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 Management

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 Aroyo, Gillian Black, Craig Benson, Kerry Byrne, Jeff Dunk, Yvonne Everett, Kevin Fingerman, James Graham, David Gwienzi, Jennifer Katt, 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 Tarton, 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

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
- BOTT 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
- BOTT 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, 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 **
- ECDN 104  *(3)* Contemporary Topics in Economics
- MATH 105I  *(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
- ECDN 450  *(4)* Energy Economics & 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 420I  *(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)
- GEDG 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
- CHEM 107  *(4)* Fundamentals of Chemistry **
- 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 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
- 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
- ESM 253  *(3)* Interpretive Computer Graphics
- 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 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 & 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
- ESM 253  *(3)* Interpretive Computer Graphics
- 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 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.

### Upper Division
- ESM 360  *(3)* Intro to Environmental Planning Methods
- ESM 365  *(3)* Local Government Planning
- ECON 423  *(3)* Environmental & Natural Resources 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 482  *(3)* Coastal & Marine Planning

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

* *CHEM 109 & CHEM 110 may be substituted for CHEM 107.
Complete one ecology & management course:

- **ESM 370**: [3] Energy Technology & Society
- **ESM 420**: [3] Ecosystem Analysis
- **ESM 430**: [3] Natural Resource Management in Protected Areas
- **WLDF 460†**: [3] Conservation Biology

Complete one natural resource science fundamentals course:

- **FOR 130**: [3] Dendrology
- **SOIL 260**: [3] Intro to Soil Science
- **BOT 350†**: [4] Plant Taxonomy

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

**Upper Division**

- **GSP 316**: [4] Cartography
- **GSP 370**: [3] Intermediate GIS
- **GSP 41B**: [3] Geospatial Programming II, or

**Environmental Education and Interpretation Minor**

Complete one natural resources depth or course approved by advisor; minimum 3 units:

- **ESM 360**: [3] Intro to Environmental Planning Methods
- **ESM 430**: [3] Natural Resource Mgmt. in Protected Areas
- **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 308**: [3] Natural Disasters
- **DCC 301**: [3] Marine Ecosystems — Human Impact
- **DCC 304**: [3] Resources of the Sea

**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**

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

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

**SDIL 260**: [3] Intro to Soil Science

**Complete either:**

- **FOR 315**: [3] Forest Management and
- **FOR 431**: [3] Forest Restoration
- **RRS 306**: [3] Rangeland Resource Principles and

**Environmental Policy Minor**

Complete one course from the following:

- **NAS 332**: [3] Environmental Justice
- **PSCI 317**: [4] Public Policy Process
- **PSCI 352**: [4] Water Politics
- **PSCI 373**: [4] Politics of Sustainability
- **PSCI 412**: [4] Legal Research

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

**ESM 105**: [3] Natural Resources 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

**Environmental & Natural Resources Planning Minor**

Complete one course from the following:

- **NAS 332**: [3] Environmental Justice
- **PSCI 317**: [4] Public Policy Process
- **PSCI 352**: [4] Water Politics
- **PSCI 373**: [4] Politics of Sustainability
- **PSCI 412**: [4] Legal Research

**Total units required for the minor:** 19
**Natural Resources Minor**

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

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
<th>Description</th>
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<tbody>
<tr>
<td>BIOL 105</td>
<td>4</td>
<td>Principles of Biology</td>
</tr>
<tr>
<td>ESM 105</td>
<td>3</td>
<td>Natural Resource Conservation</td>
</tr>
<tr>
<td>SOIL 260</td>
<td>3</td>
<td>Introduction to Soil Science</td>
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At least three courses from the following (at least 6 units must be 300 or above):

<table>
<thead>
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<tbody>
<tr>
<td>ESM 210</td>
<td>3</td>
<td>Public Land Use Policies &amp; Management</td>
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<tr>
<td>ESM 215</td>
<td>3</td>
<td>Natural Resources &amp; Recreation</td>
</tr>
<tr>
<td>ESM 365</td>
<td>3</td>
<td>Local Government Planning</td>
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<tr>
<td>FISH 300</td>
<td>3</td>
<td>Introduction to Fishery Biology</td>
</tr>
<tr>
<td>FOR 315</td>
<td>3</td>
<td>Forest Management</td>
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<td>FOR 374</td>
<td>3</td>
<td>Wilderness Area Mgmt.</td>
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<tr>
<td>OCN 301</td>
<td>3</td>
<td>Marine Ecosystems — Human Impact</td>
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<td>OCN 304</td>
<td>3</td>
<td>Resources of the Sea</td>
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<td>RRS 306</td>
<td>3</td>
<td>Wildland Resource Principles</td>
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<td>WLDF 301</td>
<td>3</td>
<td>Principles of Wildlife Management</td>
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**Natural Resources Recreation Minor**

**Total units required for the minor:** 17-18

<table>
<thead>
<tr>
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<tbody>
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<td>3</td>
<td>Public Land Use Policies &amp; Management</td>
</tr>
<tr>
<td>ESM 215</td>
<td>3</td>
<td>Natural Resources &amp; Recreation</td>
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<tr>
<td>ESM 305</td>
<td>3</td>
<td>Environmental Conflict Resolution, or</td>
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<td>ESM 309B</td>
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<td>Environmental Communication</td>
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<tr>
<td>FOR 374</td>
<td>3</td>
<td>Wilderness Area Mgmt.</td>
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<tr>
<td>ESM 415</td>
<td>3</td>
<td>Recreation &amp; Park Planning, or</td>
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<td>ESM 440</td>
<td>2</td>
<td>Managing Recreation Visitors</td>
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<tr>
<td>ESM 430</td>
<td>3</td>
<td>NR Management in Protected Areas</td>
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