

Plant Ecology in a Changing World (Biology 5460*) – A 3-credit online course	
Class meets online on Tuesday (Section 1) or Thursday (Section 2) at 10:45 am – 12:05 pm	
Course instructors for Sections 1 & 2	Steve Kannenberg, s.kannenberg@utah.edu Jim Ehleringer, jim.ehleringer@utah.edu
Online office hours - scheduled hours weekly TBD	

This course is designed to provide a small-class and engaging experience. BIOLOGY 5460 is offered as an **online course**, with optional self-guided campus walks** during the first five weeks; all other instruction is online via ZOOM. Self-guided campus walks** are described at <https://www.plantecology.net/campus.html> where online maps accessed via a smart-phone will guide the learning experience. Overall, enrollment in this class is capped at 20 students per section in order to offer BIOLOGY 5460 as a small-class and engaging experience where interactions and learning experiences are maximized.

The structure of BIOLOGY 5460 may seem new to many Biology majors	<ul style="list-style-type: none"> BIOLOGY 5460 is offered online with both synchronous and asynchronous components. All course instruction and discussion sessions are online. Self-guided campus walks** provide opportunities to learn campus vegetation and campus sustainability activities. See details at http://plantecology.net/campus-overview. Students will need reliable internet access, a computer, and good familiarity with writing, presentation, and spreadsheet software. Two topics are presented through online videos weekly, with PDFs of all slides provided in CANVAS and at http://plantecology.net. Online quizzes and problem sets accompany these topics. The class is flipped. Students will be expected to do readings and watch teaching videos prior to class time. Class sessions focus on discussion, data analyses, and student-led activities in small groups. Synchronous online class-time participation is required. Students are expected to work in online discussion groups. Students will work on problem sets in groups; group composition will vary biweekly (assignment to a group appears in CANVAS). Students are also provided opportunities to work in self-organized groups for papers, presentations, and, optionally, mini-exams.
Asynchronous online components	<ul style="list-style-type: none"> Instruction for 28 different course topics is through online videos. Reading assignments for each topic are provided as PDF files. Group-based problem sets are used to promote team work. Students will self-organize into groups for development of student papers, presentation, and mini-exam preparation.
Synchronous online components	<ul style="list-style-type: none"> Online class sessions meet once per week and regular participation is expected and will count towards a student's grade. Online student presentations occur at the end of the semester.

* The pre-requisites for BIOL 5460 are BIOL 1620 or BIOL 2010 or instructor permission

** Self-guided walks during the COVID pandemic period.

Topic, Problem Set, Examination, and Paper-due Schedule

Plant Ecology in a Changing World, Fall 2021				
Week of	Topic #	Assignments	Group	
Aug 23-27	1	Adaptation, biodiversity, and the environment	A	
	2	Climate constrains plant distributions		
Aug 30 - Sep 3	3	Biome and climate relationships	A	
	4	Desert and steppe ecosystems		
Sep 6-10	5	Grassland, savannah, and shrub ecosystems	A	
	6	Forest ecosystems		
Sep 13-17	7	Alpine and tundra ecosystems <i>Mini-exam 1 on lectures 1-6 (50 points)</i>	A	
Plant Adaptation (Environment and resource capture)				
Sep 20-24	8a	Microclimate 1 - the biophysical environment	B	
	8b	Microclimate 2 - the biophysical environment		
Sep 27 - Oct 1	9	Plants exchange energy with their environment	B	
	10	The soil-plant-atmosphere continuum		
Oct 4-8	11	Plants acquire carbon and energy through photosynthesis	C	
	12	Photosynthetic responses and adaptation to light and temperature		
Oct 8	<i>Ecology and Climate Change paper due</i>			
Oct 18-22	13	Plant adaptation to water stress	C	
	15	Changing ecosystems associated with water stress		
Resource Utilization (Integrating plant characteristics to enhance performance)				
Oct 25-29	16	Plant architecture and photosynthesis integrate plant activities	D	
	17	Resource allocation and phenology enhance performance		
Nov 1-5	19	Life history, and reproduction: its all about timing and provisioning	D	
	<i>Mini-exam 2 on lectures 8-19 (50 points)</i>			
Plant Responses to a Changing World (Sustainability, persistence, disappearance)				
Nov 8-12	22	Global anthropogenic changes occurring today that impact sustainability	D	
	23	Increased invasive species - characteristics of a serious invasive species		
Nov 15-19	24	Atmospheric changes impact plant performance and evolution	E	
	25	Atmosphere and climate impact photosynthetic pathway advantages		
Nov 22-26	26	Global carbon balance and terrestrial subsidies reduce anthropogenic emission impacts	E	
	27	Warming impacts: phenology, fires, drought stress, and species range changes		
Nov 24	<i>Proposed Ecological Policy paper due</i>			
Engineering Plant Communities (What we design as plant communities)				
Nov 29 - Dec 3	29	Envision Utah - what the pioneers saw, what we see, and what our children will see	Student presentations	
	30	Restoration ecology - plant tolerances and putting the system back together again		
Dec 6-10	31	Managed ecosystems and land-use change	Student presentations	
	32	Urban ecosystems and green infrastructure		

