UCLA IoES

"You Live in the Age of Environmental Science – Seize It"

IoES Student Handbook 2018-19

March 2019 Update

Getting your degree in Environmental Science at UCLA

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WELCOME FROM THE DIRECTOR

You have all heard or read the mantra – billions more people to be added to the planet, water scarcity, global warming, species going extinct, and on and on. It makes one wonder, what is the point. At IoES we see that gloomy mantra as a challenge, not a forecast or prophecy. There are more green business jobs than ever before. Venture capital funds and pension funds are investing in sustainable businesses all around the world. The Kentucky Coal Museum has installed solar panels for its energy. Cities are expanding urban parks at an unprecedented rate. Los Angeles is starting the most ambitious river restoration project ever undertaken in the world. The 2028 Olympics hosted in Los Angeles will leave a legacy of sustainability in one of the most biodiverse and culturally diverse corners of the world.

It is always the young that are agents of change. At IoES we are committed to giving you the tools and skills, and the intellectual sophistication to tackle really, really complex environmental problems. We do not just want you to succeed, we expect you to succeed and we will help you exceed. This guidebook is complicated because there are so many different pathways to making an environmental difference, and so many different disciplines that can be your vehicle. One thing that cuts across all environmental advance and progress is the need to excel at communication — that means telling stories and visualizing information in compelling ways. It also mean listening. UCLA is a big university. Take advantage of that to hear different views and to try your hand at telling stories about the environment. Again we will help.

Lastly, as someone who has worked for the federal government, for non-profit organizations, for private business, and for nearly ten different universities, I want to assure you that if you embrace the intellectual challenges and cultural diversity of IoES, there is a career for you – a career that is fun, rewarding, and makes a difference.

Best of luck on what will surely be a tortuous journey. A straight line might be the shortest path, but rarely is it the most interesting path.

Peter Kareiva, director
UCLA Institute of the Environment and Sustainability

ABOUT THE IOES

The mission of the UCLA Institute of the Environment and Sustainability (IoES) is to advance cross-disciplinary research, teaching, and public service on environmental matters of critical importance. The environment is defined broadly to include the interrelated issues of global climate change, loss of biological diversity, and threats to human health and well-being from the use and misuse of natural resources. We apply the tools of scientific and policy analysis, as well as moral and aesthetic values, to our endeavors.

The environment is a crucial component of sustainability, which is defined as the simultaneous consideration of environmental, economic, and social concerns. Los Angeles itself is a vital asset to this mission. As an international mega-city located in one of the world's most biologically diverse regions, Los Angeles is a magnet for scholars from around the world who are confronting similar issues of pollution, access to potable water, demand for energy, fragmentation of habitat, and the need to restore ecological function to sprawling urban settlements in a manner that supports economic growth and that is socially just and equitable.

IoES offers creative, multidisciplinary academic programs and courses that address the full complexity of current environmental problems and sustainable solutions. The bachelor of science degree in environmental science is a dual-component degree program for students seeking a challenging and invigorating science curriculum. The first component, the Environmental Science major, provides students with disciplinary breadth in several areas important to environmental science. The second component, a minor or concentration in one of seven defined environmental science areas, provides students with focused disciplinary depth in an area of their choosing.

Unlike a department that focuses on a specific field of inquiry, IoES draws together faculty experts from across the campus. There are currently over 100 faculty affiliated with Institute, representing more than 25 departments. Through our eight research centers and our local, national, and international programs, we employ innovative, cross-disciplinary approaches to address critical environmental and sustainability challenges.

IoES is committed to facilitating student participation in solving real-world sustainability problems. Drawing on the dynamism of the world's most diverse megacity and our top-tier public university, we take students of all cultures and income levels beyond campus borders to partner with leading government, non-profit, and business entities to develop cutting-edge environmental solutions.

Today's environmental challenges are too big to leave any idea unexplored. They are too pressing to exclude provocative or even unpopular ideas. For these reasons, IoES sponsors events that stimulate public dialogue on topics including nuclear energy, genetically modified organisms and the future of cars and transportation.

We thrive on the energy, optimism and impatience of our students and faculty. We envision a future that is beautiful and prosperous in 2050—air, water, food, people and nature. As humanity urbanizes, the story of how we save the planet will be written by cities like Los Angeles, by multicultural universities like UCLA, and by innovators who break down silos of disciplinary scholarship. Students at IoES, you, are part of that story.

ABOUT THE REVISED ENVIRONMENTAL SCIENCE MAJOR

The Environmental Science major graduated its first student in 2008. After 10 years as a major, a couple of factors provided the impetus for the department leadership to investigate changes that would improve the experience of students while in school and make students even more competitive for graduate programs and jobs after graduation.

We based the changes largely on feedback we've received from students. We perform a bi-annual survey of our alumni, and they provided feedback on the strengths and weaknesses of the program. In addition, in 2017 we underwent our 8-year departmental review, which brought in faculty from across departments at UCLA and faculty from comparable universities across the country to evaluate our programs and provide suggestions. Similarly our change in leadership brought fresh eyes to the program and motivated revision to make our Environmental Science program second to none in the world.

Those elements that are our strengths have remained unchanged or in fact been strengthened and emphasized in the program. Those areas that were weaknesses we've addressed in a couple of ways. We had three primary goals for the revision of the major:

1. Provide the skills and knowledge that were lacking or needed improvement under the existing program, to make our students the premier candidates for jobs and graduate programs. We've added a dedicated course in GIS, a specific course in environmental policy and regulation, and courses in advanced statistics, data management, and programming, all of which will provide extremely marketable skills.
2. Make navigating the major simpler; by consolidating the individual categories we have opened up the options for students to take many different courses in any term. This should alleviate the problem of students having few or no options in a term, especially as students near graduation. We expect this will alleviate some angst during each enrollment session and will help students graduate in a timely manner.
3. Create a better sense of cohesion and camaraderie amongst the majors, particularly by cohort, by introducing required courses intended to be taken in particular stages of advancement. Ideally Environmental Science majors will have at least one course each academic year where the majority or entirety of the class will be other Environmental Science majors, primarily from the same cohort. Complementing this will be the Jr Retreat, a complete cohort camping trip during zero week of the junior / 3rd year of study.

We hope that you will find the revised major a significant improvement and the changes helpful as you make your way through your undergraduate program.

Acknowlegements

The IoES wishes to sincerely thank all of those who put so much time and effort into this major revision. All of the many committees who read, considered and commented on the changes provided invaluable assistance in its creation.

In particular, the IoES would like to thank Professor Greg Okin, who chaired the curriculum revision working group and the B.S. Advisory Committee and was a model of mission management; the members of the curriculum working group: Jenny Jay, Rob Eagle, Alan Barreca, Noah Garrison, Royce Dieckmann, and Cully Nordby, and the contributions of the other members of the Environmental Science B.S. Advisory Committee who added valuable comments and tweaks to the plan: Ulli Seibt, Malcolm Gordon, Yifang Zhu, and Aradhna Tripati.

STUDENT RESOURCES

People

At the IoES we pride ourselves on being accessible and providing exceptional, individualized academic guidance for our students.

Royce Dieckmann, Student Affairs Officer

The first stop for all students in the major is the Student Affairs Officer. Even if you don't believe you need help or have any questions, we urge you to schedule an annual meeting with Royce. This handbook may answer many questions, but an in-person meeting should be viewed like your annual checkup. However, unlike with your medical doctors, we promise it won't be painful! Royce is available for appointments through an easy online scheduling tool (Calendly) to discuss all of your academic questions, including curriculum planning, enrollment, course substitutions, change of major/ minor/concentration, how to get involved with

research, internships, or volunteering, graduate school planning, DARS fixes, or any other questions, problems, or issues you may experience.

Make an appointment online

Life Science Bldg. 2318
(310) 206–9193
rdieckmann@ioes.ucla.edu

Noah Garrison, Environmental Science Practicum Director

If you aren't already familiar with Noah Garrison from the Introduction to Environmental Science course, Environment 10, you will be as you transition to your junior year and attend the Junior Class Retreat, while as seniors you will get to know him very well as the IoES Practicum Director. Noah is an invaluable resource available for consultation about a variety of topics in the field, but in particular if you have questions about graduate or professional school (he is also a practicing environmental attorney), career pathways, or getting involved in research or departmental honors, it will be well worth your while to make an appointment to speak with him!

Life Science Bldg. 2308
(310) 825–1926
ngarrison@ioes.ucla.edu

Cully Nordby, IoES Associate Director

Dr. Cully Nordby is Associate Director of the IoES; she oversees all academic programs for the Institute including the BS major. Her background is in behavioral ecology and conservation biology. She is also deeply involved in campus sustainability and co-supervises the student-led Student Action Research program at UCLA. She is very happy to meet with students to talk about ideas, careers, graduate school, and getting involved on campus.

Life Science Bldg. 2316
Open office hours: Mondays 1:00–2:00PM (or by appointment)
(310) 267–5607
nordby@ucla.edu

Peter Kareiva, IoES Director

Dr. Peter Kareiva is Director of the IoES. He has worked as an environmental scientist for the federal government, for the private sector, and for The Nature Conservancy. He has also been a Professor at Brown University, University of Washington, UCSB, Santa Clara University, Stanford, and University of Virginia, and has worked on conservation around the world. He is very happy to meet with students to talk about ideas, careers, and graduate school, and has an open door policy – if his door is open, come in and talk. Otherwise make an appointment through CathiLynn Luong cluong@ioes.ucla.edu.

La Kretz Hall, Suite 300 (on 3rd floor)
(310) 206–5082
pkareiva@ioes.ucla.edu

IoES Faculty

There are over 100 faculty affiliated with Institute, representing more than 25 departments across the College and several professional schools. Whatever your passion, whatever you are interested in, seek out faculty that are doing research that interests you, seek their advice, get to know them. See links below for full list.

Faculty, the professors who have formal appointments in IoES

Affiliated Faculty, the professors who have an informal affiliation with IoES

You

At the IoES our most valuable resource is you, our students. We want you to be the stars that help the IoES shine brightly. To do that, we need to know what you're doing and to do that, we've set up platforms to help you share your stories with the world.

Tell Your Story

What awards (fellowships, scholarships, recognition, honors, etc.) have you received? What work or research have you done in the environmental sector? Increasing the exposure of your successes to our broad audience creates a halo effect that increases opportunities for all IoES students, including yourself.

What sets IoES apart is our focus on sharing what we discover with the world. We bring environmental science directly to the public and decision-makers who can truly make a difference, with:

- Social media across multiple platforms: Twitter, Facebook, Instagram
- Collaboration with major media outlets in print, radio and television
- Engaging and collaborative public events
- Featured stories about our innovative students, faculty members, and centers

For students and alumni we also provide these channels of communication to facilitate discussion and networking:

- An online platform for students to publicly share IoES related projects and results
- A LinkedIn Group to share professional/academic opportunities, tips, and advice
- A Facebook Group to foster discussion and share events and updates related to sustainability from inside and outside the UCLA IoES community
- An Alumni Spotlight that showcases what our former students are now doing

To share your story, contact David Colgan, director of communications: dcolgan@ioes.ucla.edu

Web Resources

The Institute of the Environment and Sustainability features an excellent website that contains a multitude of information for students.

In particular, the section for the B.S. in Environmental Science for "Current Students" contains resources that should be consulted by all majors regularly as you pursue your undergraduate studies, such as the most recent program plan, information about the Senior Practicum, course lists, awards, scholarships, email lists and social media connections.

- https://www.ioes.ucla.edu/envisci/resources/

Piazza Email List

All majors should join the IoES undergraduate mailing list. We use a web service called Piazza, which allows you to tailor the frequency of email messages (we recommend the daily digest format). Piazza also keeps a complete, searchable archive of all messages that can be accessed on any web-capable device via the Piazza website.

Messages contain useful information for undergraduates and alumni alike, including things like new courses, invitations to events on and off campus, internship and job opportunities, research and lab opportunities, volunteering, campus clubs, study abroad, and more.

To join, simply create an account and join "IoES undergraduate advising." If you're already a Piazza user from one of your courses, you need only join the above "class" to start getting our messages.

- https://piazza.com/ucla/other/ioesundergraduateadvising

Facebook

We maintain the Environmental Science Facebook group exclusively for current students, alumni, and faculty. Keep in touch with classmates, network with alumni, and post useful and interesting messages for your peers and colleagues:

- https://www.facebook.com/groups/141172551155/

LinkedIn

Join the IoES LinkedIn group and network with faculty, staff, and other alumni of the IoES' undergraduate and graduate degree and certificate programs. It's never too early to start working on your professional network; it might even help you get your next (or first!) job.

- https://www.linkedin.com/groups/4509089

THE ENVIRONMENTAL SCIENCE MAJOR

About the Major

The bachelor's degree in environmental science is an immersive, multifaceted, educational experience. Drawing on the resources of a diverse, world-class university in UCLA, it emphasizes real-world practice—getting students off campus to solve problems with companies, organizations and communities. Along the way, students create their experience, using the campus, city and vast natural areas of California as living laboratories. After they graduate, 80 percent of our students go on to work in environmental professions, while others use what they've learned to pursue careers in social science, business, the arts, and more.

The classroom portion of the degree is rooted in physical and life sciences, including foundational courses in chemistry, biology, mathematics, and physics. And because environmental issues are human issues, all students also take multiple classes in social sciences and humanities—learning subjects such as public policy, politics, journalism, and environmental justice. To make this happen, IoES partners with departments across campus. Students are also offered unparalleled opportunities to engage with global

experts who visit UCLA and observe cutting-edge research at lectures and symposiums, or to potentially participate in that research with IoES and partner faculty. This broad education prepares our students to take on the complex, pressing environmental issues the world faces.

Interdisciplinary Major

The study and practice of environmental science are by nature interdisciplinary pursuits, and the B.S. program draws on strong connections across numerous departments at UCLA that all touch on the environmental science field. At their core, environmental issues are human issues. Rooted in life and physical sciences, our curriculum also features multiple classes in social sciences and humanities—subjects such as public policy, politics, journalism, and environmental justice. This gives students a broad perspective and tools to take on today's most complex, urgent environmental challenges. Students will take upper division courses in areas covering the physical and life sciences from departments around campus such as:

- Atmospheric and Oceanic Science
- Geography
- Earth Planetary and Space Sciences
- Ecology and Evolutionary Biology
- Civil and Environmental Engineering
- Environmental Health Sciences

And others...

In addition, students will take courses on the politics and policy of environmental issues, and on anthropogenic forces or human interactions with the environment, primarily through courses offered by the IoES but also from Geography, Public Policy, Urban Planning, English, Philosophy, and others.

Students also participate in a 1-unit Sustainability Talks series that brings faculty from within the UCLA community and experts from outside organizations and government agencies to present on topics relevant to sustainability and environmental science.

Minors

Environmental science students play a large role in directing their own education. In addition to taking upper division classes across a variety of environmental disciplines, students choose one of seven minors, which are indicated on their diplomas, to develop a deep expertise:

- Atmospheric and Oceanic Sciences
- Conservation Biology
- Environmental Engineering
- Environmental Health (Concentration; no official minor)
- Environmental Systems and Society
- Geography/Environmental Studies
- Earth and Environmental Science

Senior Practicum

Our students learn by doing, getting off-campus to solve problems over a full year with the one-of-a-kind Senior Practicum. This capstone experience is like no other, bonding students, faculty and professionals as they work in small teams to solve real-world problems. Recent practicum teams have worked to:

- Develop sustainable aquaculture models, with The Nature Conservancy
- Assess health and community Impacts of urban oil drilling in south Los Angeles, with STAND-LA
- Draft plans to connect fragmented habitat threatened by climate change in and around Sequoia National Park, with the U.S. National Park Service
- Develop a model and economic blueprint for sustainable ebony production in central Africa, with Taylor Guitars and Madinter

Declaring the Major

For students who enter UCLA as freshmen, declaring the Environmental Science major is usually a relatively simple matter.

If already enrolled in another major within the College of Letters and Science, there is no need to inform the current major department of the change of major. However, if enrolled in a major in any other college or school at UCLA, such as Engineering or Arts, the process is more involved.

Make an Appointment to Declare the Major

Major Declaration in the College of Letters and Science

The requirements for a student to change their major to Environmental Science are as follows:

If within the first two years of study, the student must:

- Be in good academic standing (not on academic probation or subject to dismissal)
- Be making progress in the preparatory courses
- Be able to complete all remaining program requirements within the unit maximum of 216 (including GE/College requirements, major, and minor requirements, as well as any other program such as additional minors or majors)
- Not have 2 or more preparatory courses with grades below C-, or an overall GPA in the major preparatory courses below 2.0.

If the above conditions are met the student can in most cases declare the major by making an appointment with the SAO.

If in the third year of study (immediately following spring quarter of the second year) or if any of the above conditions are not met, the student will need to consult with the department SAO about what steps must be taken to qualify to declare the major. It may be a simple matter of catching up with some coursework or preparing a viable academic plan. In other cases, a petition may need to be filed with the department asking for an exception to a department regulation, or a petition may be required by the College, such as in cases where a student will exceed the unit maximum or time to degree.

Major Declaration from another School at UCLA

In addition to meeting the bulleted requirements above, for a student to change their major to Environmental Science while enrolled in another school, such as the Henry Samueli School of Engineering and Applied Science (HSSEAS), Arts & Architecture, Music, or Theater Film & Television, requires that the student first obtain a change of program form and degree planner from the College Academic Counseling office at Murphy Hall, Room A316. The Environmental Science counselor will help prepare and review the plan, and if acceptable will sign it indicating departmental approval. The petition will then be returned to the College, which makes the determination whether the student will be permitted to transfer to the College and into the Environmental Science major.

Readmission

Students who have completed readmission coursework and wish to change majors to Environmental Science are always reviewed on a case-by-case basis. In most cases the bulleted requirements above must

be met and if in violation of departmental regulations a petition must be filed and approved by the department in advance of any petition to the College. Students seeking readmission with the Environmental Science major should make an appointment with the IoES SAO, Royce Dieckmann, to determine eligibility to enter the major.

Dismissal and Minimum Standards

A student may be dismissed from the major, be denied permission to enter the major, or may be denied his or her degree, depending on which of the conditions below have been violated.

1. Earns grades below C- in two or more of the major preparatory courses
2. Earns a GPA below 2.0 in the preparatory courses
3. Earns a grade below C in Environment 180A
4. Earns below a 2.0 GPA in the major overall, and in the upper-division requirements for the major

A student in violation of rules 1, 2, and 3 can petition the IoES Undergraduate Academic Committee for an exception, which is reviewed on a case-by-case basis. If rule 4 is violated, the student must petition the College for an exception to graduate or must make up the courses necessary to bring their GPA over 2.0. In any of the above cases, consult with the IoES SAO.

The Environmental Science Major Program Plan

PLACEHOLDER FOR PROGRAM PLAN P.2

Preparatory Courses

The preparatory courses for the Environmental Science major are typical for any bachelor of science program. The major requires 13 total prep courses. We recommend that students entering UCLA as freshmen take two prep courses each quarter until all 13 are completed, which will satisfy all of the prep requirements by the end of the second year of study.

Introduction to Environmental Science

Required: Environment 10 – Introduction to Environmental Science

All Environmental Science majors must take Environment 10 – Introduction to Environmental Science. Ideally students will complete this requirement in the first year of study, or during junior year for transfer students.

Environment 10 covers earth science, atmospheric science, oceanography, ecology and conservation, policy and regulation, and other environmental issues. It will usually be offered in winter quarter.

AP Credit: No AP credit equivalent available.

Course Description: ***Environment 10. Introduction to Environmental Science.*** **(4)** Lecture, three hours; laboratory, one hour. Limited to undergraduate students. Introduction to environmental science as discipline and as a way of thinking. Discussion of critical environmental issues at local and global scales. Fundamentals of physical, chemical, and biological processes important to environmental science. Laboratory exercises to augment lectures. Letter grading.

Introduction to Geographic Information Systems

Required: Geography 7 – Introduction to Geographic Information Systems

All Environmental Science majors must also take Geography 7 – Introduction to Geographic Information Systems (GIS). Learning the computer mapping technologies of GIS will provide students with background for an incredibly marketable skill and enable students to progress in upper-division courses and senior Practicum projects with an increasing emphasis on use of GIS.

AP Credit: No AP credit equivalent available.

Course Description: ***Geography 7: Introduction to Geographic Information Systems.*** (5) Lecture, three hours; laboratory, two hours. Designed for freshmen/sophomores. Introduction to fundamental principles and concepts necessary to carry out sound geographic analysis with geographic information systems (GIS). Reinforcement of key issues in GIS, such as geographic coordinate systems, map projections, spatial analysis, and visualization of spatial data. Laboratory exercises use database query, manipulation, and spatial analysis to address real-world problems. P/NP or letter grading.

Fulfills one Social Analysis GE requirement

Mathematics (Calculus)

Required:

- ***Math 31A – Differential and Integral Calculus*** **AND**
- ***Math 31B – Integration and Infinite Series***
  OR
- ***Math 3A – Calculus for Life Sciences Students*** **AND**
- ***Math 3B – Calculus for Life Sciences Students***
  OR
- ***Life Science 30A – Mathematics for Life Scientists*** **AND**
- ***Life Science 30B – Mathematics for Life Scientists***

Additional courses, depending on minor: Math 32A (Calculus of Several Variables) or 3C Ordinary Differential Equations with Linear Algebra for Life Sciences Students). **Required for Environmental Engineering minor.**

Math is fundamental to the study of all other science core courses; as such it is recommended that students enroll in the Math courses among their earliest prep courses taken during the first year. The two Math series – 31 and 3 – are similar, but students who do not feel especially strong in calculus may prefer the 3-series. Alternatively, the Life Sciences Division has created a math series (Life Science 30) as another option that they feel provides a mathematics background appropriate for students in the Division's majors, which emphasizes the application of math skills and computational models. Math 32A or 3C are additionally an option for Atmospheric and Oceanic Sciences, Earth and Environmental Science, Environmental Systems and Society, and Geography/Environmental Studies minors.

It is important for students to be aware that taking the LS 30A/B courses will foreclose the ability to pursue the Environmental Engineering minor, but all other minor options are still available. This is because the Math Department does not allow LS 30A/B to serve as a prerequisite for Math 3C or 32A.

Switching Math Series: Students may currently move between the Math department's series courses. For example, if a student took Math 31A, they can then enroll in Math 3B to complete the series. If the student took Math 3B, they may enroll in Math 32A. There are some disadvantages to switching series, primarily due to the order in which the material is taught, so students who switch should be prepared for additional challenge.

Note that there have been changes proposed for the Math 3ABC series that may change the ability of students to switch between series. We will make every attempt to notify students if or when these changes take effect. Students cannot switch from LS 30A to Math 3B or 31B; students who have taken the LS 30 courses who wish to then take calculus (Math 3 or 31 series) will have to start those from the beginning.

Math & Environmental Engineering: Students interested in pursuing the Environmental Engineering minor are urged to take Math 32A rather than 3C. 32A leads to second-year calculus courses that students who may wish to pursue graduate study in Environmental Engineering will need to take. Math 3C does not permit students to enroll in these second-year calculus courses.

AP Credit: Students who earned a score of 5 on the Calculus AB exam will have earned credit for Math 31A. Students who earned a score of 5 on the BC exam will have credit for Math 31A and 31B, while a score of 4 earns Math 31A credit.

Mathematics Course Descriptions:

Math 3A. Calculus for Life Sciences Students. (4) Lecture, three hours; discussion, one hour. Preparation: three and one half years of high school mathematics (including trigonometry). Enforced requisite: successful completion of Mathematics Diagnostic Test (score of 35 or better) or course 1 with grade of C- or better. Not open for credit to students with credit in another calculus sequence. Modeling with functions, limits, and derivatives, decisions and optimization in biology, derivative rules and tools. P/NP or letter grading.

Math 3B. Calculus for Life Sciences Students. (4) Lecture, three hours; discussion, one hour. Requisite: course 3A with grade of C- or better. Not open for credit to students with credit for course 31B. Applications of differentiation, integration, differential equations, linear models in biology, phase lines and classifying equilibrium values, bifurcations. P/NP or letter grading.

Math 3C. Ordinary Differential Equations with Linear Algebra for Life Sciences Students. (4) Lecture, three hours; discussion, one hour. Requisite: course 3B with grade of C- or better. Multivariable modeling, matrices and vectors, eigenvalues and eigenvectors, linear and nonlinear systems of differential equations, probabilistic applications of integration. P/NP or letter grading.

Math 31A. Differential and Integral Calculus. (4) Lecture, three hours; discussion, one hour. Preparation: at least three-and-one-half years of high school mathematics (including some coordinate geometry and trigonometry). Requisite: successful completion of Mathematics Diagnostic Test or course 1 with grade of C- or better. Differential calculus and applications; introduction to integration. P/NP or letter grading.

Math 31B. Integration and Infinite Series. (4) Lecture, three hours; discussion, one hour. Requisite: course 31A with grade of C- or better. Not open for credit to students with credit for course 3B. Transcendental functions; methods and applications of integration; sequences and series. P/NP or letter grading.

Math 32A. Calculus of Several Variables. (4) Lecture, three hours; discussion, one hour. Enforced requisite: course 31A with grade of C- or better. Introduction to differential calculus of several variables, vector field theory. P/NP or letter grading.

Life Science 30A. Mathematics for Life Scientists. (5) Lecture, three hours; laboratory, one hour. Preparation: three years of high school mathematics (to algebra II), some basic familiarity with computers. Mathematical modeling as tool for understanding dynamics of biological systems. Fundamental concepts of single-variable calculus and development of single- and multi-variable differential equation models of dynamical processes in ecology, physiology, and other subjects in which quantities change with time. Use of free computer program Sage for problem solving, plotting, and dynamical simulation in laboratory. Letter grading.

Life Science 30B. Mathematics for Life Scientists. (5) Lecture, three hours; laboratory, two hours. Enforced requisite: course 30A. Introduction to concept of matrices and linear transformations to equip students with some basic tools to understand dynamics of multivariable nonlinear systems. Examples from ecological, physiological, chemical, and other systems. Letter grading.

Chemistry

***Required*:**

- ***Chemistry 14A – Atomic and Molecular Structure, Equilibria, Acids, and Bases* AND**
- ***Chemistry 14B – Thermodynamics, Electrochemistry, Kinetics, and Organic Chemistry* AND**
- ***Chemistry 14BL – General and Organic Chemistry Laboratory I***
  OR
- ***Chemistry 20A – Chemical Structure* AND**
- ***Chemistry 20B – Chemical Energetics and Change* AND**
- ***Chemistry 20L – General Chemistry Laboratory***

***Additional required courses, depending on minor: Chemistry 14C (Structure of Organic Molecules) or 30A (Organic Chemistry I: Structure and Reactivity).* Required for Environmental Health concentration.**

Like calculus, chemistry is fundamental to environmental science and a strong science foundation for any B.S. program. As with math, we recommend that the Chemistry series be started during the first year of study. For most students in the Environmental Science major, the 14-series is recommended, primarily because it introduces organic chemistry earlier.

Chemistry is the most versatile of the prep courses in regard to the minors, because Chemistry 14C or 30A can be applied to any of them, with the exception of Environmental Engineering.

Switching Chemistry Series: Students generally cannot switch Chemistry series once a course in either series has been completed. It is therefore imperative that students choose the series wisely; for most Environmental Science majors we recommend the 14-series.

AP Credit: No course equivalency is granted for AP scores in Chemistry.

Chemistry Course Descriptions:

14A. Atomic and Molecular Structure, Equilibria, Acids, and Bases. (4) Lecture, three hours; discussion, one hour. Preparation: high school chemistry or equivalent background and three and one half years of high school mathematics. Enforced corequisite: Life Sciences 30A or Mathematics 3A or 31A or score of 35 or better on Mathematics Diagnostic Test. Not open to students with credit for course 20A. Introduction to physical and general chemistry principles; atomic structure based on quantum mechanics;

atomic properties; trends in periodic table; chemical bonding (Lewis structures, VSEPR theory, hybridization, and molecular orbital theory); gaseous and aqueous equilibria; properties of inorganic and organic acids, bases, buffers; titrations. P/NP or letter grading.

14B. Thermodynamics, Electrochemistry, Kinetics, and Organic Chemistry. (4) Lecture, three hours; discussion, one hour. Enforced requisite: course 14A with grade of C- or better. Enforced requisite or corequisite: Life Sciences 30B or Mathematics 3B or 31B with grade of C- or better. Not open to students with credit for course 20A, 20B, or 30A. Phase changes; thermochemistry; first, second, and third laws of thermodynamics; free energy changes; electrochemistry and its role as energy source; chemical kinetics, including catalysis, reaction mechanisms, and enzymes; coordination compounds; general classes and naming of organic molecules; structure, conformations, and relative energies of organic molecules; application of thermodynamics and kinetics to organic and biochemical reactions; use of molecular modeling software to illustrate molecular structures and their relative energies. P/NP or letter grading.

14BL. General and Organic Chemistry Laboratory I. (3) Lecture, one hour; laboratory, three hours. Enforced requisite: course 14A with grade of C- or better. Enforced corequisite: course 14B. Not open to students with credit for course 20L. Introduction to volumetric, spectrophotometric, and potentiometric analysis. Use and preparation of buffers and pH meters. Synthesis and kinetics techniques using compounds of interest to students in life sciences. P/NP or letter grading.

14C. Structure of Organic Molecules. (4) Lecture, three hours; discussion, one hour. Enforced requisite: course 14B with grade of C- or better. Not open to students with credit for course 30A. Continuing studies in structure of organic molecules, with emphasis on biological applications. Resonance, stereochemistry, conjugation, and aromaticity; spectroscopy (NMR, IR, and mass spectrometry); introduction to effects of structure on physical and chemical properties; survey of biomolecular structure. P/NP or letter grading.

20A. Chemical Structure. (4) Lecture, three hours; discussion, one hour. Preparation: high school chemistry or equivalent background and three and one half years of high school mathematics. Recommended preparation: high school physics. Enforced corequisite: Mathematics 31A. First term of general chemistry. Survey of chemical processes, quantum chemistry, atomic and molecular structure and bonding, molecular spectroscopy. P/NP or letter grading.

20B. Chemical Energetics and Change. (4) Lecture, three hours; discussion, one hour. Enforced requisites: course 20A or 20AH, and Mathematics 31A, with grades of C- or better. Enforced corequisite: Mathematics 31B. Second term of general chemistry. Intermolecular forces and organization, phase behavior, chemical thermodynamics, solutions, equilibria, reaction rates and laws. P/NP or letter grading.

20L. General Chemistry Laboratory. (3) Lecture, one hour; laboratory, three hours. Enforced requisite: course 20A with grade of C- or better. Enforced corequisite: course 20B. Use of balance, volumetric techniques, volumetric and potentiometric analysis; Beer's law, applications for environmental analysis and materials science. P/NP or letter grading.

30A. Organic Chemistry I: Structure and Reactivity. (4) Lecture, three hours; discussion, one hour. Enforced requisite: course 20B with grade of C- or better. First term of organic chemistry for Chemistry, Biochemistry, and engineering majors. Covalent bonding, shapes, stereochemistry, and acid/base properties of organic molecules. Properties, synthesis, and reactions of alkanes, cycloalkanes, alkenes, and alkynes. SN2, SN1, elimination, and radical reactions. P/NP or letter grading.

Life Sciences

Required:

- ***Life Sciences 7A - Cell and Molecular Biology*** **AND**
- ***Life Sciences 7B - Genetics, Evolution, and Ecology***

Additional courses, depending on minor: Life Sciences 7C (Physiology and Human Biology) and 23L (Introduction to Laboratory and Scientific Methodology).

Otherwise known as biology, Life Sciences at UCLA is divided into three discrete courses focusing on particular aspects of biological science. Because of the division of courses imposed by the quarter system, students should consult with the IoES SAO or the Life Sciences Core Office (lscore@lifesci.ucla.edu) prior to enrolling in any courses at any other institution intended to substitute for the UCLA courses.

Who takes Life Sciences 7C and 23L? Students wishing to pursue the Conservation Biology may choose to take LS 7C and 23L. It is also an option for students pursuing Environmental Systems and Society or Geography/Environmental Studies. 23L is the lab component previously included with LS 2 and LS 3 before the series changed. This lab course is best taken concurrently with 7C.

AP Credit: We do not recognize any AP credit as equivalent to any of the Life Science series courses.

Life Sciences Course Descriptions:

7A. Cell and Molecular Biology. (5) Lecture, three hours; discussion, 75 minutes. Introduction to basic principles of cell structure and cell biology, biochemistry, and molecular biology. P/NP or letter grading.

7B. Genetics, Evolution, and Ecology. (5) Lecture, three hours; discussion, 110 minutes. Enforced requisite: course 7A. Principles of Mendelian inheritance and population genetics. Introduction to principles and mechanisms of evolution by natural selection, population, behavioral, and community ecology, and biodiversity, including major taxa and their evolutionary, ecological, and physiological relationships. Letter grading.

7C. Physiology and Human Biology. (4) Lecture, three hours; discussion, 75 minutes. Enforced requisite: course 7B. Organization of cells into tissues and organs and principles of physiology of organ systems. Introduction to human genetics and genomics. Letter grading.

23L. Introduction to Laboratory and Scientific Methodology. (2) Laboratory, three hours; discussion, one hour. Enforced requisite: course 2. Must be taken concurrently with either course 3 or 4. Introductory life sciences laboratory designed for undergraduate students. Opportunity to conduct wet-laboratory cutting-edge bioinformatics laboratory experiments. Students work in groups of three conducting experiments in areas of physiology, metabolism, cell biology, molecular biology, genotyping, and bioinformatics. Letter grading.

Statistics

***Required*:**

- ***Statistics 12 – Introduction to Statistical Methods for Geography and Environmental Studies***
  OR
- ***Statistics 13 – Introduction to Statistical Methods for Life and Health Sciences***
  OR
- ***Life Sciences 40 - Statistics for Life Sciences***

Statistical analysis is ubiquitous in environmental science, and as such, a course in statistics is required of all Environmental Science majors. The purpose of statistics is to design, construct, and evaluate techniques for analyzing data. The data can be qualitative or quantitative, self-reported or machine-collected, and the motivations can be scientific, commercial, legal, or policy driven.

