University of Northern British Columbia
College of Science and Management

FSTY 425/NREM 625 (3) - Soil Formation and Classification

Prerequisites FSTY 205-3 or permission of instructor
September 2007

Lecture: Wednesday 18:30 - 20:20 LAB8 8-161
Lab: Tuesday 8:00 - 10:50 LAB8 8-160

Instructor: Paul Sanborn **Office hours**: Mon., 3:00-4:20 pm, Fri., 2:00-3:20 pm *(or by appointment)* **Office location**: 8-308 (Teaching Lab Bldg)

Office phone: 960-6661 **E-mail**: sanborn@unbc.ca

Course description - examination of properties, distribution, classification and formation of soils of British Columbia with emphasis on northern and interior BC; structure of Canadian System of Soil Classification and its correlation with the two leading international systems: Soil Taxonomy and the FAO World Reference Base. Field work is an integral part of the course, and two day-long **Saturday** field trips will give firsthand exposure to soils of forest and grassland environments in the BC central interior.

Objectives -The main objective of the course is to understand the formation and landscape patterns of soils in relation to environmental factors. The properties and distribution of soils will be related to environmental settings and processes with emphasis on northern and interior British Columbia. By the end of the term, students are expected to be able to recognize and describe accurately the field soil properties used in soil classification, understand the characteristics and genesis of the Orders of the Canadian System of Soil Classification, and understand the structure of the Canadian system and its relationship to other systems of soil classification.

Relationship to other courses and disciplines – FSTY 205 provides a basic introduction to the physical, chemical, and biological characteristics of soils. FSTY 425 goes further, and presents soils as natural 3-dimensional bodies that form the "skin of the earth" and display predictable patterns of spatial variation. Whether you are a forester, ecologist, geographer, or archeologist, the subject matter of this course will help you "read" landscapes in a new way, and eventually, make better interpretations of how soils will respond to land use practices.

Required Texts:

Schaetzl, R. and S. Anderson. 2005. *Soils: genesis and geomorphology*. Cambridge University Press.

Green, R.N., R.L. Trowbridge and K. Klinka. 1993. Towards a taxonomic classification of humus forms. *Forest Science Monograph No. 29*. Society of American Foresters. Washington, DC. ***(provided)***

Soil Classification Working Group (1998). *The Canadian system of soil classification*. 3rd ed. Agric. Can. Publ. 1646. 164 pp.

Valentine, K.W.G., P.N. Sprout, T.E. Baker and L.M. Lavkulich. 1978. *The soil landscapes of British Columbia.* Min. of Env., Victoria, BC. ***(provided)***

Additional readings will be placed on reserve in the Library.

Course Assignments and Grade Weighting:

Mid-term exam (**Oct 9**)			**10%**
Final exam			**30%**
Laboratory reports:	Soil description review exercise (4%)	**40%**	
	Field trip report 1(10%)		
	Field trip report 2 (10%)		
	Soil data interpretation exercise 1 (8%)		
	Soil data interpretation exercise 2 (8%)		
Class presentation (**Nov 27**)			**5%**
Term paper (due **Dec 3**)			**15%**
Total			**100%**

Assignment Descriptions:

Mid-term: The mid-term exam will primarily cover all materials presented in the lectures up to the date of the exam. The exams will include multiple choice, short answer, and essay questions.

Laboratory reports:

The three field-based laboratory reports will require you to present your field observations using the correct format and terminology used for soil descriptions, and, in the case of the two field trip reports, to make interpretations of your findings, using concepts presented in lectures and assigned readings. For the soil data interpretation exercises, you will be given original chemical and physical data for Canadian soils and make interpretations such as the degree of loss of certain elements during soil development. Calculations may require the use of a basic spreadsheet program.

Term paper: Additional details on the scope, suggested topics, format, and grading criteria will be provided at the 2nd lecture. The term paper will allow you to explore a topic related to the major themes of the course, and will require you to consult original papers in the scientific literature.

Final exam: The final exam is cumulative and will cover all material presented in the lectures, as well as the assigned readings. The exams will include multiple choice, short answer, and essay questions. Essay questions will comprise at least half of the examination, and depending on class preferences, may be drawn from a list provided at least one week prior to the examination.

IMPORTANT!

EXTENSIONS on assignments will only be permitted in the event of illness or other serious extenuating circumstances. In such circumstances, **the student** must inform the Instructor **before** the due date, or as promptly as practicable thereafter, and documentary evidence of the illness or other circumstance must be provided to the instructor (*e.g.* note from doctor). In all other cases, 10% per day will be deducted from the grade given for a late assignment.

