

ENVIRONMENTAL SCIENCE & MANAGEMENT, BACHELOR OF SCIENCE

College of Agricultural & Environmental Sciences

The Environmental Science & Management (ESM) major is jointly coordinated by the Department of Environmental Science & Policy and the Department of Land, Air, & Water Resources.

Environmental Science & Policy

Susan Harrison, Chairperson

Land, Air, & Water Resources

William Horwath, Chairperson

Department Office

Environmental Science & Policy: 2132 Wickson Hall; 530-752-3026; Environmental Science & Policy (<http://desp.ucdavis.edu/>); Faculty (<http://desp.ucdavis.edu/faculty/>)

Land, Air & Water Resources: 1110 Plant and Environmental Sciences Building; 530-752-1130; Land, Air & Water Resources (<http://lawr.ucdavis.edu/>); Faculty (<http://www.lawr.ucdavis.edu/people/faculty/>)

The Major Program

The Environmental Science & Management (ESM) major is designed for students who are interested in solving environmental problems from an interdisciplinary perspective linking the natural and social sciences. Students who choose this major will study the interaction of physical, biological, and social components of environmental problems. Students completing the program will understand the scientific basis for environmental decision making and the legal, economic, and political issues involved in management of the environment.

The Program

Courses in biology, chemistry, physics, economics, geology, and calculus form the lower division preparatory foundation of the curriculum. These are then tied together with Environmental Science & Policy ESP 001, which provides an inter-disciplinary analysis of several environmental problems. The upper division core consists of foundation courses in physical, biological, and social sciences, as well as applied courses in environmental monitoring, GIS, impact reporting, and statistical analysis. In their junior year, students must choose a specialized track from the following six options:

- Climate Change & Air Quality
- Ecology, Biodiversity, & Conservation
- Environmental Data Science
- Natural Resource Management
- Soils & Biogeochemistry
- Watershed Science

A capstone course is required for all seniors and serves to integrate the science, policy/management and biology aspects of the ESM major. All students gain practical experience through field courses and a required

internship. Selected students may also pursue an honors thesis in their senior year.

The ESM major is jointly administered by the Departments of Environmental Science & Policy (ESP) and Land, Air & Water Resources (LAWR). Any student in good standing is eligible to transfer to the major; to do so, please see the student affairs officers in 2134 Wickson Hall or in 1150 Plant & Environmental Sciences Building.

Careers

Graduates from this program are prepared to pursue careers as practicing environmental scientists, resource analysts and planners working for public agencies and private firms specializing in environmental quality, natural resources or ecological research. The major is also excellent preparation for graduate or professional training in physical and/or biological environmental science graduate programs, as well as in environmental law, administration and environmental policy.

Major Advisors

Marissa Baskett (Environmental Science & Policy); Terrence Nathan (Land, Air & Water Resources)

Advising centers for the major, including peer advising, are located in both the Environmental Science & Policy and Land, Air & Water Resources departments. Students whose last names begin with the letters:

- A-L, see Melissa Whaley in 2134 Wickson Hall.
- M-Z, see Lacle Brooks in 1150 Plant & Environmental Sciences.

Code	Title	Units
English Composition & Communication Requirement		
Choose one:		0-4
UWP 101	Advanced Composition	
or UWP 101V	Advanced Composition	
or UWP 101Y	Advanced Composition	
OR any course from the UWP 102 or UWP 104 series. (https://catalog.ucdavis.edu/courses-subject-code/uwp/)		
UWP 102B, UWP 102G, or UWP 104E recommended		
Passing the Upper Division English Composition Exam.		
Communication; choose one:		4
CMN 001	Introduction to Public Speaking	
CMN 003	Interpersonal Communication Competence	
CMN 003V	Interpersonal Communication Competence	
CMN 003Y	Interpersonal Communication Competence	
DRA 010	Introduction to Acting	
English Composition & Communication Requirement Subtotal		4-8
Preparatory Subject Matter		
<i>Biological Science</i>		
BIS 002A	Introduction to Biology: Essentials of Life on Earth	5
BIS 002B	Introduction to Biology: Principles of Ecology & Evolution	5
BIS 002C	Introduction to Biology: Biodiversity & the Tree of Life	5
<i>Geology</i>		
Choose one:		
GEL 050	Physical Geology (Recommended)	3-4
or GEL 001	The Earth	

