**Biology 5531. Soils: Formation and Function** **Spring 2007**

Instructor: Dr. Melany Fisk Office: Rankin North (Annex) 321
Phone: 262-6910 Email: fiskmc@appstate.edu
Office hours: MWF 9:00 – 11:00 or by appointment

Soils are an important interface between the earth and the atmosphere and are a zone of biological and geochemical activity upon which all terrestrial life depends. A basic understanding of soil formation and the physical, chemical, and biological properties of soil is of fundamental importance to students interested in ecology and the environmental sciences. Specific objectives of this course are to:

- learn how interactions among key factors (climate, parent material, time, biota, and topography) determine patterns of soil development and properties across the landscape;
- understand the influence of physical, chemical, and biological properties on soil function, including water and nutrient availability to plants;
- examine the impacts of management and environmental change on soil properties and functions;
- describe soils in the field, characterize biological and chemical properties in the laboratory, and relate observed properties to important climate, geologic, and landscape features.

In the lecture component of the course there will be 2 exams plus a comprehensive final exam. There will also be discussion questions in class and short written assignments. Research papers are required that explore in detail some aspect of current research in soil science or soil ecology. Laboratory assignments will be based on work we do comparing soil properties between contrasting ecosystems. They will include summaries of chemical and biological data collected from these soils and a final paper that synthesizes the comparison between systems.

**Reading Material.**
Required Textbook: *The Nature and Properties of Soils*, by N.C. Brady and R.R. Weil, 13th edition.

Textbook readings will be complemented with selected papers from the literature for more in-depth development of some topics.

**Grading.**

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| Exams | (75 points each * 2) | 150 |
| Final Exam | | 100 |
| Research Paper | | 75 |
| Written assignments | (20 pts * 5) | 100 |
| Data summaries | (25 pts * 2) | 50 |
| Paper on soil properties | | 100 |
| Total possible | | 575 points |

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| Grades will be: | 90-100% | A |
| | 80 - 89% | B |
| | 70 - 79% | C |
| | < 79% | F |

**Lecture Schedule (subject to change)** **Bio 5531, Spring 2007**

| Date | Subject | Reading |
|---|---|---|
| Jan 9 | Intro to state factors and soil development | Ch 1 & 2 |
| Jan 11 | Soil descriptions | |
| Jan 16 | Geology and weathering | Ch 2 |
| Jan 18 | Soil texture and structure | Ch 4 |
| Jan 23 | Porosity and density | Ch 4 |
| Jan 25 | Water relations | Ch 5 |
| Jan 30 | Clay minerals | Ch 8 |
| Feb 1 | No class | |
| Feb 6 | Cation exchange | Ch 8 |
| Feb 8 | **Exam 1** | |
| Feb 13 | Soil acidity and buffering capacity | Ch 9 |
| Feb 15 | Soil biota: microfauna | Ch 11 |
| Feb 20 | Soil biota: mesofauna | Ch 11 |
| Feb 22 | Organic matter decomposition | Ch 12 |
| Feb 27 | Soil organic matter and humus formation | Ch 12 |
| Mar 1 | Nutrient mineralization | Ch 13 & 14 |
| Mar 5 | Soil water status, redox reactions | Ch 7 |
| Mar 7 | Plant-soil interactions | supplementary readings |
| Mar 13,15 | **Spring Break** | |
| Mar 20 | Plant-soil interactions | supplementary readings |
| Mar 22 | **Exam 2** | |
| Mar 27 | Profile development: key processes | supplementary readings |
| Mar 29 | Diagnostic horizons | Ch 3 |
| Apr 3 | Soil classification and return to state factors | Ch 2 & 3 |
| Apr 5 | Soil disturbance | Ch 3 |
| Apr 10 | Human impacts: acidic deposition | supplementary readings |
| Apr 12 | Human impacts: land-use change | supplementary readings |
| Apr 17 | **Easter Holiday** | |
| Apr 19 | Human impacts: climate change and carbon storage | supplementary readings |
| Apr 24 | Human impacts: interactions of $CO_2$ and N enrichment | supplementary readings |

**Laboratory Schedule (subject to change)** **Bio 5531, Spring 2007**

| **Date** | **Subject** | **Assignments Due** |
|---|---|---|
| Jan 18 | Intro to soils; field sampling | |
| Jan 25 | No lab | |
| Feb 1 | No lab | |
| Feb 8 | Texture and aggregate size analyses | |
| Feb 15 | Water-holding capacity and movement | |
| Feb 22 | Nutrient mineralization, enzyme activity | *Data summary 1* |
| Mar 1 | Soil biota: microorganisms and microbial activity | |
| Mar 8 | Soil biota: micro- and mesofauna | |
| Mar 15 | **Spring Break** | |
| Mar 22 | Tour of landforms, soils, and vegetation: Saturday field trip | *Data summary 2* |
| Mar 29 | Wetland soils | |
| Apr 5 | Soil classification and formation from Mountains to Piedmont: Saturday field trip | *Paper on soil properties* |
| Apr 12 | No lab | |
| Apr 19 | No lab | |