ENVS 477/577
Soil Science
Course Syllabus

"... for only rarely have we stood back and celebrated our soils as something beautiful, and perhaps even mysterious. For what other natural body, worldwide in its distribution, has so many interesting secrets to reveal to the patient observer?"—*Les Molloy, Soils in the New Zealand Landscape: the Living Mantle, 1988*

Course Information

Instructor:	Dr. Laurel Pfeifer-Meister, 541-346-1549, lpfeife1@uoregon.edu
	Office Hours: Tuesday 1:30 – 2:30 pm or by appointment, room 394 Onyx Bridge
GTF:	Dan Shtob, dshtob@uoregon.edu
	Office Hours: Thursday 2:00 — 3:00 or by appointment, room 47A Columbia Hall
Lecture:	10:00 - 11:50 am Tuesday/Thursday, room 142 Columbia Hall
Lab:	12:00-1:50 pm Thursday, room 142 Columbia Hall
Field Trip:	Mandatory "Going Coastal" Field trip Sat. April 23rd
	Depart 7:00 am Onyx Bridge Parking Lot, Return 7:00 PM
Website:	https://canvas.uoregon.edu/courses/62281

Texts and Additional Reading (copies of books on loan in the Science Library)

- *Elements of the Nature and Property of Soils*, 3rd edition. (2010) Nyle C. Brady and Ray R. Weil, Prentice Hall. See companion website: http://www.prenhall.com/brady/
- *Dirt: The Erosion of Civilizations.* (2007) David R. Montgomery, Univ. of California Press.
- Additional Reading will be assigned via Canvas.

Course Description

This course will introduce students to the wonderful world of soils that lie, often forgotten, beneath your feet every day. Soils are one of the most fundamental ecological constraints on patterns and processes of plant distributions, nutrient and water cycling, and the productivity of both natural and managed ecosystems. Soils are also an important component of many current and historical environmental problems.

For Environmental Science majors, this course satisfies an upper division elective (Area 3A) in natural sciences. It is also widely applicable to graduate and undergraduate students in Biology, Geography, Geology, Anthropology, and Landscape Architecture, along with other majors on campus. This course is open to graduate students and undergraduate juniors and seniors who have completed a general chemistry sequence (CHEM 221-223, 224-226H or equivalent).

Learning Outcomes

Upon successful completion of this course, you should:

- Understand the physical, chemical, and biological aspects of soils.
- Be able to accurately identify and describe important soil physical characteristics in field settings.
- Be able to describe soils according to the USDA soil taxonomic system, and interpret soil properties based on taxonomic names.
- Understand the mechanisms of soil formation (pedogenesis) across varying landscapes.
- Recognize the fundamental role soils play in environmental problems, and the limits that soil degradation places on society.
- Understand soil management paradigms for ecosystem restoration and carbon sequestration.

Course Format

We will begin the course with the fundamentals of soil science and then apply this knowledge to characterize soils in the field. Later in the term, we will also address complex environmental problems pertinent to soil science (e.g., fertility, salinization, erosion). The course format involves a mixture of lecture and experiencing soils first hand in the lab and field. Scheduled are two 2-hour lectures per week, one 2-hour lab per week, and a weekend day trip. The lab is scheduled immediately after class, and we will use the entire 4-hour block occasionally to sample soils in local field sites (see schedule below). The classroom portion will be primarily lecture-based delivered at a relatively rapid pace via PowerPoint (slides will be available on Canvas). Lectures will draw on topics covered in the assigned reading. Please ask questions during lecture if a concept is unclear. Occasionally, you will also have primary literature assigned that we will discuss during class time. This is a chance to hone your critical thinking skills by interacting with the primary literature, your colleagues, and me. Additionally, you will complete weekly lab and field-based assignments about fundamental concepts in soil science that will give you another chance to exercise your critical thinking (and writing) skills.