Students are assigned to different groupings A-E during the semester for in-class activities, out-of-class group discussions, and for group assignments

Course Learning Objectives

As an interdisciplinary biology course, the learning objectives of this lecture course are:

1. To reinforce student knowledge of concepts in ecology and plant distribution, so they can describe how the principles of natural selection and mechanisms of genetic change have led to the observed diversity of life over both long-term as well recent evolutionary time frames
2. To reinforce student knowledge of structure and function concepts with expectations that students can apply knowledge of molecular, cellular, and organismal structures to explain the diverse set of functions – ranging from the subcellular to behavioral to ecological – that underlie the remarkable adaptations of individual organisms as well as responses of organisms within communities to different and sometimes rapidly changing environments
3. To reinforce student knowledge of systems-level concepts, including interactions within ecological cycles, so that students can explain how natural systems function and how humans and global changes impact vegetation at landscape and regional scales
4. To further develop critical thinking skills through data evaluation and group discussions such that students can apply the process of scientific reasoning and experimental design
5. To further develop collaboration skills through group projects, presentations, and exam preparation so that students can apply concepts and subdisciplinary knowledge from within and outside of biology to interpret biological phenomena, communicate, and work collaboratively to solve problems
6. To further expose students to the interactions between science and society, including the application of ecological knowledge to evaluate those interactions
7. To further develop writing skills through project assignments and written feedback
8. To further develop oral skills through presentations and group discussions

Achieving Learning Objectives

These course learning objectives will be achieved through online videos, group discussions, reading assignments, team-based assignments with feedback, and opportunities to develop and increase a student's oral and written communication skills. Assignments will require that students are familiar with word processing, spreadsheet, graphics, and presentation software (e.g., MS Word, Excel, and PowerPoint).

Text Books (optional) and Reading Materials

- PDF copies of all assigned readings for each topic are provided in CANVAS
- Lambers et al., *Plant Physiological Ecology* (optional reading through the Marriott Library)

CANVAS and Complementary Course Website

- The CANVAS site contains all class-related files.
- All assignments are available and submitted via CANVAS.
- Each topic is presented as a series of short videos on YOUTUBE (Plant Ecology in a Changing World)
- The website <http://plantecology.net> mirrors information to both students and the public.

Optional Online Discussion Sessions

Two TBD optional, *open, and unstructured* discussion sessions are offered weekly by the instructor to answer questions on topics presented in videos not answered during class time, to get additional experience with the modeling software exercises, and to cover other topics of student interest.

Structure of Scheduled Once-per-week ONLINE Meeting Times (Synchronous)

This class is flipped and offered online (exceptions are optional self-guided, on-campus walks).