The recommended Statistics courses are largely similar and will provide a background that is appropriate for the types of analysis students will undertake in the major. Statistics 12 is also a Social Analysis GE, while the other options are not. However, it is also offered only once a year and is usually a smaller class, so it is typically easier to enroll in Stats 13 or LS 40.

Statistics Requirements for Double Majors: Students who are planning to double major or take a minor that requires a different statistics course should consult with the IoES SAO prior to enrolling in any other statistics course. Usually we can accommodate such requirements as a substitution, particularly when the other department has a strict requirement, such as the Economics or Psychology departments. Transfer students who have already taken a lower-division statistics course must inform the IoES SAO so that credit can be applied. All other students must submit a substitution request to the IoES SAO prior to enrolling in any Statistics course other than Stats 12 or 13 or LS 40.

AP Credit: We do not recognize any AP credit as equivalent to the listed Statistics courses or to fulfill the Statistics requirement for the major prep.

<u>Statistics Course Descriptions</u>:

Statistics 12. Introduction to Statistical Methods for Geography and Environmental Studies. (5) Lecture, four hours; discussion, one hour; laboratory, one hour. Not open for credit to students with credit for course 10, 11, or 13. Introduction to statistical thinking and understanding, with emphasis on techniques used in geography and environmental science. Underlying logic behind statistical procedures, role of variation in statistical thinking, strengths and limitations of statistical summaries, and fundamental inferential tools. Emphasis on applications in geography and environmental science in laboratory work using professional statistical analysis package, including spatial statistics. P/NP or letter grading. **Fulfills one Social Analysis GE requirement**

Statistics 13. Introduction to Statistical Methods for Life and Health Sciences. (5) Lecture, three hours; discussion, one hour; laboratory, one hour. Not open for credit to students with credit for course 10, 10H, 11, 12, or 14. Presentation and interpretation of data, descriptive statistics, introduction to correlation and regression and to basic statistical inference (estimation, testing of means and proportions, ANOVA) using both bootstrap methods and parametric models. P/NP or letter grading.

Life Science 40. Statistics for Life Sciences. (5) Lecture, three hours; laboratory, two hours. Designed for life sciences students. Introduction to statistics with emphasis on computer simulation of chance probabilities as replacement for traditional formula-based approach. Simulations allow for deeper understanding of statistical concepts, and are applicable to wider class of distributions and estimators. Students learn simple programming language to carry out statistical simulations, and apply them to classic problems of elementary statistics. Letter grading.

Physics

Required:

- ***Physics 5A – Physics for Life Sciences Majors: Mechanics and Energy*** **AND**
- ***Physics 5C – Physics for Life Sciences Majors: Electricity, Magnetism, and Modern Physics***

  OR
- ***Physics 1A – Physics for Scientists and Engineers:*** **Mechanics AND**
- ***Physics 1B – Physics for Scientists and Engineers: Oscillations, Waves, Electric and Magnetic Fields***

Additional courses, depending on minor**: Physics 5B (*Physics for Life Sciences Majors: Thermodynamics, Fluids, Waves, Light, and Optics) or* 1C (**

Physics is the study of the forces and laws of nature, from the largest galaxies to the tiniest subatomic particles. It's the most fundamental science, since the laws of nature determine everything else, forming the basis of chemistry and ultimately of biology, organisms, and ecosystems. It also encompasses electricity and magnetism. Advances in these and other areas of physics have made electric power, industry, electronic devices, and our modern standard of living possible.

Choosing Physics 5A/5C/5B or 1A/1B/1C: For most students in the Environmental Science major, we recommend the 5 (formerly 6-) series of Physics. It provides more context and connection for the biological sciences than the 1-series. For students pursuing the Atmospheric and Oceanic Sciences or Earth and Environmental Science minors, the third-quarter Physics course (5B) is recommended as additional preparation for the minor. It is especially useful for upper-division Atmospheric and Oceanic Science courses for the introduction to thermodynamics.

Switching Physics Series: While it is possible to switch between Physics series, it is not recommended.

AP Credit: We do not recognize any AP credit as equivalent to any course in the Physics series.

Physics Course Descriptions:

5A. Physics for Life Sciences Majors: Mechanics and Energy. (5) Lecture, three hours; discussion, one hour; laboratory, two hours. Requisites: Life Sciences 30A, 30B, or Mathematics 3A, 3B,

3C (3C may be taken concurrently). Statics and dynamics of forces, motion, energy, including thermal energy, with applications to biological and biochemical systems. P/NP or letter grading.

5B. Physics for Life Sciences Majors: Thermodynamics, Fluids, Waves, Light, and Optics. (5) Lecture, three hours; discussion, one hour; laboratory, two hours. Requisite: course 5A. Thermal properties of matter, free energy, fluids, ideal gas, diffusion, oscillations, waves, sounds, light, and optics, with applications to biological and biochemical systems. P/NP or letter grading.

5C. Physics for Life Sciences Majors: Electricity, Magnetism, and Modern Physics. (5) Lecture, three hours; discussion, one hour; laboratory, two hours. Requisite: course 5A. Electrostatics in vacuum and in water. Electricity, circuits, magnetism, quantum, atomic and nuclear physics, radioactivity, with applications to biological and biochemical systems. P/NP or letter grading.

1A. Physics for Scientists and Engineers: Mechanics. (5) Lecture/demonstration, four hours; discussion, one hour. Recommended preparation: high school physics, one year of high school calculus or Mathematics 31A and 31B. Enforced requisites: Mathematics 31A, 31B. Enforced corequisite: Mathematics 32A. Recommended corequisite: Mathematics 32B. Motion, Newton laws, work, energy, linear and angular momentum, rotation, equilibrium, gravitation. P/NP or letter grading.

1B. Physics for Scientists and Engineers: Oscillations, Waves, Electric and Magnetic Fields. (5) Lecture/demonstration, four hours; discussion, one hour. Enforced requisites: course 1A, Mathematics 31B, 32A. Enforced corequisite: Mathematics 32B. Recommended corequisite: Mathematics 33A. Damped and driven oscillators, mechanical and acoustic waves. Electrostatics: electric field and potential, capacitors, and dielectrics. Currents and DC circuits. Magnetic field. P/NP or letter grading.

1C. Physics for Scientists and Engineers: Electrodynamics, Optics, and Special Relativity. (5) Lecture/demonstration, four hours; discussion, one hour. Enforced requisites: courses 1A, 1B, Mathematics 32A, 32B. Enforced corequisite: Mathematics 33A. Recommended corequisite: Mathematics 33B. Ampere law, Faraday law, inductance, and LRC circuits. Maxwell equations in integral and differential form. Electromagnetic waves. Light, geometrical, and physical optics. Special relativity. P/NP or letter grading.

Upper-Division Major Requirements

Course requirements of the major are structured to provide intellectual breadth and introduce students to the key fields that exist under the umbrella of environmental science, and to provide course options from multiple departments to expose students to different disciplinary approaches.

We recommend that students use the major requirements to explore the various fields and disciplines available to them before choosing a minor. Students are encouraged to take courses of greatest personal interest to them as early as possible.

The upper-division major requirements are divided into four sections:

- Physical and Life Sciences (5 courses)
- Social Science and Humanities (3 courses)
- Sustainability Talks (2 units)
- Practicum (3 courses)

All upper-division courses in the Environmental Science major must be taken for a letter grade with the exception of the Sustainability Talks, which are P/NP graded. Students must earn a C average (2.0) or above in the upper-division requirements to graduate.

The first two sections, Physical and Life Sciences, and Social Sciences and Humanities, are composed primarily of lecture-style courses, although there are also lab and field courses amongst these. Students are required to take 8 courses across these two sections. Details and course descriptions are listed below.

Students are required to take two Sustainability Talks units from a set of course options that are designed to bring students in the major together and expose them to the myriad of possibilities for careers, research, engagement and involvement with environmental matters of all types through a lecture series. These courses are one unit, P/NP graded and consist of a guest lecture each week.

The Senior Practicum is a year-long series that is the capstone to the major. The three courses are taken over fall, winter and spring quarters in the student's final year.

Note: Students do not need to complete the entirety of their prep courses prior to beginning upper-division major requirements. However, courses may have prerequisites or recommended requisites that students should complete or consider before enrolling.

Course Options

In order to facilitate review of available paths of study, course listings are presented below by section – grouped first by topic area across departments, then second by department with full course descriptions.

Multiple Listed Courses

Courses where the course number is preceded by an "M" are multiple-listed between more than one department. The course description notes which department and course number where the other offering(s) of the course may be found. Students may enroll in the course under any of the departments offering it and will receive the same credit.

Substitutions and Petitions

Students wishing to substitute a course, either one found at UCLA or from another institution, can submit a petition to IoES for consideration. It is best if this is done in advance on an advisory basis. Simply send an email to the IoES SAO with your request in the following format:

Subject line: Petition for [category]

I would like to use [course] from [institution] to be taken in [term/year] for the [category requirement].

Attach a syllabus if available or include a course description or links to course information. The more information you can provide about the course the easier it is for a determination to be made.

Program Plan

The most up-to-date version of the program plan is always available on the IoES website in the Current Students - Resources section: https://www.ioes.ucla.edu/envisci/resources

Physical and Life Sciences Requirements (5 Courses; 20-22 units)

- ***1 Required Course: Environment 175***
- ***4 Electives***

All students will take Environment 175 (recommended for 3rd year) and 4 additional electives from the course options. No more than two courses can be from any one department. For multiple-listed courses, department is determined by how it is listed in the plan, not by the department under which the student enrolls.

Environment 175 - Programming with Big Environmental Datasets. (4) Lecture, three hours. Enforced requisite: Statistics 12 or 13, or Life Science 40. Students gain practical experience conducting empirical research by learning how to program using R. Given the demands of "big data", modern empirical research usually requires the use of powerful statistical software, like R. The programming language students learn shares many similarities with other statistical programs, providing students with a valuable labor-market skill.

Physical and Life Sciences Elective Courses Listed by Topic:

The following groupings of courses are meant to help you plan your major courses based upon your interests and goals. The courses that satisfy Physical and Life Sciences elective requirements are grouped first by topic but across departmental boundaries. The groupings are meant to be suggestive of possible pathways but should not be seen as prescriptive. These courses will complement (and in some cases overlap) courses in the minor of your interest. Full course descriptions for classes, organized by department, are provided after the listings by topic.

Atmospheric Science

- AOS 101 - Fundamentals of Atmospheric Dynamics and Thermodynamics
- AOS 141 – Introduction to Atmospheric Chemistry and Air Pollution
- C125 – Atmospheric Transport and Transformations of Airborne Chemicals
- C152D – Properties and Measurement of Airborne Particles
- EPSS 153 – Oceans and Atmospheres
- GEOG 105 - Hydrology

Air Quality & Air Pollution

- AOS 104 – Fundamentals of Air and Water Pollution
- AOS 141 – Introduction to Atmospheric Chemistry and Air Pollution
- ChE C118 – Multimedia Environmental Assessment
- EHS C125 – Atmospheric Transport and Transformations of Airborne Chemicals
- EHS C152D – Properties and Measurement of Airborne Particles

Climate Science

- AOS 102 - Climate Change and Climate Modeling
- AOS 112 – Climate Change Assessment
- GEOG 102 – Tropical Climatology
- GEOG 104 – Climatology
- GEOG M106 – Applied Climatology
- GEOG M131 - Environmental Change

Ecology & Conservation

- AOS 107 - Biological Oceanography
- EEB 100 – Introduction to Ecology and Behavior
- EEB 109 – Introduction to Marine Science
- EEB 116 – Conservation Biology
- EEB 151A – Tropical Ecology
- EEB 154 – California Ecosystems
- ENV 121 – Conservation of Biodiversity
- GEOG 111 – Forest Ecosystems
- GEOG 113 – Humid Tropics

Environmental Management, Green Business & Economics

- ENV 157 – Energy, Environment, and Development

Environmental Policy, Regulation, & Law

- ENV 157 – Energy, Environment, and Development

Oceanography

- AOS 103 - Physical Oceanography
- AOS M105 – Introduction to Chemical Oceanography
- AOS 107 – Biological Oceanography
- AOS 130 – California's Ocean
- EPSS 153 – Oceans and Atmospheres

Water Treatment/Pollution

- AOS 104 – Fundamentals of Air and Water Pollution
- AOS M105 – Introduction to Chemical Oceanography
- ChE C118 – Multimedia Environmental Assessment
- C&EE 153 – Introduction to Environmental Engineering Science
- C&EE 154 – Chemical Fate and Transport in Aquatic Environments
- C&EE M166 – Environmental Microbiology
- EHS C164 – Fate and Transport of Organic Chemicals in the Aquatic Environment
- GEOG 105 - Hydrology

Earth, Soils & Natural Resources

- EPSS 101 – Earth's Energy
- EPSS C113 – Biological and Environmental Geochemistry
- EPSS 119 – Continental Drift and Plate Tectonics

- EPSS 139 – Engineering and Environmental Geology
- EPSS 150 – Remote Sensing for Earth Sciences
- EPSS 153 – Oceans and Atmospheres
- GEOG 100 – Principles of Geomorphology
- GEOG 105 - Hydrology
- GEOG M107 – Soil and Water Conservation
- GEOG 111 – Forest Ecosystems
- GEOG M127 – Soils and Environment

Environmental Health

- AOS 104 – Fundamentals of Air and Water Pollution
- AOS 141 – Introduction to Atmospheric Chemistry and Air Pollution
- C&EE M166 – Environmental Microbiology
- ChE C118 – Multimedia Environmental Assessment
- EHS 100 – Introduction to Environmental Health
- EHS C125 – Atmospheric Transport and Transformations of Airborne Chemicals
- EHS C152D – Properties and Measurement of Airborne Particles
- EHS C164 – Fate and Transport of Organic Chemicals in the Aquatic Environment

Society & Environment

- EPSS 101 – Earth's Energy
- ENV 157 – Energy, Environment, and Development

Physical and Life Sciences Elective Course Descriptions by Department:

Atmospheric and Oceanic Science

(Crossed out courses have been discontinued by the department offering them; they apply if they have been taken but will not be available in the future. Note that AOS courses are designated "A&OSCI" in course catalog).

Atmospheric and Oceanic Sciences 101. Fundamentals of Atmospheric Dynamics and Thermodynamics. (5) Lecture, four hours; discussion, one hour. Requisites: Mathematics 3B or 31B, Physics 1B or 6B. Recommended: course 3. Introduction to atmospheric environment, with emphasis on thermodynamics, dynamics, and structure of atmosphere. Laws of thermodynamics; work, heat, and cyclic processes. Adiabatic processes, moisture, and atmospheric stability. Hydrostatic balance. Fundamental equations of motion, with applications to atmospheric flow. Circulation and vorticity.

Atmospheric and Oceanic Sciences 102. Climate Change and Climate Modeling. (4) Lecture, three hours; discussion, one hour. Enforced requisites: Mathematics 3C or 32A, Physics 1B or 6C, with grades of C or better. Global environmental issues in climate change due to human activities or natural climate variations. Quantitative introduction to new science of climate modeling to understand and predict these changes. Physical processes in climate system. Atmospheric and oceanic circulation. El niño and year-to-year climate prediction. Greenhouse effect and global warming. *[Prerequisites can be waived by permission of instructor, and generally are not enforced by the enrollment system]*

Atmospheric and Oceanic Sciences 103. Physical Oceanography. (4) Lecture, three hours; discussion, one hour. Requisite: Mathematics 3B or 31B. Introductory course for physical sciences, life sciences, or engineering majors interested in environmental issues. Observations of temperature, salinity, density, and currents. Methods. Wind-driven and geostrophic currents. California Current and Gulf Stream. Internal waves. Surface waves and tides. Air/sea interactions. Coastal upwelling. Biological/physical interactions. El niño. Role of ocean in climate and global change. Santa Monica Bay field trip.

Atmospheric and Oceanic Sciences 104. Fundamentals of Air and Water Pollution. (4) Lecture, three hours; discussion, one hour. Requisite: Chemistry 14B or 20B. Chemistry and physics of air and water pollution, including photochemistry, acid rain, air pollution meteorology and dispersion, groundwater and surface water pollution, chemical cycling, air/water interface, global atmospheric change.

Atmospheric and Oceanic Sciences M105. Introduction to Chemical Oceanography. (4) (Same as Ecology and Evolutionary Biology M139.) Lecture, three hours; discussion, one hour. Introductory course for physical sciences, life sciences, and engineering majors interested in oceanic environment. Chemical composition of oceans and nature of physical, chemical, and biological processes governing this composition in past and present. Cycles of major and minor oceanic constituents, with focus on those that are most important for life (i.e., carbon, nitrogen, phosphorus, silicon, and oxygen). Investigation of primary production, export production, remineralization, diagenesis, air-sea gas exchange processes.

Atmospheric and Oceanic Sciences 107. Biological Oceanography. (4) Lecture, three hours; discussion, one hour. Introductory course for physical sciences, life sciences, and engineering majors interested in oceanic environment. Review of how biological processes are intrinsically tied to physical and chemical processes in oceans. Examination of processes that control distribution, abundance, and production of marine organisms and their spatial and temporal variability.

Atmospheric and Oceanic Sciences 112. Climate Change Assessment. (4) Lecture, three hours. Preparation: one upper-division course in Atmospheric and Oceanic Sciences or Environmental Science. Requisite: Mathematics 3B or 31B. Projections of future anthropogenic climate change and understanding

of natural climate variability depend on international climate model intercomparison projects, on large observing systems coordinating space and ground observations, and on multi-scientist climate assessments. Lectures, readings and projects address current issues in the scientific literature on assessment of climate change for students with prior background in the atmospheric, oceanic and environmental sciences.

Atmospheric and Oceanic Sciences 130. California's Ocean. (4) Lecture, four hours. Recommended requisite: course 103 or M105. Circulation, biogeochemistry, biota, water quality, measurement techniques, computational modeling, conservation, and management for California's coastal ocean, including coastal measurement cruise and term project (paper and presentation).

Atmospheric and Oceanic Sciences 141. Introduction to Atmospheric Chemistry and Air Pollution. (4) Lecture, three hours; discussion, one hour. Requisites: Chemistry 14B or 20B, Mathematics 3A or 31A, Physics 1B or 6B. Physical and chemical processes that determine composition of atmosphere and its implications for climate, ecosystems, and human welfare. Origin of atmosphere. Nitrogen, oxygen, carbon, sulfur, trace metal cycles. Climate and greenhouse effect. Atmospheric transport and turbulence. Stratospheric ozone. Oxidizing power of atmosphere. Regional air pollution: aerosols, smog, mercury, and acid rain.

Chemical Engineering

Chemical Engineering C118. Multimedia Environmental Assessment. (4) Lecture, four hours; discussion, one hour; preparation, two hours; outside study, five hours. Recommended requisites: courses 101C, 102B. Pollutant sources, estimation of source releases, waste minimization, transport and fate of chemical pollutants in environment, intermedia transfers of pollutants, multimedia modeling of chemical partitioning in environment, exposure assessment and fundamentals of risk assessment, risk reduction strategies. Concurrently scheduled with course C218.

Civil and Environmental Engineering

Civil and Environmental Engineering 153. Introduction to Environmental Engineering Science. (4) Lecture, four hours; discussion, one hour (when scheduled); outside study, seven hours. Recommended requisite: Mechanical and Aerospace Engineering 103. Water, air, and soil pollution: sources, transformations, effects, and processes for removal of contaminants. Water quality, water and wastewater treatment, waste disposal, air pollution, global environmental problems. Field trip.

Civil and Environmental Engineering 154. Chemical Fate and Transport in Aquatic Environments. (4) Lecture, four hours; discussion, two hours; outside study, six hours. Recommended requisite: course 153. Fundamental physical, chemical, and biological principles governing movement and fate of chemicals in surface waters and groundwater. Topics include physical transport in various aquatic

environments, air-water exchange, acid-base equilibria, oxidation-reduction chemistry, chemical sorption, biodegradation, and bioaccumulation. Practical quantitative problems solved considering both reaction and transport of chemicals in environment.

Civil and Environmental Engineering M166. Environmental Microbiology. (4) (Same as Environmental Health Sciences M166.) Lecture, four hours; discussion, two hours; outside study, six hours. Recommended requisite: course 153. Microbial cell and its metabolic capabilities, microbial genetics and its potentials, growth of microbes and kinetics of growth, microbial ecology and diversity, microbiology of wastewater treatment, probing of microbes, public health microbiology, pathogen control.

Earth Planetary and Space Science

Earth Planetary and Space Sciences 101. Earth's Energy: Diminishing Fossil Resources and Prospects for Sustainable Future. (4) Lecture, three hours; laboratory, two hours; two optional field trips. Preparation: one lower-division atmospheric sciences, chemistry, Earth sciences, or physics course. Earth's energy resources (fossil fuels and alternatives) from Earth science and sustainability perspective.

Earth Planetary and Space Sciences C113. Biological and Environmental Geochemistry. (4) Lecture, three hours. Requisites: Chemistry 14A and 14B (or 20A and 20B), Mathematics 3A, 3B, and 3C (or 31A and 31B). Recommended: at least one lower-division Earth, planetary, and space sciences course. Intended for junior/senior life and physical sciences students. Study of chemistry of Earth's surface environment and interplay between biology, human activity, and geology. Introduction to origin and composition of Earth, including atmosphere, crust, and hydrosphere. Examination of how these reservoirs are affected by biological cycles and feedbacks to biological evolution and diversity. Local and global-scale movements of biologically important elements like carbon, nitrogen, and phosphorus. Concurrently scheduled with course C213. *[3C not required]*

Earth Planetary and Space Sciences 119. Continental Drift and Plate Tectonics. (4) Lecture, three hours. Requisite: course 1 or 100. Designed for juniors/seniors in physical sciences. Classical concepts of sedimentation and tectonics. Alfred Wegener's theory of continental drift and ensuing controversy. Physiography of continents and oceans. Geophysical evidence regarding nature of ocean floor. Magnetic stratigraphy. Seafloor spreading. Plate tectonic model and its driving mechanisms. Tectonic, igneous, and metamorphic processes at plate boundaries. *[Requisites can be waived by instructor]*

Earth Planetary and Space Sciences 139. Engineering and Environmental Geology. (4) Lecture, three hours; discussion, one hour. Requisite: course 1 or 100. Recommended: course 111. Principles and practice of soil mechanics and foundation engineering in light of geologic conditions, recognition, prediction, and control or abatement of subsidence, landslides, earthquakes, and other

geologic aspects of urban planning and subsurface disposal of liquids and solid wastes. *[Requisites can be waived by instructor]*

Earth Planetary and Space Sciences 150. Remote Sensing for Earth Sciences. (4) Lecture, three hours. Recommended requisites: courses 1, 61. Designed for juniors/seniors and graduate students. Remote sensing related to development of natural resources. Characteristics of electromagnetic spectrum and review of remote sensing devices. Applicability to land-use classification, soil survey, urban studies, vegetation classification; emphasis on geologic interpretation of imagery. *[Requisites can be waived by instructor]*

Earth Planetary and Space Sciences 153. Oceans and Atmospheres. (4) Lecture, three hours; discussion, one hour. Requisites: Mathematics 31A, 31B, 32A, Physics 1A, 1B, and 1C (or 1AH, 1BH, and 1CH). Physics and chemistry of Earth's oceans and atmosphere; origin and evolution of planetary atmospheres; biogeochemical cycles, atmospheric radiation and climate, energetics and dynamics of oceanic and atmospheric circulation systems. *[Prerequisites can be waived by permission of instructor - students advised to have 2 calculus and 2 physics courses]*

Ecology and Evolutionary Biology

Ecology and Evolutionary Biology 100. Introduction to Ecology and Behavior. (4) Lecture, three hours; discussion, one hour. Requisite: Life Sciences 1. Not open for credit to students with credit for course 118, C119A, C119B, 122 through C126, 129, 132 through 134B, 136, or 151B. Introduction to methods and topics in ecology and behavior. Growth and regulation of populations, organization of communities and ecosystems, biogeography, and behaviors animals use to find food, choose mates, and interact in social groups.

Ecology and Evolutionary Biology 109. Introduction to Marine Science. (4) Lecture, three hours; discussion, one hour. Requisite: Life Sciences 1. Strongly recommended for prospective Marine Biology Quarter students. Introduction to physical and biological world of 70 percent of planet: oceans. Designed to be integrative, with focus on geological evolution of seas, physical and chemical properties of water, and how these abiotic processes shape ecology and evolution of marine organisms and environments.

Ecology and Evolutionary Biology 116. Conservation Biology. (4) Lecture, three hours; discussion, two hours. Requisite: Life Sciences 1. Recommended: course 100. Not open for credit to students with credit for Environment 121. Study of ecological and evolutionary principles as they apply to preservation of genetic, species, and ecosystem diversity. Discussion sections focus on interactions of science, policy, and economics in conserving biodiversity. Oral and written student presentation on specific conservation issues.

Ecology and Evolutionary Biology 151A. Tropical Ecology. (4) Lecture, one hour; discussion, two hours. Requisite: Life Sciences 1. Broad introduction to biodiversity, community structure, and dynamics and ecosystem function of range of tropical forest habitats. Discussion of such themes as biogeography, forest structure, plant growth forms, animal communities, herbivory, forest dynamics, and disturbance regimes.

Ecology and Evolutionary Biology 154. California Ecosystems. (5) Lecture, three hours; laboratory or field trip, four hours. Requisite: Life Sciences 1. Recommended: course 100. Introduction to structure, biodiversity, and dynamics of California ecosystems, with focus on Southern California, and impact of human activities on these systems.

Environment

Environment 121. Conservation of Biodiversity. (4) Lecture, three hours; discussion, two hours. Not open for credit to students with credit for r Ecology and Evolutionary Biology 116. Examination of interrelation of natural biotic and human systems. Description of distribution of biodiversity and natural processes that maintain it. Critical analysis of various levels of threats and multidimensional challenges required for mitigating threats.

Environment 157. Energy, Environment, and Development. (4) Lecture, three hours. Requisites: Mathematics 3A and 3B (or 31A and 31B), Physics 1A and 1B (or 6A and 6B). Introduction to basic energy concepts and examination of role of various energy sources, energy conversion technologies, and energy policies in modern life. Analysis of implications of current patterns of energy production and consumption for future economic and environmental well-being. Integration of concepts and methods from physical and life sciences, engineering, environmental science, economics, and public policy. Basic quantitative skills provided to analyze and critique technical, economic, and policy choices to address challenge of balancing economic growth and environmental sustainability.

Environmental Health Sciences

Environmental Health Sciences 100. Introduction to Environmental Health. (4) Lecture, three hours; discussion, one hour. Preparation: one course each in chemistry and biology. Introduction to environmental health, including coverage of sanitary principles and chronic and acute health effects of environmental contaminants.

Environmental Health Sciences C125. Atmospheric Transport and Transformations of Airborne Chemicals. (4) Lecture, four hours. Preparation: one year of calculus, one course each in physics, organic chemistry, and physical chemistry. Designed for science, engineering, and public health students. Role of regional or long-range transport, and atmospheric lifetimes and fates of airborne chemicals in phenomena such as photochemical smog, acid deposition, stratospheric ozone depletion,

accumulation of greenhouse gases, and regional and global distribution of volatile toxic compounds. Concurrently scheduled with course C225.

Environmental Health Sciences C152D. Properties and Measurement of Airborne Particles. (4) Lecture, four hours. Preparation: one year each of chemistry, physics, and calculus. Basic theory and application of aerosol science to environmental health, including properties, behavior, sampling, and measurement of aerosols and quantitative problems. Concurrently scheduled with course C252D.

Environmental Health Sciences C164. Fate and Transport of Organic Chemicals in Aquatic Environment. (4) Lecture, four hours. Recommended requisites: Chemistry 14A and 14B, or 20A and 20B. Evaluation of how and where and in what form and concentration organic pollutants are distributed in aquatic environments. Study of mass transport mechanisms moving organic chemicals between phases, biological degradation and accumulation, and chemical reactions. Effect of humic substances on these processes. Concurrently scheduled with course C264.

Geography

Geography 100. Principles of Geomorphology. (4) Lecture, three hours; reading period, one hour. Requisite: course 1. Recommended: course 100A. Study of processes that shape world's landforms, with emphasis on weathering, mass movement and fluvial erosion, transport, deposition; energy and material transfers; space and time considerations.

Geography 102. Tropical Climatology. (4) Lecture, three hours. In-depth exploration of development of tropical climate, with special reference to hurricanes, ENSO, and monsoons. Examination of human interaction with tropical climate processes and human-induced climate change in tropics. Use of climatological information to foster sound environmental management of climate-related resources in tropics.

Geography 104. Climatology. (4) Lecture, three hours; reading period, one hour. Designed for juniors/seniors. Examination of many relations between climate and world of man. Application of basic energy budget concepts to microclimates of relevance to ecosystems of agriculture, animals, man, and urban places.

Geography 105. Hydrology. (4) Lecture, three hours. Requisites: course 104, Statistics 12. Role of water in geographic systems: hydrologic phenomena in relation to climate, landforms, soils, vegetation, and cultural processes and impacts on landscape. Field projects required. *[104 not required; any statistics course is acceptable]*

Geography M106. Applied Climatology: Principles of Climate Impact on Natural Environment. (4) (Same as Atmospheric and Oceanic Sciences M106.) Lecture, three hours; discussion, one hour. Designed for juniors/seniors. Exploration of knowledge and tools to solve complex problems in contemporary applied climatology, including current practices, influence of climate on environment, and human influence on changing climates.

Geography M107. Soil and Water Conservation. (4) (Same as Environment M114.) Lecture, three hours; discussion, one hour. Enforced requisite: course 1 or 2 or Life Sciences 1 or 3. Designed for juniors/seniors. Systematic study of processes of and hazards posed by erosion, sedimentation, development, and pollution and techniques needed to conserve soil and maintain environmental quality. Scope includes agriculture, forestry, mining, and other rural uses of land.

Geography 111. Forest Ecosystems. (4) Lecture, three hours; field trips. Requisite: course 2 or Life Sciences 1. Designed for juniors/seniors. Evaluation of ecological principles as they apply to forests. Emphasis on constraints of physical environment, biotic interactions, succession, disturbances, and long-term environmental change.

Geography 113. Humid Tropics. (4) Lecture, three hours. Requisite: course 2 or 5 or Life Sciences 1. Designed for juniors/seniors. Examination of humid tropics, with emphasis on rainforests, their ecological principles, and forms of land use.

Geography M127. Soils and Environment. (4) (Same as Ecology and Evolutionary Biology M127 and Environment M127.) Lecture, three hours; discussion, one hour; field trips. General treatment of soils and environmental implications: soil development, morphology, and worldwide distribution of soil orders; physical, chemical, hydrologic, and biological properties; water use, erosion, and pollution; management of soils as related to plant growth and distribution.

Geography M131. Environmental Change. (4) (Same as Environment M130.) Lecture, three hours; reading period, one hour. Designed for juniors/seniors. Examination of natural forces producing environmental changes over past two million years. How present landscape reflects past conditions. Effects of environmental change on people. Increasing importance of human activity in environmental modification. Focus on impact of natural and anthropogenic changes on forests.

Social Sciences and Humanities (3 Courses; 12 units)

- ***1 Required Course: Environment 140***
- ***2 Electives***

Environment 140. Foundations of Environmental Policy and Regulation. (4). Lecture, three hours. Introduction to environmental policy and regulation in U.S. Provides basic knowledge and skills needed to work as professional environmental problem solver. Exploration of environmental harms that are subject to regulation, role of science in informing policy and regulation, evolution of environmental regulation, different types of regulatory instruments, regulatory process, and alternative approaches to environmental decision making. Includes California Environmental Quality Act (CEQA), Proposition 65, California's long-standing leadership role in air pollution control, and state's pioneering efforts in regulating greenhouse gas emissions.

Social Sciences and Humanities Elective Courses Listed by Topic:

The following groupings of courses are meant to help you plan your major courses based upon your interests and goals. The courses that satisfy Social Sciences and Humanities elective requirements are grouped first by topic but across departmental boundaries. The groupings are meant to be suggestive of possible pathways, but should not be seen as prescriptive. These courses will complement (and in some cases overlap) courses in the minor of your interest. Full course descriptions for classes, organized by department, are provided after the listings by topic.

Ecology & Conservation

- GEOG 135 – African Ecology and Development

Environmental Management, Green Business & Economics

- ENV 134 – Environmental Economics
- ENV M135 – California Sustainable Development: Economic Perspective
- ENV 157 – Energy, Environment, and Development
- ENV 159 – Life Cycle Analysis of Sustainability Assessment
- ENV 160 – Topics in Environmental Economics and Policy
- ENV 162 – Entrepreneurship and Finance for Environmental Scientists
- ENV 163 – Business and Natural Environment
- GEOG M128 – Global Environment and Development: Problems and Issues
- GEOG 135 – African Ecology and Development
- PUBPOL C115 – Environmental and Resource Economics and Policy

Environmental Policy, Regulation, & Law

- ENV M132 – Environmentalism: Past, Present, and Future
- ENV 157 – Energy, Environment, and Development
- ENV 160 – Topics in Environmental Economics and Policy
- ENV M161 – Global Environment and World Politics
- ENV M164 – Environmental Politics and Governance
- ENV 166 – Leadership in Water Management
- ENV M167 – Environmental Justice Through Multiple Lenses

Environmental Justice & Urban Environments

- ENV M167 – Environmental Justice Through Multiple Lenses
- GEOG M128 – Global Environment and Development: Problems and Issues
- GEOG 135 – African Ecology and Development
- GEOG M137 – Historical Geography of American Environment
- GEOG 150 – Urban Geography
- GEOG M153 – Past Societies and Their Lessons for Our Own Future
- GEOG 156 – Metropolitan LA

Water Treatment/Pollution

- ENV 166 - Leadership in Water Management

Society & Environment

- ENV M132 – Environmentalism: Past, Present, and Future
- ENV M133 – Environmental Sociology
- ENV M135 – California Sustainable Development: Economic Perspective
- ENV 150 – Environmental Journalism, Science Communications, and New Media
- ENV M153 – Introduction to Sustainable Architecture and Community Planning
- ENV 157 – Energy, Environment, and Development
- ENV M161 – Global Environment and World Politics
- ENV 162 – Entrepreneurship and Finance for Environmental Scientists
- ENV 163 – Business and Natural Environment
- ENV M164 – Environmental Politics and Governance
- ENV 166 – Leadership in Water Management
- ENV M167 – Environmental Justice Through Multiple Lenses
- GEOG M128 – Global Environment and Development: Problems and Issues
- GEOG 135 – African Ecology and Development
- GEOG M137 – Historical Geography of American Environment
- GEOG 150 – Urban Geography

- GEOG M153 – Past Societies and Their Lessons for Our Own Future
- GEOG 156 – Metropolitan LA
- PHILOSOPHY 125 – Philosophy of Science: Contemporary
- PUBLIC POLICY C115 – Environmental and Resource Economics and Policy

Social Sciences and Humanities Elective Course Descriptions by Department:

Environment

Environment M132. Environmentalism: Past, Present, and Future. (4) (Same as Geography M115 and Urban Planning M165.) Lecture, three hours; discussion, one hour. Exploration of history and origin of major environmental ideas, movements or countermovements they spawned, and new and changing nature of modern environmentalism. Introduction to early ideas of environment, how rise of modern sciences reshaped environmental thought, and how this was later transformed by 19th-century ideas and rise of American conservation movements. Review of politics of American environmental thought and contemporary environmental questions as they relate to broader set of questions about nature of development, sustainability, and equity in environmental debate. Exploration of issues in broad context, including global climate change, rise of pandemics, deforestation, and environmental justice impacts of war. Letter grading.

