

Environmental Science, Policy and Management

College of Natural Resources (<http://www.cnr.berkeley.edu/site>)

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Overview

The mission of the Department of Environmental Science, Policy, and Management (ESPM) is to bring a diverse research, teaching, and extension capacity to bear on environmental problems from local to global scales. The biological, physical, and social scientists of the department are organized into three divisions on the basis of similar disciplinary or topical research interests, but all work within the unifying framework of the analysis of environmental problems and the development of management strategies to address them. Environmental problems demand increased understanding of social, physical, and biological systems as well as the transfer of basic research findings through modeling, implementation, teaching, and extension. ESPM facilitates the cross-disciplinary collaboration necessary to address vital, contemporary questions.

The department includes three divisions: Ecosystem Sciences, Organisms and Environment, and Society and Environment. The faculty have expertise in diverse areas of critical importance to environmental issues. Excellence in research and teaching in many disciplines, all brought together to focus on environmental problems, offers students the opportunity to become leaders in research, conservation, restoration, and management of the environment, biodiversity, and natural resources.

Facilities

The Department of Environmental Science, Policy, and Management is spread among Giannini Hall, Mulford Hall, Hilgard Hall, the Valley Life Sciences Building, and Wellman Hall. In addition to laboratories and classrooms, the facilities include outstanding libraries and collections: the Bioscience and Natural Resource Library has some of the world's largest collections of books and periodicals on forestry, entomology, and natural resources, and extensive periodical collections in plant pathology and soils. ESPM also houses specialized laboratories for remote sensing and photogrammetry, tree physiology, pesticide chemistry, plant pathology, natural products chemistry and physiology, and ecology and wildlife biology, as well as well-equipped chemical and microbiological laboratories. There are also extensive herbaria, wildlife specimen collections, an entomological museum, insectary buildings, growth chambers, bioclimatic chambers, and greenhouses at the nearby Oxford Research Unit and at the Division of Biological Control on the Gill Tract near Albany.

Computer facilities include microcomputer laboratories and terminal rooms. ESPM manages field facilities at the 3,000-acre Blodgett Forest near Georgetown, Whitaker's Forest adjacent to Sequoia National Park, the Howard Forest near Willits, Russell Reservation near Lafayette, and the Baker Forest adjacent to the department's Summer Camp property.

Berkeley's location also provides easy access to numerous public and private resource management and conservation agencies including the US Forest Service, the US Fish and Wildlife Service, the US National Park Service, the California Department of Forestry and Fire Protection, and the California Department of Fish and Game.

Undergraduate Programs

Courses offered by the Department of ESPM serve students in the College of Natural Resources and across the campus in such diverse but related studies as forestry, conservation and resource studies, botany, biochemistry, geology, geography, and social science. A number of our courses are of sufficient general interest to attract students who wish to expand their intellectual horizons by learning something about environmental studies. Consult our website for updates here. (<http://ourevironment.berkeley.edu>)

Transfer Applicants

Transfer candidates should complete all lower division requirements for their intended major before entering Berkeley and may be denied admission if they have not done so. The Intersegmental General Education Transfer Curriculum (IGETC) is highly applicable to the Conservation and Resource Studies major and the Society and Environment major, and is of limited application to other ESPM programs. In cases where the transfer institution does not have a course equivalent to a specific prerequisite for the major, applicants must take the coursework the first semester of enrollment at UC Berkeley.

Summer Field Program

In the beautiful mountains of the Plumas National Forest, the UC Summer Field Camp provides students a unique opportunity to study the biota, soils, and geology of the Feather River Country. Tall ponderosa and sugar pines tower over the area, with white fir, Douglas fir, incense cedar, and black oak intermixed in the dense forests. Several streams pass through the camp. Housing is provided in cabins and bunkhouses, with a central kitchen and dining facility and a large campfire area in front. Residents enjoy easy hiking to waterfalls, lakes, and mountain meadows.

The courses of the summer field program cover wildland ecology as well as forest, range, and wildlife management; forest resource inventory; forest products; harvesting practices; and many other subjects. During the eight-week program students acquire a broad working knowledge of the concepts and techniques that wildland resource managers use in their work. Your experiences studying forestry and wildland resources in a field setting will enrich your further academic studies at Berkeley.

