

# ENVIRONMENTAL SCIENCE & MANAGEMENT

**Bachelor of Science degree with a major in Environmental Science & Management** — with concentrations in:  
 Ecological Restoration  
 Energy & Climate  
 Environmental Education & Interpretation  
 Environmental Planning & Policy  
 Geospatial Science  
 Natural Resources Recreation

## Minors

Ecological Restoration  
 Environmental Education & Interpretation  
 Environmental & Natural Resources Planning  
 Environmental Policy  
 Natural Resources  
 Natural Resources Recreation

## Certificates of Study

Environmental Education & Interpretation  
 Environmental & Natural Resources Planning  
 Geospatial Science  
 Natural Resources Policy & Administration

**Master of Science degree in Natural Resources** — with a concentration in Environmental Science & Management

## Department Chair

Steven R. Martin, Ph.D.

## Environmental Science & Management

Natural Resources Building 200  
 707-826-4147  
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## Associated Faculty & Advisors

Natalie Arroyo, Gillian Black, Craig Benson, Kerry Byrne, Daniel Cordalis, Jeff Dunk, Yvonne Everett, Kevin Fingerma, James Graham, David Gwenzi, Holly Harvey, Jennifer Kalt, Buddhika Madurapperuma, Nick Malloy, Steven Martin, Judith Mayer, Melanie McCavour, Jack Murphy, Alison O'Dowd, Jennifer Ortega, Laurie Richmond, Amy Rock, Roxann Schroeder, Sabra Steinberg, Jennifer Tarlton, William Trush, Julie Van Sickle, Tashina Welliver

## The Program

Students completing this program will have demonstrated:

- the ability to apply science to understanding ecosystems and natural resources

- the ability to understand the policy and social implications of environmental issues.
- the knowledge and skills to understand, analyze, address and manage the consequences of human actions on the physical, biological, and cultural world.

- the knowledge and skills to seek out the information and resources necessary to understand complex environmental issues.

- the writing, speaking, and electronic communication skills needed to communicate with the public and professionals concerning the environmental sciences.

- the ability to apply critical thinking skills as the basis for decision making and sound value judgments.

Graduates should find work with state, federal, and local governments, nonprofit conservation organizations, private sector consulting firms (particularly those dealing with environmental impact analysis, environmental planning, wetlands delineation, environmental restoration, geospatial applications in natural resources, energy technology and planning, and natural resource management), or go on to professional and graduate schools to study ecology, environmental law, environmental planning, human dimensions of natural resources, outdoor recreation management, geospatial science, natural resources management, wilderness management, public administration, or environmental policy.

## Preparation

High school students need strong academic preparation in math, writing, and the sciences.

## REQUIREMENTS FOR THE MAJOR

*For a description of degree requirements to be fulfilled in addition to those listed below for the major, please see "The Bachelor's Degree" section of the catalog, pp. 66-81., and "The Master's Degree" pp. 82-84.*

*Complete all courses in the major with a C- or better.*

### Core Courses (24 units)

ESM 105	(3) Natural Resource Conservation
ESM 111	(1) Environmental Science Seminar
GSP 101	(2) Geospatial Concepts <b>and</b>
GSP 101L	(1) Geospatial Concepts Lab
STAT 109†	(4) Introductory Biostatistics
ESM 230	(3) Environmental Methods

ESM 303	(4) Applied Natural History & Ecology
ESM 305	(3) Environmental Conflict Resolution
ESM 325	(3) Environmental Law & Regulation

Select one of the following concentrations:

### Ecological Restoration Concentration

*Core courses plus:*

#### Lower Division

BIOL 105	(4) Principles of Biology
BOT 105	(4) General Botany
CHEM 107	(4) Fundamentals of Chemistry
GSP 270	(3) Geographic Information Science (GIS)
SOIL 260	(3) Intro to Soil Science

#### Upper Division

BOT 350	(4) Plant Taxonomy
ESM 355	(3) Principles of Ecological Restoration
ESM 425	(3) Environmental Impact Assessment
ESM 435	(2) Grant Writing
ESM 455	(4) Applied Ecological Restoration
FOR 315	(3) Forest Management <b>and</b>
FOR 431	(3) Forest Restoration, <b>or</b>
RRS 306	(3) Rangeland Resource Principles <b>and</b>
RRS 430	(3) Wildland Restoration & Development
WSHD 310	(4) Hydrology & Watershed Management

Take **one** upper division course approved by your advisor, from BOT, ESM, FISH, FOR, GEOL, GSP, RRS, SOIL, WSHD, or WLDF. (Prerequisites may be required for some courses, depending on choice.)

