

Syllabus BIEB 174 "Ecosystems and Global Change"  
Fall quarter 2022, in person Lectures T/Th 9:30-10:50 a.m. (Mosaic 114)  
Final exam December 8, 8-11am Location TBD

Note: **everyone must wear masks in classrooms at all times, no eating or drinking in classrooms, please wear masks when entering and exiting the classroom to reduce potential for disease exposure**

Instructors:

Professor Andrew Barton (he/his), [adbarton@ucsd.edu](mailto:adbarton@ucsd.edu)  
Office hours: Tuesday 1pm on Zoom

Professor Elsa Cleland (she/hers), [ecleland@ucsd.edu](mailto:ecleland@ucsd.edu)  
Office hours: Wednesday 11am on Zoom (starting Oct. 12)

For this quarter Professor Barton will maintain grades and records of accommodations, please email him regarding these issues. Note that IAs should be contacted regarding grades for discussion sections. This course is co-taught by two faculty with complementary expertise, and each faculty member can only answer questions on the lectures they give; IAs can answer questions on all material given in the course.

Discussion Sections: Sections will be held in person (Center Hall 217B), with the exception of the 9pm section which will be held on Zoom (see Canvas for Zoom links).

Instructional Assistants:

Jacqueline "Jackie" Kinch (she/they), [jekinch@ucsd.edu](mailto:jekinch@ucsd.edu)  
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Course description: In recent decades human activities have altered ecosystems around the globe, through changes in climate, land use, and nutrient cycling. Understanding the impacts of these global changes requires a background in ecosystem ecology, a field that scales phenomena from physiological processes within organisms to global biogeochemical cycles of carbon, nitrogen and water. "Ecosystems and Global Change," will teach the fundamental concepts of ecosystem ecology, while using examples from current research in the field of environmental science. This course is designed to fulfill two primary goals: providing depth to students who want training in ecosystem science in an upper division course towards their Biology major, and providing breadth in environmental science to students in other science majors. Prerequisites: BILD 3 is the only pre-requisite. BIEB 174 is an upper division course and will build on introductory ecology concepts presented in BILD 3. While not required, introductory chemistry and physics courses will be helpful. Basic algebra is also required (simple linear equations, ratios).

Textbook: The course uses an advanced undergraduate text: "Principles of Terrestrial Ecosystem Ecology" by Chapin, Matson & Vitousek (2011), Second Edition, Springer. This version is freely available to students as an e-book (<https://link.springer.com/book/10.1007/978-1-4419-9504-9>). You will need to be on campus or enable the UCSD VPN to access the book. It is also available in an inexpensive paperback edition. Please note: the second edition is substantially revised and the chapter numbering does not correspond to the first edition. Please do not attempt to use the 2002 first edition version of the textbook, it has become outdated. In addition to this textbook, for some lectures other readings will be assigned and posted on Canvas.

Lectures: Material presented in the lectures will be the majority of what appears in exams, and the question and answer sessions during class time are an opportunity to clarify points of confusion and hear

questions from other students. Lectures will be podcast and available at [podcast.ucsd.edu](http://podcast.ucsd.edu) after the lectures. The podcasts are an excellent tool for studying and reviewing lecture materials, but should not replace attending lectures. In some rare cases, for technical reasons, the podcasts may be unavailable or incomplete. **Please do not attend lectures in person if you are ill and/or have any cold/flu-like symptoms.**

Discussion sections: Discussion sections are designed so that students have the opportunity to think critically and creatively, communicate ideas both verbally and in writing, and learn through peer-peer interactions. Approximately 5-8 review questions will be assigned each week, and posted on Canvas. To answer these questions, you will usually need to read the assigned readings prior to its corresponding lecture (i.e., you'll need to "read ahead."). The discussion section grade will be equally divided between weekly participation and written assignments.

The written questions must be submitted to Canvas **by 8am on the day of your assigned section** (up to 50% credit given for late submissions; don't wait until the last minute to submit to avoid issues such as power outages, etc.). The answers to discussion section questions must be your own work, and may not be copied wholly or in part from the textbook, lecture slides, external sources or other students. An initial submitted assignment with suspected plagiarism will receive a score of 0 points. Any subsequent submission of an assignment with plagiarized content will constitute a violation of UCSD's policy on Academic Integrity.

