Environmental Systems

Office: 188 Galbraith Hall, Revelle College

Program Faculty

Mark H. Thiemens, *Professor, Chemistry and Biochemistry, Program Director*
Alison Withey, *Associate Director*
Donna Blackman, *Associate Researcher, SIO*
Ronald S. Burton, *Professor, Marine Biology, SIO*
Richard T. Carson, *Professor, Economics*
Colm P. Caulfield, *Assistant Professor*
Christopher D. Charles, *Professor, Oceanography, SIO*
Clark Gibson, *Associate Professor, Political Science*
Sarah T. Gille, *Assistant Professor, MAE*
Mryl C. Hendershott, *Professor, Oceanography, SIO*
William S. Hodgkiss, *Professor, Electrical Engineering, SIO*
Joshua R. Kohn, *Associate Professor, Biology*
Paul Linden, *Professor, MAE*
T. Guy Masters, *Professor, Geophysics, SIO*
Naomi Oreskes, *Associate Professor, History*
Brian Palenik, *Associate Professor, Marine Biology, SIO*
Keith Pezzoli, *Lecturer, Urban Studies and Planning*
Frank L. Powell, *Professor, Medicine/Director,White Mountain Research Station*
Jeffrey B. Remmel, *Professor, Mathematics*
Richard C. J. Somerville, *Professor, Meteorology, SIO*
Lisa Tauxe, *Professor, Geosciences, SIO*
Jeffrey R. Vincent, *Professor, Environmental Economics*

There can be little doubt that in the twenty-first century the global human community is facing a substantial growth in the environmental consequences of providing food, energy, materials, and basic services to a population of more than six billion inhabitants. The Environmental Systems Program recognizes the growing demand for environmental specialists and is designed to prepare undergraduates to enter a broad spectrum of environmental careers and graduate programs in, for example, the natural sciences, the social sciences, public policy, law, and business.

This interdisciplinary program recognizes that local, national, regional, international, and global environmental problems do not fit neatly into traditional academic departments. A measurable part of society's inability to effectively manage complex environmental problems stems from the lack of specialists who can apply analytical tools that cross disciplinary boundaries. Many environmental specialists possess little training in the natural sciences including both the fundamental ideas and methodologies of the earth and *environmental* sciences. The environmental systems major was created to address both of these shortcomings.

To encourage and foster an interdisciplinary focus in the major, the Environmental Systems Program is supported by a wide range of UCSD faculty representing the natural sciences, the social sciences, the humanities, engineering, and medicine. The program includes a required lower-division core, an upper-division "integrating course sequence," two other upper-division courses and statistics, an advanced track, and a senior integrative project and seminar. There is a strong emphasis on a rigorous natural science foundation as well as an introduction to the policy sciences for all students enrolled in the major.

The Environmental Systems program places a significant value on interdisciplinary problem solving and all majors are expected to complete an integrative Senior Project in their final year. The Senior Project is designed by the student to focus on an interdisciplinary environmental problem or research topic. Appropriate topics for the Senior Project could conceivably include biodiversity conservation, coastal zone management, environmental health, climate change, environmental justice, and/or urban air quality. An important component of the Senior Project is an off-campus or laboratory internship where students might work on, for example, the development of a comprehensive management plan for a threatened ecosystem. The Senior Seminar provides a venue for the presentation and group evaluation of the ESYS Senior Projects. Distinction in the major may be awarded for outstanding projects.

The Environmental Systems Major

The requirements for completion of the environmental systems major include a lower-division core, two upper-division courses, a three course upper-division integrating sequence (ESYS 101, ESYS 102, ESYS 103), an upper-division statistics course, advanced courses in one of four tracks, and the senior project (ESYS 190A) and senior seminar (ESYS 190B). Any questions concerning the requirements should be directed to the associate director or the program adviser. Students completing the advanced tracks in "Earth Sciences,""Ecology, Behavior, and Evolution," and "Environmental Chemistry" will be awarded a B.S. in environmental systems. The B.A. in environmental systems will be granted to students completing the "Environmental Policy" track within the major.

A grade-point average of 2.0 or higher in the upper-division major program is required for graduation. Students must receive a grade of C– or better in any course to be counted toward fulfillment of the major requirements. In exceptional cases, students with a grade-point average in the major of 2.5 or greater may petition to have one grade of D accepted.

LOWER-DIVISION CORE REQUIREMENTS
(Should be completed early in student's degree program.)

