

GEOG435/535

Plants under Stress: Plant-Environment Interactions in a Changing World

Description of Course

Plant ecophysiology is the study of a plant's physiological response to its environment. These responses within vegetation serve to determine patterns in biogeography and community, landscape, and ecosystem ecology. This 3-hour course will (1) revisit the core principles and underlying assumptions that plant ecophysiology is based upon, (2) examine plant responses to a myriad of biotic and abiotic stresses, and (3) familiarize students with ecophysiological tools available to assess those plant responses. Upon completion of this course, students should be prepared to confidently outline and conduct ecophysiological experiments ~ including running, trouble-shooting, and maintaining commonly used equipment and interpreting measured response functions.

Locations and Times

Location and time classes will be held: ***Mon & Wed; 2-3:15pm; ENR2 S495***

Instructor Information

Name: Dr. Greg Barron-Gafford

Office Location: ENR2 S439

Telephone number: 520-548-0388

E-mail address: gregbg@email.arizona.edu

Office Hours: "Open Door Policy"

Web information including course homepage and instructor homepage: on D2L

Course Objectives

During this course students will:

- Gain an understanding of the origins of core principles that underlie our current understanding of plant ecophysiology.
- Read and analyze seminal works in plant ecology literature.
- Examine plant responses to a myriad of biotic and abiotic stresses.

Expected Learning Outcomes

By the end of this course, all students should be able to:

- Understand the basic processes of plant carbon uptake, water loss, and water use efficiency.
- Understand how natural processes and anthropogenic influences control plant function and how these elements interact.
- Use data analysis to develop a physically-based understanding of the processes govern plant responses to abiotic and biotic drivers.
- Demonstrate an ability to design and conduct research using plant ecophysiological concepts and appropriate methods key to biogeography and ecology.
- Communicate effectively orally and in writing to diverse audiences / publics / stakeholders.

By the end of this course, graduate students should also be able to:

- Evaluate and offer peer review, including constructive feedback to research proposals.
- Present research findings in a standard conference format including a 15-minute professional presentation or a 36" X 48" poster.

Topics

Week 1 – Introduction to plant ecophysiology and role in Biogeography and Ecology / Photosynthesis basics / Differences in photosynthetic pathways ~ C3, C4, and CAM

Week 2 – Plant water relations, transpiration, and water use efficiency

Week 3 – Plant responses to drought stress

Week 4 – Plant responses to temperature (both cold and hot) stress

Week 5 – Plant responses to low / high light stress

Week 6 – Plant responses to herbivory

Week 7 – Plant responses to elevated CO₂

Week 8 – Spring Break – No class

Week 9 – Leaf fluorescence: the safety valve for photosynthesis in periods of stress

Week 10 – Assessing plant water status: leaf porometry and leaf water potential

Week 11 – Practical applications: Introduction to the LI-6400 portable photosynthesis system

Week 12 – Conducting photosynthesis response curves I: CO₂ response curves

Week 13 – Conducting photosynthesis response curves II: Light and temperature response curves

Week 14 – Measuring whole-plant fluxes – portable chambers

Week 15 – Evaluation of potential research projects

Course Format and Teaching Methods

This course will be a blend of classroom lecture, discussion of classic and new research articles, and hands-on measurements with plant ecophysiological tools. This will be an experiential course where we put our book and paper knowledge into action by actually measuring plants experiencing a range of environmental stresses.

Required Texts

All reading materials will come from the primary literature and will be posted on D2L.

Required or Special Materials

No special tools or supplies are needed, though a laptop will be helpful when analyzing data in the classroom.

Required/Recommended Knowledge

There are no course prerequisites and any courses that must be taken simultaneously with this course.

Grading Policy

Attendance and Participation (20% of Course Grade)

Class meetings will be mixtures of lectures, discussions, group activities, and writing assignments. Some class time will include practical aspects of data analysis techniques and graphical interpretation.

Your attendance and participation is crucial to your success, and I need feedback to insure I am getting the material across. There will be several 'pop' quizzes and activities throughout the semester. We will also have regular small-group discussions where you will take turns leading and reporting your group's thoughts on a particular topic or paper. I believe upper division courses should be a chance for you to engage more deeply with the material, and these discussion groups are one venue for that critical thinking. Each group will be mentored/co-led by a graduate student in our class.

Writing Assignments (60% of Course Grade)

Five short (~ 2 pages, double-spaced) writing assignments will be required throughout the semester. Assignments are designed to emphasize fundamental principles of research in biogeography. Writing assignments will be submitted to our D2L course Dropbox. NOTE: Late assignments submitted before the following class period will be assessed a one letter grade penalty. No late assignments will be accepted beyond this point.

Project / presentations (20% of Course Grade)

* Undergraduate students will prepare and present slides on exciting or new research results they found in the literature that pertains to a topic from class. You will do this in pairs of 2. ~ 10 minutes per presentation and a discussion led by the students. A brief summary and analysis of the article is due to D2L Dropbox within one week of the presentation. PowerPoint presentations must be emailed to me the day before your presentation.

*** If you are uncertain about selecting a topic, meet with the instructor for suggestions.

* Graduate students will create a conference-quality poster or 20 minute talk associated with an aspect of the field research portion of the class. They will present their posters/presentations at the end of the semester. Upload a poster abstract to D2L Dropbox.

