

# BS ENVIRONMENTAL EARTH AND SOIL SCIENCES

## Program Learning Objectives

1. Demonstrate critical thinking and problem solving skills.
2. Effectively communicate scientific and technical knowledge in a professional manner.
3. Demonstrate the ability to integrate and apply technical knowledge in the following key areas:
  - a. Geology & Climate – rock materials and processes of the lithosphere, plate tectonics; deformational histories, and past climates;
  - b. Soils & Water – morphology, ecology, chemistry, physics, and health;
  - c. Geography & Geospatial Technology – human cultural impacts, resource utilization trends and spatial patterns, geographic information systems and modeling;
  - d. Resource Management – effects of land management activities on, and restoration and rehabilitation of, soil and water resources.
4. Demonstrate proficiency in quantitative skills and information management specific to their discipline areas.
5. Exhibit an understanding of their professional and ethical responsibilities, including respect for diversity.
6. Promote life-long learning habits by exposing students to the discovery process of applied research and demonstration projects conducted by the faculty.

## Degree Requirements and Curriculum

In addition to the program requirements listed on this page, students must also satisfy requirements outlined in more detail in the Minimum Requirements for Graduation (<http://catalog.calpoly.edu/generalrequirementsbachelorsdegree/#generaleducationtext>) section of this catalog, including:

- 60 units of upper-division courses
- Graduation Writing Requirement (GWR)
- 2.0 GPA
- U.S. Cultural Pluralism (USCP)

Note: No Major, Support or Concentration courses may be selected as credit/no credit.

### MAJOR COURSES

NR 140	Careers in Natural Resources Management and Environmental Sciences	1
ERSC 144	Introduction to Earth Science	4
ERSC 223	Rocks and Minerals	4
ERSC 303	Soil Erosion and Water Conservation	4
ERSC/GEOG 333	Human Impact on the Earth <sup>1</sup>	3-4
or BRAE 345	Aerial Photogrammetry and Remote Sensing	
or GEOG 325	Climate and Humanity	
or GEOG 350	The Global Environment	
or MATH 142	Calculus II	
SS 120	Introductory Soil Science	4

SS 221	Soil Health and Plant Nutrition	4
SS 321	Soil Morphology	4
SS 422	Soil Ecology <sup>2</sup>	4
or ERSC 423	Geomorphology	
SS 423	Environmental Soil and Water Chemistry	5
SS 424	Environmental Soil Physics - Senior Project	5
BOT 121	General Botany (B2 & B3) <sup>3</sup>	4
CHEM 127	General Chemistry for Agriculture and Life Science I (B1 & B3) <sup>3</sup>	4
CHEM 128	General Chemistry for Agriculture and Life Science II	4
CHEM 129	General Chemistry for Agriculture and Life Science III	4
CHEM 312	Organic Chemistry: Fundamentals and Applications	5
GEOG 201	Physical Geology	3
GEOG 241	Physical Geology Laboratory	1
GEOG 415	Structural Geology <sup>2</sup>	4
or GEOG 330	Principles of Stratigraphy	
MATH 161	Calculus for the Life Sciences I (B4) <sup>3,4</sup>	4
or MATH 141	Calculus I	
NR/LA 218	Introduction to Geographic Information Systems (GIS)	3
NR 310	Global Climate Change (Upper-Division B) <sup>3</sup>	4
NR 363	Undergraduate Seminar	2
NR 418	Applied GIS	3-4
or NR 355	Drone Assisted Surveying	
or NR 416	Environmental Impact Analysis and Management	
or SS 431	Digital Soil Mapping	
PHYS 121	College Physics I <sup>5</sup>	4
or PHYS 141	General Physics I	
STAT 218	Applied Statistics for the Life Sciences (GE Electives) <sup>3</sup>	4
or STAT 217	Introduction to Statistical Concepts and Methods	
Concentration (32 units) or Approved Electives (20 units) in combination with Free Electives <sup>6,7,8</sup>		20-32

### GENERAL EDUCATION (GE)

(See GE program requirements below.) 52

### FREE ELECTIVES

Free Electives 0-13

**Total units 180-181**

<sup>1</sup> Students in the Geology concentration need to take MATH 142 to meet prerequisites for courses in the concentration. Students interested in the Soil Geotechnical Studies are encouraged to take MATH 142 to meet prerequisites for courses in that area. Students interested in taking NR 355 need to take BRAE 345 to meet prerequisites.

<sup>2</sup> Students in the Geology concentration must take ERSC 423 and GEOG 415 to meet requirements for this concentration.

<sup>3</sup> Required in Major or Support; also satisfies General Education (GE) requirement.

