

# 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, Jeff Dunk, Yvonne Everett, Kevin Fingerma, James Graham, David Gwenzi, Jennifer Kalt, Buddhika Madurapperuma, Nick Malloy, Jennifer Marlow, Steven Martin, Judith Mayer, Melanie McCavour, Jack Murphy, Alison O'Dowd, Jennifer Ortega, Laurie Richmond, Amy Rock, Roxann Schroeder, Jennifer Tarlton, William Trush, Julie Van Sickle, Casey Vaughn, 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. 67-82.*

## Unit Requirements

**Core units:** 24  
**Concentration units:** 39-54  
**Total units in the major:** 73-78  
**Total units required for the degree:** 120

## Special Grade Requirement

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

## Core Courses (24 units)

ESM 105 (3) Natural Resource Conservation  
ESM 111 (1) Environmental Science Seminar  
GSP 101 (2) Geospatial Concepts and

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

## Concentrations

*Complete one of the following concentrations to fulfill the requirements of the major:*

## Ecological Restoration Concentration (47 units)

### 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 and  
FOR 431 (3) Forest Restoration, or  
RRS 306 (3) Rangeland Resource Principles and  
RRS 430 (3) Wildland Restoration & Development  
WSHD 310 (4) Hydrology & Watershed Management

*Complete 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.**

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

## Energy & Climate Concentration (54 units)

### Lower Division

BIOL 105 (4) Principles of Biology, **or**  
BOT 105 (4) General Botany

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) Energy & Climate Capstone

ESM 425 (3) Environmental Impact  
Assessment

*Complete two climate science courses:*

CHEM 370 (3) Earth System Chemistry

OCN 420† (3) Oceans and Climate

WSHD 458 (3) Climate Change & Land  
Use

*Complete two tools courses:*

ECON 423 (3) Environmental & Natural  
Resource Economics

ESM 309B (3) Environmental  
Communication

ESM 435 (2) Grant Proposal Writing  
GSP 270 (3) Geographic Information  
Science (GIS)

GEOG 301 (3) International Environmental  
Issues & Globalization

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

### Environmental Education & Interpretation Concentration (48 units)

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

*Complete 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 (45 units)

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

*Complete one skills course:*

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 (45-47 units)

#### 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

† Course requires one or more prerequi-  
sities that are not required in the major.

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

ESM 475	(4) Senior Practicum (Capstone)
ESM 482	(2) Internship, <b>or</b>
ESM 499	(2) Directed Study
<i>Complete one ecology &amp; management course:</i>	
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
<i>Complete one natural resource science fundamentals course:</i>	
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

*Complete 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 (39 units)

#### 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, <b>or</b>

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

GSP 436	(3) Advanced Remote Sensing, <b>or</b>
GSP 470	(3) Advanced Geospatial Analysis & Modeling
ESM 410	(3) Geospatial Capstone
ESM 425	(3) Environmental Impact Assessment
ESM 435	(2) Grant Proposal Writing
<i>Complete one natural resources depth or course approved by advisor; minimum 3 units:</i>	
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

#### Special Grade Requirement

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

#### Ecological Restoration Minor

**Total units required for the minor: 16**

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

*Complete either:*

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
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### Environmental Education & Interpretation Minor

**Total units required for the minor: 19**

ESM 215	(3) Natural Resources & Recreation
ESM 253	(3) Interpretive Computer Graphics [or equivalent]
ESM 350/351	(3/1) Fundamentals of Environmental Education & Interpretation, <b>and</b> 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

**Total units required for the minor: 18**

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

**Total units required for the minor: 18-19**

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

*Complete 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

Total units required for the minor: 19

- 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 6 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

Total units required for the minor: 17-18

- 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

