CAS GE/BI 525: Plant Physiological Ecology (PLANT PHYS ECOL)

Nathan G. Phillips
Department of Geography and Environment
Office: Room 441A
Stone Science Building
675 Commonwealth Avenue
617-353-2841
Nathan@bu.edu

Lecture Location/Time: CAS320/ MWF 1:00-2:00
Office Hours: MW 2:00-3:00 TH 12:00-1:00

Pre-requisites:

CH101 and PY211, and one of the following: (BI303 or BI305), or consent of instructor.

Required text:


Supplementary text on reserve:


Course Description:

Plant ecophysiology as a discipline is concerned with understanding how a plant’s structure and function reflects adaptation to its unique physical and biotic environments. This course covers first principles of physiology based on biophysics and biochemistry, and applies those principles in the context of both ecosystem structure and function, and global change. To this end, the course combines textbook readings covering first principles of plant ecophysiology with seminal literature readings and recent selections from the literature focused on contemporary issues of plant physiological ecology and global change biology. The course is designed for graduate students and advanced undergraduate students with an interest in global change science, ecology, hydrology, and/or plant sciences.

Depending on students’ schedules, we may schedule some Friday afternoons for short field trips to demonstrate the use of plant eco-physiological measurement instruments.
Lecture and Readings Schedule

Week 1:
**Overview.** The scope of eco-physiology. Time and space scales. Theoretical and experimental approaches. Relationship between eco-physiology and global change biology. *Reading: Ch. 1, Tracy and Turner 1982; Gross et al. 1989 (optional); DeLucia et al. 2001*

Weeks 2-3:
**Photosynthesis and respiration.** General characteristics of the photosynthetic apparatus. Photosynthetic responses to light, water, soil nutrients, temperature, air pollutants, and CO2. General characteristics of the respiratory system. Effects of environmental conditions on respiration. The role of respiration in plant carbon balance. *Reading: Ch. 2, Farquhar and Von Caemmerer 1982, Tezara et al. 1999*

*Term project 1-2 page synopsis due*

Week 4-5:
**Stomatal function and its control over water and carbon exchange.** Mechanism of stomatal movements. Response of stomata to environmental factors, including humidity light, and carbon dioxide. Control of photosynthesis, transpiration, and leaf energy balance by stomata, and carbon efficiency of water use. *Reading: Ch. 3, Cowan 1977, Daley and Phillips 2006; Phillips et al. (in prep).*

Week 6-7:
**Whole plant (root, stems, leaves) hydraulic structure and function**

Week 8:
**Leaf and canopy energy and water balance**

Week 9:
**Mineral Nutrition**
Acquisition of Nutrients, nutrient mobility in soils, root traits that promote nutrient uptake, transport of nutrients within plants. Nutrient acquisition in stressed or extreme environments. Effects of nutrient deficiencies. *Reading: Ch. 6, Ingestad and Agren 1988, Phillips et al. 2001. MIDTERM EXAM FRIDAY NOV 7.*
Week 10:
**Plant growth, phenology, reproduction, and its control by internal and environmental factors.**

Week 11:
**Comparative eco-physiology of major plant life forms**

Week 12-13:
**Impact of plant/community age/size on whole plant and ecosystem function.**

*Draft of term project due.*

Week 14-15:
**Impacts of climate change on plant and ecosystem function.**

Week 16:
**Scaling of plant ecophysiological processes from individuals to ecosystems**
Issues involved in scaling of linear vs. non-linear processes, power laws in plant function, error propagation. *Reading: Hinckley et al. 1998, West et al. 1999*

*Term project report due.*
Supplementary Readings:

In addition to texts cited above, the following supplemental readings will be on reserve (see week by week schedule for reading assignments).


Assignments

Problem sets will be assigned approximately every three weeks, consisting of quantitative problems and short essay questions. One midterm exam and a final exam will be given. A NSF-style Graduate Research Fellowship proposal, or Research Experience for Undergraduates (REU) application essay will also be required. Students are encouraged to develop proposal ideas relevant to their graduate research, or of exploratory interest for undergraduates. Students should consult with the instructor on proposal ideas, and submit a project synopsis during the third week of the semester. The proposal may involve direct research using instrumentation from the Biogeography Lab, or may make use of existing data sets and literature. A proposal draft is due during the 13th week of the semester, and a final proposal is due during the final week of classes. The proposal should be no more than 15 pages in length, including figures, tables, and a fully referenced bibliography. In addition a condensed proposal draft and final version, conforming to the two-page NSF Graduate Research Fellowship rule or REU specifications, will be required and due in parallel with the longer proposal. Please see www.nsf.gov/pubs/2008/nsf08593/nsf08593.htm for detailed information on NSF Graduate proposal preparation or www.nsf.gov/funding/pgm_summ.jsp?pims_id=5517&from=fund for Research Experience for Undergraduates application information.

Grading

Problem sets, 5% each = 25%
Term Project and Proposal/Application = 20%
One take home midterm exam, 25%
One in-class midterm exam, 30%

Policies

The College of Arts and Sciences policies on incomplete grades and academic conduct will be followed. For details refer to the BU undergraduate or graduate bulletins and the CAS Academic Conduct Code. All written work must be your own.