**NOTE: 24 units may double-count toward GE requirements.**

### Energy & Climate Concentration

*Core courses plus:*

#### Lower Division

BIOL 105	(4) Principles of Biology, <b>or</b>
BOT 105	(4) General Botany

† Course requires one or more prerequisites that are not required elsewhere in the major.

- CHEM 107 (4) Fundamentals of Chemistry \*\*  
 ECON 104 (3) Contemporary Topics in Economics  
 MATH 105† (3) Calculus for the Biological Sciences & Natural Resources  
 PHYX 106 (4) College Physics: Mechanics & Heat  
 PHYX 107 (4) College Physics: Electromagnetism & Modern Physics

**Upper Division**

- ECON 450 (4) Energy Economics & Climate Policy  
 ENGR 305 (3) Appropriate Technology  
 ENGR 371 (3) Energy Systems & Technology  
 ESM 370 (3) Energy, Technology & Society  
 ESM 411 (3) Sustainable Campus  
 ESM 425 (3) Environmental Impact Assessment

*Take two climate science courses:*

- CHEM 370 (3) Earth System Chemistry  
 OCN 420† (3) Oceans and Climate  
 WSHD 458 (3) Climate Change & Land Use

*Take two tools courses:*

- ECON 423 (3) Environmental & Natural Resource Economics  
 ESM 309B (3) Environmental Communication  
 ESM 435 (3) Grant Proposal Writing  
 GSP 270 (3) Geographic Information Science (GIS)  
 GEOG 301 (3) Int'l Environmental Issues & Globalization

**NOTE: 24 units may double-count toward GE requirements.**

**Environmental Education & Interpretation Concentration**

*Core courses plus:*

- BIOL 105 (4) Principles of Biology, **or**  
 BOT 105 (4) General Botany  
 GEOL 109 (4) Introduction to Geology, **or**  
 SOIL 260 (3) Introduction to Soil Science  
 CHEM 107 (4) Fundamentals of Chemistry, **or**  
 GEOG 106 (3) Physical Geography, **or**  
 PHYX 104 (4) Descriptive Astronomy  
 ESM 210 (3) Public Land Use Policies & Management  
 ESM 215 (3) Natural Resources & Recreation  
 ESM 253 (3) Interpretive Computer Graphics

- CD 209 (3) Middle Childhood Development  
 ESM 350 (3) Fundamentals of Environmental Education & Interpretation  
 ESM 351 (1) Environmental Interpretation Field Trip  
 ESM 353 (3) Environmental Education & Interpretation Graphics  
 ESM 430 (3) NR Management in Protected Areas  
 ESM 450 (3) Applied Environmental Education & Interpretation  
 ESM 453 (4) Environmental Education & Interpretation Practicum (capstone)

- ESM 482 (2) Internship, **or**  
 ESM 499 (2) Directed Study

*Take one skills course:*

- ART 340 (3) Graphic Design II  
 ART 356 (3) Museum & Gallery Practices  
 ESM 309B (3) Environmental Communication  
 ESM 425 (3) Environmental Impact Assessment  
 GSP 270 (3) Geographic Information Science (GIS)  
 REC 330 (3) Adventure Theory & Practice

Plus one upper division science or natural resources depth course approved by advisor (3 units).

**NOTE: 24 units may double-count toward GE requirements.**

**Environmental & Natural Resources Recreation Concentration**

*Core courses plus:*

- BIOL 105 (4) Principles of Biology, **or**  
 BOT 105 (4) General Botany  
 CHEM 107 (4) Fundamentals of Chemistry\*\*  
 ESM 210 (3) Public Land Use Policies & Management  
 ESM 215 (3) Natural Resources & Recreation  
 SOIL 260 (3) Intro to Soil Science  
 GSP 270 (3) Geographic Information Science (GIS)  
 FOR 374 (3) Wilderness Area Management  
 ESM 415 (3) Recreation & Park Planning (alternate years)  
 ESM 425 (3) Environmental Impact Assessment  
 ESM 430 (3) NR Management in Protected Areas  
 ESM 435 (2) Grant Proposal Writing