The once-a-week flipped-class ZOOM class time will have the following structure:

- **Student participation in discussions is expected** and is valued at 10 points weekly points
- Scheduled in-class time will be via ZOOM, with both entire-group sessions (16-20 students) and smaller breakout sessions as appropriate.
- The first 20 minutes of synchronous class time is allocated to a discussion of key topics presented in the topic videos which must be viewed by students prior to class.
- The next 60 minutes of synchronous class time is dedicated to activities, such as
 - Computer-based modeling activities related on topic themes presented in that week; students will work in groups
 - Data analyses and discussions of papers associated with that week's topics
 - Discussion of news-related events associated plant ecology (e.g., Siberian heat waves, extended drought in the southwest USA, or El Niño related fires in the Amazon)
 - Student-led presentations and evaluations of policy papers
 - Professional skills development (activities TBD)

Problem Sets (Asynchronous)

- There are 9 group-based problem sets and each is worth 25 points.
- Students will be randomly assigned into groups of 4-5 for each problem set.
- Students are expected to work together through CANVAS, ZOOM, or other social media platforms to complete and submit a problem set.
- Students within a group will receive the same score on that problem set and students will evaluate the extent to which partners in the exercise contributed to the group effort.
- After every two problem sets, students will be randomly assigned to new groups.

Mini-exams (Asynchronous)

- ***The instructors are trying a new approach for mini-exams. Students may choose to work individually or in pairs to take these two mini-exams.*** This approach will be discussed before the mini-exam to ensure that students are comfortable with this novel approach.
- There are two mini-exams during the semester and each is worth 50 points. Students will have 90 minutes over a 24-hour period to complete the mini-exams.
- These mini-exams will primarily focus on problem solving and evaluation of experimental data that is provided two weeks prior to the mini-exam. There may be a few multiple choice and fill-in-the-blank for those who feel most comfortable with those testing approaches.
- At the time of the mini-exam, students will download a common mini-exam and will have 90 minutes to complete the mini-exam and to then upload it onto CANVAS for grading.
- During the mini-exam, students may work individually or in pairs on the mini-exam, but they must be physically distanced. The use of CANVAS tools or ZOOM is allowed. If students work in pairs, then their mini-exams must reflect both names and it is expected that identical mini-exam papers will be uploaded by each student.
- As an online course, mini-exams are taken online at the time and location of your choice during the 24-hour time window.
- Students (or student pairs) will sign to agree that they will **not** share mini-exam questions with other students during the exam period. If **not signed**, the mini-exam will not be graded.
- There is no final exam.

Group-based papers (Asynchronous)

There are two group-based papers. The first paper is on “Ecology and Climate Change” and the second is on a “Proposed Ecological Policy”. Guidelines on topics and scope will be discussed extensively during class time and appear in CANVAS; technical details are elaborated below.

- Students will work in groups of four to develop and write these papers. Each student will receive the same score for this assignment.
- Students may self-select to build a team associated with each paper
- Once a team is informed, then the team will submit **both** the topic title and group composition to the instructor; this deadline is four weeks prior to the paper due date.
- A single paper is submitted by each team.
- After submission of (only) the first paper, students will be assigned to read and to provide written peer reviews of papers by two other student groups within a week.
- After papers have been reviewed and critiqued by both the instructor and student reviewers, students are provided an opportunity to revise and resubmit their paper

Assessments

Assessed assignments are individual-based or group-based efforts. For individual-based assignments, students are expected to complete the effort on their own. For group-based assignments, groups of 4-5 students may work together producing a single contribution. Each student within a group receives the same score. For mini-exams, students may work individually or in pairs. Students may find these assessment approaches unusual. However, they are designed to provide team experience, which is the more common workplace approach in today’s society.