The courses are an integral part of the core curriculum in the forestry and natural resources major, but students of any major on the Berkeley campus are welcome to apply. Students may complete most requirements of the minor in forestry by attending camp. Information and an application may be found here. (<http://nature.berkeley.edu/espm/summercamp/main.html>) The courses that comprise the camp are ESPM 105A-105D, including Sierra Nevada Ecology, Forest Measurements, Silviculture and Utilization, and Forest Management and Assessment, for a total of 11 units.

Major in Conservation and Resource Studies

The Conservation and Resource Studies major is an interdisciplinary program designed for those who are interested in environmental issues and areas of interaction among natural resources, population, energy, technology, societal institutions, and cultural values. Students draw on the course offerings of the entire campus and appropriate community

resources in the development of individual programs of study. The major's orientation is toward flexibility and an individualized educational approach to understanding the structure and dynamic functions of complex environmental systems within our society and biosphere. It encourages interaction among students, faculty, and community.

Course requirements for the major include one ESPM environmental science course, one ESPM social science course, and ESPM 90, 100, and 194A. In the freshman and sophomore years, students will be expected to take two courses in reading and composition and one course in calculus or statistics. In addition, students must take one course in general biology with lab, one social science, one course each in physical sciences and the humanities; and two courses preparatory to the individual areas of interest. For transfer students, IGETC will satisfy all lower division requirements except ESPM 90, and one course in general biology with lab, equivalent to UC Berkeley's Biology 1B (recommended), Biology 1A/1AL or Biology 11/11L. In the junior and senior years, students will concentrate on their areas of interest. A more detailed statement of major requirements is available at the ESPM website and from the department office.

Major in Forestry and Natural Resources

The major in Forestry and Natural Resources (FNR) is the result of a merger of the former majors in forestry and in resource management. Specializations in natural science and human dimensions are offered in the study of the ecology and management of forest, woodland, and grassland ecosystems. Emphases in wildlife biology, water policy, fire science, ecosystem restoration, environmental justice, remote sensing and geographical information systems, and rural sociology are available. This major prepares students for graduate school and careers in environmental consulting, public agencies, nonprofit conservation organizations, and private companies, and for professional careers in forestry, wildlife, and range management. Participation in an eight-week summer field program in the northern Sierra Nevada is required.

Accreditation and Licensing: Established in 1914, forestry at Berkeley was the first forestry degree in California to be accredited by the Society of American Foresters. Completion of the Bachelor of Science degree in forestry provides four years of credit toward meeting the required seven years of qualifying education or professional experience for licensing as a professional forester in California. Students may obtain an additional year of credit toward licensing by completing the master of forestry degree. By careful selection of electives, students who complete the Bachelor of Science in forestry degree can meet the U.S. Civil Service and state requirements for the forester position.

Major in Molecular Environmental Biology

The Molecular Environmental Biology (MEB) major is designed to expose students to the organization and function of biological organisms at the molecular, cellular, organismal, and ecological levels. The breadth of this vertically integrated program is valuable in the added perspective it provides for students interested in how organisms function in their environment. Molecular approaches are expected to play an increasing role in environmental problem-solving in the near future, and educated citizens and researchers alike will need to have a grasp of basic molecular through ecological principles in order for these approaches to be effective in problem solving. This major is appropriate for pre-health (pre-med, pre-vet, pre-pharm, etc.) students, as well as students interested in general biology. Students in this major have a choice among six areas of emphasis:

1. Animal Health and Behavior
2. Biodiversity
3. Ecology
4. Environment and Human Health
5. Anthropod Science
6. Microbiology

Major in Society and Environment

Social and environmental problems are deeply intertwined. The Society and Environment major introduces students to the main approaches and theory for environmental social sciences, including how social science tools can be applied to environmental problems, and how social science theories contribute to understanding environmental problems. At the upper division level there are three major areas of concentration. Students are exposed to all three areas and choose to focus in one: US Environmental Policy and Management, Global Environmental Politics, or Justice and Sustainability.

Major in Environmental Sciences

The Environmental Sciences (ES) major is designed for students interested in studying environmental problems from a scientific perspective. The ES major prepares students to deal with issues arising from the impact of human interaction on natural systems. To address these problems, all ES students acquire strong backgrounds in math, biological sciences, and physical sciences. Students may choose to specialize further in a biological or physical science field such as ecology, conservation biology, toxicology, geology, hydrology, meteorology, engineering, or a social science field such as planning, policy analysis, economics, environmental justice, education. Each ES student completes a year-long senior research project with the support of a mentor in a biological, physical, or interdisciplinary research area.