- ESM 440 (2) Managing Recreation Visitors &  
 ESM 440L (1) Managing Recreation Visitors Lab  
 ESM 482 (2) Internship, **or**  
 ESM 499 (2) Directed Study

*Take one of the following skills courses:*

- ESM 253 (3) Interpretive Computer Graphics  
 ESM 309B (3) Environmental Communication  
 ESM 350 (3) Fundamentals of Environmental Education & Interpretation  
 GSP 330 (3) Mobile Mapping  
 GSP 370 (3) Intermediate GIS

Plus one upper division natural resources management course (3 units), approved by advisor, from FISH, FOR, ESM, RRS, SOIL, WSHD, WLDF.

**NOTE: 24 units may double-count toward GE requirements.**

**Environmental Planning & Policy Concentration**

*Core courses plus:*

**Lower Division**

- BOT 105 (4) General Botany  
 CHEM 107 (4) Fundamentals of Chemistry\*\*  
 ESM 210 (3) Public Land Use Policies & Management  
 GSP 270 (3) Geographic Information Science (GIS)

**Upper Division**

- ESM 360 (3) Intro to Environmental Planning Methods  
 ESM 365 (3) Local Government Planning  
 ECON 423 (3) Environmental & NR Economics  
 ESM 425 (3) Environmental Impact Assessment  
 ESM 435 (2) Grant Proposal Writing  
 ESM 460 (3) Environmental Planning for Public Lands & Rural Communities, **or**  
 ESM 462 (3) Coastal & Marine Planning  
 ESM 475 (4) Senior Practicum (Capstone)  
 ESM 482 (2) Internship, **or**  
 ESM 499 (2) Directed Study

† Course requires one or more prerequisites that are not required in the major.

\*\*CHEM 109 & CHEM 110 may be substituted for CHEM 107.

Take one ecology & management course:

- ESM 355 (3) Principles of Ecological Restoration
- ESM 370 (3) Energy Technology & Society
- ESM 420 (3) Ecosystem Analysis
- ESM 430 (3) Natural Resource Management in Protected Areas
- FOR 321 (3) Fire Ecology
- FOR 374 (3) Wilderness Area Management
- FISH 476† (3) Ecology of Running Waters
- WLDF 460† (3) Conservation Biology

Take one natural resource science fundamentals course:

- FOR 130 (3) Dendrology
- GEOL 109 (3) General Geology
- SOIL 260 (3) Intro to Soil Science
- BOT 350† (4) Plant Taxonomy
- WSHD 310 (4) Hydrology & Watershed Management

Take two upper division policy and management courses, chosen from a list of approved courses provided by your advisor; from ENGR, FISH, FOR, GEOG, NAS, PHIL, PSCI, RRS, SOIL, WSHD, WLDF. (Prerequisites may be required for some courses, depending on choice.)

**NOTE: 24 units may double-count toward GE requirements.**

### Geospatial Science Concentration

Core courses plus:

#### Lower Division

- GEOG 106 (3) Physical Geography
- GSP 216 (3) Intro to Remote Sensing
- GSP 270 (3) Geographic Information Science (GIS)

#### Upper Division

- GSP 316 (4) Cartography
- GSP 318 (3) Geospatial Programming I
- GSP 326 (3) Intermediate Remote Sensing
- GSP 330 (3) Mobile Mapping
- GSP 370 (3) Intermediate GIS
- GSP 418 (3) Geospatial Programming II, **or**

† Course requires one or more prerequisites that are not required in the major.

- GSP 436 (3) Advanced Remote Sensing, **or**
- GSP 470 (3) Advanced Geospatial Analysis & Modeling
- ESM 410 (3) Environmental Science Practicum (capstone)
- ESM 425 (3) Environmental Impact Assessment
- ESM 435 (2) Grant Proposal Writing

Take one natural resources depth or course approved by advisor; minimum three units:

