Environmental and Earth System Science, B.S.

Environmental and Earth System Science is an interdisciplinary field of study that combines oceanography, atmospheric science, meteorology, geography, geology, hydrology, and environmental science. EESS students gain an understanding of how individual aspects of the environment interact, including the influence of humans on this complex system.

Examples of important questions in Environmental and Earth System Science include the influence of atmospheric chemistry on climate and air quality, biological controls on the chemistry of the oceans and atmosphere, physical controls on atmosphere and ocean circulation, and the implications of land use or climate change on the functioning of terrestrial and marine ecosystems.

The Environmental and Earth System Science (B.S.) program provides students with a fundamental understanding of the oceanographic, atmospheric, and terrestrial sciences. This program of study prepares students for careers in science, research, or technical fields. Students learn to apply basic sciences (physics, chemistry, mathematics, and biology) to understand the major processes and systems governing the Earth's climate, biogeochemical cycles, and global change. Central to the B.S. program is an understanding of relevant scientific literature, methods to collect/analyze data, and interpret results in the context of scientific theory. Students will learn to work collaboratively to understand and address complex problems and communicate scientific knowledge.

In the core courses, students will learn to explain the current and projected future state of the Earth system in the context of past climate change and current human activities. Students are then encouraged to focus on a particular area within Environmental and Earth System Science and to choose upper-division electives that build upon this core knowledge. Focus areas include but are not limited to climatology, biogeochemical cycles, oceanography, hydrology, terrestrial sciences, and atmospheric sciences. Optional specializations are available in Atmospheric Science, Hydrology and Terrestrial Ecosystems, and Oceanography.

EESS students are encouraged to become directly involved in research. The Department provides excellent opportunities to learn from and work with recognized experts in the field while fulfilling degree requirements, including the opportunity to graduate with honors.

Students may be admitted to the Environmental and Earth System Science major upon entering the University as freshmen, via change of major, or as transfer students from other colleges and universities. Information about change of major policies is available in the Physical Sciences Student Affairs Office and at the UCI Change of Major Criteria website (http://www.changeofmajor.uci.edu). For transfer student admission, preference will be given to junior-level applicants with the highest grades overall and who have satisfactorily completed the following required courses: one year of approved calculus and one year of *either* general chemistry with laboratory (preferred) or one-year of calculus-based physics with laboratory.

NOTE: The major is open to all students except Earth and Atmospheric Sciences minors.

All students must meet the University Requirements (https://catalogue.uci.edu/informationforadmittedstudents/requirementsforabachelorsdegree/).
School Requirements: None.

Major Requirements

A. Complete:	
EARTHSS 51	Land Interactions
EARTHSS 53	The Ocean System
EARTHSS 55	Earth's Atmosphere
EARTHSS 114	Earth System Science Laboratory and Field Methods
or EARTHSS 115	Aquatic Field Methods
EARTHSS 116	Introduction to Environmental Data Science
EARTHSS 192	Careers in Earth System Science
MATH 2A- 2B	Single-Variable Calculus I and Single-Variable Calculus II
STATS 7	Basic Statistics
Complete the following sequence and accompanying lab:	
CHEM 1A- 1B- 1C	General Chemistry and General Chemistry and General Chemistry
CHEM 1LC- 1LD	General Chemistry Laboratory and General Chemistry Laboratory
Select one of the following sequences and accompanying labs:	

PHYSICS 3A- 3B- 3C	Basic Physics I and Basic Physics II and Basic Physics III
PHYSICS 3LB- 3LC	Basic Physics Laboratory and Basic Physics Laboratory
or	
PHYSICS 7C- 7E	Classical Physics and Classical Physics
PHYSICS 7LC	Classical Physics Laboratory
B. Select four from the following: [1]	
EARTHSS 122	Atmospheric Dynamics
EARTHSS 130	Physical Oceanography
EARTHSS 132	Terrestrial Hydrology
EARTHSS 137	Terrestrial Ecosystems and Biogeochemistry
EARTHSS 142	Atmospheric Chemistry
EARTHSS 144	Marine Geochemistry and Biogeochemistry
C. Select three additional electives from the following: [1]	
Any 4-unit upper-division EARTHSS courses permitting enrollment for Environmental and Earth System Science majors. EARTHSS 114, EARTHSS 115, EARTHSS 116, and EARTHSS H198 may not count toward this requirement. EARTHSS 199 or one quarter of EARTHSS H199A-B-C may count only once toward the elective requirement.	
BIO SCI 93	From DNA to Organisms
BIO SCI 94	From Organisms to Ecosystems
BIO SCI 98	Biochemistry
CHEM 51A	Organic Chemistry
CHEM 51B- 51LB	Organic Chemistry and Organic Chemistry Laboratory
CHEM 51C- 51LC	Organic Chemistry and Organic Chemistry Laboratory
CHEM 141	Environmental Chemistry
MATH 2D	Multivariable Calculus I
MATH 3A	Introduction to Linear Algebra
MATH 3D	Elementary Differential Equations
MATH 105A	Numerical Analysis I
MATH 112A	Introduction to Partial Differential Equations and Applications I
MATH 115	Mathematical Modeling
PHYSICS 115A	Statistical Physics
Computing Skills (one of the following may be counted toward degree): EECS 10, ENGRMAE 10, I&C SCI 31, PHYSICS 53, or an approved programming course.	

