

**PLB 530 – PLANT ECOPHYSIOLOGY**  
**Spring Semester – 2009**

**Lectures:** Monday, Wednesday, Friday; 1:00 – 1:50 p.m., Life Science II, Rm 450  
**Instructor:** Dr. Stephen Ebbs, LS II, Rm 469B, 453-3220, [sebbs@plant.siu.edu](mailto:sebbs@plant.siu.edu)  
**Office Hours:** MWF 10-12 or by appointment  
**Required reading:** Lambers, Chapin, and Pons, Plant Physiological Ecology (ISBN:0-387-98326-0)  
Additional literature and manuscripts as assigned

**DESCRIPTION:**

This course will explore the physiological processes that influence the growth, reproduction, survival, adaptation, and evolution of plants. The physiological processes to be discussed include water relations, mineral nutrition, solute transport, and energetics (photosynthesis and respiration). The course will begin with an overview of these physiological processes, emphasizing their fundamental importance to plants and the relevant mechanisms. Having established this foundation, the course will then consider the contribution of these individual mechanisms to plant growth, development, survival, and adaptation. The influence of biotic and abiotic factors will be included to provide a context in which to discuss stress physiology and its ecological consequences for plant adaptation and evolution.

**COURSE OBJECTIVES:**

The objectives of this course are to train graduate students in plant biology and related fields to:

- 1) Recognize the scope of physiological mechanisms and processes relevant to plant ecology, including but not limited to plant molecular biology, genetics, biochemistry, cellular biology, biophysics, anatomy, and physiology;
- 2) Identify relevant concepts from these and other disciplines and integrate those concepts into a composite that increases their understanding of the breadth and depth of plant ecological processes;
- 3) Critically examine plant ecological processes to identify the biotic and abiotic factors and mechanisms that shape or influence that process;
- 4) Recognize the role and impact of stress on plants, plant populations, and communities while evaluating the positive and negative impacts of stress of growth, development, reproduction, survival, adaptation, evolution, and distribution;
- 5) Apply physiological concepts and processes to understand and describe ecological processes at the population and community level.

**Supplementary reading material**

Additional reading material may be assigned for some of the lectures. If assigned, these readings should be considered mandatory as the content of those readings may be included in the exams. These readings will generally be from the primary literature, including research papers and reviews. For students who have not previously had a course in plant physiology, a copy of a general plant physiology textbook has been placed in the departmental common room near the telephone. If possible, please restrict your usage of the book to that room so that others can gain access if necessary. While the lectures will generally offer some review of physiological processes, a complete understanding of those processes may require some additional reading.

**Seminar discussions:**

In parallel with this course, the readings in the departmental physiology seminar (PLB589B) will focus on issues and recent literature in the field of plant ecophysiology. While enrollment in that course is not mandatory for this course, the discussions do relate and extend the course material.

**Grading:**

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|-------------------------|---|
| Examinations (3)        | 300 pts (100 pts each)                                    |
| Term paper              | 150 pts   |
| Final exam (cumulative) | 150 pts (100 pts Exam #4, 50 pts comprehensive component) |
| <b>TOTAL</b>            | <b>600 pts</b>  |

**The final exam is Monday, May 4 at 2 PM.**

## PLB 530 Schedule

| Week      | Date            | Lecture topic                             | Chapter       |
|-----------|-----------------|---|---------------|
| <b>1</b>  | Jan 12          | Course introduction                       | <b>1</b>      |
|           | Jan 14          | Photosynthesis review                     | <b>2A</b>     |
|           | Jan 16          | Photosynthesis review                     | <b>2A</b>     |
| <b>2</b>  | Jan 19          | – <b>No class</b> –                       |               |
|           | Jan 21          | Photosynthesis and abiotic factors        | <b>2A, 4B</b> |
|           | Jan 23          | Photosynthesis and abiotic factors        | <b>2A, 4B</b> |
| <b>3</b>  | Jan 26          | Photosynthesis and abiotic factors        | <b>2A, 4B</b> |
|           | Jan 28          | Phloem transport review                   | <b>2C</b>     |
|           | Jan 30          | Phloem and assimilate transport           | <b>2C</b>     |
| <b>4</b>  | Feb 2           | Phloem and assimilate transport           | <b>2C</b>     |
|           | Feb 4           | Respiration review                        | <b>2B</b>     |
|           | Feb 6           | Respiration review                        | <b>2B</b>     |
| <b>5</b>  | Feb 9           | – <b>Lecture exam #1</b> –                |               |
|           | Feb 11          | Respiration and environmental factors     | <b>2B</b>     |
|           | Feb 13          | Respiration and environmental factors     | <b>2B</b>     |
| <b>6</b>  | Feb 16          | Water relations overview                  | <b>3</b>      |
|           | Feb 18          | Water relations and environmental factors | <b>3</b>      |
|           | Feb 20          | Water relations and environmental factors | <b>3</b>      |
| <b>7</b>  | Feb 23          | Water stress responses                    | <b>3</b>      |
|           | Feb 25          | Water stress responses                    | <b>3</b>      |
|           | Feb 27          | Mineral nutrition overview                | <b>6</b>      |
| <b>8</b>  | Mar 2           | Nutrient acquisition from the soil        | <b>6</b>      |
|           | Mar 4           | Nutrient acquisition from the soil        | <b>6</b>      |
|           | Mar 6           | – <b>Lecture Exam #2</b> –                |               |
| <b>9</b>  | <b>Mar 9-13</b> | <b>SPRNG BREAK</b>                        |               |
| <b>10</b> | Mar 16          | Nutrient stress and toxicity              | <b>6</b>      |
|           | Mar 18          | Nutrient stress and toxicity              | <b>6</b>      |
|           | Mar 20          | Nutrient stress and toxicity              | <b>6</b>      |
| <b>11</b> | Mar 23          | Nutrient use efficiency                   | <b>6</b>      |
|           | Mar 25          | Growth, allocation, and storage           | <b>7</b>      |
|           | Mar 27          | Growth, allocation, and storage           | <b>7</b>      |
| <b>12</b> | Mar 30          | Growth, allocation, and storage           | <b>7</b>      |
|           | Apr 1           | Growth, allocation, and storage           | <b>7</b>      |
|           | Apr 3           | Environmental influences on life cycles   | <b>8</b>      |
| <b>13</b> | Apr 6           | Environmental influences on life cycles   | <b>8</b>      |
|           | Apr 8           | – <b>Lecture exam #3</b> –                |               |
|           | Apr 10          | Ecological biochemistry                   | <b>9B</b>     |
| <b>14</b> | Apr 13          | Ecological biochemistry                   | <b>9B</b>     |
|           | Apr 15          | Ecological biochemistry                   | <b>9B</b>     |
|           | Apr 17          | Biotic interactions – mutualistic         | <b>9A</b>     |
| <b>15</b> | Apr 20          | Biotic interactions – mutualistic         | <b>9A</b>     |
|           | Apr 22          | Biotic interactions – mutualistic         | <b>9A</b>     |
|           | Apr 24          | Biotic interactions – pathogenic          | <b>9C</b>     |
| <b>16</b> | Apr 27          | Biotic interactions – pathogenic          | <b>9C</b>     |
|           | Apr 29          | Biotic interactions – plant competition   | <b>9E</b>     |
|           | May 1           | Biotic interactions – plant competition   | <b>9E</b>     |