- ESM 360 (3) Intro to Environmental Planning Methods
- ESM 430 (3) Natural Resource Mgmt. in Protected Areas
- FISH 220 (3) Water Resources & Conservation
- FISH 260 (3) Fish Conservation & Mgmt.
- FISH 300 (3) Intro to Fishery Biology
- FOR 302 (3) Forest Ecosystems & People
- FOR 307 (3) California's Forests & Woodlands
- GEOL 300† (3) Geology of California
- GEOL 303 (3) Earth Resources & Global Environmental Change
- GEOL 306† (3) General Geomorphology
- GEOL 308 (3) Natural Disasters
- OCN 301 (3) Marine Ecosystems — Human Impact
- OCN 304 (3) Resources of the Sea
- RRS 306 (3) Wildland Resource Principles
- WSHD 310 (4) Hydrology & Watershed Management
- WSHD 333 (3) Wildland Water Quality
- WLDF 301 (3) Principles of Wildlife Management
- WLDF 468 (3) Spatial Wildlife Ecology

**NOTE: 27 units may double-count toward GE requirements.**

## REQUIREMENTS FOR THE MINORS

Complete all courses in the minor with a C- or better:

### Ecological Restoration Minor

- BOT 105 (4) General Botany
- SOIL 260 (3) Intro to Soil Science
- ESM 355 (3) Principles of Ecological Restoration

Plus take either:

- FOR 315 (3) Forest Management **and**
- FOR 431 (3) Forest Restoration **or**
- RRS 306 (3) Rangeland Resource Principles **and**
- RRS 430 (3) Wildland Restoration & Development

### Environmental Education & Interpretation Minor

- ESM 215 (3) Natural Resources & Recreation
- ESM 253 (3) Interpretive Computer Graphics [or equivalent]
- ESM 350/351 (3/1) Fundamentals of Environmental Education & Interpretation, **and** Field Trip
- ESM 353 (3) Environmental Education & Interpretation Graphics
- ESM 430 (3) NR Management in Protected Areas
- ESM 450 (3) Applied Environmental Education & Interpretation

### Environmental & Natural Resources Planning Minor

- GEOG 106 (3) Physical Geography
- ESM 105 (3) Natural Resource Conservation
- ESM 210 (3) Public Land Use Policies & Management
- ESM 360 (3) Intro to Environmental Planning Methods

Plus two courses from the following:

- ESM 325 (3) Environmental Law & Regulation
- ESM 365 (3) Local Government Planning
- ESM 425 (3) Environmental Impact Assessment

### Environmental Policy Minor

- ESM 105 (3) Natural Resources Conservation
- ESM 210 (3) Public Land Use Policies & Management
- ESM 325 (3) Environmental Law & Regulation

- ESM 425 (3) Environmental Impact Assessment
- PSCI 306 (3) Environmental Politics

*Take one course from the following:*

- ECON 423 (3) Environmental & Natural Resource Economics
- NAS 332 (3) Environmental Justice
- PSCI 317 (4) Public Policy Process
- PSCI 352 (4) Water Politics
- PSCI 364 (4) Technology & Development
- PSCI 373 (4) Politics of Sustainability
- PSCI 412 (4) Legal Research
- WSHD 430 (3) Water Rights/Water Law

### **Natural Resources Minor**

- BIOL 105 (4) Principles of Biology
- ESM 105 (3) Natural Resource Conservation
- SOIL 260 (3) Introduction to Soil Science

At least three courses from the following  
(at least six units must be 300 or above):

- ESM 210 (3) Public Land Use Policies & Management
- ESM 215 (3) Natural Resources & Recreation
- ESM 365 (3) Local Government Planning
- FISH 300 (3) Introduction to Fishery Biology
- FOR 315 (3) Forest Management
- FOR 374 (3) Wilderness Area Mgmt.
- OCN 301 (3) Marine Ecosystems — Human Impact
- OCN 304 (3) Resources of the Sea
- RRS 306 (3) Wildland Resource Principles
- WLDF 301 (3) Principles of Wildlife Management

### **Natural Resources Recreation Minor**

- ESM 210 (3) Public Land Use Policies & Management
- ESM 215 (3) Natural Resources & Recreation
- ESM 305 (3) Environmental Conflict Resolution, **or**
- ESM 309B (3) Environmental Communication
- FOR 374 (3) Wilderness Area Mgmt.
- ESM 415 (3) Recreation & Park Planning, **or**
- ESM 440 (2) Managing Recreation Visitors
- ESM 430 (3) NR Management in Protected Areas