Environment M133. Environmental Sociology. (4) (Same as Society and Genetics M133 and Sociology M115.) Lecture, three hours; discussion, one hour. Relationship between society and environment. Analysis in detail of interrelations between social factors (such as class, race, gender, and religion) and environmental factors (such as pollution, waste disposal, sustainability, and global warming). P/NP or letter grading.

Environment M134. Environmental Economics. (4) (Same as Economics M134.) Lecture, three hours. Requisites: Economics 41 or Statistics 12 or 13, and Economics 101 (may be waived with consent of instructor). Introduction to major ideas in natural resources and environmental economics, with emphasis on designing incentives to protect environment. Highlights important role of using empirical data to test hypotheses about pollution's causes and consequences. P/NP or letter grading.

Environment M135. California Sustainable Development: Economic Perspective. (4) (Same as Public Policy M149 and Urban Planning M163.) Lecture, three hours. Examination of specific environmental challenges that California faces. Microeconomic perspective used, with special emphasis on incentives of polluters to reduce their pollution and incentives of local, federal, and state government to address these issues. Focus on measurement and empirical hypothesis testing. P/NP or letter grading.

Environment 150. Environmental Journalism, Science Communications, and New Media. (4) Lecture, three hours. Introduction to environmental journalism, science communications, and new

media, including weekly guest lectures by prominent successful practitioners in wide variety of media. Focus on technologies, methods, genres, and theories of communicating environmental challenges, exploring solutions, and engaging public in newspapers, television, radio, movies, online, on mobile devices, and through social media. Discussion of possibilities and limitations of different media and importance of communications for environmental science, policy, public understanding, and individual decision making. Production by students of environmental communications in variety of media. P/NP or letter grading.

Environment M153. Introduction to Sustainable Architecture and Community Planning. (4) (Same as Architecture and Urban Design CM153.) Lecture, three hours. Relationship of built environment to natural environment through whole systems approach, with focus on sustainable design of buildings and planning of communities. Emphasis on energy efficiency, renewable energy, and appropriate use of resources, including materials, water, and land. Letter grading.

Environment M155. Energy in Modern Economy. (4) (Same as Physics M155.) Lecture, three hours. Requisites: Mathematics 3A and 3B (or 31A and 31B), Physics 1A and 1B (or 6A and 6B), Statistics 12 or 13. Examination of physics of energy, history of energy development, and role that energy plays in our economy, particularly in transportation and power grid. Prospects for decreasing availability of fossil fuels and impact of global warming on energy development. Current and potential future government and social responses to energy issues. P/NP or letter grading.

Environment 157. Energy, Environment, and Development. (4) Lecture, three hours. Requisites: Mathematics 3A and 3B (or 31A and 31B), Physics 1A and 1B (or 6A and 6B). Introduction to basic energy concepts and examination of role of various energy sources, energy conversion technologies, and energy policies in modern life. Analysis of implications of current patterns of energy production and consumption for future economic and environmental well-being. Integration of concepts and methods from physical and life sciences, engineering, environmental science, economics, and public policy. Basic quantitative skills provided to analyze and critique technical, economic, and policy choices to address challenge of balancing economic growth and environmental sustainability. P/NP or letter grading.

Environment 159. Life-Cycle Analysis for Sustainability Assessment. (4) Lecture, three hours. Requisites: Mathematics 3A and 3B (or 31A and 31B). Public discourse about current patterns of production and consumption of energy, and goods and services more broadly, suggest such patterns are environmentally and economically unsustainable. Introduction to basic concept of life-cycle analysis (LCA), including analytical frameworks and quantitative techniques for systematically and holistically evaluating environmental trade-offs presented by different alternatives. Focus on methodology of LCA to compute various material inputs and environmental releases from all activities associated with life cycle (i.e., raw material extraction, processing, end use, and disposal) of products or services. Discussion of strengths and limitations of LCA as tool for decision making. Students perform life-cycle analysis of one technology, product, or service of their choice. P/NP or letter grading.

Environment 160. Topics in Environmental Economics and Policy. (4) Seminar, three hours. Requisite: Statistics 12 or 13. Examination of intersection of environmental economics and policy, with focus on testing policy-relevant environmental hypotheses using economics research approach. Invited scholars present research aimed at yielding policy-relevant results on various topics such as climate change, pollution, and transportation. P/NP or letter grading.

Environment M161. Global Environment and World Politics. (4) (Same as Political Science M122B.) Lecture, three or four hours; discussion, one hour (when scheduled). Recommended requisite: Political Science 20. Politics and policy of major global environmental issues such as climate change, integrating law, policy, and political science perspectives. P/NP or letter grading.

Environment 162. Entrepreneurship and Finance for Environmental Scientists. (4) Lecture, three hours; discussion, one hour. Focus on key entrepreneurial and financial concepts, with emphasis on applications that are vital for implementing environmental solutions in private, public, and nonprofit settings. Topics include basic elements of finance, project evaluation, financial planning, and marketing. Development of entrepreneurial skills to recognize opportunity and transfer ideas into viable projects that are better for environment and that benefit people and communities. Case studies used to equip students with tools necessary to successfully execute environmental goals and objectives. P/NP or letter grading.

Environment 163. Business and Natural Environment. (4) Lecture, three hours. Examination of role of business in mitigating environmental degradation and incentives to be more environmentally responsive. Emphasis on corporate strategies that deliver value to shareholders while responding to environmental concerns. P/NP or letter grading.

Environment M164. Environmental Politics and Governance. (4) (Same as Urban Planning M160.) Lecture, three hours. Environmental planning is more than simply finding problems and fixing them. Each policy must be negotiated and implemented within multiple, complex systems of governance. Institutions and politics matter deeply. Overview of how environmental governance works in practice and how it might be improved. Letter grading.

Environment 166. Leadership in Water Management. (4) Lecture, three hours; discussion, one hour. Limited to juniors/seniors. Examination of water quality and water supply issues, including interactions between scientific, technological, management, and policy issues. Invited experts, scholars, and practitioners discuss relevant issues such as pollution, climate change, and water infrastructure. Emphasis on solutions involving integrated water supply and wastewater systems. Leadership development through writing instruction and negotiations and media training. P/NP or letter grading.

Environment M167. Environmental Justice through Multiple Lenses. (4) (Same as Urban Planning M167.) Lecture, three hours. Examination of intersection between race, economic class, and environment in U.S., with focus on issues related to social justice. Because environmental inequality is

highly complex phenomenon, multidisciplinary and multipopulation approach taken, using alternative ways of understanding, interpreting, and taking action. P/NP or letter grading.

Geography

Geography M128. Global Environment and Development: Problems and Issues. (4) (Same as Urban Planning CM166.) Lecture, three hours; discussion, one hour. Designed for juniors/seniors. Questions of population, resource use, Third World poverty, and environment. Analysis of global economic restructuring and its connections to changing organization of production and resulting environmental impacts. Case studies from Africa, Latin America, Asia, and U.S. P/NP or letter grading.

Geography 135. African Ecology and Development. (4) Lecture, three hours; discussion, one hour. Designed for juniors/seniors. Overview of contemporary ecological and development issues in sub-Saharan Africa. P/NP or letter grading.

Geography M137. Historical Geography of American Environment. (4) (Same as Environment M137.) Lecture, three hours. Designed for juniors/seniors. Study of systematic changes of natural environment in U.S. during historical time, with emphasis on interplay between and among natural factors of climate, soils, vegetation, and landforms, and human factors of settlement, economic activity, technology, and cultural traits. P/NP or letter grading.

Geography 150. Urban Geography. (4) Lecture, three hours; reading period, one hour. Designed for juniors/seniors. Analysis of development, functions, spatial patterns, and geographic problems of cities. P/NP or letter grading.

Geography M153. Past People and Their Lessons for Our Own Future. (5) (Same as Anthropology M148 and Honors Collegium M152.) Lecture, two hours; discussion, two hours. Examination of modern and past people that met varying fates, as background to examination of how other modern people are coping or failing to cope with similar issues. Letter grading.

Geography 156. Metropolitan Los Angeles. (4) Lecture, three hours; reading period, one hour. Designed for juniors/seniors. Study of origins, growth processes, internal structure and pattern, interactions, environmental and spatial problems of Los Angeles metropolitan area. P/NP or letter grading.

Philosophy

Philosophy 125. Philosophy of Science: Contemporary. (4) Lecture, three hours; discussion, one hour. Requisite: course 31 or 124. Introduction to contemporary philosophy of science, focusing on problems of central importance. May be repeated for credit with consent of instructor.

Public Policy

Public Policy C115. Environmental and Resource Economics and Policy. (4) Lecture, three hours. Requisites: Economics 11, 143. Survey of ways economics is used to define, analyze, and resolve problems of environmental management. Overview of analytical questions addressed by environmental economists that bear on public policies. Concurrently scheduled with course CM250. Letter grading.

Sustainability Talks (2 units)

REQUIRED COURSES: Two terms of Environment 185A (or Environment 193 or 188B by petition).

The Sustainability Talks requirement is a low-impact pair of courses designed to bring students in the major and minor together and to introduce students to the myriad possibilities available in the environmental sciences through guest lectures by distinguished speakers from outside the university in a variety of fields, as well as by UCLA faculty and researchers.

Any of the above courses can be taken at any time they are offered, taken at any stage of the major, and repeated for credit. There is no required order in which to take the courses.

Environment 185A is offered every fall quarter.

Environment 193 is usually offered in spring quarter.

Environment 188B is a variable topics course.

Regarding 188B: When a special seminar is offered that is acceptable for this requirement, it will be advertised by the department through the Piazza email list. The version of 188B that is listed each quarter for the Sustainable LA Grand Challenges Research Scholars Program is not acceptable for the Colloquium requirement.

Course Descriptions:

Environment 185A. Sustainability Talks. (1) Lecture, two hours. Analysis of principles of sustainability through series of lectures by world-renowned faculty members, authors, environmentalists, and progressive thinkers, with required student response papers. May be repeated for credit. P/NP grading.

Environment 188B. Special Courses in Environment. (2) Lecture, two hours. Departmentally sponsored experimental or temporary courses, such as those taught by visiting faculty members. May be repeated for credit with topic change. P/NP or letter grading.

Environment 193. Journal Club Seminars: Environment. (1) Seminar, one hour. Limited to undergraduate students. Discussion of readings selected from current literature of field. May be repeated for credit. P/NP grading.

The Environmental Science Practicum (14 units): Environment 180A/B/C

See section on the Environmental Science Practicum, below, for additional information.

Environment 180A. Practicum in Environmental Science. (4) Lecture, three hours; discussion, two hours. Enforced requisite: Statistics 12 or 13. Limited to Environmental Science majors who have completed 40 or more units of preparation for major courses, including statistics, and 12 or more units of upper division courses toward major or minor requirements. Examination of case studies and presentation of tools and methodologies in environmental science, building on what students have been exposed to in other courses. Letter grading.

Environment 180B–180C. Practicum in Environmental Science. (5–5) Laboratory, four hours; field trips. Enforced requisite: course 180A. Course 180B is enforced requisite to 180C. Limited to junior/senior Environmental Science majors. Investigation of various aspects of one environmental case study representing actual multidisciplinary issue. Particular emphasis on developing skills required for working as professionals in this field. Work may involve site investigations, original data collection and analysis, mapping and geographic information systems, and environmental policy and law issues. Case study to be defined and conducted with collaboration of local agency or nonprofit institution. Letter grading.

Environmental Science Senior Practicum

Overview

The three-quarter Practicum in Environmental Science is the capstone educational experience required of all environmental science majors and represents a significant departure from conventional teaching and learning experiences at UCLA.

Designed to launch our students into impactful careers in the environment, the Practicum pairs teams of five to seven seniors with a faculty member or other environmental expert. Then it immerses them in an independent, original, environmental or sustainability research project for prominent clients from outside the university, ranging from The Nature Conservancy and Natural Resources Defense Council, to Northrop Grumman or the National Park Service. Clients often return to participate year after year. In addition to providing an unprecedented opportunity for our majors to produce complex, professional quality work while still a student, the Practicum generates valuable information and resources for the clients' missions.

Faculty advisors attend regular weekly meetings with their teams and may help teams arrange travel and interactions with clients or other experts in the field, as well as offer advice to guide the scope of projects. However, advisors *do not serve as project managers*; their role is more of a mentor and coach—projects do not come with step by step directions! Project leadership and management, and the quality of the final products prepared for clients, are the responsibility of the students on each team. To meet their project's goals, students will spend part of the year developing professional work habits and skills, which will

prepare them for a successful transition to careers in environmental science. Indeed, alumni often say that the Practicum experience is what gave them the edge in getting jobs or into graduate programs.

180A: Fall Quarter

Lectures, Labs, Assigning Teams, and Literature Reviews

In the first quarter of the capstone sequence, students attend lectures and presentations designed to introduce them to some of the common tools and methodologies of environmental problem solving, building on what they have been exposed to in other courses. Students become familiar with the norms and ethical and policy issues that occur in the professional practice of environmental science, and examine how scientific data and research are used to make decisions in policy, professional, regulatory and other arenas. Students are introduced to their clients and the environmental science and policy questions they will take on in their group projects in ENV 180B and 180C during the winter and spring. Based on their individual preferences and backgrounds, students are assigned to a Practicum project team roughly halfway through the quarter.

Course work for the 180A class includes two major components:

- A lab-based introduction to data handling, basic statistics and data exploration, and spatial analysis using Geographic Information Systems (GIS). Labs, which focus on the application of these tools to environmental problem solving, meet once per week, but students should expect to spend 6–8 hours per week outside of scheduled lab time completing assignments.
- The literature review – after being assigned to a Practicum project, students conduct independent literature reviews of recent scientific and policy research on a specific aspect of their project topic. Students effectively ask the question "what do we know, or not know about a particular issue?" This differs from most research papers or essays students have written in previous classes; the literature review does not involve developing and supporting a thesis. Instead, students conduct a critical analysis on the current state of research, including reviewing any gaps in knowledge and problems with research methodologies, or any controversies or major disagreements in the field, to prepare themselves for tackling their Practicum project in 180B/C.

180B/C: Winter and Spring Quarters

Proposals, Research, Presentations, Final Reports and Deliverables

During winter and spring, students work as a team on their client-based environmental projects, diving into real-life application of multi-disciplinary problem solving. Project work includes formulation of a formal research proposal providing detail on how the team will meet the project's goals, conducting

research, and development of presentations and a final report and other work product that will be defined in collaboration with the client. Depending on the nature of the project, work may include field work or reconnaissance, including travel outside of the Los Angeles area, original data collection and analysis, close collaboration with your client and other experts and stakeholders in the field, and learning any number of skills or analytical approaches necessary to complete the project. In some cases, a team's final research report may provide the basis for a publication in a peer-reviewed journal. In this case, the advisor and client will work with the students after graduation to edit for possible publication.

Working and managing in a team

Students will be faced with needing to conduct and coordinate work, by multiple team members, on multiple tracks at once, and over a limited timeframe. This is similar to situations encountered in the professional world, where preliminary research may be conducted while efforts to finalize a project framework or proposal are still being completed. In broad terms, it will be important for the success of each project that:

- Students operate independently as a professional team;
- All parties develop a high level of trust and spirit of collaboration;
- Students and faculty are responsive to clients while conducting independent research;
- Communication among team members and between parties is professional and frequent; and
- Possibly most importantly, students feel comfortable to make decisions, make mistakes, and learn from the experience.

Students should expect to devote 12–15 hours a week, on average, to their group project, although more hours in any specific week can be expected depending on the particular needs of each project. This time includes class meeting time and field trips as appropriate for each project. Importantly, to avoid excess workload during spring quarter, each team will need to ensure that progress on their group projects is evenly allocated over the two quarters.

Substitutions for the Practicum

While the capstone Practicum sequence is the expected path for all environmental science majors, we recognize there may be circumstances that require a student to substitute other coursework or research in lieu of completing part or all of the Practicum program. Any substitution will require a petition to the IoES Academic Committee, and will be evaluated on an individual basis. Please see below for an overview of general IoES policy regarding potential substitutions.

- In order to substitute any portion of the Practicum, students must be in good academic standing and maintain at least a 3.0 GPA in the major.

- All students are expected to complete 180A, the fall Practicum class and associated GIS labs. Students may petition to substitute an independent study course for 180A where the student 1) plans to substitute coursework or independent research for the 180B/C sequence in place of a Practicum project, and 2) the student has completed at least an approved introductory GIS course. In this case, and upon an approved petition, the student will be required to complete a literature review paper for credit as independent study. All students who have not previously completed an approved GIS course, however, should plan to enroll in 180A.
- Students may petition to substitute a variety of potential field courses or independent research projects in place of 180B/C and completion of a Practicum project. Programs that have previously been approved for substitution include:
- Participation in the Marine Biology Quarter (MBQ) or Field Biology Quarter (FBQ) programs through the Department of Ecology and Evolutionary Biology.
- Completion of the UC Natural Reserve System field course (taken in any term, including summer).

Complete guidelines for Practicum Substitution requests can be found in the Appendix.

MINORS

About the Minors

The Minors (or Concentration, in the case of Environmental Health) provide depth and specific instruction in a particular field of the student's greatest interest within Environmental Science. The minor is required of all Environmental Science majors, and students earn an official minor on the transcript and diploma when they graduate in six of the seven options.

Choosing a Minor

Students typically decide which minor to choose based on experiences in the upper-division coursework for the major. To aid in that discovery we recommend choosing the major courses of greatest interest as early as possible to help decide a direction. Most students determine their minor by the end of the

sophomore year or early in the junior year (see below on "How to Declare a Minor" for additional information). Students are encouraged to declare the minor prior to reaching 150 total units; after reaching 150 units students will have to make an appointment with their general academic counseling unit (CAC/AAP/Honors) for approval.

While the minors provide greater depth in a particular field, they should not be viewed as determining one's future. The minor can help students enter a particular field for graduate school or for a professional opportunity, but should always be viewed as potentially opening doors, not as closing others. While a student choosing, for example, Environmental Engineering may go on to become an engineer, the option is still open to pursue public health, law, or almost any other path.

Minor Unit Requirements

All minors, with a little planning, will include the same number of courses. There is no longer or shorter path; all can be completed with 20 units that are unique to the minor. Typically, this means that if a minor has 6 courses, one course can overlap with another part of one's program (major or another minor); if it has 7 courses, two can overlap. However, the units are key, so courses that provide fewer than 4 units may change the number of courses one needs to reach 20 unique units in the minor.

How to Declare a Minor

When to Declare

We are often asked "when should I declare my minor?" There is no specific time that is best for all students but there are some guidelines that will help.

The major is constructed so that it allows you to sample courses from a variety of departments and fields. Most students are able to start taking upper-division courses by the second year of study. We recommend that you consider taking those courses that are of greatest interest to you – and are within the minors you are considering – as some of the first courses you take in the upper-division courses for the major. That way, you can have some basis for deciding if the subject matter is what you want to focus on for your minor. If it's not, you'll still have completed a major requirement and you can try something else that appeals to you.

It is optimal, though not required, to determine your minor by the beginning of your third year of study. It is optimal because this will give you about two years in which to take the courses necessary to complete the minor. This gives you the greatest possibility to get the courses you want; the longer you wait, the greater the chance you may have to take courses that aren't as desirable in order to complete the minor on time. As noted above, students are encouraged to declare the minor prior to reaching 150 total units –

after reaching 150 units students will require approval from their general academic counseling unit (CAC/AAP/Honors).

The Process of Declaring a Minor

The first step once you've determined which you want to pursue is to make an appointment with Royce, the IoES SAO, during which he will declare the minor. This will start tracking your progress on your DARS. At the appointment Royce will tell you all about the minor, including special opportunities, course recommendations based on your interests, and other aspects of the minor that will help you progress.

The second step will be to declare the minor with the department that offers it. This has two benefits: first, it may allow you to enroll in some of that department's courses during first pass enrollment; second, it will allow you earn the minor on your transcript and diploma when you graduate.

Each department may have specific requirements that you must complete prior to declaring their minor officially. Additionally, Declaring a minor is usually a simple process. First, students should consult with the IoES SAO to declare the minor, which then tracks progress in DARS. Royce will explain any additional steps the student must take prior to declaring the minor with the department that offers it (also detailed in the sections for the minors here).

Substitution requests for minors offered by a department other than the IoES must be made to and approved by that department. Each department has its own preferences for submitting such petitions. Consult with the department SAO for instructions. See the Appendix for a list of all departmental SAO contact information.

Career Paths – Study What Interests You!

For many of you, as young scientists, choosing a career path may feel like a daunting challenge, and the decision of what to study to set yourself up for that career equally or even more intimidating. But here's the good news: there are many, many fantastic career paths available to you after you graduate, whether you continue in environmental science or not, and the minor you pick will not, by itself, predict, or limit, your future. You should feel free to study what interests you, not what you think you need to study because it's the only path to that exact right job.

According to a recent report by the U.S. Department of labor, on average people tend to change jobs *11 times* between the ages of 18 and 44, and will change careers altogether two or three times in their lifetime. Your undergraduate education path will not define your career path, rather, it will provide you with a strong background as a scientist or professional in general for you to go forward and discover what it is you want to do.

This is not to say there aren't reasons to potentially pick one minor over another. This is including whether you plan to potentially go on to a graduate program in a particular scientific discipline or for a professional program; there may be prerequisites you will need to have taken in the program subject area. But even if you decide to change course later, there are almost always opportunities to build the background needed for graduate study in a different field. Just because you minor in conservation biology does not mean you can never get a PhD in climate science! The important thing is to find a course of study will be passionate about, do well, and keep moving forward. Your choice of minor is an important first step, but only a first step toward figuring out what you will do next!

Atmospheric and Oceanic Sciences Minor

About the Minor

Department of Atmospheric and Oceanic Sciences

The Atmospheric and Oceanic Sciences minor provides a formal vehicle for students specializing in other science fields to pursue interest in the atmospheric and oceanic environment. It is designed to be flexible, recognizing that many topics in this field cross traditional disciplinary boundaries. Typical coursework includes climatology, air pollution and particulate matter, meteorology, oceanography, atmospheric thermodynamics, and related options from Mathematics, Physics, Biology, and other fields.

Where are they now?

Environmental science majors who graduated with this minor are now:

Jobs

- Field Assistant - Resource Conservation District of the Santa Monica Mountains
- Senior Research Associate - Pacific Institute
- Public Lands Business Organizer - Conservation Colorado
- Coastal Program Analyst - California Coastal Commission
- Watershed Intern - John L. Hunter and Assoc. (Environmental Consulting)
- Environmental Analyst and AERMOD/GIS Specialist, SWAPE (Environmental Consulting)

Graduate Programs

- MA in International Environmental Policy - Monterey Institute
- MPH - Columbia University
- Ph.D. in Civil and Environmental Engineering - Duke University

Contact Information/To Declare the Minor

Denise Lopez
Student Affairs Officer
dlopez@atmos.ucla.edu
Department of Atmospheric and Oceanic Science
7127 Math Sciences Building
310–825–1954

To enter the minor, students must have an overall GPA of 2.0 or better and must make an appointment with a departmental undergraduate adviser for approval in selecting a coordinated program of courses from within the department and related disciplines.

Students in the minor are encouraged to join the AOS undergraduate mailing list. Simply make the request to AOS Student Affairs Officer, Kimberly Perez, by emailing kperez@atmos.ucla.edu

Course Requirements

Additional Preparation Required: One course

- Mathematics 3C or 32A OR
- Physics 6C or 1C OR
- Chemistry 14C or 30A

Minor Requirements:

SEVEN courses required including:

- THREE from Atmospheric and Oceanic Sciences (AOS – Note courses are designated as "A&O SCI" in course catalog) M100, 101, 102, 103, 104, M105, M106, C110, C115, M120, 125, 130, M140, 141, 144, 145, 150, 155, C160, C170, 180, CM185 and

- FOUR additional courses (two of which must be upper division) from:
    - Any of the above AOS courses beyond the minimum three required or from:
    - AOS 1, 2, 3, 186 (186 must be taken twice)
    - Chemistry and Biochemistry 103, 110A, 110B, 113A, C113B, 114
    - Earth and Space Sciences 15
    - Mathematics 115A, 115B, 132, 135, 136, 146, 170A, 170B

- Ecology and Evolutionary Biology 109, C119, 122, 123A or 123B, 147, 148
- Physics 110A, 110B, 112, M122, 131, 132

Other relevant courses from related disciplines may be substituted with prior approval of the department.

One course may be taken on a Pass/No Pass basis; all other minor courses must be taken for a letter grade, with an overall grade-point average of 2.0 or better. Successful completion of the minor is indicated on the transcript and diploma.

Course Descriptions

Atmospheric & Oceanic Sciences

1. Climate Change: From Puzzles to Policy. (4) Lecture, three hours; discussion, one hour. Overview of fundamentals of Earth's climate, including greenhouse effect, water and chemical cycles, outstanding features of atmospheric and ocean circulation, and feedback between different system components. Exciting and contentious scientific puzzles of climate system, including causes of ice ages, greenhouse warming, and el niño. Importance of climate science and prediction to society, with emphasis on science's role in identifying, qualifying, and solving environmental problems such as ozone hole and greenhouse warming. P/NP or letter grading.

2. Air Pollution. (4) Lecture, three hours; discussion, one hour. Causes and effects of high concentrations of pollution in atmosphere. Topics include nature and sources of gaseous and particulate pollutants, their transport, dispersion, modification, and removal, with emphasis on atmospheric processes on scales ranging from individual sources to global effects; interaction with biosphere and oceans; stratospheric pollution. P/NP or letter grading.

3. Introduction to Atmospheric Environment. (4) Lecture, three hours; discussion, one hour. Nature and causes of weather phenomena, including atmospheric circulation, clouds and storms, lightning and precipitation, fronts and cyclones, and tornadoes and hurricanes. Atmospheric radiation, global warming, and greenhouse effect. P/NP or letter grading.

M100. Earth and Its Environment. (4) (Same as Environment M111.) Lecture, three hours. Overview of Earth as system of distinct, yet intimately related, physical and biological elements. Origins and characteristics of atmosphere, oceans, and land masses. Survey of history of Earth and of life on Earth, particularly in relation to evolution of physical world. Consideration of possibility of technological solutions to global environmental problems using knowledge gained during course. Letter grading.

101. Fundamentals of Atmospheric Dynamics and Thermodynamics. (5) Lecture, four hours; discussion, one hour. Requisites: Mathematics 3B or 31B, Physics 1B or 6B. Recommended: course 3.

Introduction to atmospheric environment, with emphasis on thermodynamics, dynamics, and structure of atmosphere. Laws of thermodynamics; work, heat, and cyclic processes. Adiabatic processes, moisture, and atmospheric stability. Hydrostatic balance. Fundamental equations of motion, with applications to atmospheric flow. Circulation and vorticity. Letter grading.

102. Climate Change and Climate Modeling. (4) Lecture, three hours; discussion, one hour. Enforced requisites: Mathematics 3C or 32A, Physics 1B or 6C, with grades of C or better. Global environmental issues in climate change due to human activities or natural climate variations. Quantitative introduction to new science of climate modeling to understand and predict these changes. Physical processes in climate system. Atmospheric and oceanic circulation. El niño and year-to-year climate prediction. Greenhouse effect and global warming. P/NP or letter grading.

103. Physical Oceanography. (4) Lecture, three hours; discussion, one hour. Requisite: Mathematics 3B or 31B. Introductory course for physical sciences, life sciences, or engineering majors interested in environmental issues. Observations of temperature, salinity, density, and currents. Methods. Wind-driven and geostrophic currents. California Current and Gulf Stream. Internal waves. Surface waves and tides. Air/sea interactions. Coastal upwelling. Biological/physical interactions. El niño. Role of ocean in climate and global change. Santa Monica Bay field trip. Letter grading.

104. Fundamentals of Air and Water Pollution. (4) Lecture, three hours; discussion, one hour. Requisite: Chemistry 14B or 20B. Chemistry and physics of air and water pollution, including photochemistry, acid rain, air pollution meteorology and dispersion, groundwater and surface water pollution, chemical cycling, air/water interface, global atmospheric change. Letter grading.

M105. Introduction to Chemical Oceanography. (4) (Same as Ecology and Evolutionary Biology M139.) Lecture, three hours; discussion, one hour. Introductory course for physical sciences, life sciences, and engineering majors interested in oceanic environment. Chemical composition of oceans and nature of physical, chemical, and biological processes governing this composition in past and present. Cycles of major and minor oceanic constituents, with focus on those that are most important for life (i.e., carbon, nitrogen, phosphorus, silicon, and oxygen). Investigation of primary production, export production, remineralization, diagenesis, air-sea gas exchange processes. Letter grading.

M106. Applied Climatology: Principles of Climate Impact on Natural Environment. (4) (Same as Geography M106.) Lecture, three hours; discussion, one hour. Designed for juniors/seniors. Exploration of knowledge and tools to solve complex problems in contemporary applied climatology, including current practices, influence of climate on environment, and human influence on changing climates. P/NP or letter grading.

C110. Advanced Dynamic and Synoptic Meteorology. (6) Laboratory, six hours. Requisite: course 101. Weather map analysis, thermodynamic diagrams, satellite interpretation, severe weather

forecasting, isentropic analysis, frontogenesis, quasi-geostrophic omega equation. Concurrently scheduled with course C227. P/NP or letter grading.

112. Climate Change Assessment. (4) Lecture, three hours. Preparation: one upper-division course in Atmospheric and Oceanic Sciences or Environmental Science. Requisite: Mathematics 3B or 31B. Projections of future anthropogenic climate change and understanding of natural climate variability depend on international climate model intercomparison projects, on large observing systems coordinating space and ground observations, and on multi-scientist climate assessments. Lectures, readings and projects address current issues in the scientific literature on assessment of climate change for students with prior background in the atmospheric, oceanic and environmental sciences. P/NP or letter grading.

C115. Mesometeorology. (4) Lecture, three hours. Requisite: course 101. Observations of phenomena with length scales ranging from 20 km to 2,000 km. Topics include polar lows, airmass thunderstorms, multicell storms, supercell tornadoes, gust fronts, downbursts, microbursts, and dry line. Discussions on design of field project. Concurrently scheduled with course C228. P/NP or letter grading.

M120. Introduction to Fluid Dynamics. (4) (Same as Earth, Planetary, and Space Sciences M140.) Lecture, three hours; discussion, one hour. Corequisite: Physics 131. Fluid statics and thermodynamics. Kinematics. Conservation laws and equations of fluid motion. Circulation theorems and vorticity dynamics. Rotating frame. Irrotational flow. Letter grading.

130. California's Ocean. (4) Lecture, four hours. Recommended requisite: course 103 or M105. Circulation, biogeochemistry, biota, water quality, measurement techniques, computational modeling, conservation, and management for California's coastal ocean, including coastal measurement cruise and term project (paper and presentation). Letter grading.

141. Introduction to Atmospheric Chemistry and Air Pollution. (4) Lecture, three hours; discussion, one hour. Requisites: Chemistry 14B or 20B, Mathematics 3A or 31A, Physics 1B or 6B. Physical and chemical processes that determine composition of atmosphere and its implications for climate, ecosystems, and human welfare. Origin of atmosphere. Nitrogen, oxygen, carbon, sulfur, trace metal cycles. Climate and greenhouse effect. Atmospheric transport and turbulence. Stratospheric ozone. Oxidizing power of atmosphere. Regional air pollution: aerosols, smog, mercury, and acid rain. Letter grading.

C144. Atmospheric Boundary Layer. (4) Lecture, three hours. Enforced requisite: course 101 with grade of B+ or better. Atmospheric boundary layer is lowest portion of atmosphere, representing interface between Earth's surface and atmosphere, is strongly affected by turbulence, and plays important role in exchange of heat, momentum, trace gases, and aerosols between Earth's surface and free troposphere. Investigation of properties of atmospheric boundary layer and processes that determine them. Concurrently scheduled with course C222. P/NP or letter grading.

145. Atmospheric Physics: Radiation, Clouds, and Aerosols. (4) Lecture, three hours; discussion, one hour. Requisites: Physics 1A, 1B, and 1C, or 6A, 6B, and 6C. Theory and application of atmospheric radiation, aerosol, and cloud processes. Topics include radiative transport, cloud and rain formation, aerosol properties, impact of aerosol and clouds on climate. Letter grading.

150. Atmospheric and Oceanic Sciences Laboratory. (5) Lecture, one hour; laboratory, six hours. Requisites: Mathematics 3B or 31B, Physics 1B and 1C (or 6B and 6C). Many of today's environmental problems, such as stratospheric ozone hole, current rise of greenhouse gas concentrations, and various severe weather phenomena, were first discovered and investigated using accurate observational techniques. Direct experimental observations remain crucial component in today's efforts to better understand weather, climate, and pollution of atmosphere and ocean. Introduction to experimental/observational approach in atmospheric and oceanic sciences. Students work in small groups to gain hands-on experience in setup, performance, analysis, and reporting of different experiments. Introduction to underlying principles of these experimental methods and basic data analysis tools. P/NP or letter grading.