EXAM POLICY: Please note that the term ends on the final day of the exam period, NOT on the last day of classes. Students are advised not to make arrangements to travel on a date prior to the date of the final exam as scheduled by the Registrar. The Instructor will not hold early exams for the purpose of accommodating travel requests.

PLAGIARISM is a very serious academic offense, and will not be tolerated by the instructor, the Program or the University. Consult the Calendar for full details on the UNBC policy regarding plagiarism. If you need advice on how to use and cite sources correctly, speak to the instructor or consult these useful Web sites:

http://www.utoronto.ca/writing/plagsep.html
http://www.ecf.toronto.edu/~writing/interactive-plagiarismtest.html
http://www.yorku.ca/tutorial/academic_integrity/index.html

COURSE OUTLINE

I. Introduction

- Soil and nonsoil, solum
- How deep is soil?
- Buried soils and paleosols
- Pedon - the basic unit of soil sampling
- Polypedon - a unit of soil classification
- Control section
- Types of soil horizons
- Rationale for soil classification in Canada and other systems
- Nature and purpose of soil classification
- Attributes of the Canadian System
- Criteria for defining soil taxa

Readings:
Soil Survey Staff (1999) Chapter 1 *(on reserve)*
Soil Classification Working Group (1998) Chapters 1 3
Schaetzl & Anderson (2005) Chapters 1 & 3

II. Concepts of soil formation

- Dokuchaev & Jenny: The 5 soil-forming factors (parent material, climate, organisms, relief, time)
- Other approaches

Readings:
Schaetzl & Anderson (2005) Chapter 11

III. Soil-forming processes

- (Bio)geochemical processes
  - Weathering/mineral transformation
  - Eluviation/illuviation
  - Redox and gleying
  - Carbonates and soluble salts
- Transport processes in soils
- Processes related to organic matter transformation
  - Decomposition
  - Humification
- Pedoturbation

Readings:
Schaetzl & Anderson (2005) Chapters 12, 9, & 10

IV. The soil orders and their classification

- Characteristics
- Distribution

Formation
- Brunisolic
- Chernozemic
- Cryosolic
- Gleysolic
- Luvisolic
- Organic
- Podzolic
- Regosolic
- Solonetzic
- Vertisolic

Readings:
Soil Classification Working Group (1998) Chapters 4-13
Valentine *et al* (1978) Part 2.4

V. Global soil classifications
- Soil Taxonomy – (US)
- World Reference Base (FAO)

Readings:
Soil Classification Working Group (1998) Chapter 16
Schaetzl & Anderson (2005) Chapter 7

VI. Soil geomorphology and paleoenvironments: case studies
- The world is a dusty place: loess-paleosol sequences (Midwest U.S., China, Europe
- Boring soils in an exciting landscape: the Nahanni karst, NWT
- Soil as a recorder of natural disturbance processes
- Frozen soils and frozen ecosystems: the paleosol record of Beringia
- More about chronosequences:
- When continental drift becomes a soil-forming factor: ancient soil landscapes of Australia

Readings:
Schaetzl & Anderson (2005) Chapters 13-15 (*specific sections to be indicated)*

FSTY 425: Schedule (Fall 2007)

Week - Date	Lab Period (T 800-1050)	Lecture Period (W 1830-2020)	Saturday field trip
1 – Sept 3	*(no lab)*	Introduction	
2 – Sept 10	Soil description review exercise (UNBC campus)	Concepts of soil formation	
3 – Sept 17	Soil description review exercise (UNBC campus) (*cont.*)	Concepts of soil formation (*cont.*)	
4 – Sept 24	*(no lab)*	Soil-forming processes: (bio)geochemical & hydrological	Aleza Lake Research Forest *or* Quesnel/Nazko (Sept. 29)
5 – Oct 1	*(no lab)*	Soil-forming processes: (bio)geochemical & hydrological (*cont.*)	
6 – Oct 8 **(Thanksgiving)**	**Midterm Exam**	Soil-forming processes: soil organic matter dynamics	Chilcotin River (Oct. 13)
7 – Oct 15	*(no lab)*	Pedoturbation: mixing it up!	
8 – Oct 22	Soil data interpretation	Soil Orders	
9 – Oct 29	Soil data interpretation (*cont.*)	Soil Orders (*cont.*)	
10 – Nov 5	Soil data interpretation (*cont.*)	Soil Orders (*cont.)*	
11 – Nov 12	Soil data interpretation (*cont.*)	Global soil classification systems: Soil Taxonomy & World Reference Base	
12 – Nov 19	Soil micromorphology demonstration	Soil geomorphology & paleoenvironments: case studies	
13 – Nov 26	Class presentations of term paper topics	Soil geomorphology & paleoenvironments: case studies (*cont.*)	
14 – Dec 3	*(no lab)*	*(no lecture)*	