.

  • Knowledge of the important life history characteristics of dominant and special-concern species.

  • Knowledge of soil properties and processes, hydrology, water quality, and watershed functions.

2. Measurement and Assessment of Ecosystem Components, Properties, and Functioning

• Competencies must be documented as an:

  • Ability to identify, measure, and map land areas and conduct spatial analyses.

  • Ability to design and implement accurate inventories and assessments of dominant or critical ecosystem components and services, ecosystem properties, and indicators of ecosystem health, including trees and other vegetation, vertebrate fauna, biodiversity, soil and water resources, timber, and recreational opportunities.

  • Ability to summarize and statistically analyze inventory and assessment data, evaluate the status of important ecosystem components, describe and interpret interactions and relationships, and project future ecosystem conditions.

3. Identification and Evaluation of Management Objectives

• Competencies must be documented as an:

  • Understanding of the valuation procedures, including market and nonmarket forces, that apply to ecosystem goods and services such as timber, water, recreational opportunities, carbon and nutrient cycling, and plant and animal biodiversity.

  • Ability to explain the relationships between demand, costs of production, and availability of those goods and services.

  • Ability to describe procedures for measuring stakeholder values and managing conflicts in the evaluation and establishment of management objectives.

  • Ability to evaluate and understand the economic, ecological, and social trade-offs of alternative land uses and ecosystem management decisions at local, regional, and global scales.

  • Knowledge and understanding of environmental policy as applied to ecosystems and the processes by which it is developed.

4. Management Planning, Practice, and Implementation

• Competencies must be documented as an:

  • Ability to develop and apply prescriptions for manipulating the composition, structure, and function of ecosystems to achieve management objectives, and to understand the impacts of those prescriptions at local and landscape scales.
• Ability to identify and control or mitigate specific threats to ecosystems such as insects, diseases, fire, pollutant stressors, and invasive plants or animals.

• Knowledge of the methods and procedures unique to the production of ecosystem goods and services such as timber, recreation, water, and wildlife populations.

• Ability to describe the process of adaptive management and its application to the management of ecosystems.

• Understanding of how federal, state, and local laws and regulations apply to management practice.

• Ability to develop management plans with specific objectives and constraints that are responsive to ownership or stakeholder goals and demonstrate clear and feasible linkages between current condition and desired future condition.

• Understanding of professional ethics, including the SAF Code, and recognition of the responsibility to adhere to ethical standards in the practice of natural resource management on behalf of clients and the public.

• Ability to integrate the knowledge, understanding, and skills from prior coursework in the development of collaborative solutions to realistic management problems.

In the College of Natural Resources, we provide holistic, individual advising services to prospective and current students who are pursuing major and minors in our college. We assist with a range of topics including course selection, academic decision-making, achieving personal and academic goals, and maximizing the Berkeley experience. If you are looking to explore your options, or you are ready to declare a major, double major, or minor, contact the undergraduate adviser for your intended major. Visit the College of Natural Resources website (http://nature.berkeley.edu/advising/undergraduate-advising) to explore all of our advising services.

Undergraduate Adviser
Ginnie Sadil
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260 Mulford Hall
510-642-7895

Contact Ginnie via email to schedule an appointment or visit 260 Mulford Hall for drop-in advising. Advising hours are weekdays 9:00 a.m. to 12:00 a.m. and 1:00 p.m. to 4:00 p.m. Closed Wednesday from 9:00 a.m. to 12:00 p.m.