155. Introduction to Ecosystem-Atmosphere Interactions. (4) Lecture, three hours; discussion, one hour. Exchanges of energy, moisture, atmospheric trace gases, and momentum between terrestrial ecosystems and atmosphere. Interactions and feedbacks between physical environment and physiological status of plants and soils. Topics include canopy structure and function, leaf energy balance, and carbon and water fluxes between plants, soils, and atmosphere. Letter grading.

C160. Remote Sensing of Atmosphere and Oceans. (4) Lecture, three hours. Requisite: Physics 1C or 6B. Theory and techniques of remote sensing; atmospheric spectroscopy, scattering, and polarization; passive and active techniques; relevant satellite systems; inversion methods; remote sensing of clouds, aerosols, temperature, precipitation, and trace constituents; remote sensing of oceans and biosphere. Concurrently scheduled with course C240B. P/NP or letter grading.

C170. Introduction to Solar System Plasmas. (4) Lecture, three hours; discussion, one hour. Requisites: Mathematics 33A, Physics 1C. Introduction to basic plasma physical processes occurring in sun, solar wind, magnetospheres, and ionospheres of planets, using simple fluid (magnetohydrodynamic) models as well as individual particle (radiation belt dynamics) approach. Solar-planetary coupling processes, geomagnetic phenomena, aurora. Concurrently scheduled with course C205A. Letter grading.

180. Numerical Methods in Atmospheric Sciences. (4) Lecture, three hours; discussion, one hour. Preparation: one course in C or Fortran programming. Requisite: Mathematics 33B. Survey of numerical methods employed in atmospheric and related sciences: theory, application, and programming. Letter grading.

186. Operational Meteorology. (2) Laboratory, six hours. Requisite: course C110. Limited to junior/senior Atmospheric, Oceanic, and Environmental Sciences majors. Daily contact with weather data and forecasting, satellite and radar data. Introduction to weather forecasting for aviation, air pollution, marine weather, fire weather, and public use. Includes daily weather map discussions and visits to observing, radiosonde, and radar installations. Letter grading.

Chemistry

103. Environmental Chemistry. (4) Lecture, four hours; discussion, one hour. Requisites: courses 30B, 30BL, 110A, 153A (or 153AH), 153L. Chemical aspects of air and water pollution, solid waste disposal, energy resources, and pesticide effects. Chemical reactions in environment and effect of chemical processes on environment. P/NP or letter grading.

110A. Physical Chemistry: Chemical Thermodynamics. (4) Lecture, three hours; discussion, one hour; tutorial, one hour. Requisites: course 20B, Mathematics 32A or 3C (for life sciences majors), Physics 1A, 1B, and 1C (may be taken concurrently), or 1AH, 1BH, and 1CH (may be taken concurrently), or 6A, 6B, and 6C (may be taken concurrently). Fundamentals of thermodynamics, chemical and phase equilibria, thermodynamics of solutions, electrochemistry. P/NP or letter grading.

110B. Physical Chemistry: Introduction to Statistical Mechanics and Kinetics. (4) Lecture, three hours; discussion, one hour; tutorial, one hour. Requisites: courses 110A, 113A, Mathematics 32B. Kinetic theory of gases, principles of statistical mechanics, statistical thermodynamics, equilibrium structure and free energy, relaxation and transport phenomena, macroscopic chemical kinetics, molecular-level reaction dynamics. P/NP or letter grading.

113A. Physical Chemistry: Introduction to Quantum Mechanics. (4) Lecture, three hours; discussion, one hour; tutorial, one hour. Requisites: course 20B, Mathematics 32A, 32B, 33A, Physics 1A, 1B, and 1C, or 1AH, 1BH, and 1CH, or 6A, 6B, and 6C, with grades of C- or better. Departure from classical mechanics: Schrödinger versus Newton equations; model systems: particle-in-box, harmonic oscillator, rigid rotor, and hydrogen atom; approximation methods: perturbation and variational methods; many-electron atoms, spin, and Pauli principle, chemical bonding. P/NP or letter grading.

C113B. Physical Chemistry: Introduction to Molecular Spectroscopy. (4) Lecture, three hours; discussion, one hour; tutorial, one hour. Requisite: course 113A. Interaction of radiation with matter, microwave spectroscopy, infrared and Raman spectroscopy, vibrations in polyatomic molecules, electronic spectroscopy, magnetic resonance spectroscopy. Concurrently scheduled with course C213B. P/NP or letter grading.

114. Physical Chemistry Laboratory. (5) Lecture, two hours; laboratory, eight hours. Enforced requisites: courses 30AL, 110A, and 113A, with grades of C- or better. Enforced corequisite: course 110B or

C113B. Lectures include techniques of physical measurement, error analysis and statistics, special topics. Laboratory includes spectroscopy, thermodynamic measurements, and chemical dynamics. P/NP or letter grading.

Earth, Planetary, and Space Science

15. Blue Planet: Introduction to Oceanography. (5) Lecture, three hours; laboratory, two hours. Not open for credit to students with credit for or currently enrolled in Ecology and Evolutionary Biology 25. General introduction to geological, physical, chemical, and biological processes and history of Earth's global ocean system. P/NP or letter grading.

Mathematics

115A–115B. Linear Algebra. (5–4) P/NP or letter grading.

115A. Lecture, three hours; discussion, two hours. Requisite: course 33A. Techniques of proof, abstract vector spaces, linear transformations, and matrices; determinants; inner product spaces; eigenvector theory.

115B. Lecture, three hours; discussion, one hour. Requisite: course 115A. Linear transformations, conjugate spaces, duality; theory of a single linear transformation, Jordan normal form; bilinear forms, quadratic forms; Euclidean and unitary spaces, symmetric skew and orthogonal linear transformations, polar decomposition.

132. Complex Analysis for Applications. (4) Lecture, three hours; discussion, one hour. Requisites: courses 32B, 33B. Introduction to basic formulas and calculation procedures of complex analysis of one variable relevant to applications. Topics include Cauchy/Riemann equations, Cauchy integral formula, power series expansion, contour integrals, residue calculus.

135. Ordinary Differential Equations. (4) Lecture, three hours; discussion, one hour. Requisites: courses 33A, 33B. Selected topics in differential equations. Laplace transforms, existence and uniqueness theorems, Fourier series, separation of variable solutions to partial differential equations, Sturm/Liouville theory, calculus of variations, two-point boundary value problems, Green's functions. P/NP or letter grading.

136. Partial Differential Equations. (4) Lecture, three hours; discussion, one hour. Requisites: courses 33A, 33B. Linear partial differential equations, boundary and initial value problems; wave equation, heat equation, and Laplace equation; separation of variables, eigenfunction expansions; selected topics, as method of characteristics for nonlinear equations.

146. Methods of Applied Mathematics. (4) Lecture, three hours; discussion, one hour. Requisites: courses 32B, 33B. Integral equations, Green's function, and calculus of variations. Selected applications from control theory, optics, dynamical systems, and other engineering problems.

170A. Probability Theory. (4) Lecture, three hours; discussion, one hour. Requisites: courses 32B, 33A. Not open to students with credit for Electrical Engineering 131A or Statistics 100A. Probability distributions, random variables and vectors, expectation. P/NP or letter grading.

170B. Probability Theory. (4) Lecture, three hours; discussion, one hour. Enforced requisite: course 170A. Convergence in distribution, normal approximation, laws of large numbers, Poisson processes, random walks. P/NP or letter grading.

Ecology and Evolutionary Biology

109. Introduction to Marine Science. (4) Lecture, three hours; discussion, one hour. Requisite: Life Sciences 1. Strongly recommended for prospective Marine Biology Quarter students. Introduction to physical and biological world of 70 percent of planet: oceans. Designed to be integrative, with focus on geological evolution of seas, physical and chemical properties of water, and how these abiotic processes shape ecology and evolution of marine organisms and environments. Letter grading.

C119A. Mathematical and Computational Modeling in Ecology. (4) Lecture, three hours; discussion, one hour. Enforced requisite: Life Sciences 30B or Mathematics 3B or 31A. Recommended: courses 100, 122, Life Sciences 1, Mathematics 3C. Introduction to modeling dynamics of ecological systems, including formulation and analysis of mathematical models, basic techniques of scientific programming, probability and stochastic modeling, and methods to relate models to data. Examples from ecology but techniques and principles applicable throughout life and physical sciences. Concurrently scheduled with course C219A. P/NP or letter grading.

122. Ecology. (4) Lecture, three hours; discussion, two hours. Requisites: course 100, Life Sciences 1, Mathematics 3B or 31A or Life Sciences 30B. Highly recommended: Mathematics 31B, 32A. Designed for departmental majors specializing in environmental and population biology. Introduction to population and community ecology, with emphasis on growth and distributions of populations, interactions between species, and structure, dynamics, and functions of communities and ecosystems. P/NP or letter grading.

123A–123B. Field Marine Ecology. (4 or 8 each) Lecture, five hours; laboratory, 15 hours. Recommended requisites: courses 100, 122. Offered either as 4- or 8-unit five-week intensive course given off campus as part of Marine Biology Quarter. Survey of current topics in marine ecology, including analysis of primary research literature combined with field study of ecology of marine organisms, populations, communities, and ecosystems. Original research project required. Letter grading. 123A. In

residence at research station located outside continental U.S. 123B. In residence at research station located within U.S., including Alaska and Hawaii.

147. Biological Oceanography. (4) Five-week intensive course. Lecture, five hours; laboratory, 15 hours. Requisites: Chemistry 14A, 14B, and 14BL, or 20A, 20B, 20L, and 30AL, Life Sciences 1, 3, 23L. Lectures include physical, chemical, and biological factors affecting abundance and distribution of organisms in marine environment. Laboratory includes experimental studies of local marine organisms, with emphasis on primary and secondary production and nutrient flux. Letter grading.

148. Biology of Marine Plants. (4) Five-week intensive course. Lecture, five hours; laboratory, 15 hours. Requisites: Chemistry 14A, 14B, and 14BL, or 20A, 20B, 20L, and 30AL, Life Sciences 1, 3, 23L. Introduction to general biology of marine algae, including basics of structure reproduction, life histories, systematics, and introduction to physiology and ecology of marine algae. Techniques in culture and laboratory investigation and utilization of algae. Given off campus at marine science center. Letter grading.

Physics

110A. Electricity and Magnetism. (4) Lecture, three hours; discussion, one hour. Requisites: courses 1A, 1B, and 1C (or 1AH, 1BH, and 1CH), 131, Mathematics 32B, 33A, 33B. Electrostatics and magnetostatics. P/NP or letter grading.

110B. Electricity and Magnetism. (4) Lecture, three hours; discussion, one hour. Requisites: courses 1A, 1B, and 1C (or 1AH, 1BH, and 1CH), 110A, Mathematics 32B, 33A, 33B. Faraday law and Maxwell equations. Propagation of electromagnetic radiation. Multipole radiation and radiation from an accelerated charge. Special theory of relativity. P/NP or letter grading.

112. Thermodynamics. (4) Lecture, three hours; discussion, one hour. Requisites: courses 1A, 1B, and 1C (or 1AH, 1BH, and 1CH), Mathematics 32B, 33A, 33B. Corequisite: course 115B. Fundamentals of thermodynamics, including first, second, and third laws. Statistical mechanical point of view and its relation to thermodynamics. Some simple applications. P/NP or letter grading.

M122. Introduction to Plasma Electronics. (4) (Same as Electrical Engineering M185.) Lecture, three hours; discussion, one hour; outside study, eight hours. Requisite: course 110A or Electrical Engineering 101A. Senior-level introductory course on electrodynamics of ionized gases and applications to materials processing, generation of coherent radiation and particle beams, and renewable energy sources. Letter grading.

131. Mathematical Methods of Physics. (4) Lecture, three hours; discussion, one hour. Requisites: courses 1A, 1B, and 1C (or 1AH, 1BH, and 1CH), Mathematics 32B, 33A, 33B. Vectors and fields in space, linear transformations, matrices, and operators; Fourier series and integrals. P/NP or letter grading.

132. Mathematical Methods of Physics. (4) Lecture, three hours; discussion, one hour. Requisites: courses 1A, 1B, and 1C (or 1AH, 1BH, and 1CH), 131, Mathematics 32B, 33A, 33B. Functions of a complex variable, including Riemann surfaces, analytic functions, Cauchy theorem and formula, Taylor and Laurent series, calculus of residues, and Laplace transforms. P/NP or letter grading.

Conservation Biology Minor

About the Minor

Department of Ecology and Evolutionary Biology

The Conservation Biology minor is designed for students who wish to augment their major program of study with courses addressing issues central to the conservation and sustainability of biodiversity and natural ecosystem processes. The minor seeks to provide students with a greater depth of experience and understanding of the role that science can play in developing conservation policy. Ecosystem conservation, including focused studies of flora and fauna and the unique requirements of specific species for biodiversity is the primary focus of the minor.

Students are encouraged to join the EEB undergraduate email list.

Where are they now?

Environmental science majors who graduated with this minor are now:

Jobs

- Marine Programs Manager - The Bay Foundation
- Education and Development Associate - Wishtoyo Foundation (Protection of Native American Culture/Environment)
- Protected Areas Management Advisor - Peace Corps (Honduras)
- Fisheries Research Associate - The Nature Conservancy
- Sea Grant Fellow - Port of San Diego
- Environmental Scientist - California Department of Water Resources
- Field Research Assistant - Madagascar Biodiversity Partnership
- Manager - National Parks Board, Singapore

Graduate Programs

- Ph.D. in Epidemiology - UNC Chapel Hill
- MESM - UCSB Bren School of Environmental Science and Management
- Ph.D. in Ecology and Conservation Biology - SUNY Stony Brook

Contact Information/To Declare the Minor

Jessica Angus, Jessica Gonzalez, and Kellie Marie Lavin
Student Affairs Officers
eebundergad@lifesci.ucla.edu
Department of Ecology & Evolutionary Biology
101 Hershey Hall
Monday-Friday, 9:00 a.m. to 12:00 p.m. and 1:00 to 3:00 p.m. Drop-In Counseling and Scheduled Appointments Available

Once EEB 100 and EEB 116 (or ENV 121) have been completed with a grade of C or better, students will go to the EEB advising offices in Hershey Hall 101 during posted office hours to declare the minor in person. EEB only accepts minor declarations during weeks 0-3 and 8-10 of any quarter (but any time in summer).

Mailing list: Submit a request to join the EEB undergraduate email list to ebundergrad@lifesci.ucla.edu

Course Requirements

Additional Preparatory Courses Required: Choose one option from

- Life Sciences 7C & 23L (or Life Sciences 3 & 23L) OR
- Chemistry 14C or Chemistry 30A.

Pre-Requisites:

All pre-requisites for the Conservation Biology minor must be completed with a grade of "C" or better:

- Life Sciences 7A (5 units) or Life Sciences 1 (5 units)
- EE BIOL 100 (4 units)
- EE BIOL 116* (4 units) or Environment 121 (4 units) – Choose one.
  *Students who have received credit for EE BIOL 116 cannot take Environment 121.

Minor Requirements:

FOUR to SIX COURSES (totaling at least 20 units) from the following list:

Ecology & Evolutionary Biology 100L, 101, 103, 105, 109, 109L, 111, 112, 114A, 114B, C119A, C119B, 122, M127, 129, M131, 142, 151A, 152, 153, 154, 155, 162, 162L, C174, 176, 180A, 180B, any course completed as part of a Field Biology Quarter (FBQ) or Marine Biology Quarter (MBQ) or approved equivalent. Geography 102, 104, M107, 113, M115, M127, M131, 135. A maximum of two Geography courses may be applied to the minor.

Please note that Labs, EE Biol 176 and 180A are two-unit courses. If these courses are taken for the minor, additional courses will be needed to reach the minimum 20 units for this category.

Field or Marine Biology Quarter

Students who are declared as a Conservation Biology are encouraged to participate in either the Field Biology Quarter (FBQ) or the Marine Biology Quarter (MBQ).

https://www.eeb.ucla.edu/ugrad_fbq.php

The Field Biology Quarter (FBQ) is a quarter-long program designed to give advanced undergraduates an opportunity to focus on the biology of organisms living in their natural environments. Emphasis is always given to integrating field and laboratory studies of the local organisms in the chosen area. The program, which consists of 16 upper division units of coursework, fulfills the field quarter requirement for Ecology Behavior and Evolution (EBE) majors. Previous sites include:

- AUSTRALIA
- CALIFORNIA DESERT
- ECUADOR
- KENYA
- MEXICO
- NICARAGUA
- THAILAND

The Marine Biology Quarter (MBQ) is a field program designed to give advanced undergraduates an opportunity to gain intimate and firsthand knowledge of marine communities, their constituents and their structure. Previous sites include:

- HAWAII
- CATALINA ISLAND
- MOOREA, TAHITI
- BODEGA MARINE LABORATORY

Application period ranges from two quarters to a full year in advance. Subscribe to the EEB mailing list for information on each application period.

Course Descriptions

Ecology & Evolutionary Biology

100. Introduction to Ecology and Behavior. (4)Lecture, three hours; discussion, one hour. Requisite: Life Sciences 1 or 7B. Not open for credit to students with credit for course 118, C119A, C119B, 122 through C126, 129, 132 through 134B, 136, or 151B. Introduction to methods and topics in ecology and behavior. Growth and regulation of populations, organization of communities and ecosystems, biogeography, and behaviors animals use to find food, choose mates, and interact in social groups. Letter grading.

100L. Introduction to Ecology and Behavior Laboratory. (4) Laboratory, four hours. Requisites: course 100 (may be taken concurrently), Life Sciences 1 or 7B. Introduction to research methods in ecology and behavior, resulting in independent research proposals and to gain understanding of scientific method, critical evaluation of research papers, and development of scientific writing skills. Involves work outside and off-campus meetings. To apply this course to the Biology upper division major laboratory requirement, the corresponding lecture course must be completed with a passing grade. Letter grading.

103. Plant Diversity and Evolution. (5) Lecture, three hours; laboratory, three hours; field trip. Requisites: Life Sciences 1, 4. Introduction to green plant tree of life, with emphasis on using phylogenetic perspective to examine major transitions in plant evolution, including evolution and diversification of land plants, vascular plants, seed plants, and currently ecologically dominant flowering plants. Introduction to phylogenetics, providing overview of theory and methodology to reconstruct and use phylogenetic trees to study organismal evolution. Exploration of 700 million years of plant evolution, with emphasis on morphological, functional, ecological, and biogeographical perspectives. Letter grading.

105. Biology of Invertebrates. (6) Lecture, three hours; laboratory/field trips, six hours. Requisite: Life Sciences 1. Introduction to systematics, evolution, natural history, morphology, and physiology of invertebrates. P/NP or letter grading.

109. Introduction to Marine Science. (4) Lecture, three hours; discussion, one hour. Requisite: Life Sciences 1 or 7B. Strongly recommended for prospective Marine Biology Quarter students. Introduction to physical and biological world of 70 percent of planet: oceans. Designed to be integrative, with focus on geological evolution of seas, physical and chemical properties of water, and how these abiotic processes shape ecology and evolution of marine organisms and environments. Letter grading.

109L. Introduction to Marine Science Laboratory. (4) Laboratory, three hours; four field trips. Requisites: course 109 (may be taken concurrently), Life Sciences 1 or 7B. Introduction to marine environments and methods used to study them. Exploration of variety of concepts in marine science, ranging from oceanography to behavior, primary productivity, and marine biodiversity, with emphasis on experimental design and scientific writing. To apply this course to the Biology upper division major laboratory requirement, the corresponding lecture course must be completed with a passing grade. Letter grading.

111. Biology of Vertebrates. (5) Lecture, three hours; laboratory, three hours; four one- to two-day field trips. Requisite: Life Sciences 1 or 7B. Adaptations, behavior, and ecology of vertebrates. Letter grading.

112. Ichthyology. (6) Lecture, three hours; laboratory, six hours; field trips. Requisite: Life Sciences 1 or 7B. Highly recommended: courses 110, 111. Biology of freshwater and marine fishes, with emphasis on their evolution, systematics, morphology, zoogeography, and ecology. Field trips to examine fishes of Southern California shoreline, tidepools, and coastal streams. Letter grading.

114A. Ornithology. (5) Lecture, three hours; laboratory / field trips, three hours. Requisite: Life Sciences 1. Recommended: course 100. Systematics, distribution, physiology, behavior, and ecology of birds. Letter grading.

114B. Field Ornithology. 8 Requisite: Life Sciences 1. Recommended: course 100. Two to three weeks of off-campus research projects followed by lecture course and offered only as part of Field Biology Quarter. Biology, particularly ecology and behavior, of birds in their natural habitat. Letter grading.

116. Conservation Biology. (4) Lecture, three hours; discussion, two hours. Requisite: Life Sciences 1 or 7B. Recommended: course 100. Not open for credit to students with credit for Environment 121. Study of ecological and evolutionary principles as they apply to preservation of genetic, species, and ecosystem diversity. Discussion sections focus on interactions of science, policy, and economics in conserving biodiversity. Oral and written student presentation on specific conservation issues. Letter grading.

C119A. Mathematical and Computational Modeling in Ecology. (4) Lecture, three hours; discussion, one hour. Enforced requisite: Life Sciences 30B or Mathematics 3B or 31A. Recommended: courses 100, 122, Life Sciences 1, Mathematics 3C. Introduction to modeling dynamics of ecological

systems, including formulation and analysis of mathematical models, basic techniques of scientific programming, probability and stochastic modeling, and methods to relate models to data. Examples from ecology but techniques and principles applicable throughout life and physical sciences. Concurrently scheduled with course C219A. P/NP or letter grading.

C119B. Modeling in Ecological Research. (4) Lecture, two hours; discussion, two hours. Requisite: course C119A. Advanced techniques in mathematical and computational modeling of ecological dynamics and other population dynamic problems. Independent research projects developed by students. Topics include model formulation, stochastic models, fitting models to data, sensitivity analysis, presentation of model results, and other topics from current literature. Concurrently scheduled with course C219B. P/NP or letter grading.

122. Ecology. (4) Lecture, three hours; discussion, two hours. Requisites: course 100, Life Sciences 1 or 7B, Mathematics 3B or 31A or Life Sciences 30B. Highly recommended: Mathematics 31B, 32A. Designed for departmental majors specializing in environmental and population biology. Introduction to population and community ecology, with emphasis on growth and distributions of populations, interactions between species, and structure, dynamics, and functions of communities and ecosystems. P/NP or letter grading.

123A. Field Marine Ecology. (4 or 8) Lecture, five hours; laboratory, 15 hours. Recommended requisites: courses 100, 122. Offered either as 4- or 8-unit five-week intensive course given off campus as part of Marine Biology Quarter that is in residence at research station located outside continental U.S. Survey of current topics in marine ecology, including analysis of primary research literature combined with field study of ecology of marine organisms, populations, communities, and ecosystems. Original research project required. Letter grading.

123B. Field Marine Ecology. (4 or 8) Lecture, five hours; laboratory, 15 hours. Recommended requisites: courses 100, 122. Offered either as 4- or 8-unit five-week intensive course given off campus as part of Marine Biology Quarter that is in residence at research station located within U.S., including Alaska and Hawaii. Survey of current topics in marine ecology, including analysis of primary research literature combined with field study of ecology of marine organisms, populations, communities, and ecosystems. Original research project required. Letter grading.

124A. Field Ecology. (4 or 8) Lecture, five hours; laboratory or field trip, 15 hours. Enforced requisites: course 100, Life Sciences 1. Recommended: courses 111, 120, 122. Offered as part of Field Biology Quarter that is in residence at research station located outside continental U.S. for part of or for duration of term. Field and laboratory research in ecology; collection, analysis, and write-up of numerical data, with emphasis on design and execution of field studies. Letter grading.

124B. Field Ecology. (4 or 8) Lecture, five hours; laboratory or field trip, 15 hours. Enforced requisites: course 100, Life Sciences 1. Recommended: courses 111, 120, 122. Offered as part of Field Biology Quarter that is in residence at research station located within U.S., including Alaska and Hawaii, for part of or for duration of term. Field and laboratory research in ecology; collection, analysis, and write-up of numerical data, with emphasis on design and execution of field studies. Letter grading.

129. Animal Behavior. (4) Lecture, three hours; discussion, two hours. Requisites: course 100, Life Sciences 1. Introduction to behavioral ecology. Methods and results of evolutionary approaches to study of animal behavior, including foraging strategies, social competition, sexual selection, mating systems, cooperation, and social organization. Letter grading.

M131. Ecosystem Ecology. (4) (Same as Geography M117.) Lecture, three hours; field trips. Requisite: Geography 1 or Life Sciences 2 or 7C. Designed for juniors/seniors. Development of principles of ecosystem ecology, with focus on understanding links between ecosystem structure and function. Emphasis on energy and water balances, nutrient cycling, plant-soil-microbe interactions, landscape heterogeneity, and human disturbance to ecosystems. P/NP or letter grading.

142. Aquatic Communities. (4) Lecture, three hours; discussion, one hour. Requisite: Life Sciences 1 or 7B. Overview of species and communities in marine and freshwater environments. Exploration of interactions of physical and biological factors that shape communities and how scientists test hypotheses. Emphasis on critical reading of primary literature. Letter grading.

151A. Tropical Ecology. (4) Lecture, one hour; discussion, two hours. Requisite: Life Sciences 1. Broad introduction to biodiversity, community structure, and dynamics and ecosystem function of range of tropical forest habitats. Discussion of such themes as biogeography, forest structure, plant growth forms, animal communities, herbivory, forest dynamics, and disturbance regimes. P/NP or letter grading.

153. Physics and Chemistry of Biotic Environments. (4) Lecture, three hours; discussion, one hour. Requisites: Chemistry 14A, 14B, and 14BL (or 20A, 20B, and 20L), Life Sciences 1. Recommended: Life Sciences 2, 3, 4, 23L, Physics 6A. Chemical and physical principles that are critical to functional responses by organisms to their habitats. Focus is integrative, providing comprehensive training in basic sciences of physics and chemistry as applied to environmental processes, and consequences of these processes for individual performance, populations, and communities. Covers variety of topics in applied chemistry, including proton pumps, carbonate biogeochemistry and ocean acidification, and allometric scaling of metabolism and effects of temperature on physiological function. Fundamentals of boundary-layer physics and their role in organism's life history. Physics as natural life process, including how organisms are mechanically structures to avoid, resist, or comply to fluid (air and water) motion. P/NP or letter grading.

154. California Ecosystems. (5) Lecture, three hours; laboratory or field trip, four hours. Requisite: Life Sciences 1. Recommended: course 100. Introduction to structure, biodiversity, and dynamics of California ecosystems, with focus on Southern California, and impact of human activities on these systems. P/NP or letter grading.

C174. Comparative Biology and Macroevolution. (4) Lecture, three hours; laboratory, three hours. Requisite: Life Sciences 1. Recommended: one introductory statistics course. Modern comparative biology provides framework for studying broad questions in evolution – How do body shapes evolve? What are dynamics of evolutionary arms race? Why are there so many species in tropics? Why are there so many beetles and so few crocodiles? Did dinosaurs put brakes on diversification of mammals? Examination of why tree of life is essential to understanding patterns of biological diversity and how phylogenetic comparative methods are used to test macroevolutionary hypotheses. Concurrently scheduled with course C230. Letter grading.

176. Ecological Ethics. (4) Seminar, four hours. Requisite: Life Sciences 1 or 7B. Debates and discussions on current ethical considerations relevant to fields of ecology, evolution, conservation, and behavior. Letter grading.

180A. Seminar: Biology and Society. (2) Seminar, two hours. Investigations and discussions of current socially important issues involving substantial biological considerations, either or both as background for policy and as consequences of policy. May be repeated once for credit with instructor change. Letter grading.

180B. Seminar: Biology and Society. (4) Seminar, four hours. Investigations and discussions of current socially important issues involving substantial biological considerations, either or both as background for policy and as consequences of policy. May be repeated once for credit with instructor change. Letter grading.

Geography

102. Tropical Climatology. (4) Lecture, three hours. In-depth exploration of development of tropical climate, with special reference to hurricanes, ENSO, and monsoons. Examination of human interaction with tropical climate processes and human-induced climate change in tropics. Use of climatological information to foster sound environmental management of climate-related resources in tropics. P/NP or letter grading.

104. Climatology. (4) Lecture, three hours; reading period, one hour. Designed for juniors/seniors. Examination of many relations between climate and world of man. Application of basic energy budget concepts to microclimates of relevance to ecosystems of agriculture, animals, man, and urban places. P/NP or letter grading.

M107. Soil and Water Conservation. (4) (Same as Environment M114.) Lecture, three hours; discussion, one hour. Enforced requisite: course 1 or 2 or Life Sciences 1 or 3. Designed for juniors/seniors. Systematic study of processes of and hazards posed by erosion, sedimentation, development, and pollution and techniques needed to conserve soil and maintain environmental quality. Scope includes agriculture, forestry, mining, and other rural uses of land. P/NP or letter grading.

113. Humid Tropics. (4) Lecture, three hours. Requisite: course 2 or 5 or Life Sciences 1. Designed for juniors/seniors. Examination of humid tropics, with emphasis on rainforests, their ecological principles, and forms of land use. Letter grading.

M115. Environmentalism: Past, Present, and Future. (4) (Same as Environment M132 and Urban Planning M165.) Lecture, three hours; discussion, one hour. Exploration of history and origin of major environmental ideas, movements or countermovements they spawned, and new and changing nature of modern environmentalism. Introduction to early ideas of environment, how rise of modern sciences reshaped environmental thought, and how this was later transformed by 19th-century ideas and rise of American conservation movements. Review of politics of American environmental thought and contemporary environmental questions as they relate to broader set of questions about nature of development, sustainability, and equity in environmental debate. Exploration of issues in broad context, including global climate change, rise of pandemics, deforestation, and environmental justice impacts of war. Letter grading.

M127. Soils and Environment. (4) (Same as Ecology and Evolutionary Biology M127 and Environment M127.) Lecture, three hours; discussion, one hour; field trips. General treatment of soils and environmental implications: soil development, morphology, and worldwide distribution of soil orders; physical, chemical, hydrologic, and biological properties; water use, erosion, and pollution; management of soils as related to plant growth and distribution. P/NP or letter grading.

M131. Environmental Change. (4) (Same as Environment M130.) Lecture, three hours; reading period, one hour. Designed for juniors/seniors. Examination of natural forces producing environmental changes over past two million years. How present landscape reflects past conditions. Effects of environmental change on people. Increasing importance of human activity in environmental modification. Focus on impact of natural and anthropogenic changes on forests. P/NP or letter grading.

135. African Ecology and Development. (4) Lecture, three hours; discussion, one hour. Designed for juniors/seniors. Overview of contemporary ecological and development issues in sub-Saharan Africa. P/NP or letter grading.

Environmental Engineering Minor

About the Minor

Department of Civil and Environmental Engineering, HSSEAS

The Environmental Engineering minor is designed for students who wish to augment their major course of study with an exposure to engineering methods applied to key environmental problems facing modern society in developed and developing countries. The minor also provides students with a brief experience and understanding of the roles that environmental engineering methods play in solving environmental problems. Research in environmental engineering focuses on the understanding and management of physical, chemical, and biological processes in the environment and in engineering systems. Primarily focuses on water issues, with key coursework in chemical fate and transport in aquatic environments, wastewater management, hydrology, environmental/chemical remediation, and related topics.

Where are they now?

Environmental science majors who graduated with this minor are now:

Jobs

- Computer Vision Research Scientist - Descartes Labs
- Data Analyst - California Center for Sustainable Communities at UCLA
- Water Resources Engineer and Project Manager - U.S. Army Corps of Engineers
- Climate Change Risk and Resilience Consultant - Arup (Environmental Consulting)
- Engineering Associate - LA County Sanitation District
- Engineering Technician - Hazen and Sawyer (Engineering/Environmental Consulting)
- Research Support - Executive Office of the Secretary General of the United Nations
- Senior Research and Policy Analyst - Governor's Office of Storm Recovery, New York
- Project Manager - Ceres Imaging (Remote Sensing)
- Assistant Water Resource Specialist - Metropolitan Water District of Southern California

Graduate Programs

- MS in Environmental Engineering - UC Berkeley
- MESM - UCSB Bren School of Environmental Science and Management
- Ph.D. in Hydrologic Sciences - UC Davis
- MA in Climate and Society - Columbia University
- MS in Civil Engineering - Stanford & Fulbright Scholar
- Ph.D. in Environmental Engineering - Princeton University

Contact Information/To Declare the Minor

To enter the minor, students must be in good academic standing (2.0 GPA or better) and file a petition in the Office of Academic and Student Affairs, 6426 Boelter Hall. Applications are processed in batches, so expect a delay between the date you apply and the minor taking effect.

To schedule an appointment:

(310) 825–9580
or go in person to
6426 Boelter Hall

http://www.seasoasa.ucla.edu/

Course Requirements

Additional Preparatory Courses Required: One course

- Mathematics 3C or 32A

Required Upper Division Courses (24 units minimum):

Civil and Environmental Engineering 153

Five electives from:

Atmospheric and Oceanic Sciences 141**; Civil and Environmental Engineering 110, 150, 151, 152, 154, 155, 156A, 156B, 157A, 157B, 157C, 157L, 163**, M165, M166; Chemical Engineering 100, 101A, 101B, 101C, 102A*, 102B, 106, 113, C118, C119, C140; Earth, Planetary, and Space Sciences 101, C113; Environment M114, M134, M153, 157, 159, 166; Environmental Health Sciences C125, C152D, C164; Mechanical and Aerospace Engineering 82, 103, 105A*, 105D, 133A, 136, 150A, 174, 182B, 182C

**Credit for both A&OSCI 141 and C&EE 163 will not be granted. *Credit for both MECH&AE 105A and CH ENGR 102A will not be granted.

A minimum of 20 units applied toward the minor requirements must be in addition to units applied toward major requirements or another minor, and at least 16 units applied toward the minor must be taken in residence at UCLA. Transfer credit for any of the above is subject to departmental approval; consult the undergraduate counselors before enrolling in any non-UCLA courses for the minor.

