

Syllabus BIEB 174 "Ecosystems and Global Change"  
Fall quarter 2023, in person Lectures T/Th 2:00-3:20 p.m., Franklin Antonio Hall (FAH) 1301  
Final exam December 14, 3 - 4:20 pm, Location TBD

Instructors:

Professor Andrew Barton (he/his), [adbarton@ucsd.edu](mailto:adbarton@ucsd.edu)  
Office hours: Tuesdays 10-11am, 8056 Humanities and Social Sciences (HSS)

Professor Elsa Cleland (she/hers), [ecleland@ucsd.edu](mailto:ecleland@ucsd.edu)  
Office hours: Tuesdays 11-11:30 a.m. Zoom, and I always leave time at the end of class to chat.  
Note that I will not have office hours on Oct. 17<sup>th</sup>

For this quarter Professor Cleland will maintain grades and records of accommodations, please email her 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.

Instructional Assistants:

Rachel Metry (she/her/hers), [rmetry@ucsd.edu](mailto:rmetry@ucsd.edu)

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. 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.

Discussion sections: Zoom discussion sections will be held by your IA at the following times on Wednesdays:  
3-3:50 p.m., 4-4:50 p.m., 6-6:50 p.m., 7-7:50pm

You may attend any of these times on any given week. 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 5-10 review questions will be assigned each week, and posted on Canvas in advance of section. To answer these questions, you will draw upon lecture content and assigned readings. 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. The discussion section grade will be based only on the written assignments submitted to Canvas. Attendance in section is not required but is highly recommended.

The written questions must be submitted to Canvas **by 8am on the day of section** (no credit will be given for late submissions). Please 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. Use of generative AI programs such as ChatGPT, or paid homework programs such as Chegg, are not permitted for these assignments, and suspected cases will be referred to the Academic Integrity Office. An initial submitted assignment with suspected plagiarism and/or academic integrity concerns 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. **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: Professors Barton and Cleland will hold regular office hours during the quarter (see times above). **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 Office Hours! 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 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. A busy schedule is not considered an acceptable reason to request special considerations for coursework and/or grading.

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. Think about the clicker 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.

Clickers: Clickers will be used in lectures to assess participation and attendance (see below). If you do not already have a Clicker, you will need to acquire one. You will need to register your Clicker prior to when we will start using Clickers on October 3. It is your responsibility to have your clicker with you at lectures and to make sure it is working properly. There will be no make-up opportunities for clicker questions, for any reason, nor can you gain clicker credit for submitting questions on paper or other means.

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:

**75% Midterm and Final Exams.** There will be 4 in-person exams during the quarter, 3 mid-term exams 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 midterms and final exam**, such that the remaining 3 assessments are each worth 25% 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.

**16% Discussion Section Questions.** For each discussion section (excluding the final section), students must submit to Canvas answers to weekly study questions. Questions must be submitted to Canvas by 8am on the day of section (Wednesday). Late assignments will receive no credit, but the lowest score for the quarter will be dropped, to allow for late-adds and other unavoidable situations. Attendance in Zoom sections is optional but highly recommended.

**8% Lecture Attendance (Clickers).** To gain full credit, answer 75% of questions in at least 12 lectures, starting October 3. This policy allows for late adds, sickness, forgotten clickers, and unavoidable absences. Partial credit will be given for attendance and participation below this threshold. Clicker answers do not need to be correct to get credit.

**1% Syllabus Contract, #FinAid Assignment.** This Canvas quiz asks students to read the syllabus carefully and completely, and to agree to the policies set forth in this syllabus. This will serve as the assignment that certifies the commencement of academic activity for financial aid requirements.

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 60%

D <60% to 50%

F <50%

**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-ups for tests or final exam.** If you miss a midterm 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 a substantive alternate assignment, covering the material from the missed assessments. Documentation for the unavoidable absences will be required 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 28: 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

**Oct 3: Lecture 2:** Carbon Cycle Part 1 - focus on marine ecosystems (Barton), ocean-focused selections from Ch. 5-7

**Oct 5: 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 10: Lecture 4:** Other Nutrient Cycles (Barton) Ch. 9, 14 Phosphorus, iron, sulfur; interactions among nutrient cycles

**Oct 12: Lecture 5:** Trophic Dynamics (Barton) Ch. 10

Plant-based trophic systems versus detritus-based trophic systems; trophic efficiencies; food webs and trophic cascades

**Oct 17: Lecture 6:** Soils (Cleland), Ch. 3. Controls over soil formation & loss; soil profiles, horizons & classification; soil properties in relation to ecosystem functioning

**Oct 19: Exam 1, Lectures 1-5**

**Oct 24: 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 26: 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 31: 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

**Nov 2: 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 7: 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 9: Exam 2, Lectures 6-10**

**Nov 14: Lecture 12:** Temporal Dynamics 2 (Cleland) Ch.12 Disturbance in terrestrial ecosystems, successional processes

**Nov 16: Lecture 13:** Anthropogenic Climate Change (Barton)  
Reading: Summary for policy makers, IPCC Working Group 1, Fifth Assessment Report

**Nov 21: Lecture 14:** Note no in person lecture this day, it will be pre-recorded and posted in the Media Gallery on Canvas. Clicker points will be assessed via a Canvas quiz.

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 23: Thanksgiving Holiday, no class**

**Nov 28: Lecture 15:** Geoengineering (Barton)  
Reading: Royal Society report on geoengineering “Geoengineering the climate: Science, governance, and uncertainty”

**Nov 30: Lecture 16:** Climate change impacts on California Ecosystems (Cleland)

**Dec 5: Exam 3, Lectures 11-16**

**Dec 7: Review session in class (no clicker points this day)**

**Dec 14: Final exam, integrated questions from across the quarter, 3 - 4:20 pm, Location TBD**

Schedule for discussion sections (on Wednesdays): 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):

Section 1: Oct 4 — Lectures 1 & 2 (Ch. 2 & Ch. 5-7 focused on marine ecosystems)

Section 2: Oct 11 — Lectures 3 & 4 (Ch. 8 & Ch. 9)

Section 3: Oct 18 — Lecture 5 (Ch. 10) & test review

Section 4: Oct 25 — Lecture 6 (Ch. 3)

Section 5: Nov 1 — Lectures 7 & 8 (Ch. 4-6 focused on terrestrial ecosystems &)

Section 6: Nov 8 — Lectures 9 & 10 (Ch. 7 focused on terrestrial ecosystems, Ch. 11) & test review

Section 7: Nov 15 — Lectures 11 & 12 (Ch. 12)

Section 8: Nov 22 — Lectures 13 & 14 (IPCC summary report & Ch. 15)

Section 9: Nov 29 — Lectures 15 & 16 (Geoengineering & California climate change) & test review

Section 10: Dec 6 — final exam 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>