<sup>4</sup> Students in the Geology concentration need to take MATH 141 to meet prerequisites for courses in the concentration. Students interested in the Soil Geotechnical Studies Approved Electives area must take MATH 141 to meet prerequisites for courses in that area.

<sup>5</sup> Students in the Geology concentration need to take PHYS 141 to meet prerequisites for courses in the concentration. Students interested in the Soil Geotechnical Studies Approved Electives area must take PHYS 141 to meet prerequisites for courses in that area.

<sup>6</sup> Unless a concentration is declared, the default will be a combination of Approved Electives and Free Electives.

<sup>7</sup> Students who do not declare a concentration are encouraged to use Approved Electives and Free Electives to earn a minor. See the below Approved Electives Guide for recommended minors.

<sup>8</sup> If a course is taken to meet a Major or Support requirement, it cannot be double-counted as an Approved Elective.

## Concentrations

- Geology (<http://catalog.calpoly.edu/collegesandprograms/collegeofagriculturefoodenvironmentalsciences/naturalresourcesmanagementenvironmentalsciences/benvironmentalearthsoilsciences/geologyconcentration/>)
- Hydrology (<http://catalog.calpoly.edu/collegesandprograms/collegeofagriculturefoodenvironmentalsciences/naturalresourcesmanagementenvironmentalsciences/benvironmentalearthsoilsciences/hydrologyconcentration/>)

## Approved Electives Guide

Approved Electives are courses that support the below career areas. Refer to number(s) next to each course to identify which courses align with each of the career areas. Consultation with an advisor is recommended prior to selecting Approved Electives; bear in mind your selections may impact pursuit of post-baccalaureate studies and/or goals.

1. Climate Change Science
2. Environmental Mitigation Strategies
3. Environmental Policy and Management
4. Environmental Soil Science
5. Forest and Environmental Practices
6. Geospatial Technology
7. Soil Geotechnical Studies
8. Sustainable Agriculture
9. Urban Forestry

A student may earn one or more of the minors listed below through the appropriate selection of Approved Electives in combination with Free Electives (refer to advising materials for the minor). However, students in this major may not obtain minors in Environmental Soil Science or Geology as the subject areas in these minors are substantially covered in this major.

- Anthropology and Geography
- Biology
- Geographic Information Systems for Agriculture
- Indigenous Studies in Natural Resources and the Environment

- Sustainable Environments
- Water Science

### Approved Electives

Select from the following:

At least 8 units must be upper-division (300-400 level)

No more than 6 units of NR 339 may count towards the degree.

Courses used to meet a degree requirement cannot double count as an elective.

AG/PLSC 315	Principles of Organic Crop Production <sup>8</sup>
AG 339	Internship in Agriculture <sup>8</sup>
AG/EDES/ENGR/ISLA/SCM/UNIV 350	The Global Environment <sup>1,8</sup>
AG 360	Holistic Management <sup>5,8</sup>
AGB 212	Agricultural Economics <sup>8</sup>
AGB 312	Agricultural Policy <sup>8</sup>
AGB 369	Agricultural Personnel Management <sup>8</sup>
AGC 205	Agricultural Communications
ANT 201	Cultural Anthropology <sup>1</sup>
or ANT 202	World History Before Writing
ANT 250	Biological Anthropology <sup>1</sup>
ARCE 211	Structures I <sup>7</sup>
or CE 204	Mechanics of Materials I
ARCE 212	Structures II <sup>7</sup>
or ME 211	Engineering Statics
ARCE 223	Mechanics of Structural Members <sup>7</sup>
or CE 207	Mechanics of Materials II
ARCE 422	Foundation Design <sup>7</sup>
ASCI 112	Principles of Animal Science <sup>8</sup>
ASCI 221	Introduction to Beef Production <sup>8</sup>
ASCI 223	Systems of Small Ruminant Management <sup>8</sup>
ASCI 239	Principles of Rangeland Management <sup>1,2,3,8</sup>
ASCI 311	Advanced Beef Cattle System Management <sup>8</sup>
ASCI 372	California Rangeland & Ranch Resource Management <sup>1,2,3,8</sup>
ASCI 465	Applied Practices for Monitoring California Rangelands <sup>1,2,3,8</sup>
BIO 329	Vertebrate Field Zoology <sup>2</sup>
BIO 400	Special Problems for Advanced Undergraduates <sup>2,5</sup>
BIO 427	Wildlife Management <sup>2</sup>
BIO 435	Plant Physiology <sup>5</sup>
BOT/PLSC 323	Plant Pathology <sup>8</sup>
BOT 326	Plant Ecology <sup>2</sup>
BIO 447	Spatial Ecology <sup>2,6</sup>
BRAE 141	Agricultural Machinery Safety <sup>8</sup>
BRAE 142	Agricultural Power and Machinery Management <sup>8</sup>

