

**PBIO 514: Soil Ecology  
Syllabus  
Winter 2007**

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Office Hours: By appointment or immediately after class  
Lecture: MW, 10-11:30, Porter Hall 417  
Laboratory: W, 12-2, Porter Hall 304  
Website: Blackboard (<http://www.plantbio.ohiou.edu/epb/instruct/pbio414>)

**Course Objectives:**

This course centers on the overlap of soil science and ecosystem ecology in order to understand how soil properties and processes influence plants. Our goal is to understand: (1) how the interactions of climate, landform, topography, and plant communities influence soil development; (2) how physical, chemical and biological properties of soils affect the availability of limiting resources to plants; and (3) how nutrients are cycled within terrestrial ecosystems and its impact on plant community composition and function.

Understanding course objectives are developed using a combination of lectures, field- and laboratory-based exercises, and individual research. Evaluation of presented material will be assessed by three means: *Critical Thinking* (analyze & evaluate), *Creative Thinking* (idea development), and *Practical Thinking* (problem solving).

**Course Materials:**

Graduate:

Brady, N.C., and Weil, R.R. (2002) **The Nature and Properties of Soils**, 13th Edition, Prentice Hall, NJ.

Coleman, D.C., and Crossley, D.A., and Hendrix, P.F. (2004) **Fundamentals of soil ecology**, 2nd Edition, Elsevier Academic Press, NY

**Grades:**

Course grades are weighted as follows:

|                 |     |
|-----------------|-----|
| Exam I          | 20% |
| Exam II (Final) | 20% |
| Lab Reports (8) | 10% |
| Research Paper  | 40% |
| Quizzes (5)     | 10% |

The two exams are 80 minutes and will be graded on a 100 point scale. The exams are cumulative of the previous material (i.e. quizzes and/or exam I). Exams cannot be made-up without prior notice to the instructor. The five quizzes are 15 minutes will be graded on a 10 point scale and will be given without prior notice as a metric of your attendance. Final letter grades will be assigned based upon the grading scale.

|                       |         |    |         |    |        |    |
|-----------------------|---------|----|---------|----|--------|----|
| <b>Grading Scale:</b> | 93-100% | A  | 90-92%  | A- |        |    |
|                       | 87-89%  | B+ | 83-86%  | B  | 80-82% | B- |
|                       | 77%-79% | C+ | 73%-76% | C  | 70-72% | C- |
|                       | 67-69%  | D+ | 63-66%  | D  | 60-62% | D- |
|                       | <60%    | F  |         |    |        |    |

### **Laboratory:**

While the lecture portion of the course provides background knowledge, the laboratory portion of the course is an opportunity for students to gain hands-on experience sampling and describing soils in the field and analyzing various soil physical, chemical, and biological properties in the lab. In each lab section, students will be grouped into teams of two or three. Activities and assignments in the lab will be cooperative efforts among team members. Attendance is critical to permit equal participation among team members, and all laboratory assignments are due at the beginning of the next laboratory meeting. Assignments will vary with each specific activity, and specific instructions for each lab assignment will be contained in the weekly lab handout.

### **Research Paper:**

The culmination of all the work in the field and lab is a research paper. The purpose of this paper is to integrate field and laboratory data in a comparison of two ecosystems. Questions to address include: *What are the main factors influencing soil formation between ecosystems? How have these contrasting factors affected the physical, chemical and biological properties these particular soils? How and why have soil properties influenced plant community composition within each ecosystem? How and why do patterns of nutrient cycling differ between your ecosystems? And, how do differences in plant composition influence patterns of nutrient cycling?* Your paper should be limited to 8-12 pages (typed, single-sided, double spaced), not including tables/figures and literature cited, and should be written in the format used by *Soil Biology and Biochemistry*.

### **Library Reserves**

Several texts, as well as journal articles, are available through course reserves in the Alden Library. These are intended to provide supplemental readings for lecture and laboratory subject matter. While this material may supply some background information

for the project paper, students are encouraged to utilize the Library's resources to conduct a literature search (for example, through the ISI Web of Science or BIOSIS) to locate relevant citations for the project paper.