Biology 3—BILD 3

Chemistry 6A, 6B, 6BL, 6C—Environmental Chemistry track students must also complete Chemistry 6CL

Physics 1A, 1B, 1C—Earth Sciences track students complete Physics 2A-B-C

Mathematics 10A, 10B, 10C—Earth Sciences track students complete Math. 20A-B, 21C, and Math. 21D is recommended

Economics 2A

UPPER-DIVISION CORE REQUIREMENTS

Economics 131. Economics of the Environment

Political Science 160AA. Introduction to Policy Analysis *or*

Political Science 168. Policy Assessment

"Integrating Course Sequence"
(Should be taken junior year.)

Environmental Systems 101. The Living Earth

Environmental Systems 102. The Solid and Fluid Earth

Environmental Systems 103. The Human Earth

Environmental Systems 190A. Integrative Project (two quarters)

Environmental Systems 190B. Senior Seminar

Environmental Systems Major Tracks

There are four advanced tracks in which students must complete a minimum of seven upper-division courses. Students will select courses following the requirements below in consultation with a faculty adviser.

Earth Sciences

Ecology, Behavior, and Evolution

Environmental Chemistry

Environmental Policy

The program is working with the School of Engineering to create an "Environmental Engineering" track to be offered at a future date.

Earth Sciences Track

Required upper-division courses:

ERTH 101. Introduction to Earth and Environmental Sciences

ERTH 102. Introduction to Geochemistry

MATH 183. Statistical Methods (This statistics course, required in sophomore year)

Upper-division electives: (must complete a minimum of seven courses)

Solid Earth emphasis:

ERTH 103. Introduction to Geophysics

ERTH 104. Geobiology

ERTH 120. Introduction to Mineralogy

ERTH 130. Geodynamics of Terrestrial Planets

ERTH 144. Isotope Geochemistry

ERTH 160. Introduction to Tectonics

ERTH 162A. Introduction to Field Geology

ERTH 162L. Structural Analysis for Field Geology

ERTH 180. Geophysics of Natural Resources

ERTH 182. Field Geophysics

SIO 210. Physical Oceanography

SIO 260. Marine Chemistry

SIO 240. Marine Geology

Other ERTH/SIO courses by petition

Ocean/Atmosphere emphasis:

ERTH 142. Atmospheric Chemistry and Biochemical Cycles

Chemistry 149A. Environmental Chemistry

Chemistry 173. Atmospheric Chemistry

SIO 240. Marine Geology

SIO 269. Special Topics in Marine Chemistry

SIO 280. Biological Oceanography

BIEB 130. Introduction to Marine Ecology

Other courses may be substituted by petition.

CURRICULUM GUIDE PLANNING

FALL	WINTER	SPRING
FRESHMAN		
Chem. 6A	Chem. 6B	Chem. 6C
Math. 20A	Math. 20B	Math. 21C
	Chem. 6BL	BILD 3
SOPHOMORE		
Math. 21D (recommended)	Phys. 2B	Phys. 2C
Phys. 2A	Econ. 131	UD ESYS elective
Econ. 2a		Poli. 160AA or 168
JUNIOR		
ERTH 101	ERTH 102	ESYS 103
ESYS 101	ESYS 102	UD ESYS elective
Math. 183	UD ESYS elective	UD ESYS elective
SENIOR		
ESYS 190A	ESYS 190A	ESYS 190B
UD ESYS elective	UD ESYS elective	UD ESYS elective

Ecology, Behavior, and Evolution Track

Required upper-division courses:

BICD 100. Genetics

BIEB 100. Biometry (satisfies upper-division statistics requirement)

Upper-division electives [a total of seven courses required, one of which must be a lab course, selected from the courses below.] Students may satisfy some part of the upper-division elective requirements through enrollment in the Environmental Biology Program at the White Mountain Research Station (WMRS). The courses that make up this program are listed below as BIEB 170-171-172. For details contact the Environmental Systems Program office.