<i>Chemistry</i>		
Choose a series:		10
CHE 002A & CHE 002B	General Chemistry and General Chemistry	
CHE 002AH & CHE 002BH	Honors General Chemistry and Honors General Chemistry	
Choose one; not required: ¹		
CHE 002C or CHE 002CH	General Chemistry or Honors General Chemistry	
<i>Physics</i>		
Choose a series:		6-12
PHY 001A & PHY 001B	Principles of Physics and Principles of Physics	
PHY 007A & PHY 007B & PHY 007C	General Physics and General Physics and General Physics	
<i>Economics</i>		
Choose one:		
ECN 001A or ECN 001AV or ECN 001AY	Principles of Microeconomics or Principles of Microeconomics or Principles of Microeconomics	4
<i>Mathematics</i>		
Choose one:		3-4
MAT 016A	Short Calculus	
MAT 017A	Calculus for Biology & Medicine (Recommended)	
MAT 021A	Calculus	
Choose one:		3-4
MAT 016B	Short Calculus	
MAT 017B	Calculus for Biology & Medicine (Recommended)	
MAT 021B	Calculus	
<i>Environmental Science & Policy</i>		
ESP 001	Environmental Analysis	4
Satisfaction of the General Education requirement.		
Preparatory Subject Matter Subtotal		48-57
Core Subject Matter		
<i>Environmental Science & Management</i>		
ESM 120	Global Environmental Interactions	4
<i>Ecology</i>		
Choose one:		4
ESP 100 or EVE 101	General Ecology or Introduction to Ecology	
<i>Environmental Science & Policy</i>		
ESP 162	Environmental Policy	4
<i>Statistics</i>		
STA 100 or STA 013 or STA 013Y	Applied Statistics for Biological Sciences (Recommended) or Elementary Statistics or Elementary Statistics	4
Students completing the Environmental Data Science track may also choose STA 032 and cannot choose STA 013 or STA 013Y.		
<i>Environmental Monitoring</i>		
Choose one:		3-4

ATM 124	Meteorological Instruments & Observations	
ESM 108	Environmental Monitoring	
ESP 151L	Limnology Laboratory	
ESP 179	Environmental Impact Assessment	
You need a unique course for each requirement and cannot double-count a class towards two requirements. For example, ESP 179 can be used for either the environmental monitoring requirement or towards the environmental policy course for your track, but not both.		
<i>Environmental Data Science</i>		
ABT/LDA 150 or ESP 106	Introduction to Geographic Information Systems or Environmental Data Science	4
<i>Internship</i>		
Choose one or more below in any combination for a total of 3 units:		3
ESM 092	Internship	
ESP 092	Internship	
ESM 192	Internship	
ESP 192	Internship	
<i>Capstone Class</i>		
ESM 195	Integrating Environmental Science & Management	2
<i>Honors Thesis; Optional</i>		
ESM 194H	Senior Honor Thesis	0-3
Core Subject Matter Subtotal		28-32
Tracks		
Choose a Track:		31-49
Climate Change & Air Quality Track (p. 2)		
Ecology, Biodiversity & Conservation Track (p. 3)		
Environmental Data Science Track (p. 4)		
Natural Resource Management Track (p. 5)		
Soils & Biogeochemistry (p. 6)		
Watershed Science Track (p. 6)		
Tracks Subtotal		31-49
Total Units		111-146

¹ CHE 002C or CHE 002CH recommended, but not required.