BRAE 150	Design Graphics and CAD for Agricultural Engineering <sup>5,6</sup>	GEOG 328	Applications in Remote Sensing and GIS <sup>1,6</sup>
BRAE 237	Introduction to Engineering Surveying <sup>5</sup>	GEOG 400	Special Problems for Advanced Undergraduates <sup>1</sup>
BRAE 239	Engineering Surveying <sup>5,6</sup>	GEOG 435	Biodiversity and Biogeography Methods
BRAE/NR 247	Forest Surveying <sup>5</sup>	GEOG 441	Advanced Applications in Geospatial Technologies <sup>1</sup>
BRAE 333	Aquacultural Engineering <sup>1,2,3,8</sup>	GEOL 203	The Geologic Record: Fossils and the History of Life <sup>1</sup>
BRAE 340	Irrigation Water Management <sup>5,8</sup>	GEOL 206	Geologic Excursions <sup>7</sup>
BRAE 345	Aerial Photogrammetry and Remote Sensing <sup>6</sup>	GEOL 305	Seismology and Earth Structure <sup>7</sup>
BRAE 348	Energy for a Sustainable Society <sup>1</sup>	GEOL 400	Special Problems for Advanced Undergraduates <sup>7</sup>
BRAE/NR 349	Water for a Sustainable Society <sup>1,2,3,8</sup>	GEOL 420	Applied Geophysics <sup>7</sup>
BRAE 447	Advanced Surveying with GIS Applications <sup>6</sup>	JOUR 203	News Reporting and Writing <sup>5</sup>
CE 112	Design Principles in Civil Engineering <sup>6</sup>	MATH 142	Calculus II <sup>4</sup>
CE 113	Computer Aided Drafting in Civil Engineering <sup>6</sup>	or MATH 162	Calculus for the Life Sciences II
CE 204	Mechanics of Materials I <sup>7</sup>	MATH 143	Calculus III <sup>7</sup>
CE 381 & CE 382	Geotechnical Engineering and Geotechnical Engineering Laboratory <sup>7</sup>	MATH 241	Calculus IV <sup>7</sup>
or ARCE 421	Soil Mechanics	MCRO 221	Microbiology <sup>5</sup>
CHEM 314	Biochemistry: Fundamentals and Applications <sup>4</sup>	MCRO 436	Microbial Ecology <sup>5</sup>
CHEM 331	Quantitative Analysis <sup>4</sup>	NR 141	Introduction to Forest Ecosystem Management <sup>5,9</sup>
CHEM 341	Environmental Chemistry: Water Pollution <sup>4</sup>	NR 142	Environmental Management <sup>8,9</sup>
CRP 212	Introduction to Urban Planning <sup>3,5,6,9</sup>	NR 200	Special Problems for Undergraduates <sup>1,2,3,4,5,6,7,8,9</sup>
CRP 336	Introduction to Environmental Planning <sup>5,6</sup>	NR 203	Resource Law Enforcement
CRP/NR 404	Environmental Law <sup>1</sup>	NR 204	Wildland Fire Control <sup>5,9</sup>
CRP/NR 408	Water Resource Law and Policy <sup>2,3,5,8</sup>	NR 208	Dendrology <sup>5,9</sup>
CRP 420	Land Use Law <sup>3,5</sup>	NR 215	Land and Resource Measurements <sup>5</sup>
CSC/CPE 101	Fundamentals of Computer Science <sup>6</sup>	NR 260	Forest Operations <sup>5</sup>
ECON 221	Microeconomics <sup>3</sup>	NR 306	Natural Resource Ecology and Habitat Management <sup>2,5,6,9</sup>
EDES 406	Sustainable Environments <sup>8</sup>	NR/ES 308	Fire and Society <sup>5</sup>
ENGL 147	Writing Arguments about STEM <sup>1,2,3</sup>	NR 312	Technology of Wildland Fire Management <sup>5</sup>
ENGL 316	Writing Sustainability <sup>1,2,3</sup>	NR 315	Forest Mensuration <sup>5</sup>
ENVE 264	Environmental Fluid Mechanics <sup>7</sup>	NR 320	Watershed Processes and Management <sup>5</sup>
ENVE 324	Introduction to Air Pollution <sup>1</sup>	NR 323	Human Dimensions in Natural Resources Management <sup>1,2,3</sup>
ERSC/GEOG 250	Physical Geography <sup>1</sup>	NR 324	Social Dimensions of Sustainable Food and Fiber Systems <sup>8</sup>
ERSC/GEOG 325	Climate and Humanity <sup>1</sup>	NR 326	Natural Resources Economics and Valuation <sup>1,3,5</sup>
ERSC/GEOG 414	Global and Regional Climatology <sup>1</sup>	NR 339	Internship in Forest and Natural Resources <sup>1,2,3,4,5,6,7,8,9</sup>
ERSC/GEOG 415	Applied Meteorology and Climatology <sup>1</sup>	NR 340	Wildland Fire Management <sup>5,9</sup>
ERSC 423	Geomorphology <sup>4,6</sup>	NR 350	Urban Forestry <sup>5,9</sup>
ERSC 442	Applied Environmental Groundwater Hydrology <sup>4</sup>	NR 355	Drone Assisted Surveying <sup>5,6</sup>
ERSC 443	Applied Environmental Contaminant Transport <sup>4</sup>	NR/ES 360	Ethnicity and the Land <sup>5</sup>
GEOG 150	Human Geography <sup>1,3</sup>	NR 365	Silviculture and Fuels Management <sup>5</sup>
GEOG 308	Global Geography <sup>1</sup>	NR 400	Special Problems for Advanced Undergraduates <sup>1,2,3,4,5,6,7,8,9</sup>

