

# ENVIRONMENTAL SCIENCE BS

The Bachelor of Science in Environmental Science strives to best prepare students to be engaged in solving environmental and sustainability problems with a strong scientific foundation. This is accomplished through a broad curriculum that covers the fundamentals of biology, geology, chemistry, and physics and then moves students through key principles of environmental science. During the first two years, students complete coursework in geology, atmospheric science, soil science, and energy. During the last two years, students complete coursework in hydrology, ecology, environmental sensing, and Earth system science. In addition, students are required to take at least three upper-division electives that fall within one of four sub-disciplines of environmental sciences (applied ecology, atmosphere and climate, energy and earth resources, or hydrology).

**Applied ecology sub-discipline:** Applied ecology considers the application of the science of ecology to real-world questions and problems. The goal of an applied ecologist is to provide recommendations on resource management that are based in science. In our department, we ask questions like: How will climate change and drought impact vegetation communities? How do wetland communities change after restoration? How do invasive species growing alongside streams impact aquatic organisms? How does wildfire affect the growth and reproduction of vegetation communities? What is the long-term success of riparian restoration?

**Atmosphere and climate sub-discipline.** The atmosphere plays one of the largest roles in shaping the environment. At any given moment and location, the state of the atmosphere (weather) controls important parameters such as the evaporation of water, the vertical movement of greenhouse gasses, and the dispersion of pollutants. On larger scales, the rotation of the Earth and the arrangement of bodies of water and landforms, have a profound impact on circulation and climate. California State University, Chico uses several technologies to study the atmosphere. The Raman-shifted Eye-safe Aerosol Lidar (REAL) provides images of the distribution of dust and wind over scales ranging from about 10 m to 5 km. Fast-response in situ sensors, such as ultrasonic anemometers and open path CO<sub>2</sub>/H<sub>2</sub>O analyzers enable the measurement of vertical fluxes. A rotating tank allows students and faculty to visualize the profound, and often non-intuitive, effects of the Earth's rotation on atmospheric and oceanic circulations.

**Energy and earth resources sub-discipline.** Energy demands consume a tremendous amount of resources. This option allows students to explore energy resources and conservation, alternative energy, sustainability, and apply those concepts to mine reclamation, solar and wind farm projects, and resource-heavy industries. Students can be involved in many projects that involve remediation (cleaning-up) including mercury contamination of abandoned hydraulic mines, or testing materials for supporting plant growth on tailings left behind from processing copper ore.

**Hydrology sub-discipline.** Hydrology is the science of water movement, composition, and distribution on earth. In our department, students learn the theoretical basis for the physical processes of precipitation, streamflow, evaporation, infiltration, subsurface flow, and hydrological storage within the context of the most current techniques and software used by practitioners. These processes govern water quantity and quality in creeks, soils, vegetation, and aquifers that are critical to sustainable water use in California and water-limited regions globally. Outdoor experiential learning is a central component to our courses on water resources management, field methods, and water quality. Hydrologists

also integrate knowledge from ecology and advanced physics in ecohydrology and environmental fluid mechanics courses. Class projects have included feasibility studies for communities with limited water resources, inventories of water composition at Lassen Volcanic National Park, and performance assessments of green infrastructure for urban storm runoff remediation.

## Advising Requirement

Advising is mandatory for this program. Consult your department advisor or program coordinator for information.

## E-advising Tools

Use the interactive e-advising tools designed to help students graduate within four years. These tools can be accessed through the Student Center in the Portal (<https://portal.csuchico.edu>).

## Grading Requirement

All courses taken to fulfill program course requirements must be taken for a letter grade except those courses specified by the department as credit/no credit grading only.

## Course Requirements for the Major: 71 units

Completion of the following courses, or their approved transfer equivalents, is required of all candidates for this degree. Courses in this program may complete more than one graduation requirement.

Course	Title	Units
<b>Lower Division</b>		
BIOL 161	Principles of Ecological, Evolutionary, and Organismal Biology	4
CHEM 111	General Chemistry I	4
CHEM 112	General Chemistry II	4
ERTH 102	Physical Geology	3
ERTH 165	Principles of Environmental Science	2
ERTH 170	Atmospheric Science	3
ERTH 265	Soils and Surficial Processes	3
Select one of the following:		4
MATH 109	Survey of Calculus	
MATH 120	Analytic Geometry and Calculus	
Select eight units from the following: <sup>1</sup>		8
PHYS 202A & PHYS 202B	General Physics I and General Physics II	
PHYS 204A	Physics for Students of Science and Engineering: Mechanics	
PHYS 204B	Physics for Students of Science and Engineering: Electricity and Magnetism	
PHYS 204C	Physics for Students of Science and Engineering: Heat, Wave Motion, Sound, Light, and Modern Topics	
<b>Upper Division</b>		
BIOL 350W	Fundamentals of Ecology (W)	3
ERTH 315	Pollution Science	3
ERTH 352	Recovery of Altered Ecosystems	3
ERTH 370W	Energy in the Human Environment (W)	3

ERTH 380	Hydrology	3
ERTH 420	Earth Systems Modeling	3
ERTH 440	Environmental Sensing	3
ERTH 475	Senior Seminar	3
MATH 315	Applied Statistical Methods I	3

**Discipline Electives**

Select three of the following:		9
ERTH 322	Mineral Resources	
ERTH 353	Environmental Fluid Mechanics	
ERTH 382	Environmental Field Methods	
ERTH 415	Hydrogeology	
ERTH 430	Wetland Ecology and Management	
ERTH 435	Boundary Layer Meteorology	
ERTH 460	Water Resources Management	
ERTH 536	Applied Ecology	

**Total Units** 71

<sup>1</sup> Students who are considering attending graduate school should consult with an advisor before selecting lower-division core courses. We recommend PHYS 204A, PHYS 204B, and PHYS 204C.

