

The Science of Soils

GES 175
Fall 2004

COURSE SYLLABUS

Course Instructor: Scott Fendorf
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Teaching Assistants: Eve Hinkley
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Meeting Times:

Lecture: 9 – 10:15 am Tuesday, Thursday
Lab: 2:15 – 5 pm Thursday

Location:

Lecture: A25 Mitchell
Lab: A25 Mitchell

Course Webpage: <http://soils.stanford.edu/classes/GES175items/ges175.htm>

Course Objectives:

- *To comprehend the physical, chemical, and biological processes functioning within soils*
- *To define factors influencing elemental (contaminant and nutrient) cycling within terrestrial ecosystems*
- *To obtain an appreciation for soils as dynamic, non-renewable natural resources*
- *To learn the difference between “soil” and “dirt”*

Text:

Brady, N. C. and R. R. Weil. xxxx. "The Nature and Properties of Soils" Prentice Hall, Inc., New Jersey. ISBN 0-13-852444-0

Grading and Exams:

Course grades will be determined based on four components of the class: participation (both within the lecture and laboratory sections), exam performance, homework, and the course project. Specifically, the following points system will be used:

Midterm (100 pts), Final (100 pts), Homework and Laboratory Exercises (100 pts),
Project (75 pts), Participation (25 pts)

Exams:

Two exams (midterm and final) will be given during the quarter, each worth 100 pts. The first exam will focus on soil physical, biological, and chemical processes. The second exam will be a 'take-home' format and will emphasize soil developmental processes, classification, and nutrient cycling; it will be dispensed on Tuesday 11/30 and due on Thursday 12/2.

Homework and Laboratory Exercises:

Either a short homework assignment or laboratory summary will be given on a near-weekly basis covering current topics.

Participation:

Everyone is expected to attend, and most importantly, interact within both the lab and lecture setting. We hope to develop a 'dynamic' class environment through such interactions.

Course Project:

You will have the opportunity to characterize a local soil of your choice, focus the project on a specific soil process, and present your work as a 4'x 4' poster (see below for more specific instructions). **Posters will be presented on December 2** (late projects can therefore not be accepted)

Information on Course Projects

The course projects allow you incorporate a bit of artistic flair while conveying a scientific message. The universal requirements for your project are: (i) you must characterize a soil and (ii) develop a **theme** that describes a process involving the soil. Many of our laboratory exercises will parallel your needs for describing the soil and, in fact, we will have many assignments that help guide you in this task. Your first assignment will be to find a soil locally that you wish to study. Please select one that seems interesting but that is also easy to access. Your second task, and one you should begin immediately, is to develop the thematic aspect of your project.

The process(es) you must describe in your project can either be one that impacts the soil or one that the soil impacts. Deciding on the slant (theme) you wish to take is your responsibility and should be started as early as possible. You may choose from a range of potential topics regarding soils; I am open to new ideas but here are a few possible themes that come to mind.

- (1) Describe soil developmental processes (weathering of rock, erosion, translocation of material) and provide a detailed characterization of a specific soil
- (2) Characterize a soil and evaluate potential reactions of a nutrient or contaminant within the system
- (3) Develop an autobiography of a soil organism while characterizing a soil
- (4) Describe how the local environment surrounding the site influences the soil you characterizing (or the reverse)

Please use either Adobe Illustrator or Microsoft Powerpoint to construct a poster scaled to 4' x 4'. Individual panels can be placed within this framework to provide a {visual+written} means of conveying your project theme. Each panel should provide a self-contained bit of information and may be a picture with a caption, a drawing, or a written description; linking the panels then provides the complete picture of your project. Please see our course web page for examples if needed. You will be responsible for having (1) a printed version that will be displayed in lab on Thursday December 2 and (2) and electronic copy brought with your poster on a CD.

Students with Documented Disabilities

Students who have a physical, psychological or learning disability that may necessitate an academic accommodation or the use of auxiliary aids and services in a class must initiate the request with the Student Disability Resource Center (SDRC). Student should not initiate such requests with their instructors. The SDRC will evaluate the request along with the required documentation, recommend appropriate accommodations, and prepare a verification letter dated in the current academic term in which the request is being made. Please contact the SDRC as soon as possible; timely notice is needed to arrange for appropriate accommodations. The SDRC is located at 563 Salvatierra Walk (723-1066 Voice; 725-1067 TTY).

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SCHEDULE I (tentatively)

Date	Lecture Topic	Laboratory Topic	Text
9/28, T	Concepts and Components		Ch. 1
9/30, Th	Physical Properties	Introduction to Soils: Horizonation and soil forming factors (short field trip)	Ch. 4
10/5, T	Soil Water - Energetics		Ch. 5, 6
10/7, Th	- Measurement - Infiltration and Flow - Evaporation and Evapotranspiration	Physical Properties - texture, structure, color	
10/12, T	Soil Materials - Clay Minerals		Ch. 8, 12
10/14, Th	- Organic Matter - Ion Exchange (Ion Retention) - Colloidal Properties	Soil Water Dynamics (and sodium effect)	
10/19, T	Salt-Affected and Sodic Soils		Ch. 10
10/21, Th	Soil Acidity	Cation Exchange, Adsorption, Liming, and pH	Ch. 9
10/26, T			
10/28, Th	Soil Microbiology - Microorganisms - Redox Processes	Soil Survey and Redox Chemistry in Action (Field trip)	Ch. 11
11/2, T			
11/4, Th	Mid-term EXAM	Soil Microorganisms	
11/9, T	Soil Development - Weathering - Horizon development - Soil Orders		Ch. 2, 3
11/11, Th	Plant Macronutrients - Nitrogen	Soil Classification System and Nutrient Dynamics (microbe follow-up 1)	Ch. 13
11/16, T			
11/18, Th	Plant Macronutrients - Sulfur - Potassium	Soil Classification (Field Trip)	Ch. 13, 14
11/23, T	Plant Macronutrients - Potassium - Phosphorus		Ch. 14
11/25, Th	THANKSGIVING	THANKSGIVING	
11/30, T	Trace Elements - Plant Micronutrients - Environmental Contaminants		Ch. 15 Ch. 18 (p 740-755)
12/2, Th	Contaminant and Nutrient Management	Poster Presentations Exams due	

LABORATORY ASSIGNMENTS

Date	Assignments	Due
9/30, Th	Site selection for project, approximate horizons	10/7
10/7, Th	Texture and color of horizons from Project Site	10/14
10/14, Th	Write-up for "Soil Water Dynamics"	10/21
10/21, Th	Write-up for "Cation Exchange, Adsorption, Liming, and pH"	10/28
10/28, Th	Describe Project Theme	11/2
11/4, Th	Write-up for "Soil Microorganisms"	11/11
11/11, Th*	Begin classifying soils from Project Site	11/13
11/18, Th*	Complete classification of soils from Project Site	12/2
12/2	Poster Presentations (in lab)	