NR/ES 406	Indigenous Peoples and International Law and Policy <sup>9</sup>	RPTA 112	Introduction to Parks and Outdoor Recreation <sup>3</sup>
NR 413	Agricultural Law <sup>1,2,3,4,8</sup>	RPTA 210	Experience Design <sup>3</sup>
NR 420	Watershed Assessment and Protection <sup>5</sup>	RPTA 255	Leadership and Diverse Groups <sup>2</sup>
NR 422	Stream Measurements and Water Quality Monitoring <sup>5,9</sup>	RPTA 302	Environmental and Wilderness Education <sup>3</sup>
NR 434	Wood Properties, Products and Sustainable Uses <sup>5,9</sup>	RPTA 325	Leadership in Outdoor Experiences <sup>3</sup>
NR 435	Environmental Policy Analysis <sup>1,3</sup>	SS/ERSC 270	Selected Topics (2) <sup>4</sup>
NR 445	Systems Thinking in Environmental Management <sup>1,2,3,4,5,6,7,8,9</sup>	SS 322	Soil Plant Relationships <sup>4,8</sup>
NR 455	Wildland-Urban Fire Protection <sup>5,9</sup>	SS/NR/BIO 421	Wetlands <sup>2,4,5</sup>
NR 472	Leadership Practice <sup>3,5</sup>	SS 431	Digital Soil Mapping <sup>3,4,5,6,9</sup>
NR 474	Forest Stewardship Practices <sup>3,5</sup>	SS 440	Forest and Range Soils <sup>4,5,9</sup>
NR 475	Senior Project - Forest Stewardship <sup>3,5</sup>	SS 444	Soil Judging <sup>4</sup>
PHIL 340	Environmental Ethics <sup>1,3</sup>	SS/ERSC 470	Selected Advanced Topics <sup>4</sup>
PHYS 122 or PHYS 142	College Physics II <sup>4</sup> General Physics II	SS/ERSC 471	Selected Advanced Laboratory <sup>4</sup>
PHYS 143	General Physics III	SS 522	Advanced Soil Fertility <sup>4</sup>
PHYS 410	Physics of Solid Earth <sup>7</sup>	SS 582	GIS in Advanced Land Management <sup>4</sup>
PLSC 123	Landscape Installation and Maintenance <sup>5,9</sup>	STAT 313	Applied Experimental Design and Regression Models <sup>6</sup>
PLSC 124	Plant Propagation <sup>5,9</sup>	STAT 331	Statistical Computing with R <sup>6</sup>
PLSC 203	Organic Enterprise Project <sup>8</sup>	UNIV 391	Appropriate Technology for the World's People: Development <sup>8</sup>
PLSC 230	Environmental Horticulture <sup>8,9</sup>	WVIT 233	Basic Viticulture <sup>8</sup>
PLSC 233	Plant Materials I <sup>5,9</sup>	WVIT 331	Advanced Viticulture - Fall <sup>8</sup>
PLSC 234	Plant Materials II <sup>5,9</sup>	WVIT 332	Advanced Viticulture - Winter <sup>8</sup>
PLSC 244	Precision Farming <sup>6,8</sup>	WVIT 333	Advanced Viticulture - Spring <sup>8</sup>
PLSC 313	Agricultural Entomology <sup>8</sup>	WVIT 428	Winegrape Vineyard Management <sup>8</sup>
PLSC 321	Weed Biology and Management <sup>5,8</sup>	Any SCM course and any upper division AG, ANT, BIO, BOT, BRAE, CHEM, COMS, EDES, ENVE, ERSC, GEOG, GEOL, JOUR, MCRO, PLSC, NR, RPTA, SS, or UNIV courses	
PLSC 327	Vertebrate Pest Management <sup>5</sup>	<b>General Education (GE) Requirements</b>	
PLSC 350	Abiotic Plant Problems <sup>9</sup>	<ul style="list-style-type: none"> <li>72 units required, 20 of which are specified in Major and/or Support.</li> <li>If any of the remaining 52 units is used to satisfy a Major or Support requirement, additional units of Free Electives may be needed to complete the total units required for the degree.</li> <li>See the complete GE course listing (<a href="http://catalog.calpoly.edu/generalrequirementsbachelorsdegree/#generaleducationtext">http://catalog.calpoly.edu/generalrequirementsbachelorsdegree/#generaleducationtext</a>).</li> <li>A grade of C- or better is required in one course in each of the following GE Areas: A1 (Oral Communication), A2 (Written Communication), A3 (Critical Thinking), and B4 (Mathematics/Quantitative Reasoning).</li> </ul>	
PLSC 381	Native Plants for California Landscapes <sup>8,9</sup>	<b>Area A</b>	<b>English Language Communication and Critical Thinking</b>
PLSC 420	Organic Crop Production Systems <sup>8</sup>	A1	Oral Communication 4
PLSC 425	Arboriculture <sup>5,9</sup>	A2	Written Communication 4
PLSC 431	Insect Pest Management <sup>8</sup>	A3	Critical Thinking <sup>2</sup> 4
PLSC 441	Biological Control for Pest Management <sup>8</sup>	<b>Area B</b>	<b>Scientific Inquiry and Quantitative Reasoning</b>
PLSC 445	Cropping Systems <sup>8</sup>	B1	Physical Science (4 units in Major) <sup>1</sup> 0
PLSC 450	Current Issues in the Strawberry Industry <sup>8</sup>	B2	Life Science (4 units in Major) <sup>1</sup> 0
POLS 112	American and California Government <sup>3</sup>	B3	One lab taken with either a B1 or B2 course
POLS 245	Judicial Process <sup>3</sup>		
POLS 332	World Food Systems		
POLS 341	American Constitutional Law <sup>3</sup>		
POLS 343	Civil Rights in America <sup>3</sup>		
POLS 344	Civil Liberties <sup>3</sup>		
PSC 201	Physical Oceanography <sup>1</sup>		
PSC 320	Energy, Society and the Environment <sup>1</sup>		