## Electives Requirement

To complete the total units required for the bachelor's degree, select additional elective courses from the total University offerings. You should consult with an advisor regarding the selection of courses which will provide breadth to your University experience and possibly apply to a supportive second major or minor.

## Honors in the Major

Honors in the Major is a program of independent work in your major. It requires six units of honors coursework completed over two semesters.

The Honors in the Major program allows you to work closely with a faculty mentor in your area of interest on an original performance or research project. This year-long collaboration allows you to work in your field at a professional level and culminates in a public presentation of your work. Students sometimes take their projects beyond the University for submission in professional journals, presentation at conferences, or academic competition. Such experience is valuable for graduate school and professional life. Your honors work will be recognized at your graduation, on your permanent transcripts, and on your diploma. It is often accompanied by letters of commendation from your mentor in the department or the department chair.

Some common features of Honors in the Major program are:

- You must take six units of Honors in the Major coursework. All six units are honors courses (marked by a suffix of H), and at least three of these units are independent study (399H, 499H, 599H) as specified by your department. You must complete each course with a minimum grade of B.
- You must have completed 9 units of upper-division coursework or 21 overall units in your major before you can be admitted to Honors in the Major. Check the requirements for your major carefully, as there may be specific courses that must be included in these units.
- Your cumulative GPA should be at least 3.5 or within the top 5% of majors in your department.

- Your GPA in your major should be at least 3.5 or within the top 5% of majors in your department.
- Most students apply for or are invited to participate in Honors in the Major during the second semester of their junior year. Then they complete the six units of coursework over the two semesters of their senior year.
- Your honors work culminates with a public presentation of your honors project.

Honors in the Major is not part of the Honors Program. Each department administers its own program. Please contact your major department or major advisor to apply.

See Bachelor's Degree Requirements (<https://catalog.csuchico.edu/undergraduate-requirements/bachelors-degree-requirements/>) for complete details on general degree requirements. A minimum of 39 units, including those required for the major, must be upper division.

## General Education Requirements: 43 units

See General Education (<https://catalog.csuchico.edu/colleges-departments/undergraduate-education-academic-success/general-education/#general-education-requirements-text>) and the Class Schedule (<http://www.csuchico.edu/schedule/>) for the most current information on General Education requirements and course offerings.

This major has approved GE modification(s). See below for information on how to apply these modification(s).

- EARTH 370W is an approved major course substitution for Upper-Division Physical and Biological Sciences (UD-5).

## American Institutions Course Requirements: 6 units

The American Institutions graduation requirement, as mandated in Title 5, Section 40404 (<https://govt.westlaw.com/calregs/Document/I56C041434C6911EC93A8000D3A7C4BC3/?viewType=FullText&originationContext=documenttoc&transitionType=CategoryPage>), requires that students satisfactorily complete courses in United States history, the US Constitution, and government and American ideals (including California state and local government). At Chico State, HIST 130 meets the US history requirement (US-1), and POLS 155 meets the US Constitution and government requirement (US-2) and the California state and local government requirement (US-3). POLS 155 also fulfills three units of GE Area 4, Social and Behavioral Sciences. See Bachelor's Degree Requirements (<https://catalog.csuchico.edu/undergraduate-requirements/bachelors-degree-requirements/#amin>) for more information.

## Diversity Course Requirements: 6 units

You must complete a minimum of two courses that focus primarily on cultural diversity. At least one course must be in US Diversity (USD) and at least one in Global Cultures (GC). See Diversity Requirements (<https://catalog.csuchico.edu/undergraduate-requirements/diversity-requirements/>) for a full list of courses. Many courses taken to satisfy these requirements may also apply to General Education (<https://catalog.csuchico.edu/colleges-departments/undergraduate-education-academic-success/general-education/>).

## Upper-Division Writing Requirement

Writing Across the Curriculum (EM 17-009 (<https://www.csuchico.edu/pres/em/2017/17-009.shtml/>)) is a graduation requirement and may be demonstrated through satisfactory completion of four Writing (W) courses, two of which are designated by the major department. See Writing and Math Requirements (<https://catalog.csuchico.edu/undergraduate-requirements/writing-math-requirements/>) for more details on the four courses. The first of the major designated Writing (W) courses is listed below.

- BIOL 350W Fundamentals of Ecology (W)

The second major-designated Writing course is the Graduation Writing Assessment Requirement (GW) (EO 665 (<https://calstate.policystat.com/policy/9585618/latest/>)). Students must earn a C- or higher to receive GW credit. The GE English Composition (1A) (<https://catalog.csuchico.edu/colleges-departments/undergraduate-education-academic-success/general-education/#1A>) requirement must be completed before a student is permitted to register for a GW course.