Each minor course must be taken for a letter grade, and students must have a minimum grade of C (2.0) in each and an overall grade-point average of 2.0 or better. Successful completion of the minor is indicated on the transcript and diploma.

Additional Guidance for the Environmental Engineering Minor

General Comments

This minor was originally conceived as a component of the BS in Environmental Science, offered by the Institute of the Environment, but may be of interest to students from other programs.

There are no prerequisite "traps" in the list of courses. The required course CEE 153 has only a recommended prerequisite of MAE 103, but more than a decade of experience has shown that students can achieve well in CEE 153 without having taken MAE 103. All other courses used to satisfy the minor have at most CEE 153 as a prerequisite. However, EHS C125 and C164 do recommend additional chemistry courses.

Unless the twenty unique unit requirement for a minor is lifted, students in HSSEAS majors can use this minor to satisfy only two of the TBR requirements in Civil and Environmental Engineering.

The requirement for a minimum grade of C in each course may be appealed in the case of a C-, but generally not in the case of any D grade. Consideration of appeals in the case of a C- grade will take into account the student's overall academic record.

Course Descriptions

Atmospheric and Oceanic Sciences

141. Introduction to Atmospheric Chemistry and Air Pollution. (4). Lecture, three hours; discussion, one hour. Requisites: Chemistry 14B or 20B, Mathematics 3A or 31A, Physics 1B or 6B. Physical and chemical processes that determine composition of atmosphere and its implications for climate, ecosystems, and human welfare. Origin of atmosphere. Nitrogen, oxygen, carbon, sulfur, trace metal cycles. Climate and greenhouse effect. Atmospheric transport and turbulence. Stratospheric ozone. Oxidizing power of atmosphere. Regional air pollution: aerosols, smog, mercury, and acid rain. Letter grading.

110. Introduction to Probability and Statistics for Engineers. (4) Lecture, four hours; outside study, eight hours. Requisites: course 15, Mathematics 32A, 33A. Introduction to fundamental concepts and applications of probability and statistics in civil engineering, with focus on how these concepts are used in experimental design and sampling, data analysis, risk and reliability analysis, and project design under uncertainty. Topics include basic probability concepts, random variables and analytical probability distributions, functions of random variables, estimating parameters from observational data, regression, hypothesis testing, and Bayesian concepts. Letter grading.

150. Introduction to Hydrology. (4) Lecture, four hours; discussion, two hours; outside study, six hours. Requisite: Mechanical and Aerospace Engineering 103. Recommended: course 15. Study of hydrologic cycle and relevant atmospheric processes, water and energy balance, radiation, precipitation formation, infiltration, evaporation, vegetation transpiration, groundwater flow, storm runoff, and flood processes. Letter grading.

151. Introduction to Water Resources Engineering. (4) Lecture, four hours; discussion, two hours; outside study, six hours. Recommended requisite: Mechanical and Aerospace Engineering 103. Principles of hydraulics, flow of water in open channels and pressure conduits, reservoirs and dams, hydraulic machinery, hydroelectric power. Introduction to system analysis and design applied to water resources engineering. Letter grading.

152. Hydraulic and Hydrologic Design. (4) Lecture, four hours; discussion, two hours; outside study, six hours. Enforced requisites: courses 150, 151. Analysis and design of hydraulic and hydrologic systems, including stormwater management systems, potable and recycled water distribution systems, wastewater collection systems, and constructed wetlands. Emphasis on practical design components, including reading/interpreting professional drawings and documents, environmental impact reports, permitting, agency coordination, and engineering ethics. Project-based course includes analysis of alternative designs, use of engineering economics, and preparation of written engineering reports. Letter grading.

153. Introduction to Environmental Engineering Science. (4) Lecture, four hours; outside study, eight hours. Recommended requisite: Mechanical and Aerospace Engineering 103. Water, air, and soil pollution: sources, transformations, effects, and processes for removal of contaminants. Water quality, water and wastewater treatment, waste disposal, air pollution, global environmental problems. Field trip. Letter grading.

154. Chemical Fate and Transport in Aquatic Environments. (4) Lecture, four hours; outside study, eight hours. Recommended requisite: course 153. Fundamental physical, chemical, and biological principles governing movement and fate of chemicals in surface waters and groundwater. Topics include

physical transport in various aquatic environments, air-water exchange, acid-base equilibria, oxidation-reduction chemistry, chemical sorption, biodegradation, and bioaccumulation. Practical quantitative problems solved considering both reaction and transport of chemicals in environment. Letter grading.

155. Unit Operations and Processes for Water and Wastewater Treatment. (4) Lecture, four hours; discussion, two hours; outside study, six hours. Requisite: course 153. Biological, chemical, and physical methods used to modify water quality. Fundamentals of phenomena governing design of engineered systems for water and wastewater treatment systems. Field trip. Letter grading.

156A. Environmental Chemistry Laboratory. (4) Lecture, four hours; laboratory, four hours; outside study, four hours. Requisites: course 153 (may be taken concurrently), Chemistry 20A, 20B. Basic laboratory techniques in analytical chemistry related to water and wastewater analysis. Selected experiments include gravimetric analysis, titrimetry spectrophotometry, redox systems, pH and electrical conductivity. Concepts to be applied to analysis of 'real' water samples in course 156B. Letter grading.

156B. Environmental Engineering Unit Operations and Processes Laboratory. (4) Laboratory, six hours; discussion, two hours; outside study, four hours. Requisites: Chemistry 20A, 20B. Characterization and analysis of typical natural waters and wastewaters for inorganic and organic constituents. Selected experiments include analysis of solids, nitrogen species, oxygen demand, and chlorine residual, that are used in unit operation experiments that include reactor dynamics, aeration, gas stripping, coagulation/flocculation, and membrane separation. Letter grading.

157A. Hydrologic Modeling. (4) Lecture, four hours; discussion, two hours; outside study, six hours. Enforced requisite: course 150 or 151. Introduction to hydrologic modeling. Topics selected from areas of (1) open-channel flow, including one-dimensional steady flow and unsteady flow, (2) pipe flow and water distribution systems, (3) rainfall-runoff modeling, and (4) groundwater flow and contaminant transport modeling, with focus on use of industry and/or research standard models with locally relevant applications. Letter grading.

157B. Design of Water Treatment Plants. (4) Lecture, two hours; discussion, two hours; laboratory, four hours; other, four hours. Requisite: course 155. Water quality standards and regulations, overview of water treatment plants, design of unit operations, predesign of water treatment plants, hydraulics of plants, process control, and cost estimation. Letter grading.

157C. Design of Wastewater Treatment Plants. (4) Lecture, four hours; outside study, eight hours. Requisite: course 155. Process design of wastewater treatment plants, including primary and secondary treatment, detailed design review of existing plants, process control, and economics. Letter grading.

157L. Hydrologic Analysis. (4) Lecture, two hours; laboratory, four hours; outside study, six hours. Requisite: course 150. Collection, compilation, and interpretation of data for quantification of

components of hydrologic cycle, including precipitation, evaporation, infiltration, and runoff. Use of hydrologic variables and parameters for development, construction, and application of analytical models for selected problems in hydrology and water resources. Letter grading.

157M. Hydrology of Mountain Watersheds. (4) Fieldwork, three hours; laboratory, two hours; outside study, one hour; one field trip. Requisite: course 150 or 157L. Advanced field-based course with focus on study of catchment processes in snow-dominated and mountainous regions. Students measure and quantify snowpack properties and watershed fluxes, investigate geochemical properties of surface and groundwater systems, and classify mountain streams and flooding potential. Letter grading.

163. Introduction to Atmospheric Chemistry and Air Pollution. (4) Lecture, four hours; outside study, eight hours. Requisites: course 153, Chemistry 20A, 20B, Mathematics 31A, 31B, Physics 1A, 1B. Description of processes affecting chemical composition of troposphere: air pollutant concentrations/standards, urban and regional ozone, aerosol pollution, formation/deposition of acid precipitation, fate of anthropogenic/toxic/natural organic and inorganic compounds, selected global chemical cycle(s). Control technologies. Letter grading.

M165. Environmental Nanotechnology: Implications and Applications. (4) (Same as Engineering M103.) Lecture, four hours; discussion, two hours; outside study, six hours. Recommended requisite: Engineering M101. Introduction to potential implications of nanotechnology to environmental systems as well as potential application of nanotechnology to environmental protection. Technical contents include three multidisciplinary areas: (1) physical, chemical, and biological properties of nanomaterials, (2) transport, reactivity, and toxicity of nanoscale materials in natural environmental systems, and (3) use of nanotechnology for energy and water production, plus environmental protection, *monitoring, and remediation. Letter grading.*

M166. Environmental Microbiology. (4) (Same as Environmental Health Sciences M166.) Lecture, four hours; discussion, two hours; outside study, six hours. Recommended requisite: course 153. Microbial cell and its metabolic capabilities, microbial genetics and its potentials, growth of microbes and kinetics of growth, microbial ecology and diversity, microbiology of wastewater treatment, probing of microbes, public health microbiology, pathogen control. Letter grading.

Chemical Engineering

100. Fundamentals of Chemical and Biomolecular Engineering. (4) Lecture, four hours; discussion, one hour; outside study, seven hours. Requisites: Chemistry 20B, 20L, Mathematics 32B (may be taken concurrently), Physics 1A. Introduction to analysis and design of industrial chemical processes. Material and energy balances. Introduction to programming in MATLAB. Letter grading.

101A. Transport Phenomena I. (4) Lecture, four hours; discussion, one hour; outside study, seven hours. Requisites: Mathematics 33A, 33B. Corequisite: course 109. Introduction to analysis of fluid flow in chemical, biological, materials, and molecular processes. Fundamentals of momentum transport, Newton law of viscosity, mass and momentum conservation in laminar flow, Navier/Stokes equations, and engineering analysis of flow systems. Letter grading.

101B. Transport Phenomena II: Heat Transfer. (4) Lecture, four hours; discussion, one hour; outside study, seven hours. Enforced requisite: course 101A. Introduction to analysis of heat transfer in chemical, biological, materials, and molecular processes. Fundamentals of thermal energy transport, molecular-level heat transfer in gases, liquids, and solids, forced and free convection, radiation, and engineering analysis of heat transfer in process systems. Letter grading.

101C. Mass Transfer. (4) Lecture, four hours; discussion, one hour; outside study, seven hours. Requisites: courses 100, 101B, 102B. Introduction to analysis of mass transfer in systems of interest to chemical engineering practice. Fundamentals of mass species transport, Fick law of diffusion, diffusion in chemically reacting flows, interphase mass transfer, multicomponent systems. Letter grading.

102A. Thermodynamics I. (4) (Formerly numbered M105A.) Lecture, four hours; discussion, one hour; outside study, seven hours. Requisites: Mathematics 33A, 33B. Introduction to thermodynamics of chemical and biological processes. Work, energy, heat, and first law of thermodynamics. Second law, extremum principles, entropy, and free energy. Ideal and real gases, property evaluation. Thermodynamics of flow systems. Applications of first and second laws in biological processes and living organisms. Letter grading.

102B. Thermodynamics II. (4) (Formerly numbered 102.) Lecture, four hours; discussion, one hour; outside study, seven hours. Requisites: course 102A, Mathematics 33A, 33B. Fundamentals of classical and statistical thermodynamics in chemical and biological sciences. Phase equilibria in single and multicomponent systems. Thermodynamics of ideal and nonideal solutions. Chemical reaction equilibria. Statistical ensembles and partition functions. Statistical thermodynamics of ideal gases. Intermolecular interactions and liquid state. Thermodynamics of polymers and biological macromolecules. Letter grading.

106. Chemical Reaction Engineering. (4) Lecture, four hours; discussion, one hour; outside study, seven hours. Requisites: courses 100, 101C, 102B. Fundamentals of chemical kinetics and catalysis. Introduction to analysis and design of homogeneous and heterogeneous chemical reactors. Letter grading.

113. Air Pollution Engineering. (4) Lecture, four hours; preparation, two hours; outside study, six hours. Requisites: courses 101C, 102B. Integrated approach to air pollution, including concentrations of atmospheric pollutants, air pollution standards, air pollution sources and control technology, and

relationship of air quality to emission sources. Links air pollution to multimedia environmental assessment. Letter grading.

C118. Multimedia Environmental Assessment. (4) Lecture, four hours; preparation, two hours; outside study, six hours. Recommended requisites: courses 101C, 102B. Pollutant sources, estimation of source releases, waste minimization, transport and fate of chemical pollutants in environment, intermedia transfers of pollutants, multimedia modeling of chemical partitioning in environment, exposure assessment and fundamentals of risk assessment, risk reduction strategies. Concurrently scheduled with course C218. Letter grading.

C119. Pollution Prevention for Chemical Processes. (4) Lecture, four hours; discussion, one hour; outside study, seven hours. Requisite: course 108A. Systematic methods for design of environment-friendly processes. Development of methods at molecular, unit-operation, and network levels. Synthesis of mass exchange, heat exchange, and reactor networks. Concurrently scheduled with course C219. Letter grading.

C140. Fundamentals of Aerosol Technology. (4) Lecture, four hours; outside study, eight hours. Requisite: course 101C. Technology of particle/gas systems with applications to gas cleaning, commercial production of fine particles, and catalysis. Particle transport and deposition, optical properties, experimental methods, dynamics and control of particle formation processes. Concurrently scheduled with course C240. Letter grading.

Earth, Planetary and Space Sciences

101. Earth's Energy: Diminishing Fossil Resources and Prospects for Sustainable Future. (4) Lecture, three hours; laboratory, two hours; two optional field trips. Preparation: one lower division atmospheric sciences, chemistry, Earth sciences, or physics course. Not open for credit to students with credit for course 101F. Earth's energy resources (fossil fuels and alternatives) from Earth science and sustainability perspective. P/NP or letter grading.

C113. Biological and Environmental Geochemistry. (4) Lecture, three hours. Requisites: Chemistry 14A and 14B (or 20A and 20B), Mathematics 3A, 3B, and 3C (or 31A and 31B). Recommended: at least one lower division Earth, planetary, and space sciences course. Intended for junior/senior life and physical sciences students. Study of chemistry of Earth's surface environment and interplay between biology, human activity, and geology. Introduction to origin and composition of Earth, including atmosphere, crust, and hydrosphere. Examination of how these reservoirs are affected by biological cycles and feedbacks to biological evolution and diversity. Local and global-scale movements of biologically important elements like carbon, nitrogen, and phosphorus. Concurrently scheduled with course C213. P/NP or letter grading.

Environment

M114. Soil and Water Conservation. (4) (Same as Geography M107.) Lecture, three hours; discussion, one hour. Enforced requisite: Geography 1 or 2 or Life Sciences 1 or 3. Designed for juniors/seniors. Systematic study of processes of and hazards posed by erosion, sedimentation, development, and pollution and techniques needed to conserve soil and maintain environmental quality. Scope includes agriculture, forestry, mining, and other rural uses of land. P/NP or letter grading.

M134. Environmental Economics. (4) (Same as Economics M134.) Lecture, three hours. Requisites: Economics 41 or Statistics 12 or 13, and Economics 101 (may be waived with consent of instructor). Introduction to major ideas in natural resources and environmental economics, with emphasis on designing incentives to protect environment. Highlights important role of using empirical data to test hypotheses about pollution's causes and consequences. P/NP or letter grading.

M153. Introduction to Sustainable Architecture and Community Planning. (4) (Same as Architecture and Urban Design CM153.) Lecture, three hours. Relationship of built environment to natural environment through whole systems approach, with focus on sustainable design of buildings and planning of communities. Emphasis on energy efficiency, renewable energy, and appropriate use of resources, including materials, water, and land. Letter grading.

157. Energy, Environment, and Development. (4) Lecture, three hours. Requisites: Mathematics 3A and 3B (or 31A and 31B), Physics 1A and 1B (or 6A and 6B). Introduction to basic energy concepts and examination of role of various energy sources, energy conversion technologies, and energy policies in modern life. Analysis of implications of current patterns of energy production and consumption for future economic and environmental well-being. Integration of concepts and methods from physical and life sciences, engineering, environmental science, economics, and public policy. Basic quantitative skills provided to analyze and critique technical, economic, and policy choices to address challenge of balancing economic growth and environmental sustainability. P/NP or letter grading.

159. Life-Cycle Analysis of Sustainability Assessment. (4) Lecture, three hours. Requisites: Mathematics 3A and 3B (or 31A and 31B). Public discourse about current patterns of production and consumption of energy, and goods and services more broadly, suggest such patterns are environmentally and economically unsustainable. Introduction to basic concept of life-cycle analysis (LCA), including analytical frameworks and quantitative techniques for systematically and holistically evaluating environmental trade-offs presented by different alternatives. Focus on methodology of LCA to compute various material inputs and environmental releases from all activities associated with life cycle (i.e., raw material extraction, processing, end use, and disposal) of products or services. Discussion of strengths and limitations of LCA as tool for decision making. Students perform life-cycle analysis of one technology, product, or service of their choice. P/NP or letter grading.

166. Leadership in Water Management. (4) Lecture, three hours; discussion, one hour. Limited to juniors/seniors. Examination of water quality and water supply issues, including interactions between scientific, technological, management, and policy issues. Invited experts, scholars, and practitioners discuss relevant issues such as pollution, climate change, and water infrastructure. Emphasis on solutions involving integrated water supply and wastewater systems. Leadership development through writing instruction and negotiations and media training. P/NP or letter grading.

Environmental Health Sciences

C125. Atmospheric Transport and Transformations of Airborne Chemicals. (4) Lecture, four hours. Preparation: one year of calculus, one course each in physics, organic chemistry, and physical chemistry. Designed for science, engineering, and public health students. Role of regional or long-range transport, and atmospheric lifetimes and fates of airborne chemicals in phenomena such as photochemical smog, acid deposition, stratospheric ozone depletion, accumulation of greenhouse gases, and regional and global distribution of volatile toxic compounds. Concurrently scheduled with course C225. P/NP or letter grading.

C152D. Properties and Measurement of Airborne Particles. (4) Lecture, four hours. Preparation: one year each of chemistry, physics, and calculus. Basic theory and application of aerosol science to environmental health, including properties, behavior, sampling, and measurement of aerosols and quantitative problems. Concurrently scheduled with course C252D. P/NP or letter grading.

C164. Fate and Transport of Organic Chemicals in Aquatic Environment. (4) Lecture, four hours. Recommended requisites: Chemistry 14A and 14B, or 20A and 20B. Evaluation of how and where and in what form and concentration organic pollutants are distributed in aquatic environments. Study of mass transport mechanisms moving organic chemicals between phases, biological degradation and accumulation, and chemical reactions. Effect of humic substances on these processes. Concurrently scheduled with course C264. P/NP or letter grading.

Mechanical and Aerospace Engineering

103. Elementary Fluid Mechanics. (4) Lecture, four hours; discussion, two hours; outside study, six hours. Requisites: Mathematics 32B, 33A, Physics 1B. Introductory course dealing with application of principles of mechanics to flow of compressible and incompressible fluids. Letter grading.

105A. Introduction to Engineering Thermodynamics. (4) (Formerly numbered M105A.) Lecture, four hours; discussion, two hours; outside study, six hours. Requisites: Chemistry 20B, Mathematics 32B. Phenomenological thermodynamics. Concepts of equilibrium, temperature, and reversibility. First law and concept of energy; second law and concept of entropy. Equations of state and thermodynamic

properties. Engineering applications of these principles in analysis and design of closed and open systems. Letter grading.

105D. Transport Phenomena. (4) Lecture, four hours; discussion, two hours; outside study, six hours. Requisites: courses 103, 105A, Mathematics 32B, 33B. Transport phenomena; heat conduction, mass species diffusion, convective heat and mass transfer, and radiation. Engineering applications in thermal and environmental control. Letter grading.

133A. Engineering Thermodynamics. (4) Lecture, four hours; discussion, two hours; outside study, six hours. Requisites: courses 103, 105A, 105D. Applications of thermodynamic principles to engineering processes. Energy conversion systems. Rankine cycle and other cycles, refrigeration, psychrometry, reactive and nonreactive fluid flow systems. Letter grading.

136. Energy and Environment. (4) Lecture, four hours; outside study, eight hours. Requisite: course 105D. Recommended: courses 131A, 133A. Global energy use and supply, electrical power generation, fossil fuel and nuclear power plants, renewable energy such as hydropower, biomass, geothermal, solar, wind, and ocean, fuel cells, transportation, energy conservation, air and water pollution, global warming. Letter grading.

150A. Intermediate Fluid Mechanics. (4) Lecture, four hours; discussion, one hour; outside study, seven hours. Requisites: courses 103, 182A, Computer Science 31. Basic equations governing fluid motion. Fundamental solutions of Navier/Stokes equations. Lubrication theory. Elementary potential flow theory. Boundary layers. Turbulent flow in pipes and boundary layers. Compressible flow: normal shocks, channel flow with friction or heat addition. Letter grading.

150D. Fluid Dynamics of Biological Systems. (4) Lecture, four hours; outside study, eight hours. Requisite: course 103. Mechanics of aquatic locomotion; insect and bird flight aerodynamics; pulsatile flow in circulatory system; rheology of blood; transport in microcirculation; role of fluid dynamics in arterial diseases. Letter grading.

174. Probability and Its Applications to Risk, Reliability, and Quality Control. (4) Lecture, four hours; discussion, two hours; outside study, six hours. Introduction to probability theory; random variables, distributions, functions of random variables, models of failure of components, reliability, redundancy, complex systems, stress-strength models, fault tree analysis, statistical quality control by variables and by attributes, acceptance sampling. Letter grading.

182A. Mathematics of Engineering. (4) Lecture, four hours; discussion, two hours; outside study, six hours. Requisites: Mathematics 33A, 33B. Methods of solving ordinary differential equations in engineering. Review of matrix algebra. Solutions of systems of first- and second-order ordinary

differential equations. Introduction to Laplace transforms and their application to ordinary differential equations. Introduction to boundary value problems. Letter grading.

182B. Mathematics of Engineering. (4) Lecture, four hours; discussion, one hour; outside study, seven hours. Requisite: course 182A. Analytical methods for solving partial differential equations arising in engineering. Separation of variables, eigenvalue problems, Sturm/Liouville theory. Development and use of special functions. Representation by means of orthonormal functions; Galerkin method. Use of Green's function and transform methods. Letter grading.

182C. Numerical Methods for Engineering Applications. (4) Lecture, four hours; discussion, one hour; outside study, seven hours. Requisites: course 182A, Computer Science 31. Recommended: Electrical Engineering 103. Basic topics from numerical analysis having wide application in solution of practical engineering problems, computer arithmetic, and errors. Solution of linear and nonlinear systems. Algebraic eigenvalue problem. Least-square methods, numerical quadrature, and finite difference approximations. Numerical solution of initial and boundary value problems for ordinary and partial differential equations. Letter grading.

Undergraduate Research Opportunities in Environmental Engineering

Students interested in participating in research in the area of environmental engineering are encouraged to contact directly the faculty instructors of the environmental engineering courses to see what research opportunities may be available.

Graduate Study in Environmental Engineering

Students wishing to enter a graduate program in environmental engineering should plan to take several additional courses. The following are the required preparatory courses for admission to the Environmental Engineering Masters Degree program at UCLA:

Chemistry and Biochemistry 20A, 20B, 20L; Mathematics 32A, 32B, 33A, 33B; Physics 1A/4AL, 1B; Mechanical and Aerospace Engineering 103, 105A; Civil and Environmental Engineering 151 or 153. The Chemistry and Biochemistry 14A/B/BL series, and the Physics 6A/B series are also acceptable, but the Mathematics 3A/B series does not lead to the differential equations course 33B, so students are advised to take the 31A/B series. Any course that includes thermodynamics is acceptable in place of MAE 105A. Note that MAE 103 and 105A, and CEE 151 and 153 are all acceptable requirements for the Environmental Engineering Minor.

Environmental Engineering Masters degree programs at universities other than UCLA should have entrance requirements similar to those of UCLA, but students are encouraged to obtain information specific to the schools to which they plan to apply.

Students interested in environmental engineering careers should also take the Fundamentals of Engineering Exam (previously called the Engineer-in-Training Exam) - see http://ncees.org/exams/fe-exam/. Students without an accredited Bachelor's Degree can take this exam (in spite of what the website implies). Once the Master's Degree is completed there is no issue about a non-engineering Bachelor's Degree and students can eventually proceed to obtain the Professional Engineers license.

Earth and Environmental Science Minor

About the Minor

Department of Earth Planetary and Space Sciences

In the Earth and Environmental Science minor students study the interaction of the solid Earth, oceans, and atmosphere with human activities. The minor provides background in Earth sciences that is especially appropriate for students intending to become K through 12 teachers in Earth, physical, or life sciences. It may also be of interest to students who plan careers in business, dentistry, environmental sciences, government, journalism, law, medicine, or public health.

Where are they now?

Environmental science majors who graduated with this minor are now:

Jobs

- Staff Geologist - EGA Consultants
- Environmental Analyst - Sapphos Environmental, Inc.
- Senior Staff Scientist - Geosyntec Consultants (Engineering and Environmental Consulting)
- Account Supervisor - Havas (Analytics and Brand Marketing)
- Research and Development Laboratory Coordinator - StemGenex

Graduate Programs

- MS in Marine Biology and Biological Oceanography - University of Washington
- MS in Watershed Science - Cal State Monterey Bay

Department Contact Information/To Declare

Lauri Holbrook
Student Affairs Officer
holbrook@epss.ucla.edu
Department of Earth, Planetary and Space Sciences
3683 Geology Building
310–825–3917

Course Requirements

Entry Requirements

To enter the minor, students must have an overall grade-point average of 2.0 or better. A minimum of 20 upper division units applied toward the minor requirements must be in addition to units applied toward major or minor requirements in another department or program. Each minor course must be taken for a letter grade, and students must have an overall grade-point average of 2.0 or better.

Additional preparation required: One course

- Mathematics 3C or 32A OR
- Physics 6C or 5B or 1COR
- Chemistry 14C or 30A

Minor requirements (7 courses, 28 units, two course overlap permitted)

- Earth and Space Sciences 1, one course from 5, 13, 15, or 61.
- Choose five from: Earth and Space Sciences 101, 112, C113, 139, 150, 153. Consult with the EPS Sci Department for other applicable courses.

Course Descriptions

Earth Planetary and Space Sciences

1. Introduction to Earth Science. (5) Lecture, three hours; laboratory, two hours; field days. Not open to students with credit for or currently enrolled in course 100. Elements of Earth science; study of Earth materials; nature and interpretation of geologic evidence; study of geologic processes; historical aspects of geology. Mandatory field trips introduce students to solving of geologic problems in field. P/NP or letter grading.

5. Environmental Geology of Los Angeles. (4) Lecture, three hours; discussion, two hours; field trips. Geologic hazards and natural resources of greater Los Angeles region. Topics include Los Angeles geologic hazards such as earthquakes, landslides, and floods; Southern California oil fields; gold and gem mining in region; local beach processes; and Los Angeles water resource problems. Field trips to San Andreas fault, California aqueduct, active landslides, and historic gold mines. P/NP or letter grading.

13. Natural Disasters. (5) Lecture, three hours; discussion, one hour; one field day. Global urbanization together with historical demographic population shift to coastal areas, especially around Pacific Ocean's "Ring of Fire," are placing increasingly large parts of this planet's human population at risk due to earthquakes, volcanos, and tsunamis. Global climate change combines with variety of geologic processes to create enhanced risks from catastrophic mass movements (e.g., landslides), hurricanes, floods, and fires. Exploration of physical processes behind natural disasters and discussion of how these natural events affect quality of human life. P/NP or letter grading.

15. Blue Planet: Introduction to Oceanography. (5) Lecture, three hours; laboratory, two hours. Not open for credit to students with credit for or currently enrolled in Ecology and Evolutionary Biology 25. General introduction to geological, physical, chemical, and biological processes and history of Earth's global ocean system. P/NP or letter grading.

61. Geologic Maps. (4) Lecture, two hours; laboratory, three hours; five field days. Enforced requisite: course 1. Planning, creation, and interpretation of geologic maps, including both practical and philosophical problems that arise. Topographic and geologic mapping in field. Interpretation of published maps in laboratory. P/NP or letter grading.

101. Earth's Energy: Diminishing Fossil Resources and Prospects for Sustainable Future. (4) Lecture, three hours; laboratory, two hours; two optional field trips. Preparation: one lower-division atmospheric sciences, chemistry, Earth sciences, or physics course. Earth's energy resources (fossil fuels and alternatives) from Earth science and sustainability perspective. P/NP or letter grading.

112. Structural Geology. (5) Lecture, three hours; laboratory, six hours. Requisites: courses 1, 61. Recommended: course 51. Planar and linear structures at different scales in sedimentary, metamorphic, and igneous rocks. Faults and folds, their description, classification, and kinematic and dynamic analysis. Deformation, strength, fracture, and rheological properties of rocks. P/NP or letter grading.

C113. Biological and Environmental Geochemistry. (4) Lecture, three hours. Requisites: Chemistry 14A and 14B (or 20A and 20B), Mathematics 3A, 3B, and 3C (or 31A and 31B). Recommended: at least one lower-division Earth, planetary, and space sciences course. Intended for junior/senior life and physical sciences students. Study of chemistry of Earth's surface environment and interplay between biology, human activity, and geology. Introduction to origin and composition of Earth, including atmosphere, crust, and hydrosphere. Examination of how these reservoirs are affected by biological cycles

and feedbacks to biological evolution and diversity. Local and global-scale movements of biologically important elements like carbon, nitrogen, and phosphorus. Concurrently scheduled with course C213. P/NP or letter grading.

139. Engineering and Environmental Geology. (4) Lecture, three hours; discussion, one hour. Requisite: course 1 or 100. Recommended: course 111. Principles and practice of soil mechanics and foundation engineering in light of geologic conditions, recognition, prediction, and control or abatement of subsidence, landslides, earthquakes, and other geologic aspects of urban planning and subsurface disposal of liquids and solid wastes. P/NP or letter grading.

150. Remote Sensing for Earth Sciences. (4) Lecture, three hours. Recommended requisites: courses 1, 61. Designed for juniors/seniors and graduate students. Remote sensing related to development of natural resources. Characteristics of electromagnetic spectrum and review of remote sensing devices. Applicability to land-use classification, soil survey, urban studies, vegetation classification; emphasis on geologic interpretation of imagery. P/NP or letter grading.

153. Oceans and Atmospheres. (4) Lecture, three hours; discussion, one hour. Requisites: Mathematics 31A, 31B, 32A, Physics 1A, 1B, and 1C (or 1AH, 1BH, and 1CH). Physics and chemistry of Earth's oceans and atmosphere; origin and evolution of planetary atmospheres; biogeochemical cycles, atmospheric radiation and climate, energetics and dynamics of oceanic and atmospheric circulation systems. P/NP or letter grading.

Environmental Health Concentration

About the Minor

Environmental Health Sciences, Fielding School of Public Health

Research in Environmental Health Sciences focus on the effects of biological, chemical and physical hazards in the environment on human and ecosystem health, and the means of managing these hazards. Coursework in pollutant sources, treatment, fate and management in the environment – soil, air, water, including urban environments – and the effect these pollutants have on human health is the primary focus of the coursework in this concentration.

SPECIAL NOTE: Unlike the other concentrations in the Environmental Science major, Environmental Health Sciences is NOT a minor. Students completing this concentration will NOT receive a notation on the transcript or diploma. However, students who successfully complete the concentration have been very successful professionally and especially in turning their experience into graduate school admissions. The

EHS concentration allows only those few in the Environmental Science major to participate in courses that are otherwise only available to graduate students in Public Health. A high level of achievement in these graduate level courses is impressive to graduate schools in Public Health and related fields, and often yields strong recommendations from the faculty as well. A highly motivated undergraduate who does well in this concentration will absolutely not be disadvantaged by the lack of a minor on his or her record.

Where are they now?

Environmental science majors who graduated with this concentration are now:

Jobs

- Assistant Environmental Services Specialist - City of San Jose
- Assistant Specialist of Air Pollution Exposure and Epidemiology - UC Irvine
- Life Scientist - U.S. Environmental Protection Agency
- Senior Monitoring and Evaluation Advisor - Centers for Disease Control and Prevention

Graduate Programs

- MBA, Sustainable Management - Presido Graduate School
- MS in Infectious Disease Epidemiology - Harvard
- MS in Environmental Health - Harvard
- MPH - University of Minnesota, Twin Cities

Contact Information/To Declare the Concentration

Students declare the concentration at the Institute of the Environment and Sustainability SAO Office.

Royce Dieckmann
Student Affairs Officer
rdieckmann@ioes.ucla.edu
2318 Life Science Building
310-206-9193

Make an appointment.

Entry requirements

To enter the Environmental Health concentration, students must have earned a B or better in Chemistry 14A, 14B, 14BL, 14C (or 20A, 20B, 20L, 30A) and have an overall 3.0+ GPA in preparatory requirements for the Environmental Science major.

Course Requirements

Additional preparation required: Choose one

- Chemistry 14C or 30A, or
- Life Science 7C & 23L (or Life Science 3 & 23L)

Concentration Requirements (6 courses, 22-24 units, one course overlap permitted)

- Environmental Health Sciences 100 and C135, or C185A and C185B
- Epidemiology 100
- At least three from: Chemistry and Biochemistry 153A; Environmental Health Sciences C125, C140, C152D, C157, C164, M166

Course Descriptions

Chemistry & Biochemistry

153A. Biochemistry: Introduction to Structure, Enzymes, and Metabolism. (4) Lecture, four hours; discussion, one hour. Requisite: course 14D or 30B, with grade of C- or better. Recommended: Life Sciences 2, 3, 23L. Structure of proteins, carbohydrates, and lipids; enzyme catalysis and principles of metabolism, including glycolysis, citric acid cycle, and oxidative phosphorylation. P/NP or letter grading.

Environmental Health Sciences

100. Introduction to Environmental Health. (4) Lecture, three hours; discussion, one hour. Preparation: one course each in chemistry and biology. Introduction to environmental health, including coverage of sanitary principles and chronic and acute health effects of environmental contaminants. P/NP or letter grading.