**Scientific Journals Relevant to Research Paper**

|                                     |   |
|-------------------------------------|---|
| Soil Biology and Biochemistry       | Soil Science Society of America Journal |
| Canadian Journal of Forest Research | Ecology                                 |
| Oecologia                           | Journal of Ecology                      |
| Ecological Applications             |   |

## P BIO 514 Topic Schedule

| Week   | Date | Subject                                | Reading Assignment            |
|--------|------|--|-------------------------------|
| 1      | 1/3  | Introduction                           | FSE Ch 1                      |
|        |      | <b>I. Soil Development</b>             |                               |
| 2      | 1/8  | Soil Formation                         | NPS, ch. 2                    |
|        | 1/10 | Soil Classification                    | NPS, ch. 3                    |
|        |      | <b>II. Soil Physical Properties</b>    |                               |
| 3      | 1/15 | MLK Day (NO CLASS)                     |                               |
|        | 1/17 | Texture, Structure, Density & Pores    | NPS, sec., 4.0-4.7            |
| 4      | 1/22 | Soil Water                             | NPS, ch. 5                    |
|        | 1/24 | Structure & Function of Clay Minerals  | NPS, sec., 8.0 - 8.6          |
| 5      | 1/29 | SOM: Litter & Humus                    | Journal Reading (JR)          |
|        | 1/31 | <b>Exam I</b>                          |                               |
|        |      | <b>III. Soil Chemical Properties</b>   |                               |
| 6      | 2/5  | Cation Exchange Capacity & Reactions   | NPS, sec., 8.7 - 8.11         |
|        | 2/7  | Soil Acidity & Buffer Capacity         | NPS, sec., 9.0 - 9.4          |
|        |      | <b>IV. Soil Biology</b>                |                               |
| 7      | 2/12 | Soil Fauna                             | NPS, 11.0-11.6; FSE Ch 4 & JR |
|        | 2/14 | Microbial Community                    | FSE Ch 3 & Ch 6 & JR          |
| 8      | 2/19 | Soil Microbial Interactions with Roots | NPS, sec., 11.7 & JR          |
|        | 2/21 | Plant Roots & Nutrient Acquisition     | FSE Ch 2 & JR                 |
|        |      | <b>V. Soil Processes</b>               |                               |
| 9      | 2/26 | Decomposition: Processes & Mechanisms  | FSE Ch 5 & JR                 |
|        | 2/28 | Soils & Ecosystem Carbon Budget        | FSE Ch 8 & JR                 |
| 10     | 3/5  | Soil Biogeochemical Cycles             | JR                            |
|        | 3/7  | The Soil Resource & Human Activities   | JR                            |
| Finals | 3/12 | <b>Final EXAM</b>                      |                               |

## Laboratory Schedule

**All Assignments are Due at the Beginning of the Next Laboratory Meeting**

| Week | Date | Subject   |
|------|------|---|
| 1    | 1/3  | Tour of Landforms, Soils, and Vegetation        |
| 2    | 1/10 | The Ridges - introduction to describing soils   |
| 3    | 1/17 | Pine Plantation                                 |
| 4    | 1/24 | Mixed-Oak Hardwoods                             |
| 5*   | 1/27 | Oak Savanna/Prairie Ecosystems - Oak Openings   |
|      | 1/31 | Soil Texture, & Bulk Density                    |
| 6    | 2/7  | Soil pH and Organic Matter                      |
| 7    | 2/14 | Cation Exchange Capacity and Base Saturation    |
| 8    | 2/21 | Microbial Biomass and Nitrogen Mineralization   |
| 9    | 2/28 | Complete Microbial Biomass/N Mineralization Lab |
| 10   | 3/7  | Final Presentations, Summary, and Integration   |

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*Please Note:* On weeks 1 through 4, we will depart for our field trips at *12:10 p.m.* from behind Porter Hall, sharp! Please notify us ahead of time if you will not be able to attend a field trip. **Plan to get dirty on these outings!** Dress appropriately and bring warm clothes and/or rain gear if the weather looks threatening. Don't forget your lab handouts (which you've read ahead of time), a notepad, and a writing instrument that works on wet paper. Do *not* bring anything that you want to keep clean, like lecture notes. Beginning week 5, we will meet indoors in the Teaching Lab, 304 Porter Hall.

\* We will leave for the Northern Field Trip promptly at 7:00 a.m. Saturday, January 27th from Porter Hall to visit Oak Savanna & Prairie Ecosystems. Please pack a lunch and we will stop for dinner on our way back to Athens. We should return by 9:30 p.m.