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 these 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 ecophys-
siology so that you can better understand the mechanics of plant responses to their environment.

**Specific Objectives**

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

- **Photosynthesis**
  - Describe the major processes involved in photosynthesis and how environmental variable affects these processes
  - Measure and analyze light response curves and A-Ci curves
  - Interpret the meaning of different light response parameters and the conditions where different parameter values would be advantageous

- **Water Use**
  - Explain the movement of water through plants, including the soil moisture and atmospheric conditions that affect water movement
  - Calculate Water-Use Efficiency of different plants and analyze the impact on growth
  - Identify different water-use strategies and the impact on ecosystem function

- **Nutrient Uptake and Use**
  - Describe the major processes involved in nutrient uptake, including the different forms of nutrients used by plants
  - Be able to differentiate among different nutrient-use strategies
  - Identify and interpret different nutrient-use strategies

- **Whole Plant Growth Responses to environmental variability**

- Develop a project idea that will help apply the material covered in class to each student’s area of interest

1 **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 of 1/19 (school begins on 1/20)
- M – NO CLASS
- W - Introduction
- F – Some background info on Photosynthesis

Week of 1/26
- M - Photosynthesis I – Light reactions
- W - Photosynthesis II - Dark Reactions
- F - Introduction to Licor 6400

Week of 2/2
- M - ACTIVITY: Fitting and analyzing Light Response Curves
- W - Substrate Supply of photosynthesis
- F – ACTIVITY: A-Ci curve activity

Week of 2/9
- M - Water-Use Efficiency
- W - C3/C4/CAM
- F - ACTIVITY: WUE/ Carbon Isotopes

Week 2/16
- M - Review
- W - Exam
- F - Carbon translocation and storage I

Week of 2/23
- M - Carbon translocation and storage I
- W - Respiration
- F - ACTIVITY: Q10 activity
Week of 3/2
- M - Water potential, VPD and SPAC
- W - Water uptake and transport through the plant
- F - ACTIVITY: Pressure Chamber Demo

Week of 3/9
- M - Cavitation and Refilling
- W - Stomatal responses to their environment
- F - ACTIVITY: Water transport

Week of 3/16
***** SPRING BREAK *****

Week of 3/23
- M - Scaling up leaf-level measurements
- W - Nitrogen uptake
- F - ACTIVITY: Root washing/scanning

Week of 3/30
- M - Root structure and function
- W - Nitrogen-Use Efficiency
- F - Review/Discussion

Week of 4/6
- M - Exam
- W - Whole-plant growth responses/Biomass allocation
- F - Discussion

Week of 4/13
- M - Age-related growth decline
- W - Seed production
- F - Germination and seedling growth
Week 4/20

- M – Discussion
- W – Interactions among plants
- F - Symbiotic Relationships

Week of 4/27

- M – Functional Plant Traits
- W – Ecophysiological responses to climate change
- F - ACTIVITY: Measuring leaf traits

Week of 5/4

- M – Ecophysiology and global scale processes
- W – Discussion
- F – Review

FINAL EXAM on 5/13 4:10pm - 6:10pm (we will meet in the same room that our normally scheduled classes have met)