Minors

Minor in Conservation and Resource Studies (CRS)

Conservation and Resource Studies is an interdisciplinary program designed for those who are interested in environmental issues and areas of interaction among natural resources, population, energy, technology, societal institutions, and cultural values. Students draw on the course offerings of the entire campus and appropriate community resources in the development of individual programs of study.

The CRS minor is oriented toward flexibility and an individualized educational approach to understanding the structure and dynamic functions of complex environmental systems within our society and biosphere. It encourages interaction among students, faculty, and community.

Minor in Forestry and Natural Resources

A minor in Forestry and Natural Resources is for students who are interested in learning about 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. Many students elect to complete the minor by participating in the eight-week summer field program, Forestry Field Camp, in the northern Sierra Nevada and taking one additional course on the UC Berkeley campus.

Students in many diverse majors such as integrative biology, business administration, and civil engineering may find this minor complimentary to their professional career goals.

Graduate Programs

The degree programs address environmental problems of major social and political impact, which are based in the biological and physical sciences. Two general types of education are needed to produce people qualified to address these hybrid problems: broadly based interdisciplinary education, and disciplinary education in relevant fields supplemented with exposure to cross-disciplinary communication and problem solving. The ESPM program offers both types of education.

Interest in environmental problems has resulted in a dramatic recent increase in undergraduate and graduate programs dealing with various aspects of environmental science. Our program integrates the biological, social, and physical sciences to provide advanced education in basic and applied environmental sciences, develops critical analytical abilities, and fosters the capacity to conduct research into the structure and function of ecosystems at molecular through ecosystem scales and their interlinked human social systems.

The goal of the program is to provide both a strong disciplinary education and broadly based experience in cross-disciplinary communication and problem solving. In order to achieve this, the program leading to the MS and PhD in environmental science, policy, and management will require that a student complete three core courses, and coursework in the following four broad areas: disciplinary emphasis, area of specialization, research methods, and breadth requirement. The graduate adviser and a guiding committee, chosen by the student and approved by the graduate adviser, will be responsible for designing a program that fulfills the degree requirements and meets the student's needs. This program structure provides the student with flexibility for interdisciplinary interaction within the graduate program, while ensuring at least a minimum level of disciplinary competence and understanding.

Three Fields of Emphasis

Students will be required to demonstrate competence in one of the three fields of emphasis defined below. Specific coursework within each field will be chosen by the guiding committee in conjunction with the student and approved by the graduate adviser. The three fields provide flexibility within a clear program structure.

Disciplinary Emphasis

The disciplinary emphasis is the broadest academic area encompassing the student's interests. Currently the three disciplinary emphases within the department are ecosystem sciences, organisms and environment, and society and environment. A student pursuing a strongly interdisciplinary program may study more than one of these disciplines in depth.

1. **Ecosystem Sciences:** The Ecosystem Sciences Division increases knowledge of the biological, chemical, and physical processes that determine terrestrial ecosystem dynamics in order to provide a scientific basis for management and to analyze the adverse stresses that society places on terrestrial ecosystems. Central to this is collaboration between biological and physical scientists, leading to an integrated understanding of ecosystem composition, structure, and function, as well as to the extension of basic research findings through modeling, implementation, and educational activities. The principal research and teaching efforts are directed toward forests, grasslands, and agricultural lands, including their interactions with contiguous aquatic, wetland, and marine ecosystems and the atmosphere. Investigation is carried out over a wide range of spatial and temporal scales, with emphasis on extending understanding of processes derived from research at smaller scales to landscape,

regional, and global scales. The role of human activities, including ecosystem management scenarios, is an integral component.

2. **Organisms and Environment:** The mission of the Division of Organisms and Environment is to use fundamental research on insect systems to address critical environmental issues and to solve vital environmental problems. Research interests in this division are wide ranging, from the molecular to whole ecosystems, providing a strong integration of biological processes and a diversity of intellectual challenges for graduate students. Systematics and biodiversity, behavior and neurobiology, and ecology and biological control are notable strengths in Organisms and Environment. Other research emphases include environmental toxicology, medical entomology, and insect-microbe interactions.
3. **Society and Environment:** Faculty and students of the Division of Society and Environment study how social distributions of power and resources affect environmental dynamics and their social consequences. Research and teaching focus on how cultural, social, political, and economic institutions affect the treatment of natural resources and interactions with environmental phenomena; and on the practical processes, methods, and implications of forming, choosing, and applying policy and management regimes in different institutional frameworks and environmental settings. This knowledge is applied to concrete problems in human-ecosystem relations from local to global scales in a wide variety of cultural and historical contexts. Theories and methods are chosen from the full range of science and interpretive analysis to satisfy the standards of both significant scholarship and effective practical contribution for the problem of interest.