During section, students will discuss an assigned question in small groups, and will then present that answer to the larger group. Hence, it's important to come prepared. The submitted questions will be graded based on completeness but not accuracy, so it is the students' responsibility to make sure they understand the answers by participating in section discussion. A great way to do this is to "correct" your answers during the section. Participation in discussions is critical to doing well in the course. **Please do not attend sections in person if you are ill and/or have any cold/flu-like symptoms.**

If you have a serious and unavoidable issue that makes it impossible for you to attend discussion (illness, including symptoms consistent with COVID-19, emergency or unavoidable absence), you must 1) email your IA before section, or as soon as possible in case of an emergency, 2) submit documentation of the issue (screenshot of your daily symptom checker is sufficient in the case of illness or symptoms), 3) submit your review questions on time, and 4) email a 300-400 word essay on one of the main topics from lectures in the previous week (the essay is due within five days of the missed section). If these conditions are satisfied students will receive full credit for both participation and review questions (as described below, up to 50% credit will be given for late review questions). **Note that IAs keep track of all discussion section points.**

Group work during discussion section: Working in a group is a great way to practice productive professional relationships. You should treat your fellow students in the same way that you would want to be treated in a workplace. Treat everyone with respect, and ask questions rather than make assumptions about shared views or experience. Put your best effort into group work, including listening to everyone's perspectives and ideas. By entering into the class, you have agreed to abide by UCSD's Principles of Community: <https://ucsd.edu/about/principles.html>

"Office hours" and email: Based on student feedback that they prefer the flexibility of Zoom office hours, we've pivoted away from in-person "office hours" to Q&A Zoom sessions, where you can submit your questions via chat or voice. When you look in the Calendar on Canvas, you'll see that we have multiple opportunities for Q&A per week to facilitate interaction among students, faculty, and IAs. The Q&A sessions are where you should have all of your questions answered about course content, and they are scheduled at different times of day to accommodate students with different schedules. **We cannot answer content questions via email;** this policy is based on years of experience - often times if students have a question, their understanding of a topic is "muddy," making the question unclear, and it's hard for us to know if we've addressed your question via email. Much better to just come to the Q&A! If you need to

have a confidential discussion about unavoidable absences or other circumstances that are impacting your learning, or you'd like to discuss graduate school pathways with faculty etc., please email us to set up a one on one Zoom meeting.

Expectations: This is an upper division course, and will build on concepts gained in lower division courses. Ideally you will find it challenging but not overwhelming. As a 4 credit course, the expected time commitment is 12 hours per week (4 hours in lecture/discussion section and 8 hours of outside reading/studying). Schedule this amount of time in your weekly schedule so that you feel prepared for lecture/discussion and confident for your exams.

Academic integrity: Academic integrity is taken extremely seriously at all universities, and UCSD is no exception. Our expectations for this course are as follows: You may collaboratively discuss discussion section questions with other students at any time before the final exam, but you must write the answers in your own words (two students may not submit the same written work, this would constitute cheating, and will be monitored by Turnitin plagiarism software). **To be clear, you may not copy and paste any material from lecture slides or readings to answer discussion questions, this will result in zero points and possible referral to the Academic Integrity office.** You may not use any resources nor copy another student's work during the in person tests and exam. **Any student caught cheating will fail the course.** In other words, just do your own best work, and be confident that we as faculty and IAs will do our part to maintain a learning environment where academic integrity is supported. For information on academic integrity at UCSD: <http://senate.ucsd.edu/Operating-Procedures/Senate-Manual/Appendices/2>

#### How to do well in the course

1. Focus on the big picture. Ecosystems are dynamic and exciting, if you can cultivate a curiosity about how they work, the material will be more interesting to you, and will “stick in your head.”
2. Approach lectures and section ready to focus on the material. Read the chapter before lecture, and answer the review questions prior to section.
3. Immediately after lecture, complete the lecture follow-up questions (Canvas quiz). Think about the questions, and figure out if there are areas that you don't understand, these concepts will likely return on tests and exams.
4. After lecture, look again at the review questions associated with the chapter covered, and use your lecture notes to help you answer the questions completely. Schedule 8 hours a week reading, studying, and answering review questions.
5. Participate in discussion section, sharing your answer to the review questions with other students. Note when the IAs or other students add additional aspects to the answer that you didn't think of. Your biggest challenge is to figure out what you don't know.

Grading & Assessment: Assessment reinforces the ideas presented over the quarter, and allows students to gauge their progress in the subject. Grading will be based proportionally on the following assessments:

72% Tests and Exams. There will be 4 in-person assessments during the quarter, 3 mid-term tests and a final exam (which will be in the same format, so like another mid-term). The assessments will consist of multiple choice and short-answer questions. **We will drop the lowest score among the tests and final exam**, such that the remaining 3 assessments are each worth 24% of your final grade. This is to account for events that could cause you to miss a test, or impact your performance, such as illness, quarantine requirement, social unrest, etc. **We recommend all students take the final exam**, as it is unlikely you will know your mid-term 3 grade before the final.

8% Lecture follow-up questions (think of these as asynchronous clicker questions, or participation points). There will be a short Canvas quiz associated with each lecture, consisting of multiple choice questions that will serve as practice questions for your graded tests. These are meant to encourage you to

engage with the lecture. There are unlimited attempts to get these questions correct. The post-lecture follow-up questions must be completed 24 hours prior to the test covering the material (that is, one day in advance of the test). Because these can be completed remotely, no credit will be given for late submissions, except in truly exceptional cases with documentation (e.g. hospitalization).