C125. Atmospheric Transport and Transformations of Airborne Chemicals. (4) Lecture, four hours. Preparation: one year of calculus, one course each in physics, organic chemistry, and physical chemistry. Designed for science, engineering, and public health students. Role of regional or long-range

transport, and atmospheric lifetimes and fates of airborne chemicals in phenomena such as photochemical smog, acid deposition, stratospheric ozone depletion, accumulation of greenhouse gases, and regional and global distribution of volatile toxic compounds. Concurrently scheduled with course C225. P/NP or letter grading.

C135. Environmental Policy for Science and Engineering. (4) Lecture, four hours. Limited to senior undergraduate and graduate students. Examination of theoretical underpinnings of several major types of regulatory policy, as well as practical issues involved in implementing and enforcing each. Exploration of selection and impact of regulatory forms from variety of disciplines and viewpoints. Focus on traditional command and control regulation (including self-executing performance standards and permitting), market-based regulation (such as emissions trading), remediation, and emerging regulatory approaches such as management-based regulation and alternatives assessment. Issues of compliance and enforcement. Concurrently scheduled with course C235. P/NP or letter grading.

C140. Fundamentals of Toxicology. (4) Lecture, four hours. Preparation: one course each in biology, organic chemistry, and biochemistry. Essential aspects of toxicology, with emphasis on human species. Absorption, distribution, excretion, biotransformation, as well as basic toxicologic processes and organ systems. Concurrently scheduled with course C240. Letter grading.

C152D. Properties and Measurement of Airborne Particles. (4) Lecture, four hours. Preparation: one year each of chemistry, physics, and calculus. Basic theory and application of aerosol science to environmental health, including properties, behavior, sampling, and measurement of aerosols and quantitative problems. Concurrently scheduled with course C252D. P/NP or letter grading.

C157. Risk Assessment and Standard Setting. (4) Seminar, four hours. Requisites: course C140, Epidemiology 100. Designed to provide students with opportunity to review scientific basis for association of selected occupational and environmental exposures with disease. Special emphasis on critical evaluations of literature. Attention specifically to interface of science and regulatory standards. Concurrently scheduled with course C257. P/NP or letter grading.

C164. Fate and Transport of Organic Chemicals in Aquatic Environment. (4) Lecture, four hours. Recommended requisites: Chemistry 14A and 14B, or 20A and 20B. Evaluation of how and where and in what form and concentration organic pollutants are distributed in aquatic environments. Study of mass transport mechanisms moving organic chemicals between phases, biological degradation and accumulation, and chemical reactions. Effect of humic substances on these processes. Concurrently scheduled with course C264. P/NP or letter grading.

M166. Environmental Microbiology. (4) (Same as Civil Engineering M166.) Lecture, four hours; discussion, two hours; outside study, six hours. Recommended requisite: Civil Engineering 153. Microbial cell and its metabolic capabilities, microbial genetics and its potentials, growth of microbes and kinetics of

growth, microbial ecology and diversity, microbiology of wastewater treatment, probing of microbes, public health microbiology, pathogen control. Letter grading.

C185A. Foundations of Environmental Health Sciences. (6) Lecture, six hours. Preparation: one year of undergraduate biology and chemistry. Introduction to field of environmental health sciences designed for students pursuing MS degrees. Examination of series of topics relevant to science of environmental health (e.g., population, agriculture/food, microbiology, energy, climate change, water, waste, air) by introducing scientific basis from ecological perspective and describing how topics relate to health on biochemical and molecular basis. Emphasis on scientific aspects of field, with focus on critique of primary literature and quantitative approaches for examination of topics to provide skills that are critical to perform research. Concurrently scheduled with course C200A. Letter grading.

C185B. Foundations of Environmental Health Sciences for Public Health Professionals. (6) Lecture, six hours. Preparation: one year of undergraduate biology and chemistry. Introduction to field of environmental health sciences designed for students pursuing M.P.H. degree in Environmental Health Sciences. Examination of series of topics that cover scientific principles of field, as well as translation of science to environmental health practice. Topics include physical, chemical, and biological hazards, as well as risk assessment and communication. Acquisition of skills important for public health professionals, such as application of scientific information to real-world problems and ability to communicate effectively with different stakeholders. Concurrently scheduled with course C200B. Letter grading.

Epidemiology

100. Principles of Epidemiology. (4) Lecture, four hours; discussion, two hours. Preparation: one full biological sciences course. Not open for credit to students with credit for course 200A, 200B, or 200C. Introduction to epidemiology, including factors governing health and disease in populations. Letter grading.

Environmental Systems and Society Minor

About the Minor

Institute of the Environment and Sustainability

The Environmental Systems and Society minor is designed for students who wish to augment their major program of study with courses addressing the relationships between environmental science and associated social and political issues. The minor seeks to impart a deeper understanding of environmental

systems related to air, land, water and biological resources. A main goal of the program is to provide students with a foundation for sound decision making as a professional and a citizen. Coursework focuses primarily in three areas: environmental policy and regulations; environmental management, particularly in the context of economics and business management; and sustainability practices and implementation.

Where are they now?

Environmental science majors who graduated with this minor are now:

Jobs

- Facilities Associate - Los Angeles Cleantech Incubator (LACI)
- Co-Founder and CEO - SEED Consulting Group
- Associate, Carbon Projects - 3Degrees Group
- Google Maps Community Manager - Google
- Social and Community Program Manager - YouTube
- Regulatory Analyst - California Public Utilities Commission
- Real Time Asset Manager - Pacific Gas and Electric
- Environmental Scientist - SWAPE (Environmental Consulting)
- Energy Engineer - ARUP (Environmental Consulting)

Graduate Programs

- MS in Global Medicine - USC
- MBA - UC Irvine
- MBA - Presidio Graduate School
- MPH - Harvard
- J.D. - NYU School of Law

Department Contact Information/To Declare

To enter the Environmental Systems and Society minor, students must be in good academic standing (2.0 grade-point average) and file a petition at the Institute of the Environment SAO Office, Life Science 2308. All minor courses must be taken for a letter grade, with an overall grade-point average of 2.0 or better.

Make an appointment.

Course Requirements

Note: The courses listed here are a subset of those officially listed for the Minor, Environmental Science majors must follow these specific course requirements:

Additional preparation required: Choose one

- Chemistry 14C or 30 A, or
- Mathematics 3C or 32A, or
- Physics 6C or 1C, or
- Life Science 3 & 23L or Life Science 7C & 23L, or
- Earth Planetary and Space Sciences 1

Minor requirements (7 courses, 28-30 units, two course overlap permitted)

- Seven courses from Environment: M109, M111, 121, M130, M132, M133, M134, M135, M137, 150, M153, M155, 157, 159, 160, M161, 162, 163, M164, 166, M167, 186
- The ESLP 185 series (185A, plus 185B or 185C taken in winter and spring) is an acceptable substitute for one UD elective.

Course Descriptions

Environment

M109. Human Impact on Biophysical Environment: What Science Has Learned. (4) (Same as Geography M109.) Lecture, three hours; reading period, one hour. Designed for juniors/seniors. Examination of history, mechanisms, and consequences of interactions between humans and environment. Exploration in depth of three thematic topics (deforestation, desertification, and greenhouse gas increase and ozone depletion) and four major subjects (soil, biodiversity, water, and landforms). P/NP or letter grading.

M111. Earth and Its Environment. (4) (Same as Atmospheric and Oceanic Sciences M100.) Lecture, three hours. Overview of Earth as system of distinct, yet intimately related, physical and biological elements. Origins and characteristics of atmosphere, oceans, and land masses. Survey of history of Earth and of life on Earth, particularly in relation to evolution of physical world. Consideration of possibility of technological solutions to global environmental problems using knowledge gained during course. Letter grading.

121. Conservation of Biodiversity. (4) Lecture, three hours; discussion, two hours. Not open for credit to students with credit for Ecology and Evolutionary Biology 116. Examination of interrelation of natural biotic and human systems. Description of distribution of biodiversity and natural processes that maintain it. Critical analysis of various levels of threats and multidimensional challenges required for mitigating threats. Letter grading.

M130. Environmental Change. (4) (Same as Geography M131.) Lecture, three hours; reading period, one hour. Designed for juniors/seniors. Examination of natural forces producing environmental changes over past two million years. How present landscape reflects past conditions. Effects of environmental change on people. Increasing importance of human activity in environmental modification. Focus on impact of natural and anthropogenic changes on forests. P/NP or letter grading.

M132. Environmentalism: Past, Present, and Future. (4) (Same as Geography M115 and Urban Planning M165.) Lecture, three hours; discussion, one hour. Exploration of history and origin of major environmental ideas, movements or countermovements they spawned, and new and changing nature of modern environmentalism. Introduction to early ideas of environment, how rise of modern sciences reshaped environmental thought, and how this was later transformed by 19th-century ideas and rise of American conservation movements. Review of politics of American environmental thought and contemporary environmental questions as they relate to broader set of questions about nature of development, sustainability, and equity in environmental debate. Exploration of issues in broad context, including global climate change, rise of pandemics, deforestation, and environmental justice impacts of war. Letter grading.

M133. Environmental Sociology. (4) (Same as Society and Genetics M133 and Sociology M115.) Lecture, three hours; discussion, one hour. Relationship between society and environment. Analysis in detail of interrelations between social factors (such as class, race, gender, and religion) and environmental factors (such as pollution, waste disposal, sustainability, and global warming). P/NP or letter grading.

M134. Environmental Economics. (4) (Same as Economics M134.) Lecture, three hours. Requisites: Economics 41 or Statistics 12 or 13, and Economics 101 (may be waived with consent of instructor). Introduction to major ideas in natural resources and environmental economics, with emphasis on designing incentives to protect environment. Highlights important role of using empirical data to test hypotheses about pollution's causes and consequences. P/NP or letter grading.

M135. California Sustainable Development: Economic Perspective. (4) (Same as Public Policy M149 and Urban Planning M163.) Lecture, three hours. Examination of specific environmental challenges that California faces. Microeconomic perspective used, with special emphasis on incentives of polluters to reduce their pollution and incentives of local, federal, and state government to address these issues. Focus on measurement and empirical hypothesis testing. P/NP or letter grading.

M137. Historical Geography of American Environment. (4) (Same as Geography M137.) Lecture, three hours. Designed for juniors/seniors. Study of systematic changes of natural environment in U.S. during historical time, with emphasis on interplay between and among natural factors of climate, soils, vegetation, and landforms, and human factors of settlement, economic activity, technology, and cultural traits. P/NP or letter grading.

150. Environmental Journalism, Science Communications, and New Media. (4) Lecture, three hours. Introduction to environmental journalism, science communications, and new media, including weekly guest lectures by prominent successful practitioners in wide variety of media. Focus on technologies, methods, genres, and theories of communicating environmental challenges, exploring solutions, and engaging public in newspapers, television, radio, movies, online, on mobile devices, and through social media. Discussion of possibilities and limitations of different media and importance of communications for environmental science, policy, public understanding, and individual decision making. Production by students of environmental communications in variety of media. P/NP or letter grading.

M153. Introduction to Sustainable Architecture and Community Planning. (4) (Same as Architecture and Urban Design CM153.) Lecture, three hours. Relationship of built environment to natural environment through whole systems approach, with focus on sustainable design of buildings and planning of communities. Emphasis on energy efficiency, renewable energy, and appropriate use of resources, including materials, water, and land. Letter grading.

M155. Energy in Modern Economy. (4) (Same as Physics M155.) Lecture, three hours. Requisites: Mathematics 3A and 3B (or 31A and 31B), Physics 1A and 1B (or 6A and 6B), Statistics 12 or 13. Examination of physics of energy, history of energy development, and role that energy plays in our economy, particularly in transportation and power grid. Prospects for decreasing availability of fossil fuels and impact of global warming on energy development. Current and potential future government and social responses to energy issues. P/NP or letter grading.

157. Energy, Environment, and Development. (4) Lecture, three hours. Requisites: Mathematics 3A and 3B (or 31A and 31B), Physics 1A and 1B (or 6A and 6B). Introduction to basic energy concepts and examination of role of various energy sources, energy conversion technologies, and energy policies in modern life. Analysis of implications of current patterns of energy production and consumption for future economic and environmental well-being. Integration of concepts and methods from physical and life sciences, engineering, environmental science, economics, and public policy. Basic quantitative skills provided to analyze and critique technical, economic, and policy choices to address challenge of balancing economic growth and environmental sustainability. P/NP or letter grading.

159. Life-Cycle Analysis for Sustainability Assessment. (4) Lecture, three hours. Requisites: Mathematics 3A and 3B (or 31A and 31B). Public discourse about current patterns of production and consumption of energy, and goods and services more broadly, suggest such patterns are environmentally

and economically unsustainable. Introduction to basic concept of life-cycle analysis (LCA), including analytical frameworks and quantitative techniques for systematically and holistically evaluating environmental trade-offs presented by different alternatives. Focus on methodology of LCA to compute various material inputs and environmental releases from all activities associated with life cycle (i.e., raw material extraction, processing, end use, and disposal) of products or services. Discussion of strengths and limitations of LCA as tool for decision making. Students perform life-cycle analysis of one technology, product, or service of their choice. P/NP or letter grading.

160. Topics in Environmental Economics and Policy. (4) Seminar, three hours. Requisite: Statistics 12 or 13. Examination of intersection of environmental economics and policy, with focus on testing policy-relevant environmental hypotheses using economics research approach. Invited scholars present research aimed at yielding policy-relevant results on various topics such as climate change, pollution, and transportation. P/NP or letter grading.

M161. Global Environment and World Politics. (4) (Same as Political Science M122B.) Lecture, three or four hours; discussion, one hour (when scheduled). Recommended requisite: Political Science 20. Politics and policy of major global environmental issues such as climate change, integrating law, policy, and political science perspectives. P/NP or letter grading.

162. Entrepreneurship and Finance for Environmental Scientists. (4) Lecture, three hours; discussion, one hour. Focus on key entrepreneurial and financial concepts, with emphasis on applications that are vital for implementing environmental solutions in private, public, and nonprofit settings. Topics include basic elements of finance, project evaluation, financial planning, and marketing. Development of entrepreneurial skills to recognize opportunity and transfer ideas into viable projects that are better for environment and that benefit people and communities. Case studies used to equip students with tools necessary to successfully execute environmental goals and objectives. P/NP or letter grading.

163. Business and Natural Environment. (4) Lecture, three hours. Examination of role of business in mitigating environmental degradation and incentives to be more environmentally responsive. Emphasis on corporate strategies that deliver value to shareholders while responding to environmental concerns. P/NP or letter grading.

M164. Environmental Politics and Governance. (4) (Same as Urban Planning M160.) Lecture, three hours. Environmental planning is more than simply finding problems and fixing them. Each policy must be negotiated and implemented within multiple, complex systems of governance. Institutions and politics matter deeply. Overview of how environmental governance works in practice and how it might be improved. Letter grading.

166. Leadership in Water Management. (4) Lecture, three hours; discussion, one hour. Limited to juniors/seniors. Examination of water quality and water supply issues, including interactions between

scientific, technological, management, and policy issues. Invited experts, scholars, and practitioners discuss relevant issues such as pollution, climate change, and water infrastructure. Emphasis on solutions involving integrated water supply and wastewater systems. Leadership development through writing instruction and negotiations and media training. P/NP or letter grading.

M167. Environmental Justice through Multiple Lenses. (4) (Same as Urban Planning M167.) Lecture, three hours. Examination of intersection between race, economic class, and environment in U.S., with focus on issues related to social justice. Because environmental inequality is highly complex phenomenon, multidisciplinary and multipopulation approach taken, using alternative ways of understanding, interpreting, and taking action. P/NP or letter grading.

185B. Sustainability Action Research. (2) Lecture, two hours; fieldwork, four hours. Investigation of issues of campus sustainability, including energy efficiency, transportation, waste stream management, sustainable food practices, and more by student research to generate coalition of student researchers that, together with faculty members and UCLA staff, strive to make UCLA more sustainable community. May be repeated for credit. Letter grading.

185C. Sustainability Action Leaders. (3) Seminar, two hours; fieldwork, six hours. Students lead research teams to investigate issues of campus sustainability, including energy efficiency, transportation, waste stream management, sustainable food practices, and more to generate coalition of student researchers that, together with faculty members and UCLA staff, strive to make UCLA more sustainable community. May be repeated for credit. Letter grading.

186. Comparative Sustainability Practices in Local/Global Settings. (4) Fieldwork, four hours. Guided fieldwork and comparative analysis used to assess local sustainability practices and policies in diverse regional or international settings. Emphasis on comparing role of local and regional culture. geography, economic climate, and governmental policies on sustainability awareness and practices. Use of observations, interviews, and unobtrusive measures to document and analyze role and influence of local/global context on sustainability behavior of individuals, small businesses, and other institutions in everyday life. Letter grading.

Geography/Environmental Studies Minor

About the Minor

Department of Geography

The Geography/Environmental Studies minor is intended for students interested in environmental issues and emphasizes a systems approach to gaining a causal understanding of major environmental problems facing our society and the world at large. The uniqueness of the minor lies in its geographical perspective on the impact, at various geographical scales, of human activity on natural systems and on the implications of global environmental change on local, regional, and global human systems.

Where are they now?

Environmental science majors who graduated with this minor are now:

Jobs

- Associate - Energy Innovation: Policy and Technology LLC
- Associate - Environmental Science Associates (Environmental Consulting)
- Researcher - University of Washington, School of Environmental and Forestry Sciences
- Experiential Education Instructor - Oakley School
- Utility Specialist, Origination and Power Supply - San Francisco Public Utilities Commission
- Environmental Scientist/Sustainability Consultant - U.S. Green Chamber of Commerce
- Americorps Watershed Stewards Project Member - CA Department of Fish and Game
- Environmental Planner/Deputy Project Manager - AECOM (Environmental Consulting)

Graduate Programs

- Law School - UC Hastings College of Law
- MS in Sustainability Management - Columbia University
- MESM - Bren School of Environmental Management

Department Contact Information/To Declare

Upon completion (with a grade of C or higher) of any one Geography course applicable to the minor, students can declare the minor in person at the Geography Department Advising Office, 1255 Bunche Hall with the Geography Department SAO.

Nayla Huq
Student Affairs Officer
nayla@geog.ucla.edu
Department of Geography
1255 Bunche Hall
310–825–1166

Course Requirements

Entry Requirements

To enter the Geography/Environmental Studies minor, students must have an overall grade-point average of 2.0 or better and file a petition in the Geography Department Advising Office, 1255 Bunche Hall. Courses should be selected in consultation with the departmental adviser. At least three of the five upper division courses must be taken in residence at UCLA. All minor courses must be taken for a letter grade.

Additional preparation required: One course chosen from

- Chemistry 14C or 30 A
- Mathematics 3C or 32A
- Physics 5B or 1C or 6C
- Life Science 7C & 23L or LS 3 & 23L
- Earth Planetary and Space Sciences 1

Minor requirements (7 courses, 30 units, two-course overlap possible)

- Geography 5 AND
- Choose one from: Geography 1, 2, 3, 4, or 6 AND
- Choose three from: Geography M106, M107, M109, 110, 113, 114, M115, 116, 120, 121, 122, 123, 124, 125, 126, M127, M128, 129, M131, 132, 135, 136, M137, 159C, 159D, 159E AND
- Two additional upper division Geography courses, excluding those from the preceding list and courses 190–199. GEOG 191 (Variable Topics) may count towards the minor. For which category, contact the Academic Counselor. One Independent Research class (Geog 199) may apply towards the Minor (must be taken as a 4 unit, letter graded course).

(Crossed out courses have been discontinued by the department offering them; they apply if they have been taken but will not be available in the future).

Course Descriptions

Geography

1. Earth's Physical Environment. (5) Lecture, three hours; laboratory, two hours. Study of Earth's physical environment, with particular reference to nature and distribution of landforms and climate and their significance to people. P/NP or letter grading.

2. Biodiversity in Changing World. (5) Lecture, three hours; discussion, two hours. Biogeographic exploration of plant and animal diversity and conservation issues on continents and islands around world. Study of physical, biotic, and human factors responsible for evolution, persistence, and extinction of species and ecological communities. Analysis of effects of human activity. P/NP or letter grading.

3. Cultural Geography. (5) Lecture, three hours; discussion, two hours. Introduction to cultural geography of modern world, with examination of key concepts of space, place, and landscape as these have shaped and been shaped by connections between societies and their natural environments. Examples from variety of landscapes and places since 1800 and especially from Los Angeles region. P/NP or letter grading.

4. Globalization: Regional Development and World Economy. (5) Lecture, three hours; discussion, one hour. Economic geography explores spatial distribution of all forms of human productive activity at number of geographical scales—local, regional, national, and global. Key theme is impact of increasingly powerful global economic forces on organization of production. P/NP or letter grading.

5. People and Earth's Ecosystems. (5) Lecture, three hours; laboratory, two hours. Exploration of ways in which human activity impacts natural environment and how modification of environment can eventually have significant consequences for human activity. Examination, using case studies, of real environmental problems that confront us today. P/NP or letter grading.

6. World Regions: Concepts and Contemporary Issues. (5) Lecture, three hours; discussion, two hours. Interdisciplinary and historical approach to modern peoples, their differences in wealth or poverty, and their local origins of food production. Brief introduction to physical geography and biogeography of each region. Discussion of each region's peoples, languages, foods, prehistories, and histories. Letter grading.

100. Principles of Geomorphology. (4) Lecture, three hours; reading period, one hour. Requisite: course 1. Recommended: course 100A. Study of processes that shape world's landforms, with emphasis on weathering, mass movement and fluvial erosion, transport, deposition; energy and material transfers; space and time considerations. P/NP or letter grading.

101. Coastal Geomorphology. (4) Lecture, three hours; reading period, one hour. Requisite: course 1. Recommended: course 101A. Study of origin and development of coastal landforms, with emphasis on past and present changes, hydrodynamic processes, sediment transfers, and such features as beaches, estuaries, lagoons, deltas, wetlands, dunes, seacliffs, and coral reefs, together with coastal zone management. P/NP or letter grading.

102. Tropical Climatology. (4) Lecture, three hours. In-depth exploration of development of tropical climate, with special reference to hurricanes, ENSO, and monsoons. Examination of human interaction with tropical climate processes and human-induced climate change in tropics. Use of climatological information to foster sound environmental management of climate-related resources in tropics. P/NP or letter grading.

104. Climatology. (4) Lecture, three hours; reading period, one hour. Designed for juniors/seniors. Examination of many relations between climate and world of man. Application of basic energy budget concepts to microclimates of relevance to ecosystems of agriculture, animals, man, and urban places. P/NP or letter grading.

105. Hydrology. (4) Lecture, three hours. Requisites: course 104, Statistics 12. Role of water in geographic systems: hydrologic phenomena in relation to climate, landforms, soils, vegetation, and cultural processes and impacts on landscape. Field projects required. P/NP or letter grading.

M106. Applied Climatology: Principles of Climate Impact on Natural Environment. (4) (Same as Atmospheric and Oceanic Sciences M106.) Lecture, three hours; discussion, one hour. Designed for juniors/seniors. Exploration of knowledge and tools to solve complex problems in contemporary applied climatology, including current practices, influence of climate on environment, and human influence on changing climates. P/NP or letter grading.

M107. Soil and Water Conservation. (4) (Same as Environment M114.) Lecture, three hours; discussion, one hour. Enforced requisite: course 1 or 2 or Life Sciences 1 or 3. Designed for juniors/seniors. Systematic study of processes of and hazards posed by erosion, sedimentation, development, and pollution and techniques needed to conserve soil and maintain environmental quality. Scope includes agriculture, forestry, mining, and other rural uses of land. P/NP or letter grading.

108. World Vegetation. (4) Lecture, three hours; reading period, one hour. Designed for juniors/seniors. Characteristics, distribution, environmental and cultural relationships of world's principal vegetation patterns. P/NP or letter grading.

M109. Human Impact on Biophysical Environment: What Science Has Learned. (4) (Same as Environment M109.) Lecture, three hours; reading period, one hour. Designed for juniors/seniors. Examination of history, mechanisms, and consequences of interactions between humans and

environment. Exploration in depth of three thematic topics (deforestation, desertification, and greenhouse gas increase and ozone depletion) and four major subjects (soil, biodiversity, water, and landforms). P/NP or letter grading.

110. Population and Natural Resources. (4) Lecture, three hours; reading period, one hour. Designed for juniors/seniors. Examination of debate about environmental change and ability of planet to maintain growing population. Introduction and evaluation of basic demographic processes in context of food production, energy use, and environmental degradation. Discussion of major debates about use of resources in context of increasing population in developing countries and decreasing population in Western countries. P/NP or letter grading.

111. Forest Ecosystems. (4) Lecture, three hours; field trips. Requisite: course 2 or Life Sciences 1. Designed for juniors/seniors. Evaluation of ecological principles as they apply to forests. Emphasis on constraints of physical environment, biotic interactions, succession, disturbances, and long-term environmental change. P/NP or letter grading.

112. Analytical Animal Geography. (4) Lecture, three hours. Requisites: courses 1, 2 or Life Sciences 1, Statistics 12. Designed for juniors/seniors. Analysis of processes of expanding and contracting distribution areas. Focus on island biogeography and its implications for biodiversity trends in natural and anthropogenic environments. P/NP or letter grading.

113. Humid Tropics. (4) Lecture, three hours. Requisite: course 2 or 5 or Life Sciences 1. Designed for juniors/seniors. Examination of humid tropics, with emphasis on rainforests, their ecological principles, and forms of land use. Letter grading.

114. Africa and African Diaspora in Americas. (4) Lecture, three hours. Designed for juniors/seniors. Historical-geographical examination of Africa's role in Americas, with emphasis on environment, agriculture, food systems, and medicinal crops. P/NP or letter grading.

M115. Environmentalism: Past, Present, and Future. (4) (Same as Environment M132 and Urban Planning M165.) Lecture, three hours; discussion, one hour. Exploration of history and origin of major environmental ideas, movements or countermovements they spawned, and new and changing nature of modern environmentalism. Introduction to early ideas of environment, how rise of modern sciences reshaped environmental thought, and how this was later transformed by 19th-century ideas and rise of American conservation movements. Review of politics of American environmental thought and contemporary environmental questions as they relate to broader set of questions about nature of development, sustainability, and equity in environmental debate. Exploration of issues in broad context, including global climate change, rise of pandemics, deforestation, and environmental justice impacts of war. Letter grading.

116. Biogeography of Plant and Animal Invasions. (4) Lecture, three hours; reading period, one hour. Requisite: course 1 or 2 or 5. Examination of theories and examples of invasion of new environments by plants and animals introduced through natural processes or by human activity. P/NP or letter grading.

M117. Ecosystem Ecology. (4) (Same as Ecology and Evolutionary Biology M131.) Lecture, three hours; field trips. Enforced requisite: course 1 or Life Sciences 2. Designed for juniors/seniors. Development of principles of ecosystem ecology, with focus on understanding links between ecosystem structure and function. Emphasis on energy and water balances, nutrient cycling, plant-soil-microbe interactions, landscape heterogeneity, and human disturbance to ecosystems. P/NP or letter grading.

118. Medical Geography. (4) Lecture, three hours; reading period, one hour. Requisite: course 5. Examination of patterns of population/place/disease interactions and some effects of change and development on disease etiology and problems of healthcare. P/NP or letter grading.

119. Biophysical and Social Transformations in Northern Regions. (4) Lecture, three hours. Enforced requisite: course 5. Substantial transformation of world's northern high latitudes due to climate change, natural resource development, and key demographic trends in 21st century. Climate models project rising mean air temperatures and precipitation, and less sea-ice cover in Arctic Ocean, consistent with field observations of rising river flows, shrinking glaciers, and thawing permafrost. Ability of northern societies to react to these phenomena is shaped by new legal frameworks, like aboriginal land-claims agreements in North America, and resource economics, like oil and gas industry in West Siberia. Eight northern countries (including U.S.) face array of challenges and opportunities ranging from species extinctions to increased viability of shipping lanes. Major cities like Vancouver and Helsinki are becoming highly desired places to live, emigrate, and work. Blending of principles of human and biophysical geography to gain new understanding of northern quarter of planet, placed within broader global context. Letter grading.

122. Wildlife Conservation in Eastern and Southern Africa. (4) Lecture, three hours; reading period, one hour. Requisite: course 5. Designed for juniors/seniors. Analysis of tropical ecosystems of eastern Africa, including wildlife communities, vegetation, climate, and human impact. Discussion of national park systems and their natural and anthropogenic ecological dynamics. P/NP or letter grading.

123. Bioresource Management. (4) Lecture, three hours. Requisites: courses 2, 5. Recommended: Statistics 12. Designed for juniors/seniors. Theory and practice of management and conservation of bioresources. Introduction to wildlife management, endangered species conservation, and design and maintenance of National Parks and ecological reserves. P/NP or letter grading.

124. Environmental Impact Analysis. (4) Lecture, three hours. Preparation: two environmental studies cluster courses. Requisite: Statistics 12. Introduction to interdisciplinary analysis of local and

regional impacts on environmental systems. Evaluation of state and federal concepts for analysis of environmental impact. P/NP or letter grading.

125. Health and Global Environment. (4) Lecture, three hours; reading period, one hour. Impact of environment and lifestyle on individual health examined from geographical perspective, with examples from both developed and developing countries. P/NP or letter grading.

126. Geography of Extinction. (4) Lecture, three hours; reading period, one hour. Requisite: course 5. Designed for juniors/seniors. Geographic and taxonomic survey and analysis of biotic extinctions over past 15,000 years. Identification of extinction factors and pathways through case studies of extinct and endangered species and communities. P/NP or letter grading.

M127. Soils and Environment. (4) (Same as Ecology and Evolutionary Biology M127 and Environment M127.) Lecture, three hours; discussion, one hour; field trips. General treatment of soils and environmental implications: soil development, morphology, and worldwide distribution of soil orders; physical, chemical, hydrologic, and biological properties; water use, erosion, and pollution; management of soils as related to plant growth and distribution. P/NP or letter grading.

M128. Global Environment and Development: Problems and Issues. (4) (Same as Urban Planning CM166.) Lecture, three hours; discussion, one hour. Designed for juniors/seniors. Questions of population, resource use, Third World poverty, and environment. Analysis of global economic restructuring and its connections to changing organization of production and resulting environmental impacts. Case studies from Africa, Latin America, Asia, and U.S. P/NP or letter grading.

129. Seminar: Environmental Studies. (4) Seminar, three hours; reading period, two hours. Preparation: one course each from natural and human systems cores, three environmental studies cluster courses. Limited to seniors. Qualitative/quantitative analysis of problems associated with rational protection and use of selected environmental systems (urban, rural, forest, desert, coastal, water, soil, or others). P/NP or letter grading.

130. Geographical Discovery and Exploration. (4) Lecture, three hours; reading period, one hour. Requisites: courses 1, 3. Designed for juniors/seniors. Survey of history of exploration from earliest times to modern, with emphasis on period from Marco Polo to present. P/NP or letter grading.

M131. Environmental Change. (4) (Same as Environment M130.) Lecture, three hours; reading period, one hour. Designed for juniors/seniors. Examination of natural forces producing environmental changes over past two million years. How present landscape reflects past conditions. Effects of environmental change on people. Increasing importance of human activity in environmental modification. Focus on impact of natural and anthropogenic changes on forests. P/NP or letter grading.

132. Food and Environment. (4) Lecture, three hours. Designed for juniors/seniors. Thematic orientation to food systems and their role in environmental and cultural transformations. P/NP or letter grading. Part of the "Environmental Cluster" courses.

133. Cultural Geography of Modern World. (4) Lecture, three hours; reading period, one hour. Designed for juniors/seniors and graduate students. Historical and structural approach to cultural geography of modern world system, with particular emphasis on structure and functioning of its core, semi-periphery, and periphery. P/NP or letter grading.

135. African Ecology and Development. (4) Lecture, three hours; discussion, one hour. Designed for juniors/seniors. Overview of contemporary ecological and development issues in sub-Saharan Africa. P/NP or letter grading.

M137. Historical Geography of American Environment. (4) (Same as Environment M137.) Lecture, three hours. Designed for juniors/seniors. Study of systematic changes of natural environment in U.S. during historical time, with emphasis on interplay between and among natural factors of climate, soils, vegetation, and landforms, and human factors of settlement, economic activity, technology, and cultural traits. P/NP or letter grading.

138. Place, Identity, and Networked World. (4) Lecture, three hours; reading period, one hour. Communications technologies, such as personal computers and Internet, seem to be connected to dramatic changes in identities of people, groups, and places. Exploration of those changes and their implications for social institutions and human values and practices. P/NP or letter grading.

139. Japan in World: Culture, Place, and Global Connections. (4) Lecture, three hours; reading period, one hour. Focus on questions of culture and place in Japan. Exploration of ways that these questions—and Japan itself—have been shaped by historical and contemporary interactions involving people in both Japan and other parts of world. P/NP or letter grading.

140. Political Geography. (4) Lecture, three hours; reading period, one hour. Designed for juniors/seniors. Spatiality of political activity, spatial constitution of political power, control over space as central component to political struggles. Studies at local, national, state, and global scales. P/NP or letter grading.

141. Uneven Development Geographies: Prosperity and Impoverishment in Third World. (4) Lecture, three hours. Geographical perspective on part of globe commonly called Third World (global South). How development has shaped livelihood possibilities and practices, by global processes stretching back centuries, and transformative possibilities of Third World agency. World societies seek to transform Third World into their own image through theories and practices of colonialism, development, and globalization. Study of those theories and Third World alternatives to examine how they have shaped

livelihood possibilities. Social differences between stagnant livelihood possibilities for Third World majority and minorities that prosper massively, as well as geographical differences (culturally, environmentally, and socially) across Third World. Examination of possibilities of Third World agency, ranging from interstate collaboration to village activism, asking whether such agency and alternative imaginaries can enable Third World residents to break with First World developmentalism. P/NP or letter grading.

142. Population Geography. (4) Lecture, three hours; reading period, one hour. Designed for juniors/seniors. Study of social and behavioral perspectives influencing people in their patterns of demographic change, migration, and mobility, with special emphasis on spatial relationships and selected case studies. P/NP or letter grading.