Online participation	170 pts	Weekly group participation is expected
Online quizzes	147 pts	Individual based
Online problem sets	180 pts	Group based ; each awarded same score
Paper 1 (Ecology and climate change)	100 pts	Group based ; each receives same score
Paper 2 (Proposed ecological policy)	100 pts	Group based ; each receives same score
Mini-exams	100 pts	Individual based or pair-based

To allow flexibility,

- The lowest problem set score will be dropped (-25 points)
- The two lowest quiz scores will be dropped (-28 points)

Students are not competing with each other for a grade; in theory everyone can achieve an “A”.

A student’s final grade will be based on a cumulative point total (758 points), using a scale approximating score percentages as shown below.

- 91-100% = A; 90% = A-
- 89% = B+; 81-88% = B; 80% = B-
- 79% = C+; 71-78% = C; 70% = C-
- 60-69% = D; <60% = E

It is important to note that 73% of a student’s grade will be based on a combination of class time engagement and on group/team efforts (e.g., online participation, problem sets, and papers).

ADA Information

The Americans with Disabilities Act. The University of Utah seeks to provide equal access to its programs, services, and activities for people with disabilities. If you will need accommodations in this class, reasonable prior notice needs to be given to the Center for Disability and Access, 162 Olpin Union Building, (801) 581-5020. CDA will work with you and the instructor to make arrangements for accommodations. All written information in this course can be made available in an alternative format with prior notification to the CDA.

Addressing Sexual Harassment and Misconduct

Title IX makes it clear that violence and harassment based on sex and gender (which includes sexual orientation and gender identity/expression) is a civil rights offense subject to the same kinds of accountability and the same kinds of support applied to offenses against other protected categories such as race, national origin, color, religion, age, status as a person with a disability, veteran's status or genetic information. If you or someone you know has been harassed or assaulted, you are encouraged to report it to the Title IX Coordinator in the Office of Equal Opportunity and Affirmative Action, 135 Park Building, 801-581-8365, or the Office of the Dean of Students, 270 Union Building, 801-581-7066. For support and confidential consultation, contact the Center for Student Wellness, 426 SSB, 801-581-7776. To report to the police, contact the Department of Public Safety, 801-585-2677(COPS).

Student Safety

The University of Utah values the safety of all campus community members. Report suspicious activity. To request a courtesy escort, call campus police at 801-585-COPS (801-585-2677). You will receive important emergency alerts and safety messages regarding campus safety via text message. For more information regarding safety and to view available training resources, visit <http://safeu.utah.edu>.

Inclusivity, Diversity, Wellness, and Veterans

Names/Pronouns. Class rosters are provided to the instructor with the student's legal name as well as "Preferred first name" (if previously entered by you in the Student Profile section of your CIS account). While CIS refers to this as merely a preference, I will honor you by referring to you with the name and pronoun that feels best for you. Please advise me of any name change or pronoun preference so I can help create a learning environment in which you, your name, and your pronoun are respected. If you need any assistance or support, please reach out to the LGBT Resource Center. <https://lgbt.utah.edu>

Wellness statement. Personal concerns such as stress, anxiety, relationship difficulties, depression, cross-cultural differences, etc., can interfere with a student's ability to succeed and thrive at the University of Utah. For helpful resources contact the Center for Student Wellness at www.wellness.utah.edu or 801-581-7776.

Diversity / Inclusivity. It is my intent that students from all diverse backgrounds and perspectives be well served by this course, that students' learning needs be addressed both in and out of class, and that the diversity that students bring to this class be viewed as a resource,

strength and benefit. It is my intent to present materials and activities that are respectful of diversity: gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture. Your suggestions are encouraged and appreciated. Please let me know ways to improve the effectiveness of the course for you personally or for other students or student groups. In addition, if any of our class meetings conflict with your religious events, please let me know so that we can make arrangements. (Source: University of Iowa College of Education)

Veterans Center. If you are a student veteran, the U of Utah has a Veterans Support Center located in Room 161 in the Olpin Union Building. Hours: M-F 8-5pm. Please visit their website for more information about what support they offer, a list of ongoing events and links to outside resources: <http://veteranscenter.utah.edu/>. Please also let me know if you need any additional support in this class for any reason.