Climate Change & Air Quality Track

Code	Title	Units
<i>Atmospheric Science</i>		
ATM 060	Introduction to Atmospheric Science	4
ATM 116	Modern Climate Change	3
ESM 131	Air as a Resource	3
<i>Additional Climate Science & Meteorology</i>		
Choose two:		6-8
ATM 110	Weather Observation & Analysis	
ATM 115	Hydroclimatology	
ATM 133	Biometeorology	
ATM 160	Introduction to Atmospheric Chemistry	
GEL 108	Earth History: Paleoclimates	
<i>Environmental Science</i>		

Choose three environmental science courses, must select at least one from section A and one from section B 9-14

A - Physical

ESM 100	Principles of Hydrologic Science
ESM 121	Water Science & Management
ESP/GEL 116N	Oceanography
ESP 152	Coastal Oceanography
HYD 141	Physical Hydrology
HYD 143	Ecohydrology
SSC 100	Principles of Soil Science

B - Biomes

ENH 160	Restoration Ecology
ESM 141	Role of Fire in Natural Ecosystems
ESM/PLS 144	Trees & Forests
ESP 124	Marine & Coastal Field Ecology
ESP/GEL 150C	Biological Oceanography
ESP 151	Limnology
ESP 155	Wetland Ecology
EVE 115	Marine Ecology
EVE/PLB 117	Plant Ecology
EVE 147	Biogeography
EVE 149	Evolution of Ecological Systems
GEL 136	Ecogeomorphology of Rivers & Streams
PLS 101	Agriculture & the Environment
PLS 130	Rangelands: Ecology, Conservation & Restoration
PLS 162	Urban Ecology
WFC 168	Climate Change Ecology

Environmental Policy

Choose two: 7-8

ESP/ECI 163	Energy & Environmental Aspects of Transportation
ESP 165	Climate Policy
ESP 167	Energy Policy
ESP 171	Urban & Regional Planning
ESP 172	Public Lands Management
ESP 174	Environmental Justice Policy & Practice
ESP 179	Environmental Impact Assessment
SOC 160	Sociology of the Environment

Total Units 32-40

Ecology, Biodiversity & Conservation Track

Code Title Units

Courses appearing in more than one section can only be used to fulfill one section.

Physical Processes

Choose one: 3-5

ATM 060	Introduction to Atmospheric Science
ATM 116	Modern Climate Change
ATM 133	Biometeorology
ESM 121	Water Science & Management

ESM 131	Air as a Resource
ESP 152	Coastal Oceanography
GEL 134	Environmental Geology & Land Use Planning
HYD 143	Ecohydrology
SSC 100	Principles of Soil Science

Environmental Policy

Choose one: 3-5

ESP 161	Environmental Law
ESP 166	Ocean & Coastal Policy
ESP 168A	Methods of Environmental Policy Analysis
ESP 169	Water Policy & Politics
ESP 170	Conservation Biology Policy
ESP 171	Urban & Regional Planning
ESP 172	Public Lands Management
ESP 174	Environmental Justice Policy & Practice
ESP 179	Environmental Impact Assessment
SOC 160	Sociology of the Environment

Evolution

EVE 100 Introduction to Evolution 4

Conservation Biology

Choose one: 4

WFC 154	Conservation Biology
or ESP 127	Plant Conservation Biology

Field Methods

Choose one: 3-5

ESP 123	Introduction to Field & Laboratory Methods in Ecology
ESP 124	Marine & Coastal Field Ecology
ESP 151L	Limnology Laboratory
EVE/ENT 180A	Experimental Ecology & Evolution in the Field
WFC 100	Field Methods in Wildlife, Fish, & Conservation Biology
WFC 126	Conservation in Working Landscapes
ENH 160 & 160L	Restoration Ecology and Restoration Ecology Laboratory
PLS 147 & 147L	California Plant Communities and California Plant Communities Field Study

Population Ecology

Choose one:

ESP 121	Population Ecology	4
or WFC 122	Population Dynamics & Estimation	

Community Ecology

Choose one: 3-4

EVE 104	Community Ecology
EVE 115	Marine Ecology
EVE 181	Ecology & Evolution of Animal-Plant Interactions
PLB/EVE 117	Plant Ecology
WFC 155	Wildlife Habitat Ecology & Conservation

Ecosystems

Choose one: 3-4

ENH 160	Restoration Ecology
ESP 151	Limnology
ESP 155	Wetland Ecology
EVE 147	Biogeography
HYD 143	Ecohydrology
PLS 162	Urban Ecology
PLS 163	Ecosystem & Landscape Ecology