143. Population in Interacting World. (4) Lecture, three hours. Provides multidisciplinary understanding of and appreciation for human population phenomena and problems in different parts of world and at different geographical scales—from local to global. Particular emphasis on understanding and critically reflecting on (1) contemporary population problems at global, national, and local scale, including both dramatic decline and persistence of high levels of fertility in parts of developing world, record low fertility and population aging in highly industrialized countries, increasing levels of international migration, refugee crises, massive rural to urban migrations, and creation of mega-cities in less developed world, (2) policies adopted to address these problems, such as family planning policies to reduce fertility, immigration policies, and so on, and (3) gender dimension of contemporary population problems and policies. P/NP or letter grading.

144. Ethnicity in American Cities. (4) Lecture, three hours; reading period, two hours. Limited to juniors/seniors. Designed to encourage and facilitate critical thinking about geographical aspects of ethnicity in contemporary America. Use of comparative perspective to explain changing distribution, social, economic, and political behavior, and adjustment problems ethnic groups face in contemporary American cities. P/NP or letter grading.

145. Slavery and Human Trafficking. (4) Lecture, three hours; reading period, one hour. Enforced requisite: one course from 3, 4, Anthropology 9, Gender Studies 10, or Sociology 1. Limited to juniors/seniors. Exploration of how, why, and to what ends human trafficking has been conceptualized as global problem that warrants international response. Examination of recent activist, governmental, scholarly, and media responses, and reflection on what is and is not accomplished by them. Questions of human trafficking are implicitly geographical, requiring consideration of ways freedom is spatially defined and how movement across borders is encouraged and regulated. How questions of labor, migration, sexuality, rights, ethics, embodiment, representation, and governance pertain to human trafficking. What people mean when they speak of human trafficking as slavery. Meanings of slavery and freedom in world today using examples from U.S. and Europe, with focus on Philippines as case study for exploring both contemporary examples and historical forms of enslavement. P/NP or letter grading.

M146. Feminist Geography. (4) (Same as Gender Studies M146.) Lecture, three hours; discussion, one hour. Critical engagement of gender as concept of geographic inquiry. Gender as spatial process, analysis of feminist geographic theory and methods, landscapes of gender, challenges of representing gender. Spaces of femininity, masculinity, and sexuality. P/NP or letter grading.

147. Social Geography. (4) Lecture, three hours; discussion, one hour. Study of spatiality of social differences such as race, class, gender, age, sexuality, location. Critical explorations of identity, social categories, and spatial structures. Importance of space and place in social life. P/NP or letter grading.

148. Economic Geography. (4) Lecture, three hours; reading period, one hour. Requisite: course 4. Designed for juniors/seniors. Geographical aspects of economic production and growth. General theory of space-economy. Land-use processes. Location of industry. Regional development. P/NP or letter grading.

M149. Transportation Geography. (4) (Same as Urban Planning M150.) Lecture, three hours. Requisite: course 3 or 4. Designed for juniors/seniors. Study of geographical aspects of transportation, with focus on characteristics and functions of various modes and on complexities of intra-urban transport. P/NP or letter grading.

150. Urban Geography. (4) Lecture, three hours; reading period, one hour. Designed for juniors/seniors. Analysis of development, functions, spatial patterns, and geographic problems of cities. P/NP or letter grading.

151. Cities and Social Difference. (4) Lecture, three hours; discussion, one hour. City landscapes embody best and worst of U.S. society: diversity and poverty, opportunity and violence. Study of urban spaces, social differences, inequality, and conflicts over uses and meanings of city space. Social urban geography. P/NP or letter grading.

152. Cities of Europe. (4) Lecture, three hours; reading period, one hour. Designed for juniors/seniors. Urbanization of Europe, growth of city systems and internal spatial structure, functions, and geographic problems of contemporary European cities. Particular attention to historical development and landscapes of capital cities such as Rome, Paris, and Berlin. P/NP or letter grading.

M153. Past People and Their Lessons for Our Own Future. (5) (Same as Anthropology M148 and Honors Collegium M152.) Lecture, two hours; discussion, two hours. Examination of modern and past people that met varying fates, as background to examination of how other modern people are coping or failing to cope with similar issues. Letter grading.

155. Industrial Location and Regional Development. (4) Lecture, three hours. Requisite: course 4 or Economics 1 or 2 or 5 or 11. Designed for juniors/seniors. Reexamination of industrial location theory in light of contemporary theories of industrial organization and local labor markets. Consideration of

empirical patterns of industrialization and regional growth, with special reference to Frostbelt/Sunbelt shifts and offshore relocation. P/NP or letter grading.

156. Metropolitan Los Angeles. (4) Lecture, three hours; reading period, one hour. Designed for juniors/seniors. Study of origins, growth processes, internal structure and pattern, interactions, environmental and spatial problems of Los Angeles metropolitan area. P/NP or letter grading.

158. Korean Urban Experience. (4) Lecture, three hours; reading period, one hour. Designed for juniors/seniors with previous coursework in geography or East Asian studies. Study of cities by geographers entails analysis of evolution, functions, spatial patterns, and other geographical problems of urban societies throughout history. Examination of Korean urban experience as found in Seoul, South Korea, along with other cities in both Koreas and overseas where Korean diaspora resides. Korean experience to be juxtaposed against responses by other cities of world to similar challenges. Geography of housing and associated processes of urban redevelopment whereby built environment is continuously being reproduced and transformed. Current urban debates, as well as topics showing interplay between competing visions of city. P/NP or letter grading.

159A–159E. Problems in Geography. (4 each) Discussion, three hours; reading period, one hour. Preparation: completion of three courses in one concentration. Limited to seniors. Seminar course in which students carry out intensive research projects developed from courses within one concentration. P/NP or letter grading. 159A. Urban and Regional Development Studies; 159B. Spatial Demography and Social Processes in Cities; 159C. Culture and Environment in Modern World; 159D. Physical Geography; 159E. Biogeography.

Procedures

162. Glacier Environments of California's High Sierra. (4) Fieldwork, 10 hours; discussion, four hours. Introduction to alpine glacial environment through three hours of introductory lecture followed by intensive seven-day field trip to California's High Sierra. Students carry out laboratory exercises, as well as data collection for research projects designed around their individual interests. Presentation of additional evening lectures, using presentation facilities at Sierra Nevada Aquatic Research Laboratory (SNARL). Offered in summer only. P/NP or letter grading.

163. Field Analysis in Biogeography. (4) Fieldwork, eight hours. Requisites: courses 2, 5, 108, 112. Examination of field procedures and intellectual concepts used in observation, measurement, analysis, and interpretation of phenomena pertinent to biogeography and interrelated human influences. P/NP or letter grading.

166. Environmental Modeling. (4) Lecture, one hour; laboratory, two hours. Presentation of basic concepts related to computer modeling of biogeochemical cycles, geomorphic processes, and other

phenomena relevant to changing Earth and its inhabitants. Laboratory exercises include building basic computer models and working with existing models. P/NP or letter grading.

167. Cartography. (4) Lecture, two hours; laboratory, four hours. Enforced requisite: course 7. Designed for juniors/seniors. Survey of field of cartography. Theory and construction of map projections, compilation procedures, principles of generalization, symbolization, terrain representation, lettering, drafting and scribing, and map reproduction methods. P/NP or letter grading.

168. Intermediate Geographic Information Systems. (4) Lecture, two hours; laboratory, two hours. Enforced requisite: course 7. Extension of basic concepts presented in course 7. How geographic and spatial analyses inform, integrate, and extend scientific inquiry in physical, life, and social sciences. Discussion of range of decisions and critical judgments necessary to carry out sound spatial analyses. Development of technical proficiency within geographic information systems (GIS) environment. P/NP or letter grading.

169. Satellite Remote Sensing and Imaging Geographic Information Systems. (4)Lecture, two hours; laboratory, one hour. Enforced requisite: course 7. Introduction to fast-growing field of environmental monitoring from space. Application of Landsat, radar, Global Positioning System (GPS), and Earth Observing System satellites to land-use change, oceanography, meteorology, and environmental monitoring. Introduction to digital image-processing and imaging geographic information systems (GIS) software. P/NP or letter grading.

170. Advanced Geographic Information Systems. (4) Lecture, three hours; discussion, one hour. Enforced requisite: course 168. Introduction to full geographic information systems (GIS) functionality, using ARC/INFO on UNIX workstations. Spatial manipulation, query, and computation of datasets carried out in project-oriented approach. P/NP or letter grading.

M171. Introduction to Spatial Statistics. (4) (Same as Statistics M171.) Lecture, three hours; laboratory, one hour. Requisite: one course from Statistics 10, 11, 12, 13, or 14. Introduction to methods of measurement and interpretation of geographic distributions and associations. P/NP or letter grading.

172. Remote Sensing: Digital Image Processing and Analysis. (4) Lecture, three hours; laboratory, one hour. Enforced requisite: course 169. Digital processing methods for manipulating and analyzing image data. Topics include statistical description, geometric and radiometric correction, classification, image enhancement and filtering, and change detection schemes. Reinforcement of procedures presented in lecture with laboratory exercises and student project. P/NP or letter grading.

173. Geographic Information Systems Programming and Development. (4) Lecture, two hours; laboratory, two hours. Enforced requisite: course 168. Introduction to fundamental concepts and architecture of programming objects in widely used geographic information systems (GIS), and

programming in GIS environment. Topics include GIS customization and development using variety of programming languages. Lectures followed by laboratory exercises. P/NP or letter grading.

174. Advanced Remote Sensing. (5) Lecture, three hours; laboratory, two hours. Enforced requisites: courses 169, 172. Remote sensing in visible and infrared wavelength regions to understand basic concepts of radiation propagation and interaction with matter, how digital remote sensing images are acquired, and constraints on available data and data analysis. P/NP or letter grading.

177. Field Methods in Physical Geography. (5 Lecture, three hours; laboratory, three hours. Not open for credit to students with credit for course M127. Examination of field procedures and concepts used in observation, measurement, analysis, and interpretation of physical phenomena pertinent to natural and built environment. Topics vary from year to year and may include soils, geomorphology, and field methods in geographic information science. May be repeated for credit with topic change. P/NP or letter grading.

Regions

180. North America. (4) Lecture, three hours; reading period, one hour. Designed for juniors/seniors. Delimitation and analysis of principal geographic regions of U.S. and Canada. P/NP or letter grading.

181. Mexico, Central America, Caribbean. (4) Lecture, three hours; reading period, one hour. Designed for juniors/seniors. Study of geographic factors, physical and cultural, that are basic to understanding historical development of Middle America and contemporary economic and cultural geography of Mexico and countries of Central America and West Indies. P/NP or letter grading.

182A. Spanish South America. (4) Lecture, three hours; reading period, one hour. Designed for juniors/seniors. Study of geographic factors, physical and cultural, that are basic to understanding historical development of Spanish South America and contemporary economic and cultural geography of individual Spanish-speaking countries. P/NP or letter grading.

182B. Brazil. (4) Lecture, three hours; reading period, one hour. Designed for juniors/seniors. Study of geographic factors, physical and cultural, that are basic to understanding historical development of Portuguese South America and contemporary economic and cultural geography of Brazil. P/NP or letter grading.

183. The Mediterranean World. (4) Lecture, three hours; reading period, one hour. Designed for juniors/seniors. Study of geographic factors, physical and cultural, that are basic to understanding historical development of Mediterranean region, with emphasis on 1500s to present. Introduction to great disputes in history and ecology centered on this region and character of two shores of Mediterranean basin. P/NP or letter grading.

184. California. (4) Lecture, three hours; reading period, one hour. Limited to juniors/seniors. Systematic and regional treatment of geography of California, including physical, cultural, and economic aspects and detailed studies of various regions. P/NP or letter grading.

185. South and Southeast Asia. (4) Lecture, three hours; reading period, one hour. Designed for juniors/seniors. Regional synthesis with varying emphasis on people of South or Southeast Asia in their physical, biotic, and cultural environment and its dynamic transformation. P/NP or letter grading.

186. Contemporary China. (4) Lecture, three hours; reading period, one hour. Designed for juniors/seniors. Systematic geographic analysis of elements of landscape, resources, population, and socioeconomic characteristics of People's Republic of China. Dynamics that have led to China's major role in East Asian and international scene, with special attention to China-Japan and Sino-American relations and their geographic bases. P/NP or letter grading.

SPECIAL OPPORTUNITIES AND DOUBLE MAJORS/MINORS

Special Opportunities

Summer Session

Summer session is a great way to get ahead, catch up, or help manage your schedule by taking courses at UCLA or elsewhere.

Summer at UCLA

UCLA offers two sessions each summer, A and C session, which run from mid-June through July, and August through mid-September, respectively. Each 6-week session offers a variety of courses, including some that are tough to enroll in during the academic year but are easier to get into in the summer. All units, grades, and course credit automatically apply to your program, so there's no hassle with sending transcripts or finding compatible equivalent courses, and you can be assured you'll get the quality instruction you've come to expect at UCLA.

The official UCLA Summer Sessions schedule is on-line in January and registration for UCLA students begins in February. Two courses in a session is considered a full-time load due to the condensed nature of Summer Sessions.

UCLA summer session fees are charged on a per-unit fee basis. The unit maximum for summer is 18 units total, whether taken in a single session or multiple, although this can be increased with a petition to the College of L&S at A316 Murphy Hall.

Financial aid is also available in summer; there is a unit minimum (6) and applications start in February, so don't wait to apply for aid.

- https://www.summer.ucla.edu/

Summer at a Community College

Taking summer courses at a **Community College** can be a low-cost and possibly local alternative for those who will be away from Los Angeles in the summer. Each community college releases its schedule for summer on different dates and enrollment is specific to the school. Community colleges only offer lower-division courses, so they can be a great way to complete GE requirements, language, or some lower-div prep courses, but in all cases you must consult with either the College (for GE/language) or the department to determine which courses will transfer to fulfill requirements.

Grades do not transfer from community colleges, although you must earn at least a C to get credit. Units will transfer until you reach 105 total units, after which time you can no longer accrue units from community college courses. This can be a good thing, as it can help keep your unit count below the maximum if you intend to take on an ambitious program or have taken many courses already. Course credit can apply but again, you must consult with the proper office to ensure that the correct course for the requirement you wish to fulfill is being taken.

Summer at another University

Summer courses can also be taken at **another 4-year university**. There are thousands of public and private universities in the United States that offer summer session; therefore all courses taken at any other university must be approved in advance by petition to the department (for major or minor courses) or the College (for GE/College requirements).

If taken at any other University of California campus, in addition to course credit, the units and grades will transfer and affect your UCGPA. If taken at any other university, units and course credit can transfer but the grades will not affect your UCGPA (although at least a "C" grade is required to earn credit). As with Community Colleges, a transcript must be sent to UCLA following completion of the courses.

Study Abroad

The IoES encourages students to explore the many opportunities for study abroad available through UCLA and other campuses and organizations.

UC Education Abroad Program

UC EAP is a UC-systemwide Education Abroad Program that specializes in semester or year-long study abroad at foreign universities. You can choose from hundreds of universities located in dozens of countries across the globe.

When choosing where to go, consider what is unique, special, and intriguing to you about the places you are considering and think about what sort of experience you want to have. Once you've figured that out, we here at the IoES can work with you and the EAP counselors to find the best fit for you. We can help figure out courses for you to take, so don't become preoccupied with that.

For semester-length UC EAP programs, you will go, usually alone, to the foreign university and take the same courses with the resident population of students. It is an immersive experience in the culture, climate, and people of the location you choose. This type of cultural immersion is exciting and often a once-in-a-lifetime opportunity, but it also requires maturity on the part of the participant as you will be away from nearly everything familiar to you for many months.

Because the Practicum occurs throughout senior year, we recommend that students plan for semester abroad programs like EAP to take place either during the Junior year, or in fall of a 5th year (13th semester) if that is viable for you. Fall is often favorable because you trade a fall quarter for a fall semester; spring semesters straddle the UCLA winter and spring quarter. However, this should be only one factor in your decision, which should also include the climate/season, finances, and other considerations.

- https://ieo.ucla.edu/uceap
- http://uc.eap.ucop.edu/

Travel Study

Travel Study, like EAP, offers students a unique experience, but usually these programs are shorter, focus on a specific site or topic of study in a region, and the majority of students and instructors will be from U.S. universities. Programs as short as one week or as long as a semester are available through travel study programs.

UCLA offers some in the summer, although at the moment we do not have any environment-specific travel study options. UC Davis, on the other hand, has many terrific summer programs that go to a variety of locales. In addition, other universities offer travel study programs that are open to any students in the USA and there are also privately run organizations that offer travel study.

Students should check with counselors both in the department appropriate to the field of study and in UC EAP to help determine transferability of any non-UC program.

- https://ieo.ucla.edu/travelstudy

Field studies in a foreign place

- https://studyabroad.ucdavis.edu/programs/summerabroad/index.html
- http://www.wildlandsstudies.com/
- http://www.fieldstudies.org/

UC Natural Reserve System: California Ecology and Conservation Field Course

The UC Natural Reserve System is a network of protected natural areas throughout California. Its 39 sites include more than 756,000 acres, making it the largest university-administered reserve system in the world. Most major state ecosystems are represented, from coastal tidepools to inland deserts, and lush wetlands to redwood forests. The reserves also serve as a gateway to more than a million acres of public lands. Founded in 1965 to provide undisturbed environments for research, education, and public service, the Natural Reserve System contributes to the understanding and wise stewardship of the earth.

The California Ecology and Conservation course brings together 27 students from across the UC system for seven weeks of intensive learning at NRS reserves. Guided by experienced field instructors, undergraduates transform into scientists by conducting independent research studies. Students learn to notice natural patterns, frame questions into feasible research projects, and practice standard techniques such as surveys of animal and plant populations. At the conclusion of each project, students analyze their data and present their findings to the class in oral presentations, posters, and reports. Students hone their research, public speaking, and scientific writing skills with constant practice and feedback. All the while, students gain a working familiarity with California's diverse ecosystems while immersed in the NRS's classrooms without walls.

California Ecology and Conservation is open to all University of California undergraduates in good standing with their home campus who have at least a 2.5 GPA and have passed an introductory ecology or biology course prior to applying for the program. Students receive 19 units of credit for the term; consult

with your major and/or minor department for applicability of credit for your program. The program is offered in spring, summer, and fall.

- http://www.ucnrs.org/teaching/cec.html

Double Majors

Students wishing to double major are best served by identifying the two majors as early as possible in one's academic career. The key to successfully double-majoring is planning in order to make sure the course load is manageable and to ensure completion within a reasonable time-to-degree, since nearly all double majors will exceed the unit maximum.

Double majors with BS in environmental science are always subject to approval by the College of L&S (and if in another school at UCLA, such as HSSEAS or AA, approval by that school as well).

There is a process to declaring a double major. The first step is to devise a plan that accommodates all the courses necessary to complete both majors as well as the other requirements of the school to which you belong. This plan should be vetted by the SAOs from each department in which you will major.

To officially declare a double major, you must complete all preparatory courses for both majors, and at least two unique upper-division courses for each, prior to declaring. At that point you will have both departments review and sign-off on your course plan and then submit that to the College (and if applicable to the school to which you belong) for approval.

Up to 5 upper-division courses may overlap between the requirements for the majors involved. There is no limit on lower-division course overlap. The rules for minors still apply: 20 total units must be unique to any minor.

https://www.admission.ucla.edu/prospect/Majors/lsmajor.htm

Other Minors

In addition to the minor required of all environmental science majors, students are welcome to pursue any other minor offered at UCLA. The procedure for declaring a minor varies by department, so always check with relevant SAO. One requirement is universal to all minors: 20 units must be unique to the minor (not overlapping with one's major or another minor).

http://www.admission.ucla.edu/prospect/majors/lsminor.htm

RESEARCH, GRANTS, AND OTHER RESOURCES

Research Opportunities

Beyond the Practicum

All environmental science students participate in the Senior Practicum, the year-long capstone program that pairs teams of seniors with real-world clients to deliver science-based solutions for pressing environmental issues (see, Practicum). As exceptional as that experience is, some students choose to go beyond the Practicum by getting directly involved in research being conducted by UCLA's world-class faculty. We encourage you to explore different possibilities available on campus.

A multitude of research possibilities are open to you as undergraduates, but to get involved takes some initiative and legwork. Often, professors and researchers doing work that would be of interest to you have smaller labs than those in more traditional disciplines like biology, psychology, or medical fields. The PIs

(Primary Investigators, or lead faculty members) are interested in mentoring students who have some background in the field already, and this generally means students who have taken their course(s). First and second year students should not despair, however! There are programs at UCLA that are tailored to getting you involved in research.

Undergraduate Research Centers

There are two Undergraduate Research Centers, one for the Sciences and one for Humanities/Social Sciences:

http://www.ugresearchsci.ucla.edu

http://www.ugeducation.ucla.edu/urhass/default.htm

Both of these centers post open research opportunities. While these opportunities may not directly relate to environmental science, they can be invaluable experiences that introduce you to lab procedures and safety, collaborative work, specific research skills, and exposure to the professional research environment that can serve you well when looking for opportunities later. Researchers prefer to take on students with experience in these areas, so even if you start off doing something unrelated to your professional or academic goals, the experience you gain in these labs can make a huge difference.

Sustainable LA Grand Challenges Research Program

There is also a unique opportunity to get involved in faculty-driven sustainability research, through the Sustainable LA Grand Challenges Research Program. Designed to get students in the early stages of their education, particularly 2nd & 3rd years, involved in faculty research, this program pairs students with faculty researchers working on projects to develop the technologies, policies, and strategies to make LA County sustainable by 2050. You must apply to the program in the spring; the program begins in fall and is an annual commitment. If accepted, you will be assisted in finding a PI/mentor and you will also attend a course each quarter that will provide additional instruction and mentoring.

https://grandchallenges.ucla.edu/sustainable-la/

Apply here: https://www3.research.ucla.edu/GC/student-immersion

IoES Faculty Research

If you are more certain of your academic goals, we encourage you to directly approach faculty with whom you are interested in pursuing research. Many faculty are willing to take on undergraduate research

assistants and/or place you with a graduate student or postdoctoral researcher working in their lab who needs assistance.

The best way to get to know faculty is to take a class, if possible, and be an active participant. Ask relevant questions in class, go to office hours to discuss your interest in the material, and of course, do well in the class. Most faculty find their undergraduate research assistants from the students they know. If it's not possible to take a class with a faculty member, *do your research on their research*. You can look up a lot of information online. IoES has an extensive "People" section with useful biographies, descriptions of research interests, and links to faculty CVs and publications.

Above all, if you are seeking a research position, don't be too shy to ask! Don't worry faculty expect to be approached about their research and opportunities they might have for students. Be prepared when you do approach them - do not go in and ask "what research do you do?", read their website and papers for yourself and go in with enthusiasm for what they do. Ask them at least one really good question about their work, or even better, pitch a new idea. Yes, you will have ideas they have not thought of! And even if they have thought of it, they will be impressed.

Not sure where to start? Take a look at the IoES research centers or extensive network of other sustainability-related UCLA research centers to find faculty working in an area of your greatest interest.

Sustainability Action Research

For a more student-centered research opportunity, the Sustainability Action Research (SAR) program might be a great fit. SAR is a student-initiated, student-designed, and student-facilitated research program offered through IoES. In the winter and spring quarters of each academic year, students on SAR teams are partnered with a campus stakeholder to research, rethink, investigate, and tackle UCLA's greatest sustainability issues. Applications are due in the fall.

https://www.ioes.ucla.edu/sar

99/199 Research Units

Students pursuing lower-division research opportunities typically do so through the Undergraduate Research Centers and enroll in Student Research Program (SRP) 99 units with the assistance of the Undergraduate Research Center (URC).

Students pursuing research in their field of study, such as with an IoES faculty researcher, can do so either on a volunteer basis or it may be useful to you as a student to pursue an independent study course, particularly if you are pursuing your own original research under the guidance of a faculty member or have a significant role in the research being undertaken by the faculty member. In these cases, you can

enroll in Environment 199 - Independent Study as a contract course. In consultation with the faculty advisor and the department SAO, you will design the course of study and create a unique contract course through the Contract Course function on My UCLA. This contract is then signed by the faculty member and then brought to the SAO Royce Dieckmann to approve the contract and enroll you in the course. This should be done no later than the end of the 2nd week of the quarter in which the contract course will be taken.

Honors in Environmental Science

The Honors Program in environmental science is intended to provide exceptional students the opportunity for advanced research and study, under the guidance of a faculty member, leading to the completion of an honors thesis. To qualify for graduation with honors, students must complete all requirements for the major, have a cumulative grade-point average of 3.5 or better in upper division course work in the major, have an overall grade-point average of 3.0 or better, complete at least eight units of Environment 198 taken over at least two quarters, and produce a completed, satisfactory honors thesis paper. The honors thesis requirements are in addition to the requirement of a completed Practicum in Environmental Science project.

See the complete Guidelines for Departmental Honors in Environmental Science in the Appendix.

Glickfeld Excellence in Environmental Research Grant

A $4,000 annual grant is awarded to one Environmental Science student each year.

The funds will be used to pay the salary of a student working as a research assistant under supervision of a faculty member at UCLA.

With gratitude to Madelyn and Bruce Glickfeld, the IoES is pleased to offer the undergraduate Glickfeld Excellence in Environmental Research Grant.

The $4000 annual grant will be given to one Environmental Science student per year. The funds will be used to pay the salary for a student to work as a research assistant under supervision of a faculty member at UCLA. The benefits of the research grant are many:

The student will gain valuable training and experience, whether in a laboratory or other research setting. This experience will translate into job skills and impressive resume/cv items, and make the student more competitive for graduate programs or future job opportunities.

The award will cover up to three quarters of research work, assuming $15/hour and 7–8 hours of research per week. However, it will be up to the student and faculty advisor to determine hours and length of study.

Faculty will be more willing to take the supported student on as a research assistant. The award will assure the student's commitment and reliability to faculty and will make the student a desirable hire. We will assist students in finding a faculty member whose research is of interest and value to the student.

Junior or sophomore awardees may have the opportunity to continue with their project which could result in an Honor's Thesis and/or publication.

Qualifications:

- Must be eligible to work in the U.S.
- Students in all years of the program are eligible to apply but ideally should have three terms (can include summer) remaining prior to graduation.

Who Should Apply?

Environmental Science B.S. Majors...

- who are currently doing research and would like to continue for the next year.
- who want to do research and know what they want to do and with which faculty member they want to work.
- who want to do research but need some guidance about where to go and who to ask.
- who want to do research and have an idea about what they want to do, but need guidance on how to get started.

In short, ANY ES Major who has a desire to get involved in research can apply! Don't be shy – your goals and desire to participate in research will be major factors in our decision!

Application period is in spring to begin research in either summer or fall the following academic year.

To Apply:

Send an email to rdieckmann@ioes.ucla.edu with the following information in an attached document (word or pdf preferred):

1. Your name
2. Your UID#
3. Faculty advisor name and contact information (if known) If you are currently doing or have done research, supply your faculty advisor's name and contact information, and your direct supervisor

if other than the faculty member (such as a postdoc or graduate student with whom you work closely). If you have never done research before or want to try something new, please list faculty members with whom you would like to work.

4. Tell us about your specific research question and goals. Please include your reasons for wanting to pursue a research position. (600 words max.)

Application deadline: TBD. Check website for updates: https://www.ioes.ucla.edu/envisci/scholarships/

Questions? Email Royce Dieckmann, IoES SAO: rdieckmann@ioes.ucla.edu

Getting Involved

When school is in session, UCLA effectively becomes a city of 80,000 people. With its commitment to health and sustainability, the campus has become a living laboratory, taking on issues from renewable energy to water reuse to food sourcing to biodiversity to creating a healthy workforce and more.

The diverse population of greater L.A. is at 18.68 million and growing, yet there is a wealth of nature all around. From the Santa Monica Mountains to the tide pools of Palos Verdes, Los Angeles represents the frontier of urban humanity's interaction with nature. Water, food supply, energy, pollution and environmental justice are all part of the equation. Many UCLA students engage off campus by volunteering with community groups, teaching LA's youth about sustainability and the environment, or simply getting out in nature. There are many ways to get involved. Sign up, try it out, make friends, find your passion!

On Campus

Environmental Student Network

The Environmental Student Network (ESN) is a UCLA campus student organization dedicated to providing networking opportunities for Environmental Science majors and anyone who wants to be involved in the environmental field in general. ESN additionally provides a setting for environmentally conscious students to come together; ESN holds volunteer events, socials, and hikes throughout the year in an effort to provide students opportunities to become further involved. All majors are welcome—all that's necessary to participate is a passion for the environment and a desire to help!

2018–19 President: Renee Delamater
Contact ESN: uclaesn@gmail.com

Sustainability Talks

Sustainability Talks is a student-led speaker series offered each Fall quarter as Environment 185A, a 1-unit, pass/no pass course. Student Co-Directors line-up professionals, academics, and activists in sustainable fields such as energy, climate change, air quality, environmental justice, food, transportation, fashion, entertainment, public health technology, film and more. This course is a great way to meet other students, hear from people at the cutting edge of sustainability, and to get ideas for volunteer and internship opportunities.

2019-20 Co-Directors: David Scolari dascolari@ucla.edu; Mingyi Chen mchen1225@gmail.com

This course is required for the Sustainability Talks and may be applied toward the Colloquium requirement for students on the pre-2018 program. Together with Sustainability Action Research (below) the courses (Environment 185 A/B/C) may be applied toward the Environmental Systems and Society minor.

Sustainability Action Research Program

Sustainability Action Research (SAR) is a student-initiated, student-designed, and student-facilitated research program offered through the IoES. In a two-quarter sequence of classes in winter and spring (Environment 185 B/C), students on SAR teams are partnered with a campus stakeholder to research, rethink, investigate, and tackle UCLA's greatest sustainability issues. This program is a great way to get involved in real-world research and is kind of like the Practicum, but with UCLA as the client. The program is open to anyone and you enroll by applying to be a team member (185B) or a team leader (185C). Each year there are 7–8 teams of 5–7 students working with Facilities, Housing, Health System, Transportation, Dining, and others. Enrollment may be competitive depending on demand.
https://www.ioes.ucla.edu/sar

2018–19 Leadership: Brooke Shimasaki – Co-Director, bshima@ucla.edu
Lea Le Rouzo – Co-Director, lealerouzo@gmail.com

Together with Sustainability Talks, the courses (Environment 185 A/B/C) may be applied toward the Environmental Systems and Society minor.

UCLA Sustainability Office Internships

The UCLA Sustainability Office has an ongoing, open call for student volunteers wanting to get involved in campus projects. Opportunities range from one-time activities to short term or term projects. You may be able to work directly with Nurit Katz, UCLA Chief Sustainability Officer, or Bonny Bentzin, Deputy Chief Sustainability Officer. Both are wonderful women and are great resources, especially if you are thinking of a career in sustainability.

https://www.sustain.ucla.edu/get-involved/volunteer

The Green Initiative Fund

Have your own ideas about improving sustainability on campus? You can apply for funding to make them happen through The Green Initiative Fund (TGIF), a grant-making fund for sustainability projects on UCLA's campus. Roughly, $200,000 per year is available for student-initiated sustainability projects on campus. Projects are selected by a committee consisting of students, faculty, and staff in which students have the majority vote. TGIF is funded by a $4 per quarter student fee.

The goal of TGIF is to enable and empower students to take an active role in making UCLA a leader in sustainability. TGIF provides much needed funding for projects that reduce UCLA's negative impact on the environment. Past projects have varied from solar panels on Ackerman to hydration stations, student events, and more.

http://tgif.ucla.edu

Student Organizations

Among the hundreds of UCLA student groups, there are over 25 dedicated to environmental issues. Some are listed here on the UCLA Sustainability website: https://www.sustain.ucla.edu/our-initiatives/student-organizations For a full list, check out the "Environmental" category on the USAC page: https://sa.ucla.edu/RCO/public/search.

Whether you want to garden, visit high school classrooms, run the UCLA Farmer's Market, advocate for fossil-Free UCLA or fair-trade products, run for USAC officer positions, or just about anything else you can imagine - there is a student group oust there for you. And if there isn't one? Start one! Student groups are a great way to meet people and to get involved in activities on and off campus.

USAC and ASUCLA

Both the Undergraduate Student Association Council (USAC) and the Associated Students of UCLA (ASUCLA) have demonstrated their commitment to sustainability. USAC made sustainability a key area of concentration and has begun to promote sustainability efforts in the residence halls, as well as throughout the undergraduate student government offices. ASUCLA, the largest student-run student union in the country, agreed to develop a policy on sustainability as well as sustainability plan, all because of student efforts. To learn more about ASUCLA's sustainability efforts visit http://asucla.ucla.edu/about-asucla/target-zero-waste

Off Campus

The City of Los Angeles is home to an almost dizzying array of environmental organizations and agencies– non-governmental organizations (NGOs) like Heal the Bay, the Natural Resources Defense Council (NRDC), Center for Biological Diversity; local, state, and Federal agencies including the City of Los Angeles and City of Santa Monica's Office of Sustainability, the Los Angeles Regional Water Quality Control Board, and National Park Service; as well as initiatives like the Los Angeles Cleantech Incubator (LACI) and private companies and consulting firms that all employ scientists, sustainability experts, and policy researchers. Below are some possible paths for getting involved with organizations beyond UCLA.

Volunteer

One of the best ways to gain invaluable experience while at the same time exploring areas of research or possible career paths that might interest you is through volunteering. A number of environmental non-profit organizations and government agencies, at the local, state, and federal level, provide opportunities for students to join in part-time roles to carry out work ranging from substantive research, to

environmental restoration efforts, to assistance with educational and outreach initiatives. For more information on possible volunteer opportunities, or to connect with students and alumni that may have volunteered for organizations that interest you, please contact Noah Garrison (ngarrison@ioes.ucla.edu) or Royce Dieckmann (rdieckmann@ioes.ucla.edu).

Internships

Similar to volunteer opportunities, internships are valuable for students seeking experience in a specific field or type of organization, and can certainly be useful for networking purposes when seeking employment upon graduation. The goal of any internship is that the student be provided with a learning opportunity about the type of work the organization does and ideally will be involved in many aspects of the positions available at the organization. NGOs, government agencies, public utilities, private companies and corporations - students can intern almost anywhere. There are two main types of internships - paid or unpaid - and a different set of regulations that cover them.

Paid internships are the most desirable for obvious reasons. Students are employed on a temporary basis and paid for the work that they do while also learning the ropes of the organization. If you are fortunate enough to land a paid internship, there is no requirement that you must also earn college credit (although you still can if you so desire).

