Spring, 2024

Plant Ecophysiology – Biology 2210 (or ES 2223)

Young Spruces - Rockwell Kent

Professor Barry Logan
Laboratory Instructor: Kyle Martin

Lecture: M & W: 2:50 – 4:15PM
Hatch 214

Laboratory: W,Th or F: 9:05AM – 12:05PM
Druckenmiller 222

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Office Hours:
M & T 9:00-10:00AM
(or by appointment)

M & T 10:00-11:00AM
(or by appointment)

Prerequisites: Biology 1102, 1109 or recommendation of the Biology Department

Course Description: Examines the functional attributes of plants and the manner in which they vary across the plant kingdom by the processes of evolution and acclimation. Topics of focus include photosynthesis and protection against high-light stress, the acquisition and distribution of water and mineral nutrients, and environmental and hormonal control of development. Special topics discussed may include plant parasitism, carnivory, the origins and present state of agriculture, plant responses to global climate change, plant life in extreme environments, and the impacts of local land-use history on plant communities. Contemporary research instrumentation is used in weekly laboratories, some conducted in the field, to enable first-hand exploration of phenomena discussed in lecture.

***Inquiry in the Natural Sciences* & *Mathematical, Computational and Statistical Reasoning* requirements:** This course can be completed to satisfy either the INS or MCSR distribution requirement. This course is dedicated to understanding plant function, distribution and responses to the environment. We will pursue this through lecture; guided problem solving and critical thinking; reading and discussion of journal articles describing original research, review articles & chapters; field excursions; and field/lab exercises designed to offer you opportunities to pursue authentic research using contemporary instrumentation. As such, we will (more than) meet the goals of INS courses through just about every element of the course. Our discussions of published research will focus on the interpretation of data presented graphically and on rigorous assessment of statistical analyses. Our explorations of aspects of plant function, particularly those relating to plant water relations, will be quantitative in nature. The greater share of our field/lab exercises will involve quantitative data collection and analyses. Throughout the course we are "applying general tools of mathematics and statistics" and thus meeting the goals of the MCSR requirement.

Readings: Our class meetings will be supported by readings from various sources including review and primary journal articles, book chapters, and writing Jaret and I have prepared. There is no assigned textbook, although I will be happy to direct you to informative and well-written texts, if you like. Most readings will be in electronic format and placed in a repository on our course Canvas site. I will update our reading schedule regularly during the semester and post it to our course Blackboard site.

Grading: Grades will be determined based upon a 1000 pt. system, composed of the following components (described below):

	Points
Wednesday Check-Ins	100
Waypoints (70 pts. ea.)	280
Article Summary/Ananlysis	120
Laboratory Components	300
Final Exam	200
Total	**1000**
Participation & Involvement	The "*X*" Factor

Wednesday Check-Ins: Most weeks that do not include a waypoint (see below) we will answer a question concerning the lecture material of the preceding two class meetings. Check-Ins provide an incentive to review material. Check-Ins also give me an opportunity to offer you input on your strategies for answering questions in a lower-stakes setting. You must be present in class to complete a Wednesday check-in. I will drop your lowest check-in from your overall score. In the event of an excused absence, I will simply factor the missed check-in out of the determination of the overall grade (*i.e.*, it will not count against you and there will be no make-up).

Waypoints: Each waypoint will be allocated 40 minutes of class time and emphasize material presented in lecture and lab (biological concepts only from lab, not methodological material) since the previous waypoint, with the caveat that we build upon our knowledge through the semester such that 'old' material never loses its relevance. Waypoints include questions that expect you to apply concepts discussed in class to novel scenarios or to synthesize material from more than one class period. On all questions I am searching for *correct*, *complete*, *clear* and *concise* answers.

Article Summary/Analysis: From a collection I provide, you have the opportunity to prepare a summary/analysis of a research article. This need only be 500 words in length. In it you should summarize the experiments and findings, discuss whether the experimental results support the conclusions, and offer your overall impressions of the study/article. You will have the opportunity to revise. [One third of a letter grade will be deducted from papers more than a day late. A further one third will be deducted for every additional three days late (*i.e.,* two thirds for 4 days late, a full letter grade for 7 days late, *etc.*]

Laboratory assignments: These will be described in detail in lab.