Choose one cross-cutting ecology course 3-5

ESM 141	Role of Fire in Natural Ecosystems
ESM/PLS 144	Trees & Forests
ESP 124	Marine & Coastal Field Ecology
ESP/GEL 150C	Biological Oceanography
ESP 151	Limnology
ESP 155	Wetland Ecology
ETX 150	Evolution in Human-Altered Environments
EVE 109	Molecular Ecology
EVE 115	Marine Ecology
EVE 138	Ecology of Tropical Latitudes
PLS 130	Rangelands: Ecology, Conservation & Restoration
WFC 125	Tropical Ecology & Conservation
WFC 151	Wildlife Ecology
WFC 155	Wildlife Habitat Ecology & Conservation
WFC 168	Climate Change Ecology

Choose one organismal biology course 3-5

ENT 103	Insects Systematics
ENT 116	Freshwater Macroinvertebrates (Discontinued)
EVE 112	Biology of Invertebrates
EVE 114	Experimental Invertebrate Biology
PLB/PLS 102	California Floristics (fulfills both the organismal lecture and lab requirements, simultaneously)
PLB/PLS 116	Plant Morphology & Evolution (fulfills both the organismal lecture and lab requirements, simultaneously)
PLB/EVE 119	Population Biology of Invasive Plants & Weeds (fulfills both the organismal lecture and lab requirements, simultaneously)
WFC 110	Biology & Conservation of Wild Mammals
WFC 111	Biology & Conservation of Wild Birds
WFC 120	Biology & Conservation of Fishes
WFC 134	Herpetology

Complete one lab associated with either the cross-cutting ecology or organismal biology course: 0-4

ENT 116L	Aquatic Insect Collection (Discontinued)
ESP 151L	Limnology Laboratory
ESP 155L	Wetland Ecology Laboratory
EVE 112L	Biology of Invertebrates Laboratory
EVE/ENT 180B	Experimental Ecology & Evolution in the Field
WFC 110L	Laboratory in Biology & Conservation of Wild Mammals

WFC 111L	Laboratory in Biology & Conservation of Wild Birds
WFC 120L	Laboratory in Biology & Conservation of Fishes
WFC 134L	Herpetology Laboratory

Total Units 33-49

Environmental Data Science Track

Code	Title	Units
<i>Environmental Data Science</i>		4
ESP 106	Environmental Data Science	
<i>Programming</i>		4
ECS 032A	Introduction to Programming	
<i>Data Analysis</i>		
Choose one:		4
ABT 181N	Concepts & Methods in Geographic Information Systems	
ABT/HYD 182	Environmental Analysis Using GIS	
<i>Remote Sensing</i>		
Choose one:		4-5
ESM 185	Aerial Photo Interpretation & Remote Sensing	
ESM 186	Environmental Remote Sensing	
<i>Environmental Policy</i>		
Choose one:		3-4
ESP/ECI 163	Energy & Environmental Aspects of Transportation	
ESP 165	Climate Policy	
ESP 166	Ocean & Coastal Policy	
ESP 169	Water Policy & Politics	
ESP 171	Urban & Regional Planning	
ESP 172	Public Lands Management	
ESP 174	Environmental Justice Policy & Practice	
ESP 179	Environmental Impact Assessment	
SOC 160	Sociology of the Environment	
<i>Quantitative Environmental Science</i>		
Choose one:		3-4
ATM 120	Atmospheric Thermodynamics & Cloud Physics	
ESP 121	Population Ecology	
HYD 143	Ecohydrology	
PLS 123	Introduction to Plant & Crop Systems Modeling	
WFC 122	Population Dynamics & Estimation	
<i>Statistical Analysis</i>		
Choose two:		8
STA 104	Applied Statistical Methods: Nonparametric Statistics	
STA 106	Applied Statistical Methods: Analysis of Variance	
STA 108	Applied Statistical Methods: Regression Analysis	
STA 130A	Mathematical Statistics: Brief Course	