Unpaid internships are again subdivided due to California labor laws for the purposes of the logistics you may encounter. If you intern at a for-profit organization, you will need to earn college credit for the internship. We make that easy with our Environment 195 Internship course, and there are other ways to also earn credit for an internship at UCLA, detailed below. If you intern at a non-profit or government agency, it is not strictly speaking required that you earn credit, although many such organizations prefer that you do.

Most UCLA departments offer a course that can provide internship credit, usually 2 or 4 units depending on how many hours per week a student works at the internship. There is also an office on campus, called the Center for Community Learning, that will help arrange the course credit and manage the student's experience, if that is desired.

For internships with an environmental or sustainability aspect we recommend that students enroll through our **Environment 195 Internship course** for credit. We will assist you in finding a faculty member to oversee the internship course and assist you with enrolling. However, some faculty may prefer that students enroll in the course through the faculty member's home department. In these cases the process of filling out the contract is the same but the completed contract will be taken to that department's SAO for approval and enrollment.

Summer internships can create a small complication. During the academic year (fall/winter/spring), because fees are on a flat basis, there is no additional charge for enrolling in an internship course. However, many students find summer internships. In these cases, the per-unit summer fee basis is used to charge the student for the internship course. This is a University policy, and one that the department is not fond of. In these cases, sometimes the employer might cover the fee, but often not. If you find that this expense creates difficulty for you, please consult with Royce Dieckmann as there is sometimes a loophole that we can use that might save you considerable expense.

How to find an internship

Internship in the environmental sector opportunities come up frequently and will be posted to the IoES Undergraduate message board through the IoES Undergraduate Advising board hosted by Piazza. Associated departments, such as your minor department, will also send out notices about internship opportunities. In addition, opportunities are often posted on BruinView. However, the best way to find an internship in line with your interests and goals is to identify organizations for whom you would like to work, research their opportunities, and send a resume and statement of interest to their HR department or other appropriate contact. Also, many IoES faculty and staff have connections to various groups and agencies, so ask us. We may be be able to help introduce you.

Course, Academic, Health, and Other Student Resources

Course Information

Schedule of Classes

Searchable list of all courses offered in a particular term with up-to-date enrollment.

- https://sa.ucla.edu/ro/public/soc

Course Descriptions

All UCLA courses (searchable by department)

- http://www.registrar.ucla.edu/Academics/Course-Descriptions

IoES Environment courses

- http://catalog.registrar.ucla.edu/ucla-catalog2017-428.html

UCLA Catalog Major & Minor Description/Requirements

- http://catalog.registrar.ucla.edu/ucla-catalog2017–426.html

Academic Calendars

Never miss that first day of class or forget about a holiday again:

- http://www.registrar.ucla.edu/Calendars/Overview

Campus Student Services

College Academic Counseling (CAC)

Murphy Hall A316

College Academic Counseling (CAC) helps students plan and shape their undergraduate career at UCLA and assists in engaging students in a broader dialogue to clarify academic and personal goals. CAC advising includes degree requirement, general education requirement, credit transfers, and other services to ensure that you are on the right track towards graduation. College Academic Counseling is solely for the majors within the College of Letters and Sciences.

Academic Advancement Program (AAP)

1232 Campbell Hall

The Academic Advancement Program (AAP), a multiracial program, represents the best of what United States society aspires to: access, equity, opportunity, and excellence. Built on principles of social justice, AAP has a threefold mission:

1. to advocate and facilitate the access, academic success, and graduation of students who have been historically underrepresented in higher education;
2. inform and prepare students for graduate and professional schools; and
3. to develop the academic, scientific, political, economic, and community leadership necessary to transform society.

Honors

Murphy Hall A311

UCLA Honors provides diverse, high-achieving students the framework for a unique undergraduate educational experience—one that is dynamic, innovative, interdisciplinary, student-oriented, rich in research, and centered on active, participatory learning.

We educate, one student at a time, by delivering exceptional experiences that cultivate intellectual inquiry; inspire passion for creative discovery, expression, and application; and empower students to shape the future. Each Honors experience can be individually tailored based on the choices students make in fulfilling their coursework commitments. Honors programs provide exceptional undergraduate students an opportunity to pursue individual excellence.

Student Athletics

Academic & Student Services supports the unique needs of each student-athlete by providing strategic services and programming in the areas of academic support, academic counseling, student-athlete development, and student services. Our student-centered approach empowers student-athletes to maximize their educational experience as they pursue their academic and personal goals. It is our mission to graduate self-sufficient learners who are able to successfully embark on life after college.

UCLA International Education Office - Education Abroad Program

B–300 Murphy Hall, (310) 825–4995

The International Education Office provides information about various study abroad programs, both UC and non-UC sponsored, including the UC-wide Education Abroad Program (EAP). Students seeking study abroad opportunities usually coordinate with this office and the major or minor department to evaluate potential coursework abroad.

Career Center

Strathmore Building, 501 Westwood Plaza, (310) 825–2981

The UCLA Career Center provides career planning, pre-professional advising and employment assistance to current UCLA students. Most services are free; some are fee-based. The Career Center holds workshops, fairs, and other events for a multitude of careers and graduate school possibilities. It also has an extensive career and graduate program library, the Bruinview site that features job and internship opportunities, and individual counseling and assessment.

Financial Aid

A–129J Murphy Hall, (310) 206–0400

The Financial Aid Office provides financial aid counseling and information to students who apply and are qualified to receive need-based aid, including grants, loans, work study, etc.

Registrar's Office

1113 Murphy Hall, (310) 825–1091

As custodian of student records, the Registrar's Office is responsible for services including enrollment, degrees, classes, transcripts, grades, official publications, and more.

Scholarship Resource Center

233 Covel Commons, (310) 206–2875

The Scholarship Resource Center provides help for students in search of scholarship information, resources, and support services, regardless of financial aid eligibility and at no charge.

UCLA Counseling and Psychological Services (CAPS)

John Wooden Center West, (310) 825–0768

Provides confidential, one-on-one therapy services and other programs designed to promote the emotional and mental well-being to the UCLA community, including the Wellness Skills Programs and Workshops across campus and the Wellness Self-Help Lab at John Wooden Center West. 24-hour Help Access Line available. (www.counseling.ucla.edu)

UCLA PEER Helpline

(310) 825-HELP (4357)

Provides crisis intervention and referral hotline staffed by UCLA students and staff members.

Arthur Ashe Student Health & Wellness Center

221 Westwood Plaza, (310) 825–4073

The Ashe Center provides outpatient services for UCLA students; most services are prepaid by registration fees. A current Bruin Card is required for service.

Dashew Center for International Students & Scholars

106 Bradley Hall, (310) 825–1681

The Dashew Center assists international students with questions about immigration, employment, government regulations, visas, financial aid, academic and administrative procedures, cultural adjustment and personal matters.

Center for Accessible Education (CAE)

A–255 Murphy Hall, (310) 825–1501

Formerly known as the Office for Students with Disabilities, the UCLA Center for Accessible Education facilitates academic accommodations for regularly enrolled, matriculating students with documented permanent and temporary disabilities. Accommodations are designed to promote successful engagement in the UCLA academic experience.

Office of the Dean of Students

1206 Murphy Hall, (310) 825–3871

The Office of the Dean of Students is concerned with matters of disciplinary action including academic integrity (cheating, plagarism); student conduct; sexual harassment; UC policies regarding campus activities, organizations and students; Dean's Certification; among others.

Office of Ombuds Services

Strathmore Building, 501 Westwood Plaza, (310) 825–7627

The Office of Ombuds Services is a place where members of the UCLA community–students, faculty, staff and administrators–can go for assistance in resolving conflicts, disputes or complaints on an informal basis. In order to afford visitors the greatest freedom in using its services, the Office is independent, neutral and confidential.

Student Legal Services

70 Dodd Hall, (310) 825–9894

Student Legal Services provides confidential legal counseling and assistance from attorneys and/or law students (under direct supervision by attorneys) regarding a wide range of legal issues to currently registered and enrolled students.

Research Grants, Scholarships & Financial Aid

IoES Exclusive Research Grants & Scholarships

The IoES administers a grant and scholarship for undergraduate students to support their work at the IoES.

The Glickfeld Excellence in Environmental Research Grant

A $4,000 annual grant is awarded to one Environmental Science student each year. The funds will be used to pay the salary of a student working as a research assistant under supervision of a faculty member at UCLA. (See additional detail in section on Glickfeld Research Grant, above.)

The Greenspan Family Scholarship

In 2018–19, we are pleased to offer once again a $2,000 Greenspan Family Scholarship exclusive for IoES Environmental Science majors.

Please visit the IoES website for deadlines and applications.

UCLA Financial Aid

UCLA offers a variety of financial aid options to students, including grants, fee waivers, scholarships, work-study, subsidized and unsubsidized loans. More information on UCLA financial aid can be found here.

Eligibility for most forms of financial aid requires the filing of a Free Application for Federal Student Aid (FAFSA). You can file a FAFSA here.

There are thousands of scholarships available to students. The sheer number of scholarships and eligibility requirements can be overwhelming. Luckily, UCLA has an office dedicated to helping students find scholarships – the Scholarship Resource Center.

UCLA Scholarship Resource Center

The Scholarship Resource Center (SRC) was established at UCLA in 1996 to provide scholarship information, resources, and support services to all UCLA students, regardless of financial eligibility. It offers free resources to help you find scholarships:

- Departmental Scholarships
- UCLA Scholarships
- Scholarship Search Databases
- National and International Scholarships
- SRC Group on my.ucla.edu
- Tips for Scholarship Applicants and for Parents
- Library of scholarship books, many of which contain listings not on the web
- Bulletin boards displaying a wide range of up-to-date opportunities

It offers free resources to help students apply for scholarships:

- Individual Counseling by appointment for scholarship-related questions
- One-on-one Writing Assistance by appointment for scholarship essays and personal statements
- Workshops, such as How to Find Scholarships, Writing Personal Statements, How to Get Letters of Recommendation, and others

223 Covel Commons
(310) 206–2875
http://www.ugeducation.ucla.edu/src

SRC hours are 11:00 a.m. to 6:00 p.m. during the academic year and 12:00 p.m. to 5:00 p.m. during the summer.

Other UCLA Student Services Links

MyUCLA Student Services Directory:

1. ADA / 504 Compliance Office
2. Arthur Ashe Student Health & Wellness Center

3. Bruin Resource Center
4. Career Center
5. Center for Accessible Education
6. Community Programs Office
7. Counseling and Psychological Services
8. Dashew Center for International Students & Scholars
9. Dean of Student Offices
10. Emergency Preparedness
11. First Year Experience
12. Office of Fraternity and Sorority Life
13. Global Citizens Fellowship
14. Graduate Student Resource Center
15. Lesbian Gay Bisexual & Transgender Campus Resource Center
16. Office Technology Center
17. Parent and Family Program
18. Recreation
19. Registrar's Office
20. Residential Life
21. Silk Road to the Future
22. Student Affairs Information & Research Office
23. Student Affairs Information Technology
24. Student Legal Services
25. Student Loan Services and Collections
26. Student Organizations, Leadership & Engagement

APPENDIX

Environmental Science Official Catalog Description

Capstone Major

The Environmental Science major is a designated capstone major. In collaboration with a local agency or nonprofit institution, students work individually and in groups to complete projects that require them to integrate many of the skills, principles, theories, and concepts they have learned throughout the curriculum and apply them to real systems. Students are expected to contribute meaningfully to the analysis and solution of particular environmental science issues involving multiple disciplines and stakeholders with different perspectives. Those completing the major should possess critical thinking skills, problem-solving abilities, and familiarity with essential computational, data collection, and analysis skills, as well as demonstrate effective oral and written communication skills. Graduates should also be able to identify key ethical issues and analyze the consequences of various professional dilemmas, as well as work productively as part of a team.

The Environmental Science BS program represents strong collaboration between the Institute of the Environment and Sustainability and the departments of Atmospheric and Oceanic Sciences; Civil and Environmental Engineering; Earth, Planetary, and Space Sciences; Ecology and Evolutionary Biology; Environmental Health Sciences; and Geography. The program is designed for students who are deeply interested in the study of environmental science. There are two components to the program, and both must be completed to receive the degree. The first component, the Environmental Science major, requires completion of lower-division requirements grounded in basic natural sciences, a five-course upper-division environmental science requirement reflecting the disciplinary breadth of environmental science, three social sciences/humanities courses, participation in a sustainability-focused speaker series, and completion of an environmental science practicum. The second component is a minor or concentration in one of seven environmental science areas, each associated with a particular department. With assistance from IoES staff, students must formally apply to and be accepted by the associated department to receive the minor.

Learning Outcomes

The Environmental Science major has the following learning outcomes:

- Ability to apply theories or concepts from coursework to analysis of issues in the field

- Ability to make meaningful contribution to analysis and solution of particular issues involving multiple disciplines and stakeholders with different perspectives
- Critical thinking skills, problem-solving abilities, and familiarity with computational and data collection and analysis procedures essential to the field
- Ability to identify ethical issues raised by a particular issue
- Ability to analyze the consequences of various professional dilemmas
- Ability to work productively with others as part of a team
- Effective oral and written communication skills

Preparation for the Major

Required: Chemistry 14A, 14B, and 14BL (or 20A, 20B, and 20L), Environment 10, Geography 7, Life Sciences 7A, 7B, Mathematics 3A and 3B (or 31A and 31B, or Life Sciences 30A and 30B), Physics 5A and 5C (or 1A and 1B), Statistics 12 or 13 (or Life Sciences 40).

For the **atmospheric and oceanic sciences minor:** Chemistry and Biochemistry 14C (or 30A) or Mathematics 3C (or 32A) or Physics 1C (or 5B) is also required.

For the **conservation biology minor:** Chemistry and Biochemistry 14C (or 30A) or Life Sciences 7C and 23L is also required.

For the **Earth and environmental science minor:** Chemistry and Biochemistry 14C (or 30A) or Mathematics 3C (or 32A) or Physics 1C (or 5B), Earth, Planetary, and Space Sciences 1, and one course from 5, 13, 15, or 61 are also required.

For the **environmental engineering minor:** Mathematics 3C (or 32A) is also required.

For the **environmental health concentration:** Chemistry and Biochemistry 14C (or 30A) is also required.

For the **environmental systems and society minor:** one course from Chemistry and Biochemistry 14C (or 30A), Earth, Planetary, and Space Sciences 1, Life Sciences 7C (and 23L), Mathematics 3C (or 32A), and Physics 5B (or 1C) is also required.

For the **geography/environmental studies minor:** one course from Chemistry and Biochemistry 14C (or 30A), Earth, Planetary, and Space Sciences 1, Life Sciences 7C (and 23L), Mathematics 3C (or 32A), and Physics 5B (or 1C), plus Geography 5 and one course from 1, 2, 3, 4, or 6 are also required. Students should take these courses before enrolling in upper-division courses.

Each course applied toward requirements for preparation for the major must be passed with a grade of C– or better. Students receiving a grade below C– in two courses, either in separate courses or repetitions of the same course, are subject to dismissal from the major.

Transfer Students

Transfer applicants to the Environmental Science major with 90 or more units must complete as many of the following introductory courses as possible prior to admission to UCLA: two general chemistry courses with laboratory for majors, two general biology courses with laboratory for majors, two calculus courses, and two calculus-based physics courses.

Refer to the UCLA transfer admission guide for up-to-date information regarding transfer selection for admission.

The Major

The major consists of four requirements: physical and life science, social science and humanities, practicum/sustainability talks, and minor or concentration, as follows:

Physical and Life Sciences Requirements

Required: Environment 175 and found additional courses from the following physical and life sciences areas. No more than two courses may be from any one department. Atmospheric and Oceanic Sciences 101, 102, 103, 104, M105, 107, 112, 130, 141, Chemical Engineering C118, Civil Engineering 153, 154, M166, Earth, Planetary, and Space Sciences 101, C113, 119, 139, 150, 153, Ecology and Evolutionary Biology 100, 109, 116, 151A, 154, Environment 121, 157, Environmental Health Sciences 100, C125, C152D, C164, Geography 100, 102, 104, 105, M106, M107, 111, 113, M127, M131.

Social Sciences and Humanities Requirements

Required: Environment 140 and two courses from Environment M132, M133, M137, 150, M153, M155, 157, 159, 160, M161, 162, 163, M164, 166, M167, Geography M128, 135, M137, 150, M153, 156, Philosophy 125, Public Policy C115.

Practicum/Sustainability Talks Requirements

Required: Environment 180A, 180B, 180C, and two terms of 185A.

Minor and Concentration Requirements

A minimum of 20 units applied toward the minor requirements must be in addition to units applied toward major requirements or another minor. Successful completion of a minor is indicated on the transcript and diploma.

For the **atmospheric and oceanic sciences minor:** seven 4-unit courses, including (1) three from Atmospheric and Oceanic Sciences M100, 101, 102, 103, 104, M105, M106, 107, C110, C115, M120, 130, 141, C144, 145, 150, 155, C160, C170, 180 and (2) four additional courses, two of which must be upper-division, from any of the above atmospheric and oceanic sciences courses beyond the minimum four required or from Atmospheric and Oceanic Sciences 1, 2, 3, 186 (must be taken twice), Chemistry and Biochemistry 103, 110A, 110B, 113A, C113B, 114, Earth, Planetary, and Space Sciences 15, Ecology and Evolutionary Biology 109, C119A, 122, 123A or 123B, 147, 148, Mathematics 115A, 115B, 132, 135, 136, 146, 170A, 170B, Physics 110A, 110B, 112, M122, 131, 132. Other relevant courses from related disciplines may be substituted with prior approval of the department. At least five courses approved for the minor must be upper-division. One course may be taken on a Passed / Not Passed basis.

For the **conservation biology minor:** Ecology and Evolutionary Biology 100, 116 (or Environment 121), and four to six courses from 100L, 101, 103, 105, 109, 109L, 111, 112, 114A, 114B, C119A, C119B, 122, M127, 129, M131, 142, 151A, 152, 153, 154, 155, 162, 162L, C174, 176, 180A, 180B, any courses associated with the Field Biology Quarter or the Marine Biology Quarter or approved equivalent, Geography 102, 104, M107, 113, M115, 131, 135 (a maximum of two Geography courses may be applied to the minor) are required.

For the **Earth and environmental science minor:** five courses from Earth, Planetary, and Space Sciences 101, 112, C113, 139, 150, 153 are required.

For the **environmental engineering minor:** Civil Engineering 153 and five courses from Atmospheric and Oceanic Sciences 141, Chemical Engineering 100, 101A, 101B, 101C 102A, 102B, 106, 113, C118, C119, C140, Civil Engineering 110, 150, 151, 152, 154, 155, 156A, 156B, 157A, 157B, 157C, 157L, M165, M166, Earth, Planetary, and Space Sciences 101, C113, Environment M114, 134, M153, 157, 159, 166, Environmental Health Sciences C125, C152D, C164, Mechanical and Aerospace Engineering 103, 105A, 105D, 133A, 136, 150A, 174, 182B, 182C are required. Credit for both Chemical Engineering 102A and Mechanical and Aerospace Engineering 105A is not allowed.

For the **environmental health concentration:** Epidemiology 100, two courses from Environmental Health Sciences 100, C135, C185A, C185B, and three courses from Chemistry and Biochemistry 153A, Environmental Health Sciences C125, C140, C152D, C157, C164, 203 are required.

For the **environmental systems and society minor:** seven courses from Environment M109, M111, 121, M130, M132, M133, 134, M135, M137, 150, M153, M155, 157, 159, 160, M161, 162, 163, M164, 166, M167, 186 are required.

For the **geography/environmental studies minor:** three courses from Geography M106, M107, M109, 110, 113, M115, 116, 122, 123, 124, 125, 126, M127, M128, 129, M131, 132, 135, M137, 159C, 159D, 159E, and any two additional upper-division geography courses (except those from the preceding list and courses 194 through 199) are required.

Each course applied toward requirements for the major, except Environment 185A, must be taken for a letter grade. Students must maintain an overall grade-point average of 2.0 (C) or better in all courses applied toward the major.

Honors Program

The honors program provides exceptional students an opportunity for advanced research and study, under the guidance of a faculty member, that leads to the completion of an honors thesis or research project. To qualify for graduation with honors, students must (1) complete all requirements for the major, (2) have a cumulative grade-point average of 3.5 or better in upper-division coursework in the major and an overall GPA of 3.0 or better, (3) complete at least 8 units of Environment 198 taken over at least two terms, and (4) produce a completed satisfactory honors thesis. The honors thesis or research project is in addition to the requirement of the completed practicum in environmental science project. Contact the student affairs officer for further information.

Guidelines for Environmental Science Departmental Honors Program

I. REQUIREMENTS FOR ELIGIBILITY

A. Junior class standing (≥ 90 completed units of university-level course work – do not consider AP or IB units when calculating)

B. Cumulative GPA of ≥ 3.0 in all university-level course work (including courses required as preparation for the major)

C. Cumulative GPA of ≥ 3.5 in course work required in the major (excluding courses required as preparation for the major)

D. At the discretion of the Environmental Science Program, prior completion of one or more specified courses

NOTE: The above are the minimum GPA requirements to earn Departmental Honors at graduation. Students who have a realistic chance of attaining the GPA minimums by their Degree Expected Term but who do not yet qualify at the time of application may be allowed, upon review and approval by the IoES Honors Committee, to pursue Departmental Honors.

II. REQUIREMENTS FOR ADMISSION

A. Selection and agreement of a faculty sponsor (generally a participating faculty member in the Institute of the Environment and Sustainability who should also be a member of the UCLA Academic Senate. If a non-Academic Senate is the primary advisor, a Senate member should act as a secondary sponsor and co-signer.)

B. Selection of a suitable thesis topic.

C. Completion and submission to the Environmental Science Honors Committee of a complete application form, Degree Progress Report, and Prospectus (see Application and Prospectus Guidelines below)

III. ENROLLMENT IN DEPARTMENTAL HONORS PROGRAM

All Departmental Honors students are required to enroll in two to three quarters of Environment 198 for a total of 8 units. Students wishing to pursue Departmental Honors must also complete the Senior Practicum (180ABC) series; Departmental Honors cannot substitute for the Senior Practicum, nor can it be used as a substitute for any other major or minor/concentration requirement.

IV. REQUIREMENTS FOR CONTINUATION ("MINIMUM PROGRESS")

A. Acceptable progress towards completion of required Environmental Science Honors course work, monitored quarterly by the faculty sponsor

B. Acceptable progress towards completion of an Environmental Science Honors Thesis, monitored quarterly or more frequently by the faculty sponsor

C. At the discretion of the Environmental Science Program, participation of the student in additional "enrichment experiences," monitored quarterly by the faculty sponsor

V. REQUIREMENTS FOR GRADUATION WITH DEPARTMENTAL "HONORS" OR "HIGHEST HONORS"

A. Completion of all requirements for the major

B. Cumulative GPA of ≥ 3.0 in all university-level course work

C. Cumulative GPA of ≥ 3.5 in upper division course work in the Major

D. Completion of required Honors course work (Environment 198)

E. Completion and acceptance by the Environmental Science Honors Committee of the Honors Thesis.

Application and Prospectus Guidelines

1. The prospectus should be 2–3 pages with references, and include the following components:
2. Background: What is the motivation and context for the thesis topic? Place the problem in its broader scientific, environmental, and policy (if applicable) context, and include a summary of what is known about the problem already.
3. Explain who the audience is: Who will find this thesis topic important? What agency or group would be interested in the results?
4. Clearly state your objectives. What question are you asking?
5. Include a clear timeline showing the steps you will take to complete the thesis and your approximate time of completion for each. A condensed version of this timeline should be provided on the contract you submit to your advisor.
6. Specifics regarding the thesis: What kind of data are you collecting? What methods are you using? Where will the research take place (e.g. field site)? What type of analysis will you be using? What are your expected results?
7. A brief summary of the support you have or will need to carry out the thesis work. This includes who your advisor is, and your access to the tools you need to get your thesis done.
8. References
9. The thesis must have some depth and measure of completion. Merely assisting on projects in a lab or a research group will not suffice. We expect products (below) focused on one topic.
10. Progress Report: Students must submit a progress report at the end of each quarter for the duration of their enrollment in the Environment 198 Honors Program. This can focus on skills learned and measurements made, as well as preliminary results and if necessary, changes in your research plan. This is a formal requirement, and should be 2–3 pages submitted to the IoES and to your advisor.
11. In order for the honors thesis to be accepted for satisfaction of the Environmental Science Departmental Honors Program, it will need to satisfy the following criteria:
12. You must submit an acceptable written final thesis paper that describes the results of independent research based on an investigation of the literature about the topic, fieldwork, or lab results and data. The thesis should be approximately 20 to 30 pages, but remember, quantity is not a

substitute for quality. You must also make an acceptable oral presentation of your results. The thesis paper and presentation should be complete, and include a motivation and background section that covers its broader context, methods, results, conclusions, and suggestions for further work. The work should be placed in a broader context that includes environmental impacts as well as the implications for specific policy, regulatory, economic and/or social issues where applicable.

13. The oral presentation will normally be made before or after the presentations made by the 180B/C students, typically during the final Environmental Science Colloquium class meeting in spring quarter. It must present your thesis results delivered in a clear, well-crafted and professional manner.
14. The prospectus and thesis should be approved by your advisor, and the thesis should be accompanied by a short statement from your advisor stating the final grade for the project and his or her recommendation for level of honors. It is critical that your advisor understand the commitment they are making to you and your project; the Honors project goes well beyond the expectations of a normal 199 independent study.
15. The Environmental Science Faculty Advisory Committee will determine, with consideration of the advising faculty member's recommendation, the level of Honors to be granted. If for some reason you are unable to complete the thesis or satisfy these criteria, you will still earn the units and the grades for completion of Environment 198 courses, but no other credit will be given.

Deadlines and important information for pursuing the Environmental Science Honors Program:

Application and Prospectus Deadline:

You must submit the attached application and a satisfactory prospectus (proposal of your thesis topic) to the IoES Honors Faculty Committee and to your proposed advisor no later than two weeks before the end of the term prior to the term in which you will enroll for the first time in Environment 198. It is generally advisable to begin the project during fall or winter quarter, but students starting in spring can complete it if enrolled in Environment 198 during summer or the subsequent fall, if eligible to continue at UCLA. Submit these materials, via email attachments, to rdieckmann@ioes.ucla.edu.

Contract Course Deadline: Friday of week two (fall, winter & spring)

Upon acceptance to the Environmental Science Departmental Honors Program, you will need to submit a copy of the Environment 198 enrollment contract signed by your project advisor at the beginning (or earlier) of each quarter for which you will enroll in Environment 198. The strict deadline for contract course enrollment is before the end of week 2 of each quarter in which you will enroll. You will create the Environment 198 course on your My UCLA site, by clicking on "contract courses" and following the step-by-step instructions found there. The 198 course is variable units per quarter, with a mandatory grade basis (not P/NP). You will need to submit a course contract to enroll in the 198 units for each quarter

prior to completing the project. Bring the contract in person to the IoES SAO (Royce Dieckmann) in Life Science 2308.

PRACTICUM VS. HONORS: An independent practicum project is NOT a departmental honors project. The two are separate, and completing the Departmental Honors Program does not exempt one from, or substitute for, the Senior Practicum.

ALTERNATIVES: Any student contemplating pursuing the Honors Program with faculty outside of UCLA or that will take place at another institution must consult with and gain the prior written approval of the IoES Faculty Honors Committee prior to undertaking any such project.

Questions: Email Royce Dieckmann, IoES SAO at rdieckmann@ioes.ucla.edu

Application For Departmental Honors Program In Environmental Science

Complete this application and submit it to the Environmental Science Honors Committee by emailing to rdieckmann@ioes.ucla.edu.

Name: _____

SID# _____

Date _____

Minor/Concentration: _____

As of _____(date), I have completed _____(number of units) of university-level course work. My cumulative GPA in this course work is _____(GPA).

My cumulative GPA in courses required for the Major (but excluding those courses listed as preparation for the Major) is: _____ (GPA)

Proposed Title of Honors Thesis:

Name of Faculty Sponsor (Academic Senate Member):

Department of Faculty Sponsor:

Signature of Faculty Sponsor:

Additional Faculty Sponsor(s):

Prospectus of Proposed Project: Attach (as a Word document) a brief summary of the nature of the topic to be investigated, the techniques, materials, to be used in this investigation, and the results anticipated; include reference citations or relevant bibliographies as appropriate. Please see the attached prospectus guidelines when preparing this document.

Degree Progress Report: Attach a current copy of your degree progress report (available via URSA).

Practicum substitution requests guidelines

Students wishing to pursue an independent research project in lieu of participating on a Practicum team should contact the IoES Practicum Director, Noah Garrison at ngarrison@ioes.ucla.edu

1. Students wishing to pursue an independent project for the practicum must enroll in Environment 180A in fall quarter of the academic year in which you will graduate. There is no substitute available for 180A. This is a stand-alone course that provides a variety of important skills that are not provided elsewhere.
2. You must be in good academic standing, and have a minimum GPA of 3.0 or better in the major.
3. You must submit a satisfactory prospectus (proposal of your project) to the IoES faculty committee and to your proposed advisor by [date varies based on date group projects will be assigned]. The prospectus should be 2–3 pages with references, and include the following components:
4. Background: What is the motivation and context for the project? Place the problem in its broader scientific, environmental, and policy (if applicable) context, and include a summary of what is known about the problem already.
5. Explain who the audience is: Who will find this project important? What agency or group would be interested in the project results?
6. Clearly state your objectives. What question are you asking?
7. Include a clear timeline showing the steps you will take to complete the project and your approximate time of completion for each. A condensed version of this timeline should be provided on the contract you submit to your advisor.
8. Specifics regarding the project: What kind of data are you collecting? What methods are you using? Where will the research take place (e.g. field site)? What type of analysis will you be using? What are your expected results?
9. A brief summary of the support you have or will need to carry out the project. This includes who your advisor is, and your access to the tools you need to get your project done.
10. References

11. The project must have some depth and measure of completion. Merely assisting on projects in a lab or similar will not suffice, and although you can help with more than one project, we expect products (below) focused on one project.
12. Progress Report: For projects lasting longer than one quarter (the most common situation), you will need to submit a progress report before the end of the first quarter. This can focus on skills learned and measurements made, as well as preliminary results and if necessary, changes in your research plan. This is a formal requirement, and should be 2–3 pages submitted to the department and to your advisor. Students who fail to submit an acceptable progress report will not be permitted to enroll in the second term of Environment 199 until the progress report has been submitted.
13. In order for the project to be accepted as a substitution for Environment 180B and C to fulfill the Practicum component of the Environmental Science major, it will need to satisfy the following criteria:
14. You must submit an acceptable written final project report, and make an acceptable oral presentation of your results. The paper and presentation should be complete, and include a motivation and background section that covers its broader context, methods, results, conclusions, and suggestions for further work. The work should be placed in a broader context that includes environmental impacts as well as the implications for specific policy, regulatory, economic and/or social issues where applicable.
15. The oral presentation will normally be made before or after the presentations made by the 180B/C students, typically during the final Environmental Science Colloquium class meeting in spring quarter. It must be a scientific presentation of your project results delivered in a clear, well crafted and professional manner that is on time (does not go over the allotted time limit, and uses at least 90% of the allotted time). If your presentation does not pass, you will have one more chance to make an oral presentation in front of one or more appropriate faculty.
16. The prospectus and final paper should be approved by your advisor, and the final paper should be accompanied by a short statement from your advisor certifying that you performed work at least equivalent to 10 units of independent research. It is critical that your advisor read and understand the commitment they are making to you and your project; the practicum project goes well beyond the expectations of a normal 199 independent study.
17. The Environmental Science Faculty Advisory Committee will determine whether the final project is a satisfactory substitution for the Practicum. If for some reason you are unable to complete the project and satisfy these criteria for course substitution, you may still be eligible to apply the unit credit towards upper division credit for your major by petition.

Deadlines and important information for pursuing an independent project for the Practicum:

Prospectus Deadline:

You will need to have your prospectus document completed by [the week that group projects are assigned]. The deadline to submit a final, polished prospectus to the faculty committee of the IoES will be the end of [the week that group projects are assigned] and you must secure a faculty advisor by that time. This is accomplished much more easily with a strong prospectus. Email a copy to rdieckmann@ioes.ucla.edu to distribute to the faculty committee.

Contract Course Deadline: Friday of week two (winter & spring)

You will need to submit a signed copy of the following contract with your project advisor at the beginning of winter quarter or earlier, along with your course enrollment contract, before the end of week 2 of winter quarter to the IoES SAO (Royce) in Life Science 2308. You will create the Environment 199 course on your MyUCLA site, by choosing the link for "contract courses" and following the step-by-step instructions found there. The 199 is 4 units per quarter, with a mandatory grade basis (not P/NP). You will need to also submit a course contract to enroll in the 199 units for spring quarter.

- **Honors**: An independent practicum project is NOT a departmental honors project. However, if you are enrolled with College Honors, the 180A/B/C courses already automatically grant units with College Honors. Students who qualify to apply for the Departmental Honors Program will be contacted with guidelines and instructions for applying to that program.
- **Alternatives**: Students interested in the Field Biology Quarter or the Marine Biology Quarter should consult with Royce Dieckmann, SAO in the IoES, prior to the deadline for independent project prospectuses, and with the counselors in the Ecology & Evolutionary Biology department regarding availability and admission to those programs. Any student contemplating a project with faculty outside of UCLA or that will take place at another institution must consult with the IoES prior to undertaking any such project and before the week 4 deadline for independent project prospectus.

Students whose proposals are rejected by the IoES faculty committee will be placed with 180B/C groups.

Policies and Procedures

Below you will find the College Academic Counseling website, which has information on just about any academic regulation that applies to undergraduates. Also included here are their quick-reference guides for the most frequently-accessed information.

http://cac.ucla.edu/

Informational Guides & Links

- Calculating GPA
- Departmental Counselor Directory
- Dismissal Appeal
- Expected Cumulative Progress (ECP)
- Graduation Checklist
- Graduate in Absentia
- Incomplete / Deferred / In Progress Grades
- Pre-Health Requirements
- Readmission
- Course Repeat Policy
- Residency
- UNEX Concurrent Enrollment