B4	Mathematics/Quantitative Reasoning (4 units in Major) <sup>1</sup>	0
Upper-Division B (4 units in Major) <sup>1</sup>		0
<b>Area C</b>	<b>Arts and Humanities</b>	
Lower-division courses in Area C must come from three different subject prefixes.		
C1	Arts: Arts, Cinema, Dance, Music, Theater	4
C2	Humanities: Literature, Philosophy, Languages other than English	4
Lower-Division C Elective - Select a course from either C1 or C2		4
Upper-Division C <sup>3</sup>		4
<b>Area D</b>	<b>Social Sciences - Select courses in Area D from at least two different prefixes</b>	
D1	American Institutions (Title 5, Section 40404 Requirement)	4
D2	Lower-Division D <sup>4</sup>	4
Upper-Division D <sup>5</sup>		4
<b>Area E</b>	<b>Lifelong Learning and Self-Development</b>	
Lower-Division E		4
<b>Area F</b>	<b>Ethnic Studies</b>	
F	Ethnic Studies	4
<b>GE Electives in Areas B, C, and D</b>		
Select courses from two different areas; may be lower-division or upper-division courses.		
GE Electives (4 units in Majors plus 4 units in GE) <sup>1</sup>		4
<b>Total units</b>		<b>52</b>

<sup>1</sup> Required in Major or Support; also satisfies General Education (GE) requirement.

<sup>2</sup> Recommended course to satisfy GE Area A3: ENGL 147.

<sup>3</sup> Recommended courses to satisfy GE Area Upper-division C: NR 360 or ENGL 316.

<sup>4</sup> Recommended course to satisfy GE Area D2: GEOG 150.

<sup>5</sup> Recommended courses to satisfy GE Area Upper-division D: BRAE 349, GEOG 308, or NR 323.