This course will survey the diversity, structure and functioning of California’s ecosystems through time and the ways they have influenced and responded to human activities and stewardship. Topics will include ecosystem drivers such as climate, soils, and land use history; human and ecological prehistory of the state; comparative marine, freshwater, and terrestrial ecosystem dynamics; and managed ecosystems such as range, fisheries and agriculture in California. The course will also emphasize important skills to understand as a scientist or consumer of scientific information, including data collection, exploration and analysis; library-based research on ecological topics; and scientific and science writing.

The course prerequisite for UCSC students is ENVS 100. Cross-campus and non-ENVS students need to have taken one course each in statistics, ecology and writing, and can request a permission code from the instructor by providing transcripts indicating that these courses have been completed successfully. This course serves as one upper-division natural science course in the UCSC ENVS major.

Teaching staff
Instructor: Erika Zavaleta, Zavaleta@ucsc.edu
Teaching assistant: Elissa Olimpi, eolimpi@ucsc.edu

Course website and components

Course Website: Enrolled students can begin the class on 1/4/16 at login.uconline.edu

This course is made up of (1) content materials (video field trips and narrated slide lectures) organized into 31 topic units, grouped into five thematic modules; (2) three to four field laboratory exercises designed to be done on your own, each followed by data-sharing; a data analysis and writing workshop (to be scheduled to maximize participation once student schedules are available; and a short assignment designed to help you develop your scientific writing and data reporting skills; (3) a final exam; and (4) a research paper assignment designed to allow you to explore a topic of your choice in greater depth.

Readings
The readings for the class will be drawn mainly from *Ecosystems of California*, edited by Erika Zavaleta and Harold Mooney and available for online purchase in hard copy or as an e-book (http://www.ucpress.edu/book.php?isbn=9780520278806). Additional readings will be provided in the form of online sites and documents.

We recommend doing readings associated with each unit before watching the related lectures and video field trips.

Student Grading and Evaluation
Students’ achievements will be evaluated through (1) participation in video field trips and lectures, via responses to writing prompts in each video and slide lecture, (2) participation in lab discussion sessions; (2) quizzes focused on informational content from the lectures and readings.
(one for each unit); (3) 3-4 brief field writing assignments; (4) an individual research paper (6-8 pages); and (5) a final exam.

**Grading Breakdown**

<table>
<thead>
<tr>
<th>Component</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecture/ video field trip participation</td>
<td>15%</td>
</tr>
<tr>
<td>Unit quizzes</td>
<td>20%</td>
</tr>
<tr>
<td>Field workshop participation (online)</td>
<td>5%</td>
</tr>
<tr>
<td>Field reports</td>
<td>20%</td>
</tr>
<tr>
<td>Individual research paper</td>
<td>20%</td>
</tr>
<tr>
<td>Final exam</td>
<td>20%</td>
</tr>
</tbody>
</table>

**Learning Objectives for the Course** *(see p. 5 for major learning outcomes addressed)*

Students will be able to describe the interacting forces that underlie the evolution and maintenance of California’s exceptional diversity of ecosystems. Students will be able to describe the characteristic components of California’s major ecosystems and the processes that give rise to and maintain this character. Students will be able to compare the relative contributions of these processes to shaping different ecosystem types and to describe how research in California’s ecosystems has contributed to general ecological theory. Students will be able to critically evaluate management, restoration and conservation approaches proposed for California’s diverse ecosystems. Students will be able to research, individually and collaboratively, specific topics in the ecology and stewardship of California’s ecosystems in greater depth. Finally, students will be able to analyze and evaluate tradeoffs between the human benefits derived from California’s ecosystems and their degradation.

The course will proceed as follows, with 31 units organized into 5 modules, and with three field exercises tailored to the locations of enrolled students.

**Module 0: INTRODUCTION**

Unit 1: *Introduction to California’s ecosystems and this course*
Overview of course resources: course readings, guide to scientific writing, JMP statistics and graphing tutorial, research tools and links.

**Module 1: DRIVERS of California’s ecological patterns**
Unit 2, *Climate and Atmosphere*
Unit 3, *Fire as an Ecosystem Process*
Unit 4, *Geomorphology and Soils*
Unit 5, *Population and Land Use*
Unit 6, *Oceanographic Drivers*
Unit 7, *Biological Diversity and Invasions*

**Module 2: MARINE ECOSYSTEMS**
Unit 8, *The Offshore Ecosystem*
Unit 9, *Shallow Rocky Reefs and Kelp Forests*
Unit 10, *Intertidal*
Unit 11, *Estuaries*
Unit 12, Sandy Beaches
Unit 13, Coastal Dunes

Module 3: AQUATIC AND MONTANE ECOSYSTEMS
Unit 14, Wetlands
Unit 15, Lakes
Unit 16, Rivers
Unit 17, Montane Forests
Unit 18, Subalpine Forests
Unit 19, Alpine Ecosystems

Module 4: LOWLAND TERRESTRIAL ECOSYSTEMS
Unit 20, Coastal Sage Scrub
Unit 21, Grasslands
Unit 22, Chaparral
Unit 23, Oak Woodlands
Unit 24, Coast Redwood Forests
Unit 25, Deserts

Module 5: MANAGED SYSTEMS AND STEWARDSHIP
Unit 26, Managed Island Ecosystems
Unit 27, Marine Fisheries
Unit 28, Forestry
Unit 29, Range Ecosystems
Unit 30, Agriculture
Unit 31, Urban Ecosystems

Computers and Data Analysis
For this class you will need:

- Reliable computer
- Reliable internet connection
- Webcam and a microphone (built-in or peripheral)
- Modern web browser (Firefox, Safari, or Chrome)
- Word or similar word processing software
- Excel or similar data entry and manipulation software
- Google Drive to share data and documents
- JMP statistics software (available through ITS for free to UCSC students: http://its.ucsc.edu/software/jmp/)
- Other required software will be available on the course website.