Final exam: The final exam will be cumulative and must be completed in person as scheduled. Our final exam, whose timing I cannot control, will be Wednesday, May 15 (1:30-4:30PM). Please arrange your end-of-semester travel accordingly.

Participation & involvement: The success of this course, both collectively and for you as individuals, hinges on your active participation. Lectures and labs require your preparation and input. If you show up for lectures and labs mentally keen and full of zeal, curiosity, and a willingness to engage, then we will all enjoy the course more fully and come away with a meaningful appreciation for plants and plant function. When assigning grades to those students who find themselves "on the borderline," we will give serious consideration to their degree of participation and involvement.

We will not set numerical standards for grades until the end of the course; however, please feel free to make an appointment to discuss how you are doing, if you like.

We expect knowledge of and strict adherence to Bowdoin's Academic Honor Code (which can be found in the Student Handbook).

A passing grade in *Plant Ecophysiology* requires passing knowledge of the subject matter, as reflected by waypoint and final exam scores, for which an average score of 60% or above may be required for passing this course.

Lecture syllabus

Date	Topic	Waypoint/Check-In
Jan. 22	Introductions, Overview & Photosynthesis: broad strokes	
24	Light gathering & Electron transport	
29	Photoprotection	
31	Photoprotection & The Calvin cycle	Check-In
Feb. 5	The Calvin cycle	
7	Sensing photosynthesis remotely	Check-In
12	Translocation	
14	Translocation	Waypoint #1
19	The properties of water & Water potentials	
21	The soil-plant-atmosphere continuum	Check-In
26	The soil-plant-atmosphere continuum	
28	Xylem cavitation	Check-In
March 4	Redwood ecophysiology & The limits to tree height	
6	Dismantling the dogma of unidirectional water flow	Waypoint #2
11	*Spring Break*	
13	*Spring Break*	
18	*Spring Break*	
20	*Spring Break*	
25	Tree rings and what they reveal	
27	Elevated CO_2 and global change	Check-In
April 1	The soil microenvironment & Mineral uptake	
3	Mycorrhizae	Check-In
8	Nitrogen fixation: biological and anthropogenic	
10	Carnivory & Alternative methods of gathering nutrients	Check-In
15	Photomorphogenesis: Phytochromes	Waypoint #3
17	Photomorphogenesis: Phytochromes	
22	Hormones	
24	Hormones	Check-In
29	Plant parasites	
May 1	Drought	Check-In
6	Reproductive physiology	
8	Reproductive physiology	Waypoint #4
May 15	Final Exam – 1:30PM	

Laboratory Schedule

Week	**Laboratory**
Jan. 22	Overview of Our Semester – Common Local Evergreen Plants (Field Excursion)
Jan. 29	Anatomy of Seed Plants
Feb. 5	Methods in Plant Ecophysiology – Light & Photosynthesis
Feb. 12	Methods in Plant Ecophysiology – Chlorophyll Fluorescence
Feb. 19	Methods in Plant Ecophysiology – Leaf Pigments (HPLC)
Feb. 26	Methods in Plant Ecophysiology – Hydraulic Conductivity of Needles & Stems
March 4	Hydraulic Conductivity in Context: Maple Tapping
March 11	*Spring Break*
March 28	*Spring Break*
March 25	Thermogenesis & Respiration (Field Excursion)
April 1	Group-Designed Research Projects
April 8	Group-Designed Research Projects
April 15	Group-Designed Research Projects
April 22	Springworks Aquaponic Farm (Field Excursion)
April 29	Parasitic Plants (Field Excursion)
May 8	*7-9PM* Poster Session (Whole Class)

Laboratory Policy

Laboratory attendance is mandatory. You must discuss any pending conflicts with the instructor *in advance*. Under some circumstances we may allow you to switch between sections on a given week, if that will eliminate a conflict, but this is not to be considered a generally accepted practice.

Read the laboratory before coming to lab. This will ease the flow of the lab session for you, the instructor, and your lab partners.

Many of the lab exercises require that you work in groups. However, each individual is expected to keep track of his/her group's data and, when necessary, data generated by the entire class. You are expected to complete assignments individually. You could be assessed a point penalty for turning in assignments after their due date.