20% Discussion Sections. For each discussion section, equal points will be given for A) participation in one discussion section per week, and B) complete answers to the weeks' questions turned in on Canvas by 8am on the day of your assigned section (up to 50% credit for late submissions, final deadline to submit is Dec. 2).

We will use the following grading scale this quarter for final grades:

A+ 100% to 98%  
A <98% to 90%  
A- <90% to 88%  
B+ <88% to 85%  
B <85% to 80%  
B- <80% to 78%  
C+ <78% to 76%  
C <76% to 70%  
C- <70% to 65%  
D <65% to 60%  
F <60%

**What will be on the tests/exam?** The assessments will focus on material that has been presented during lectures, and discussed in section. You do not need to know details from the reading that are not covered in the lectures. You should consider lectures, discussion sections, and Canvas quizzes as practice for the in-person assessments.

**Please note that there will be no make-up tests or final exam.** If you miss a test or the final exam, you will be assigned zero points for that assessment (remember you can drop the lowest grade). If you miss a test due to a serious illness, emergency or unavoidable absence we recommend you provide documentation to the faculty within 5 days of the assessment, because it allows faculty to advise you on how best to stay current with the material, and ensure you're on track to do well with your remaining assessments. In the unlikely event that you miss more than two assessments due to these kinds of serious, unavoidable issues (including need to quarantine), you can complete an equivalent alternate assignment, covering the material from the missed assessments. Documentation for the unavoidable absences will be required in order to obtain credit for this alternate assessment (screenshot of the daily symptom checker is sufficient in the case of illness/symptoms).

#### Schedule of lectures, readings, and assessments

**Sept 22: Lecture 1:** Earth's Physical Climate Part 1 (Barton), Ch. 2

Earth's climate, landforms & vegetation contributions to climate; ecosystems of the globe and their relationships to climate

**Sept 27: Lecture 2:** Carbon Cycle Part 1 - focus on marine ecosystems (Barton), ocean-focused selections from Ch. 5-7

**Sept 29: Lecture 3:** Nitrogen Cycle (Barton) Ch. 8

Nitrogen (N) inputs to ecosystems; biological N-fixation; N mineralization and pathways of loss; human-caused N deposition, causes & consequences

**Oct 4: Lecture 4:** Other Nutrient Cycles (Barton) Ch. 9, 14 Phosphorus, iron, sulfur; interactions among nutrient cycles

**Oct 6: Lecture 5:** Trophic Dynamics (Barton) Ch. 10  
Plant-based trophic systems versus detritus-based trophic systems; trophic efficiencies; food webs and trophic cascades

**Oct 11: Test 1, Lectures 1-5**

**Oct 13: Lecture 6:** Geology and Soils (Cleland), Ch. 3. Controls over soil formation & loss; soil profiles, horizons & classification; soil properties in relation to ecosystem functioning

**Oct 18: Lecture 7:** Water and Energy Balance (Cleland), Ch. 4  
Ecosystem water inputs and losses; water movements among soil, roots, leaves, canopies; evapotranspiration and the energy balance

**Oct 20: Lecture 8:** Carbon Cycle Part 2 - focus on terrestrial plant carbon budgets (Cleland), Ch. 5-6  
Photosynthetic pathways (C3, C4, CAM); net photosynthesis in the leaf; limitation by light, CO<sub>2</sub>, water and nitrogen Plant respiration; net primary production (NPP); allocation of growth to different tissues; tissue turnover; global distribution of biomass and NPP; net ecosystem production (NEP) and controls

**Oct 25: Lecture 9:** Carbon Cycle Part 3: Decomposition (Cleland) Ch. 7  
Biological breakdown of litter by bacterial, fungi and animals; litter breakdown through chemical and physical processes; environmental and enzymatic controls over decomposition; long-term carbon storage in soil

**Oct 27: Lecture 10** Species Effects on Ecosystem Processes (Cleland) Ch. 11  
The functional trait concept; species-effects on ecosystems, climate and disturbance regimes; relationship between biodiversity and ecosystem function

**Nov 1: Test 2 Lectures 6-10**

**Nov 3: Lecture 11:** Temporal Dynamics 1 (Barton) Ch. 12  
Interannual versus long-term fluctuations in ecosystem processes; alternate stable states in terrestrial and aquatic systems

**Nov 8: Lecture 12:** Anthropogenic Climate Change (Barton)  
Reading: Summary for policy makers, IPCC Working Group 1, Fifth Assessment Report