1 Courses in section B may not double count for section C.

Optional Specializations

Two optional specializations are available for Environmental and Earth System Science majors: Geographic Information System and Environmental Data Science.

Specialization in Geographic Information System (GIS)

Requirements	
Complete:	
EARTHSS 134	Fundamentals of GIS for Environmental Science
EARTHSS 135W	Advanced Geographic Information Systems for Environmental Science

Courses taken for the GIS Specialization can be used toward the Environmental and Earth System Science major. Courses must be taken for a letter grade in order to count for the GIS Specialization.

For students double majoring in Urban Studies or Environmental Science and Policy, the optional GIS Specialization can only be applied to one major.

Specialization in Environmental Data Science

Requirements	
Complete:	
EARTHSS 118	Analysis, Modeling, and Visualization of Multidimensionnal Environmental Data
EARTHSS 138	Satellite Remote Sensing for Earth System Science

Courses taken for the Environmental Data Science Specialization can be used toward the Environmental and Earth System Science major. Courses must be taken for a letter grade in order to count for the Environmental Data Science Specialization.

Concentration in Geosciences Education with Secondary Teaching Certification

This concentration allows students pursuing the B.S. in Environmental and Earth System Science to earn a bachelor's degree and complete the required course work and field experience for a California Preliminary Single Subject Teaching Credential at the same time. In addition to the requirements listed above, students must complete the following courses:

CHEM 193	Research Methods
or PHYSICS 193	Research Methods
EARTHSS 7	Physical Geology [1]
or EARTHSS 140	Advanced Geology
EDUC 55	Knowing and Learning in Mathematics and Science
EDUC 109	Reading and Writing in Mathematics and Science
EDUC 143AW	Classroom Interactions I
EDUC 143BW	Classroom Interactions II
EDUC 148	Complex Pedagogical Design
EDUC 158	Student Teaching Mathematics and Science in Middle/High School (two quarters)
LPS 60	The Making of Modern Science
PHY SCI 5	California Teach 1: Introduction to Science and Mathematics Teaching
PHY SCI 105	California Teach 2: Middle School Science and Mathematics Teaching
PHYSICS 20A	Introduction to Astronomy
or PHYSICS 20B	Cosmology: Humanity's Place in the Universe

[1] EARTHSS 140 may overlap with the major requirement in section C.

With careful, early planning, it is possible for students to complete the bachelor's degree and the secondary teaching certification in four years.

For additional information about teacher certification requirements and enrollment procedures, visit the Cal Teach website (http://www.education.uci.edu/calteach/). Interested students are strongly encouraged to contact the Cal Teach Resource and Advising Center or the Physical Sciences Student Affairs Office.

Freshman		
Fall	**Winter**	**Spring**
MATH 2A	MATH 2B	STATS 7
CHEM 1A	CHEM 1B	CHEM 1C & CHEM 1LC
EARTHSS 45	General Education/Elective	General Education/Elective
Generl Education/Elective	General Education/Elective	General Education/Elective
Sophomore		
Fall	**Winter**	**Spring**
EARTHSS 51	EARTHSS 53	EARTHSS 55
PHYSICS 3A	PHYSICS 3B & PHYSICS 3LB	PHYSICS 3C & PHYSICS 3LC
General Education/Elective	General Education/Elective	General Education/Elective
CHEM 1LD	General Education/Elective	General Education/Elective

Junior		
Fall	**Winter**	**Spring**
EARTHSS 114	EARTHSS 116	EARTHSS Section B Requirement
EARTHSS 192	EARTHSS Section B Requirement	EARTHSS Section B Requirement
EARTHSS Section B Requirement	General Education/Elective	General Education/Elective
General Education/Elective		
Senior		
Fall	**Winter**	**Spring**
Approved Elective	Approved Elective	Approved Elective
Approved Elective	General Education/Elective	General Education/Elective
General Education/Elective	General Education/Elective	General Education/Elective

Some students (particularly transfer students) take EARTHSS 51 , EARTHSS 53, and EARTHSS 55 in the junior year.

Environmental and Earth System Science Honors Program. In the year-long honors course sequence, students admitted into the ESS Honors Program pursue research with faculty in the Department, and prepare a written thesis of their work. Visit the Environmental and Earth System Science Honors Program website (https://www.ess.uci.edu/undergrad/ess/honors/) for more information.

Teaching Certification. Earth System Science students interested in teaching careers can earn a bachelor's degree concurrently with a California Preliminary Single Subject Teaching Credential. See the Concentration in Geosciences Education with Secondary Teaching Certification section below for more information.

Some students go on to graduate school in physical sciences, engineering, or related areas. Others begin careers as research scientists in academic, public, or private institutions (may require a graduate-level degree). Options that may be available are scientist positions in the following roles: environmental policy and planning, environmental consulting, air quality monitoring and assessment, laboratory analysis, scientific research, science education, natural resource management, wildlife management, conservation and environmental protection, and water resource management.

- Earth and Atmospheric Sciences, Minor
- Earth System Science, Ph.D.
- Environmental and Earth System Science, B.S.