BIBC 100. Structural Biochemistry

BIBC 102. Metabolic Biochemistry

BIBC 103. Biochemical Techniques

BIBC 115. Computer Programming in Biology

BIBC 120. Nutrition

BIBC 130. Marine Biochemistry

BICD 110. Cell Biology

BICD 120. Fundamental of Plant Biology

BICD 130. Embryos, Genes, and Development

BICD 134. Human Reproduction and Development

BIEB 102. Introductory Ecology—Organisms and Habitats

BIEB 121. Ecology Laboratory

BIEB 126. Plant Ecology

BIEB 130. Introduction to Marine Ecology

BIEB 140. Biodiversity

BIEB 150. Evolution

BIEB 156. Population Genetics

BIEB 164. Behavioral Ecology

BIEB 166. Animal Communication

BIEB 170. Field Ecology (WMRS)

BIEB 171. Physiological Ecology (WMRS)

BIEB 172. Applied Conservation Biology (WMRS)

BIEB 176. Conservation and the Human Predicament

BIEB 178. Principles of Conservation Ecology

BIEB 179. Conservation Biology Laboratory

BIEB 180. Principles of Conservation Genetics

BIMM 100. Molecular Biology

BIMM 110. Molecular Basis of Disease

BIMM 114. Virology

BIMM 120. Bacteriology

BIMM 121. Laboratory in Microbiology

BIMM 124. Medical Microbiology

BIMM 126. Environmental Microbiology

BIMM 127. Environmental Microbiology Laboratory

BIPN 100. Mammalian Physiology I

BIPN 102. Mammalian Physiology II

BIPN 105. Animal Physiology Lab (6)

BIPN 106. Comparative Physiology (4)

Other courses may be substituted by petition.

CURRICULUM GUIDE PLANNING

FALL	WINTER	SPRING
FRESHMAN		
Chem. 6A	Chem. 6B	Chem. 6C
Math. 10A	Chem. 6BL	Math. 10C
	Math. 10B	BILD 3

SOPHOMORE		
Phys. 1A	Phys. 1B	Phys. 1C
Econ. 2A	Econ. 131	UD ESYS elective
BICD 100	BIEB 100 (statistics)	Poli. 160AA or 168
JUNIOR		
ESYS 101	ESYS 102	ESYS 103
UD ESYS elective lab	UD ESYS elective	UD ESYS elective
SENIOR		
ESYS 190A	ESYS 190A	ESYS 190B
UD ESYS elective	UD ESYS elective	UD ESYS Elective

Environmental Chemistry Track

Students must complete two of the following courses:

Chemistry 149A. Environmental Chemistry

Chemistry 149B. Environmental Chemistry

Chemistry 173. Atmospheric Chemistry

Students must complete:

Math. 183. Statistical Methods (This statistics course required in sophomore year)

Chemistry 140A and B. Organic Chemistry

One upper-division lab from either:

Chemistry 106. Instrumental Analysis Laboratory

Chemistry 143A. Organic Chemistry Laboratory

Two other upper-division courses, for example:

Chemistry 122. Biochemical Evolution

Chemistry 124. Bioinorganic Chemistry

Chemistry 126/127. Physical Chemistry

Chemistry 131/132/133. Physical Chemistry

Chemistry 140C. Organic Chemistry

Other courses may be substituted by petition.

CURRICULUM GUIDE PLANNING

FALL	WINTER	SPRING
FRESHMAN		
Chem. 6A	Chem. 6B	Chem. 6C
Math. 10A	Chem. 6BL	Math. 10C
BILD 3	Math. 10B	Chem. 6CL
SOPHOMORE		
Phys. 1A	Phys. 1B	Phys. 1C
Econ. 2A	Econ. 131	Chem. 140A
Math. 183		Poli. 160AA or 168
JUNIOR		
Chem. 140B	*Chem. 149B	*Chem. 173
*Chem. 149A	Chem. 106 OR	Chem. 143A
ESYS 101	ESYS 102	ESYS 103
SENIOR		
ESYS 190A	ESYS 190A	ESYS 190B
UD ESYS elective	UD ESYS elective	

* Choose (2) out of 3

Environmental Policy Track

Students complete a minimum of seven courses selected from the following list. It is also possible to complete the requirements for the Environmental Policy track with a specialization that includes courses from one of the other tracks. For example, a course of study with a focus on conservation biology and policy for students who may be interested in the policy and scientific dimensions of habitat conservation planning for endangered species, would include advanced courses from the Ecology, Behavior, and Evolution track.

One upper-division *Statistics* course—ANGN 157. The Analysis of Systematic Data

Economics 132. Energy Economics

Economics 125. Economics of Population Growth

Economics 116. Economic Development

Economics 130. Public Policy

Political Science 102L. The Politics of Regulation

Political Science 125. The Politics of Conservation in Developing Countries