* Graduate students also will help evaluate undergraduate in-class presentations using a rubric supplied by the Instructor. Thoughtful evaluation of undergraduate presentations counts as a portion of the Participation and Attendance grade for graduate students, and provides practice evaluating public presentations.

Grading

The grading weights are as follows:

Attendance & Participation	20%
Writing Assignments	60%
Final Project and Presentation	20%
Total	100%

Final course grades will correspond to the following scale:

A = 90 or above

B = 80 – 89

C = 70 – 79

D = 60 – 69

E = 59 or below

Final Project (there is no Final Exam)

The date and time of the final project, along with links to the Final Exam Regulations, <https://www.registrar.arizona.edu/courses/final-examination-regulations-and-information>, and Final Exam Schedule, <http://www.registrar.arizona.edu/schedules/finals.htm>

University policy regarding grades and grading systems is available at <http://catalog.arizona.edu/policy/grades-and-grading-system>

Late Work Policy

As a rule, work will not be accepted late except in case of documented emergency or illness. You may petition the professor in writing for an exception if you feel you have a compelling reason for turning work in late.

Requests for incomplete (I) or withdrawal (W) must be made in accordance with University policies, which are available at <http://catalog.arizona.edu/policy/grades-and-grading-system#incomplete> and <http://catalog.arizona.edu/policy/grades-and-grading-system#Withdrawal> respectively.

Absence and Class Participation Policy

The UA's policy concerning Class Attendance, Participation, and Administrative Drops is available at: <http://catalog.arizona.edu/policy/class-attendance-participation-and-administrative-drop>

The UA policy regarding absences for any sincerely held religious belief, observance or practice will be accommodated where reasonable, <http://policy.arizona.edu/human-resources/religious-accommodation-policy>.

Absences pre-approved by the UA Dean of Students (or Dean Designee) will be honored. See: <https://deanofstudents.arizona.edu/absences>

Participating in the course and attending lectures and other course events are vital to the learning process. As such, attendance is required at all lectures and discussion section meetings. Students who miss class due to illness or emergency are required to bring documentation from their health-care provider or other relevant, professional third parties. Failure to submit third-party documentation will result in unexcused absences.

Classroom Behavior

To foster a positive learning environment, students are asked to refrain from disruptive conversations with people sitting around them during lecture. Students observed engaging in disruptive activity will be asked to cease this behavior. Students who continue to disrupt the class will be asked to leave lecture or discussion and may be reported to the Dean of Students.

Threatening Behavior Policy

Required language: The UA Threatening Behavior by Students Policy prohibits threats of physical harm to any member of the University community, including to oneself. See <http://policy.arizona.edu/education-and-student-affairs/threatening-behavior-students>.

Accessibility and Accommodations

It is the University's goal that learning experiences be as accessible as possible. If you anticipate or experience physical or academic barriers based on disability, please let me know immediately so that we can discuss options. You are also welcome to contact Disability Resources (520-621-3268) to establish reasonable accommodations. For additional information on Disability Resources and reasonable accommodations, please visit <http://drc.arizona.edu/>.

If you have reasonable accommodations, please plan to meet with me by appointment or during office hours to discuss accommodations and how my course requirements and activities may impact your ability to fully participate.

Please be aware that the accessible table and chairs in this room should remain available for students who find that standard classroom seating is not usable.

Student Code of Academic Integrity

Students are encouraged to share intellectual views and discuss freely the principles and applications of course materials. However, graded work/exercises must be the product of independent effort unless otherwise instructed. Students are expected to adhere to the UA Code of Academic Integrity as described in the UA General Catalog. See: <http://deanofstudents.arizona.edu/academic-integrity/students/academic-integrity>.

The University Libraries have some excellent tips for avoiding plagiarism available at: <http://new.library.arizona.edu/research/citing/plagiarism>

Selling class notes and/or other course materials to other students or to a third party for resale is not permitted without the instructor's express written consent. Violations to this and other course rules are subject to the Code of Academic Integrity and may result in course sanctions. Additionally, students who use D2L or UA email to sell or buy these copyrighted materials are subject to Code of Conduct Violations for misuse of student email addresses. This conduct may also constitute copyright infringement.

UA Nondiscrimination and Anti-harassment Policy

The University is committed to creating and maintaining an environment free of discrimination; see:

<http://policy.arizona.edu/human-resources/nondiscrimination-and-anti-harassment-policy>

Our classroom is a place where everyone is encouraged to express well-formed opinions and their reasons for those opinions. We also want to create a tolerant and open environment where such opinions can be expressed without resorting to bullying or discrimination of others.

Additional Resources for Students

UA Non-discrimination and Anti-harassment policy:

<http://policy.arizona.edu/sites/default/files/Nondiscrimination.pdf>

UA Academic policies and procedures are available at:

<http://catalog.arizona.edu/policies>

Student Assistance and Advocacy information is available at:

<http://deanofstudents.arizona.edu/student-assistance/students/student-assistance>

Confidentiality of Student Records

<http://www.registrar.arizona.edu/personal-information/family-educational-rights-and-privacy-act-1974-ferpa?topic=ferpa>

Subject to Change Statement

Information contained in the course syllabus, other than the grade and absence policy, may be subject to change with advance notice, as deemed appropriate by the instructor.