F510 - Ecophysiology of Trees

Syllabus & Schedule

Course Description

This course was designed to help graduate students develop both a conceptual and practical understanding of how plants respond to their environment. This course involves a lecture/discussion format in order to introduce concepts to students (Lecture) and then provide an opportunity for students to gain confidence in using the terminology and discussing the implications to their field and beyond through discussions. The lab section of the course will introduce students to some of the instruments commonly used in ecophysiology research and give them an opportunity to use as much of the instrumentation and analyze the resulting data. We will often carry out numerical exercises to increase the students' ability to interpret the meaning of data and how it can lead to ecological patterns and processes seen in the field. This course will take a carbon-based approach to ecophysiology, as carbon represents the commodity of the transfer of energy for the plant. Within this framework we will cover the following concepts: Photosynthesis, water uptake and use, respiration, translocation, nutrient uptake and use, seed production/germination, whole-plant growth responses, biomass allocation, age-related growth decline, and global perspectives. Throughout the course we will highlight the special for different functional groups, for example: we will discuss the implications of height on tree growth, the impact of C3/C4 photosynthesis in grassland and desert communities, or the investment in deep roots of shrubs. We will discuss how those factors lead to different growth strategies between woody-species and herbaceous plants as they relate to different topics throughout the semester. However, this class is intended to cover basic ecophysiological concepts that relate to all growth forms, so students interested in ecosystems from grasslands forests will find relevant and engaging topics throughout the semester.

Course Goals

To convert you all to ecophysiologists! Ultimately, my goal is to help you become familiar with the basic concepts and techniques that are fundamental to ecophsyiology so that you can better understand the mechanics of plant responses to their environment.

Specific Learning Objectives

When finished with this course, students should have mastered the following concepts and skills:

1. Describe, measure, and quantify the key processes involved in photosynthesis and how they respond to environmental conditions.
2. Describe the mechanisms involved in the movement of water through plants, including the soil moisture and atmospheric conditions that affect water movement.
3. Measure key water-relations parameters that can be used to calculate plant water use and survival under different soil moisture conditions
4. Calculate the leaf energy balance under different environmental conditions
5. Describe the major processes involved in nutrient uptake, including the different forms of nutrients used by plants
6. Calculate plant nutrient-use efficiency and evaluate the ecological implications of different strategies.

7. Integrate the above concepts to evaluate the ecological implications of different plant growth strategies. Course Outline and Schedule

Here are the topics that we will be covering in this course and a tentative schedule. The schedule is likely to shift some during the semester except for the exam dates, the exams will occur on the dates listed.

	Week	Lecture	Lab Recitation
Jan 15	1	Introduction	
		Experimental Treatments	Develop Experimental Design
Jan 22	2	Light Reactions I	
		Light Reactions II	Setup experiment
Jan 29	3		
			Light Response Curves
Feb 5	4	Carbon Reactions I	
		Carbon Reactions II	Fluorescence Activity
Feb 12	5	Literature Discussion	
		Fluorescence	CO2 Response curves
Feb 19	6	SPAC	
		Stomatal Responses to water limitation	Leaf Water Potential
Feb 26	7	VPD Response Curves (Activity)	
		Plant Hydraulic Conductance	Measuring Plant Hydraulic Conductance
Mar 5	8	Responses of conductance to drought	
		Literature Discussion	No Lab
Mar 12	9	Spring Recess – No Class	
Mar 19	10	Analyzing pressure-volume curves	
		Leaf Energy Balance	Measuring Pressure-volume curves Measuring energy balance parameters
Mar 26	11	Activity: calculating energy balance	
		Literature Discussion	Measuring Nutrient Uptake Rates
Apr2	12	Nutrient Uptake rates I	
		Nutrient Uptake rates II	Measuring root structure
Apr 9	13	Root Structure	
		Nutrient-Use Efficiency I	Preparing samples for nutrient-use efficiency analysis
Apr 16	14	Nutrient-Use Efficiency II	
		Literature Discussion	Nutrient-Use efficiency calculations
Apr 23	15	Whole-Plant growth strategies I	
		Whole-Plant growth strategies I	Group Work
Apr 30	16	Student Presentations	
		Student Presentations	Clean-up greenhouse