STA 130B	Mathematical Statistics: Brief Course
STA 135	Multivariate Data Analysis
STA 137	Applied Time Series Analysis
STA 141A	Fundamentals of Statistical Data Science
STA 141B	Data & Web Technologies for Data Analysis
STA 142A	Statistical Learning I

Physical Processes

Choose one:	3-5
ATM 110	Weather Observation & Analysis
ATM 116	Modern Climate Change
ATM 133	Biometeorology
ESM 100	Principles of Hydrologic Science
ESM 121	Water Science & Management
ESM 131	Air as a Resource
SSC 100	Principles of Soil Science

Biological Processes

Choose one:	3-5
ESP 124	Marine & Coastal Field Ecology
ESP/GEL 150C	Biological Oceanography
ESP 151	Limnology
ESP 152	Coastal Oceanography
ESP 155	Wetland Ecology
EVE/PLB 117	Plant Ecology
EVE 147	Biogeography
GEL 136	Ecogeomorphology of Rivers & Streams
PLS 101	Agriculture & the Environment
PLS 130	Rangelands: Ecology, Conservation & Restoration
PLS 163	Ecosystem & Landscape Ecology
WFC 125	Tropical Ecology & Conservation
WFC 168	Climate Change Ecology

Total Units 36-43

Natural Resource Management Track

Code	Title	Units
Courses appearing in more than one section can only be used to fulfill one section.		
<i>Environmental Policy</i>		
Choose three:		9-13
ESP 160	The Policy Process	
ESP 165	Climate Policy	
ESP 166	Ocean & Coastal Policy	
ESP 167	Energy Policy	
ESP 168A	Methods of Environmental Policy Analysis	
ESP 169	Water Policy & Politics	
ESP 170	Conservation Biology Policy	
ESP 171	Urban & Regional Planning	
ESP 172	Public Lands Management	
ESP 174	Environmental Justice Policy & Practice	
ESP 179	Environmental Impact Assessment	
HYD 150	Water Law	
SOC 160	Sociology of the Environment	

Environmental Law

Choose one:	3-4
ESP 161	Environmental Law
or HYD 150	Water Law

Statistics

Choose one:	4
ARE 106	Econometric Theory & Applications
ECN 102	Analysis of Economic Data
STA 101	Advanced Applied Statistics for the Biological Sciences
STA 103	Applied Statistics for Business & Economics
STA 106	Applied Statistical Methods: Analysis of Variance
STA 108	Applied Statistical Methods: Regression Analysis
STA 130A	Mathematical Statistics: Brief Course
STA 131A	Introduction to Probability Theory
Or equivalent upper division statistics.	

Biological Processes

Choose two:	6-8
ENT 104	Behavioral Ecology of Insects
ESM 141	Role of Fire in Natural Ecosystems
ESM/PLS 144	Trees & Forests
ESP 151	Limnology
ESP 155	Wetland Ecology
EVE 115	Marine Ecology
PLB/EVE 117	Plant Ecology
PLS 130	Rangelands: Ecology, Conservation & Restoration
WFC 110	Biology & Conservation of Wild Mammals
WFC 111	Biology & Conservation of Wild Birds
WFC 120	Biology & Conservation of Fishes
WFC 134	Herpetology

Physical Processes

Choose two:	6-9
ATM 116	Modern Climate Change
ATM 133	Biometeorology
ESM 121	Water Science & Management
ESM 131	Air as a Resource
ESP/GEL 116N	Oceanography
ESP 152	Coastal Oceanography
HYD 143	Ecohydrology
SSC 100	Principles of Soil Science

Remote Sensing

Choose one:	4-5
ESM 185	Aerial Photo Interpretation & Remote Sensing
or ESM 186	Environmental Remote Sensing