Writing Assignments
Each student will write a 6-8 page research paper on a topic selected by him or her in consultation with the course staff. Our goal is to provide you with an opportunity to engage the scientific literature to investigate more deeply a theme or question from the readings, lectures, field trips, or field assignments. The assignment will proceed in stages, including a proposed topic and preliminary list of references; a peer-reviewed draft; and a final revision.
In addition, each student will complete 3-4 short (1- to 3-page) assignments based on data collected during the field exercises and involving data exploration, graphing, statistical analysis, and formal scientific writing. Online workshops will be conducted to introduce and support each field assignment.

Field Exercises
You will be going out to collect some basic field data a few times over the course of the quarter to contribute to course-wide datasets about statewide and local ecological patterns. A key to being able to assimilate information outdoors is comfort.

- Eat and drink water before and during field trips. Things like peanuts, raisins, cheese, fresh or dried fruit, or chocolate are good snack choices. A quart-sized container of water is essential.
- Dress in layers, so garments can be added or subtracted as necessary to maintain body temperature in cold, windy weather. A shirt and outer sweater (preferably wool or fleece), along with a vest and/or windbreaker, make a good combination. You don't have to wear them all at once! Wear sturdy pants (shorts are often a disaster in the field) and closed shoes with socks and some traction, such as tennis shoes. Carry a warm hat and a sun hat (e.g. baseball cap).
- Gloves, not mittens, are a better choice, since it's easier to adjust the focus of your binoculars, take notes, and handle plants while wearing gloves.
- Consider lip protection, sunscreen, and sunglasses for bright, sunny days.

Things to Bring
- Watch: weatherproof and digital. Stopwatch function is also useful.
- Binoculars and hand lens if you have them.
- Field Notebook with pens and pencils
- Smart phone or digital camera
- Backpack
- Food and drink
- Field guides if you have them

POISON OAK: California has a lot of it, so you have to take precautions to avoid it. First, be able to identify it – look at some pictures online; leaves of three. Second, wear long pants and a long sleeve shirt if you are sensitive. Third, get it off yourself as soon as possible if exposed. Your first line of defense is to rinse off with COLD water as soon as possible. Buy some Tecnu if you get exposed; when you get back home, follow the Tecnu instructions followed by a cool shower. After your field trip, if exposed, wash your field clothes – separately if you can – to get the oil out of your clothing.

TICKS: Ticks are a possible chance to experience parasitism. While many can be around, and you are fairly likely to see them, you’re unlikely to have one bite you if you follow some simple guidelines:
- wear long pants and socks (a light color helps you see them); brush off your pants if you walk into vegetation
- check for them when you get home -- on your clothes and in the places where they are
likely to hit a barrier and stop (beltline, sockline, hairline/ neck, other nooks and crannies like armpits). Wash your clothes and take a shower.

If you do get a tick embedded in your skin, (1) estimate how long it has been there – if <24 hours, you are in good shape with respect to exposure to Lyme disease. (2) Use tweezers to gently and slowly pull the tick STRAIGHT out (no twisting or angles) to get all the parts out from under your skin. If you think it’s been in for more than a day, keep it so that you can get it tested for Lyme if necessary. If you notice a red ring or swelling in the days to weeks after the bite, or if the tick could have been in for >24 hours, take yourself and the tick (in an envelope, e.g.) to the doctor.

**Learning outcomes addressed**

This course addresses the following learning outcomes of the Environmental Studies major at UCSC:

2. Describe the structure and functioning of major physical and ecological components of the earth’s systems.
3. Access and analyze a complex literature addressing specific topics in environmental studies, and evaluate the usefulness and limitations of individual sources of information.
4. Demonstrate effective oral and written communication skills.

This course addresses the following learning outcomes of the Ecology and Evolutionary Biology major at UCSC:

1. Students will demonstrate broad-based knowledge of the fundamentals of Ecology, Behavior, Evolution and Physiology and the relationships among these disciplines.
3. Students will demonstrate skills in identifying, accessing, comprehending and synthesizing scientific information, including interpretation of the primary scientific literature. This includes understanding key questions and hypotheses, interpreting results and conclusions, and evaluating quality through critique.
5. Students will demonstrate an ability to understand and apply fundamental quantitative skills, including models and statistical analyses, so as to properly interpret published research and apply such skills in their own research.
6. Students will demonstrate the ability to communicate original scientific work in the form of a scientific paper, as well as in oral or poster presentations.