Area of Specialization

The area of specialization is a narrower field within the context of the disciplinary emphasis. Some examples of these areas are microbial community ecology, ecosystem function, insect population and community ecology, biological control of arthropods, insect conservation biology, American environmental history and policy, international forest management, biogeochemistry, Mediterranean grassland ecosystems, remote sensing, and forest management.

Research Methods

Candidates for the PhD must demonstrate competence in research techniques appropriate for the disciplinary emphasis and area of specialization. Preparation in this field must include experimental design, sampling design, estimation, and hypothesis testing.

Breadth Requirement

Each student's program must include coursework addressing human and ecosystem processes and the relationship between them. All students must complete the required core courses, ESPM 201A-201C-201S. In addition, while in residence, doctoral students in the natural sciences must complete one additional course in the application of social sciences to environmental problems, and those in the social sciences must complete one additional course in the biological or physical sciences. The level of this course will be determined by the guiding committee, based on the student's background and experience. The course must be a minimum of 2 graduate units or 3 upper division undergraduate units, and must be taken for a letter grade unless it is offered on an S/U basis only.

Required Core Courses

All master's and doctoral students in ESPM are required to take a core course sequence. The first required course, ESPM 201A, Research Approaches in Environmental Science, Policy, and Management (3 units),

will be taken in the first fall semester by all new master's and doctoral students. ESPM 201C, the seminar entitled Environmental Forum (1 unit), is required for all doctoral students and must either have been taken before, or be in progress, when the doctoral oral qualifying examination is held. Master's students are not required to take 201C. ESPM 201S, Environmental Science, Policy, and Management Colloquium (1 unit), is required for all doctoral students and must be taken once before the oral qualifying examination. ESPM 201S may be repeated for credit.

Students are also required to complete a minimum of 6 units in their area of specialization. In addition, students in natural sciences must complete one additional course in the application of social sciences to environmental problems, and students in social sciences must complete one additional course in the biological or physical sciences. The Guiding Committee and the head graduate adviser will approve the selection of appropriate courses to meet these course requirements.

Admission to the Graduate Program

Applicants for admission to the graduate program must hold a bachelor's degree from a university or college with curricula and standards equivalent to those of the University of California. The completed undergraduate program should normally be in a field relevant to the disciplinary emphasis chosen. Applicants without this background may be admitted with the understanding that their coursework must compensate for deficiencies in their preparation. We suggest that prospective applicants consult with faculty or the Graduate Student Services Office for advice on what courses may be recommended.

It is critical that all applicants identify on their application faculty whose research and work overlap with their strengths and interests. Without this information, the admission committee will not be able to evaluate your application properly. You may wish to contact faculty during the application process, but it is not required. Faculty sponsorship of entering graduate students will be determined once all applications have been reviewed and final admission offers have been made. The ESPM admission committee, not individual faculty, makes the final decisions on who will be offered admission to the program. Applications are accepted for the fall semester only.

Research Facilities

Departmental facilities of high quality are available to support graduate student research and education. Facilities include state-of-the-art instrumentation and laboratories, insectary buildings, controlled environment chambers, extensive greenhouse space, and field plots at the Oxford Tract (on campus). Field facilities available to departmental faculty and students include the 3500 acre Blodgett Forest; Whitaker's Forest with giant sequoia stands adjacent to King's Canyon National Park; Russell Reservation, located 13 miles east of the campus. Students may conduct research with an agricultural orientation at any of several University of California field stations which are located throughout the state.

Supplementing the University library are extensive holdings covering the physical, biological, and sociological dimensions of forestry and wildland resource management. The department also houses an outstanding entomological museum that supports both teaching and research programs in insect systematics and ecology.