Total Units 32-43

Soils & Biogeochemistry

Code	Title	Units
<i>Soil Science</i>		
SSC 100	Principles of Soil Science	5
<i>Additional Soil Science</i>		
Choose four:		16-21
ESM 100	Principles of Hydrologic Science	
HYD 134	Aqueous Geochemistry	
SSC 102	Environmental Soil Chemistry	
SSC 105	Field Studies of Soils in California Ecosystems	
SSC 107	Soil Physics	
SSC 109	Sustainable Nutrient Management	
SSC 111	Soil Microbiology	
SSC 112	Soil Ecology	
SSC 120	Soil Genesis, Morphology, & Classification	
<i>Environmental Science & Policy</i>		
Choose two:		6-8
ESM 121	Water Science & Management	
ESP 165	Climate Policy	
ESP 166	Ocean & Coastal Policy	
ESP 171	Urban & Regional Planning	
ESP 172	Public Lands Management	
ESP 174	Environmental Justice Policy & Practice	
ESP 179	Environmental Impact Assessment	
SOC 160	Sociology of the Environment	
<i>Land Use Analysis</i>		
Choose one:		3-4
ESM 185	Aerial Photo Interpretation & Remote Sensing	
GEL 134	Environmental Geology & Land Use Planning	
HYD/EBS 147	Runoff, Erosion & Water Quality Management	
SSC 118	Soils in Land Use & the Environment	
<i>Physical & Biological Processes</i>		
Choose two:		6-8
ATM 160	Introduction to Atmospheric Chemistry	
ESM/PLS 144	Trees & Forests	
ESP/GEL 116N	Oceanography	
ESP/GEL 150A	Physical & Chemical Oceanography	
ESP/GEL 150C	Biological Oceanography	
ESP 151	Limnology	
ESP 155	Wetland Ecology	
EVE/PLB 117	Plant Ecology	
GEL 132	Introductory Inorganic Geochemistry	
PLS 130	Rangelands: Ecology, Conservation & Restoration	
Total Units		36-46

Watershed Science Track

Code	Title	Units
<i>Evapotranspiration</i>		
Choose one:		4
ATM 133	Biometeorology	
HYD 118/ EBS 148/ESM 118	Evapotranspiration Principles, Measurement & Modeling	
HYD 124	Plant-Water-Soil Relationships	
<i>Water Science</i>		
Choose one:		3
ESM 121	Water Science & Management	
HYD/SAS 010	Water, Power, Society	
<i>Soil & Hydrologic Science</i>		
SSC 100	Principles of Soil Science	5
ESM 100	Principles of Hydrologic Science	4
<i>Additional Hydrologic Science</i>		
Choose two:		7-8
ESM 108	Environmental Monitoring	
HYD/ESM/ABT 110	Irrigation Systems & Water Management	
HYD 118/ EBS 148/ESM 118	Evapotranspiration Principles, Measurement & Modeling	
HYD 141	Physical Hydrology	
HYD 143	Ecohydrology	
HYD/EBS 144	Groundwater Hydrology	
HYD 145	Water Science & Design	
<i>Geomorphology</i>		
Choose one:		3-5
ESP 151L	Limnology Laboratory	
GEL 035	Rivers	
GEL 109	Earth History: Sediments & Strata	
GEL 136	Ecogeomorphology of Rivers & Streams	
GEL 139	Rivers: Form, Function & Management	
GEL 140	Introduction to Process Geomorphology	
<i>Spatial Data Analysis</i>		
Choose one:		4
ABT 181N	Concepts & Methods in Geographic Information Systems	
ABT/HYD 182	Environmental Analysis Using GIS	
<i>Environmental Policy</i>		
Choose two:		6-11
ESP 166	Ocean & Coastal Policy	
ESP 168A	Methods of Environmental Policy Analysis	
ESP 169	Water Policy & Politics	
ESP 172	Public Lands Management	
ESP 179	Environmental Impact Assessment	
HYD 150	Water Law	
LDA 060	Landform & Grading Studio	
<i>Soil Science</i>		
Choose one:		4-5
SSC 105	Field Studies of Soils in California Ecosystems	

SSC 118	Soils in Land Use & the Environment	
SSC 120	Soil Genesis, Morphology, & Classification	
<i>Aquatic Organisms & Habitat</i>		
Choose one:		3-4
ENT 116	Freshwater Macroinvertebrates (Discontinued)	
ESP 151	Limnology	
EVE 115	Marine Ecology	
WFC 120	Biology & Conservation of Fishes	
WFC 134	Herpetology	
Total Units		43-53