**Nov 10: Lecture 13:** Temporal Dynamics2 (Cleland) Ch.12 Disturbance in terrestrial ecosystems, successional processes

**Nov 15: Lecture 14:** Managing and Sustaining Ecosystems (Cleland) Ch. 15 Concepts in ecosystem management: natural variability, resilience, stability; application for managing forests, fisheries; ecological restoration; valuation of ecosystem goods and services

**Nov 17: Lecture 15:** Geoengineering (Barton)  
Reading: Royal Society report on geoengineering “Geoengineering the climate: Science, governance, and uncertainty”

**Nov 22: Lecture 16:** Climate change impacts on California Ecosystems (Cleland)  
Optional reading: excerpts from the Fourth California Climate Assessment

**Nov 24: Thanksgiving Holiday, no class**

**Nov 28: Last day to turn in late discussion section questions**

**Nov 29: Test 3 Lectures 11-16**

**Dec 1: Review session in class**

**Dec 8: Final exam, integrated questions from across the quarter, 8-11am, location TBD**

Schedule for discussion sections: Questions for the discussion sections will be posted on Canvas before your section meets. The topics for sections meeting on the following dates are as follows (Ch = Chapters in your textbook):

Discussion Section Schedule (all Mondays):

Sept 26 - Lecture 1 (Ch 2)

Oct 3 - Lectures 2 & 3 (Ch 5-7 focused on marine ecosystems & Ch 8)

Oct 10 - Lectures 4 & 5 (Ch 9 & 10) & test review

Oct 17 - Lecture 6 (Ch 3)

Oct 24 - Lectures 7 & 8 (Ch 4 & Ch 5-6 focused on terrestrial ecosystems)

Oct 31 - Lectures 9 & 10 (Ch 7 focused on terrestrial ecosystems & Ch 11) & test review

Nov 7 - Lecture 11 & 12 (Ch 12 & IPCC summary report)

Nov 14 - Lecture 13 & 14 (Ch 12 & 15, intro to lightening debates in section)

Nov 21 - Lectures 15 (Geoengineering, lightning debates in section)

Nov 28 - Lectures 16 (optional reading), test review

Students with disabilities: Students requesting accommodations and services due to a disability for this course need to provide a current Authorization for Accommodation (AFA) letter issued by the Office for Students with Disabilities (OSD), prior to eligibility for requests. Receipt of AFAs in advance is necessary for appropriate planning for the provision of reasonable accommodations. For more information, email the OSD at [osd@ucsd.edu](mailto:osd@ucsd.edu), visit their office at University Center 202 8-4:30 M-F, or go online at <http://disabilities.ucsd.edu/about/index.html>

Resources for student support: A college education teaches you to identify solutions to tough problems. These are skills that future employers will value. University students often encounter non-academic issues as well, and UC San Diego has invested in a variety of resources to help students. You can and should use these resources to ensure your success, here's a partial list that may be useful to you:

**Academic Success**, including advising, tutoring, mentoring, research opportunities etc.:

<https://ucsd.edu/academics/academic-success.html>

**Basic Needs** refers to the most essential resources required to thrive as a student, which includes access to nutritious food, stable housing, and financial wellness resources. **The Hub** is a new UC San Diego space that offers students the opportunity to engage in and link to Basic Needs resources. This includes the Triton Food Pantry: <https://basicneeds.ucsd.edu/>

The **Campus Community Centers** at UC San Diego build community among our diverse population of students, faculty and staff members. Each provides a forum to increase awareness of social issues, encourage dialogue, build community, improve retention, increase outreach and yield, and foster academic success. For a list of the many campus community centers, as well as other resources to support students, go to: <https://diversity.ucsd.edu/centers/index.html>

**Counseling and Psychological Services (CAPS)** provides free, confidential, psychological counseling and crisis services for registered UCSD students. CAPS also provides a variety of groups, workshops, and drop-in forums. For more information, please visit our Counseling Services page: <https://caps.ucsd.edu/>

**CARE at the Sexual Assault Resource Center** is the UC San Diego confidential advocacy and education office for sexual violence and gender-based violence (dating violence, domestic violence, stalking). CARE provides free and confidential services for students, staff and faculty impacted by sexual assault, relationship violence and stalking.

The **Undocumented Student Services Center** is committed to serving our undocumented students and their families through holistic services. We also advocate for generating a sense of community for all students that are undocumented or come from mixed immigration-status families.  
<https://students.ucsd.edu/sponsor/undoc/>

Resources for **Students with Dependents**: <https://students.ucsd.edu/well-being/wellness-resources/student-parents/index.html>

The **Student Veterans Resource Center (SVRC)** is committed to ensuring that military affiliated students successfully make the transition from the military environment to campus life, and are assisted in their progress toward completing their academic degree. In collaboration with other University partners, the SVRC seeks to identify and mitigate the barriers to academic success that are specific to the military affiliated student community. <https://students.ucsd.edu/sponsor/veterans/index.html>