Master of Forestry (MF)

The Master of Forestry (MF) degree is the advanced professional forestry degree granted by the Department of Environmental Science, Policy,

and Management. The student who has completed an undergraduate curriculum in forestry is usually broadly trained in the principles of forestry but has not yet developed proficiency in the application of these principles to diverse problems involved in professional practice. The Master of Forestry program is designed to advance the student's understanding of the essentials of professional forest management at the graduate level within the context of resource and environmental planning of sustainable systems.

The MF program consists of three components: coursework, an internship, and a professional paper. The coursework consists of 24 semester units of upper division and graduate courses of which at least 12 units must be at the graduate level. This program of study must be approved by the graduate adviser and guiding professor as constituting appropriate advanced specialized training in professional forest resource management. The internship, normally with a public or private forest land management organization, provides direct experience in the application of theory to professional land management. The purpose of the professional paper is to demonstrate, within a distinct framework, a student's ability to assemble and analyze data and to recommend a resolution of an applied forest problem. The paper may be based on the internship or on another supervised professional work experience, or may be a report based on independent analysis. The paper must be accepted and approved by the guiding professor and graduate adviser.

Upon completion of the program of coursework, and approval of the professional paper, the student will take a comprehensive oral examination covering the field of forest management and present the results of their professional paper. Although major emphasis will be placed on the professional project, students should be prepared to demonstrate mastery of the general field of forestry.

Interdepartmental Graduate Group in Range Management (MS)

For information about the MS degree in range management, see the Range Management section of this bulletin. Additional information about the graduate programs offered by the Department of Environmental Science, Policy, and Management may be obtained from the Graduate Student Services, 133 Mulford Hall, (510) 642-6410; fax: (510) 643-2759; e-mail: espmgrad@nature.berkeley.edu ; or from the department's website (<http://ourenvironment.berkeley.edu/graduate-programs/degrees/ms-range-management>) .

ESPM 2 The Biosphere 3 Units

Department: Environ Sci, Policy, and Management

Course level: Undergraduate

Term course may be offered: Fall

Grading: Letter grade.

Hours and format: 3 hours of Lecture and 1 hour of Discussion per week for 15 weeks.

An introduction to the unifying principles and fundamental concepts underlying our scientific understanding of the biosphere. Topics covered include the physical life support system on earth; nutrient cycles and factors regulating the chemical composition of water, air, and soil; the architecture and physiology of life; population biology and community ecology; human dependence on the biosphere; and the magnitude and consequences of human interventions in the biosphere.

ESPM 6 Environmental Biology 3 Units

Department: Environ Sci, Policy, and Management

Course level: Undergraduate

Term course may be offered: Fall

Grading: Letter grade.

Hours and format: 2 hours of Lecture and 1 hour of Discussion per week for 15 weeks.

Prerequisites: One course in introductory college biology is recommended. Intended for nonscience majors.

Basic biological and ecological principles discussed in relation to environmental disruptions. Human interactions with the environment; their meaning for animals and plants. Discussion of basic ecological processes as a basis for understanding environmental problems and formulating strategies for their solution.

Instructor: Chapela

ESPM 9 Environmental Science Case Study Seminar 3 Units

Department: Environ Sci, Policy, and Management

Course level: Undergraduate

Term course may be offered: Spring

Grading: Letter grade.

Hours and format: 3 hours of Seminar per week for 15 weeks.

Utilizing a field intensive seminar format, the course will introduce lower division students to the process of addressing real environmental problems. Through a progression of case studies, students will explore a spectrum of research design and implementation approaches. By the end of the semester, they will be able to frame a researchable question, design a protocol for gathering relevant information, analyze the information, and derive an objective conclusion. Throughout the semester, students will present case study results in oral and written form.

Instructors: Fairfax, Spencer

ESPM C10/L & S C30V Environmental Issues 4 Units

Department: Environmental Science, Policy, and Management; Environ Sci, Policy, and Management; Letters and Science

Course level: Undergraduate

Terms course may be offered: Fall and spring

Grading: Letter grade.

Hours and format: 3 hours of Lecture and 1.5 hours of Discussion per week for 15 weeks.

Relationship between human society and the natural environment; case studies of ecosystem maintenance and disruption. Issues of economic development, population, energy, resources, technology, and alternative systems.

Students will receive no credit for C10 after taking 10. Instructor: Welter

ESPM C11/L & S C30U Americans and the Global Forest 4 Units

Department: Environmental Science, Policy, and Management; Environ Sci, Policy, and Management; Letters and Science

Course level: Undergraduate

Term course may be offered: Fall

Grading: Letter grade.