## **Guidelines for the ecophysiology term paper**

**Purpose:** The purpose of this assignment is to provide students in this course with an opportunity to explore in greater detail a topic of interest in the field of plant ecophysiology, and ideally one closely related to their degree research. As an instructor, I realize that not all students perform well on exams. This assignment allows these students to demonstrate to me that they have a mastery of at least one of the topics we will explore in this course. I believe the greatest merit of this assignment is that it provides an opportunity for students to choose something that interests them and pursue that topic. My hope is that an exploration of a topic that is of interest will prompt a better effort on the student's part, which should earn them a higher score. If the student also relates the material to their own research, the writing may also help them with thesis or dissertation preparation as well as give them a broader knowledge of the material, which could prove useful for candidacy exams and thesis/dissertation defense.

**Topics:** The choice of topics will be left initially to the student, although the final topic must be approved by me. The topic need not be selected from the course syllabus or from the text, but must fall under the heading of "Plant ecophysiology" as we have addressed it this semester. Students are encouraged to select a topic of interest to them, even if it relates to their graduate research. For those searching for a topic, I recommend that students peruse the Table of Contents of the journals listed at <http://www.biology.duke.edu/jackson/ecophys/journals.htm>. Alternately, students can meet with me to explore potential topics. The topic selected should be one that is of current interest in the field of plant physiology and the presentation should reflect up-to-date knowledge of this topic.

**Format:** The paper must be at least 20 double-spaced pages in length, excluding diagrams, figures, tables, and references. Margins should be at least 1 inch on all sides. No specific format is to be followed, but students should organize their presentation into a logical format that explores the topic thoroughly. Though not specifically required, students are encouraged to make use of diagrams, figures, tables, or other resources to enhance their presentation. These visual aids can be taken from the works cited in your paper, as long as proper acknowledgement is included. Figures and tables should be numbered sequentially in the text (i.e. - Table 1, Table 2, etc. and Figure 1, Figure 2, etc.). Images included should be large enough to be clearly read and understand and should be accompanied by an appropriate caption describing the content of the figure, diagram, or table. Look to the primary research journals for examples of how to properly present figures and tables.

**Citations:** Students are expected to properly cite the material presented in their paper. Use a citation scheme from a journal such as *Plant Physiology*, *Journal of Ecology*, etc. Students should utilize the primary literature (journals, conference proceedings, books) to gather their information. Textbooks, web sites, and encyclopedias are not acceptable sources of information. Students unfamiliar with such resources are encouraged to contact me early for additional information.

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| <b>First draft due date:</b>                             | March 23, 2009                             |
| <b>First draft return with comments and suggestions:</b> | April 8, 2009 (on or before this date)     |
| <b>Revised paper due date:</b>                           | May 6, 2009 (firm deadline, no extensions) |

## **Emergency Procedures.**

Southern Illinois University Carbondale is committed to providing a safe and healthy environment for study and work. Because some health and safety circumstances are beyond our control, we ask that you become familiar with the SIUC Emergency Response Plan and Building Emergency Response Team (BERT) program. Emergency response information is available on posters in buildings on campus, available on BERT's website at [www.bert.siu.edu](http://www.bert.siu.edu), Department of Safety's website [www.dps.siu.edu](http://www.dps.siu.edu) (disaster drop down) and in Emergency Response Guideline pamphlet. Know how to respond to each type of emergency.

Instructors will provide guidance and direction to students in the classroom in the event of an emergency affecting your location. It is important that you follow these instructions and stay with your instructor during an evacuation or sheltering emergency. The Building Emergency Response Team will provide assistance to your instructor in evacuating the building or sheltering within the facility.