Tentative Schedule

Week	Date	Lecture/Exams	Reading*	Notes
1	3/29	The Wonderful World of Soils	Ch. 1	
1	3/31	Physical Properties	Ch. 4	Lab: Introduction to field description of soils**.
2	4/5	Physical Properties		
2	4/7	Local Field Trip During Class and Lab Time		Meet in 142 Columbia; Ch. 1-3 Dirt summary due
3	4/12	Soil Formation (Pedogenesis)	Ch. 2	
3	4/14	Soil Formation (Pedogenesis)		Lab: Soil Physical Properties
4	4/19	Soil Formation & Classification	Ch. 3	
4	4/21	Soil Classification		Lab: Soil Survey Ch. 4-5 Dirt summary due
4	4/23	Mandatory "Going Coastal" Field Trip		Meet 7 am Onyx Bridge Lot
5	4/26	Soil Physical Properties / Alan Savory TED Talk	Ch. 4	
5	4/28	Midterm 1		NO LAB
6	5/3	Soil Water	Ch. 5-7	
6	5/5	Soil Water		Lab: Soil Water Ch. 6-7 Dirt summary due
7	5/10	Soil Colloids	Ch. 8	
7	5/12	Wetland Field Trip During Class and Lab Time		Meet 10 am Onyx Bridge Lot
8	5/17	Soil Colloids & CEC		
8	5/19	Nutrient cycling and soil fertility	Ch. 12	Lab: Soil Chemistry Ch. 8-9 Dirt summary due
9	5/24	Soil Fertility and Plant Nutrition		
9	5/26	Vignettes of Active Soil Research; Erosion	Ch. 14	Lab: Soil Compost
10	5/31	Midterm 2		Not Cumulative
10	6/2	*Dirt: the Erosion of Civilizations* by Montgomery. Class discussion		Ch. 10 summary and final essay due on Dirt reading!

*From Brady and Weil, other reading will be posted to Canvas.

**Print and bring Ch. 4 of Manual for Judging Oregon Soils & pp. 103, 124 of Brady and Weil.

Course schedule is subject to change. Any changes will be announced in advance during class or on Canvas.

Expectations and Grading Criteria

I expect students to attend all labs and field trips. I will not grade down for missed lectures, but active participation and discussion during lectures will greatly enhance the quality of the class. I may increase your grade by up to half a letter grade for exemplary participation. Moreover, **you are responsible for class-related work missed as a result of an absence; this work may be made up at my discretion.**

Students will be evaluated based upon participation, lab quizzes, lab and field reports, two midterms, biweekly chapter summaries and a final essay on *Dirt: The Erosion of Civilizations*. **10% will be deducted each day an assignment is late.**

Students enrolled in ENVS 577 will have one additional assignment based on an oral presentation that each student will give once throughout the quarter. These presentations will be given on Tuesdays of every week as responses to specific soil management issues, addressing (a) what further questions should be asked about the soil issue, (b) what data is needed and how it would be obtained, and (c) potential management strategies. Dates for these presentations will be arranged during the first week of class. If a graduate student feels strongly that another project will enhance their thesis/dissertation study and ultimately their career goals, I am open to proposals—but the proposed alternative must directly relate to soil science and be equivalent in scope.

Grades and overall evaluation of student performance will be based on course activities in the following proportions:

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Lab Quizzes – 10%	Lab Quizzes – 8%	A+ = > 97%, A = 92.5 – 97%
Lab/ Field Reports – 35%	Lab / Field Reports - 30%	A- = 89.5 – 92.5%, B+ = 87.0 – 89.5%,
Mid-term exams - 40%	Presentation – 10%	B = 83.0 – 87.0%, B- = 79.5 – 83.0%
Dirt essays– 15%	Mid-term exams - 40%	C+ = 77.0 – 79.5%, C = 73.0 – 77%
--	Dirt Essays – 12%	C- = 69.5 – 73.0%, D = 59.5 – 69.5%

Labs and Field Trips

Promoting hands-on learning about soils is an important component of this class. We'll occasionally use some or all of the lecture time on Thursdays for labs and field trips. Labs will be used to do an extensive physical description of the soil horizons from field sites and to provide other hands-on opportunities to interact with course material. Lab and field guides will be posted on Canvas by Monday of each week. You are expected to have read through the guide for that day and completed any pre-lab/field assignments detailed in the guide. Students will work in teams in the lab and may share data, but ALL writing must be their own for the lab reports. Field trips happen irrespective of the weather and will involve digging in the soils, so bring appropriate clothing and shoes. Lab quizzes will be held at the beginning of most labs, and may include questions about the upcoming lab, and also results / conclusions of the previous lab. There is a **mandatory field trip on Saturday, April 23rd**. Place this on your calendars now.

Crises happen. If you are having problems that are interfering with your ability to do the work in this class, please let me know promptly. I am willing to make special arrangements when the need is real and when you have done your best to deal with the situation in a timely manner.

Academic integrity and Diversity

I expect students to complete assignments and exams in a manner consistent with academic integrity. Students must produce original work and cite all relevant sources for ideas, quotations, etc. Academic dishonesty is a serious offense and will be treated according to the guidelines in the Student Conduct

Code. Moreover, I expect students to adhere to the University's commitment to freedom of thought and expression of all its members by encouraging open inquiry and respecting a diversity of opinions in this course. Please refer to the Student Conduct Code for more information on the University's Academic Dishonesty Policy and Diversity Education: http://uodos.uoregon.edu/

University of Oregon's Accessible Education Center

At this University we do our best to facilitate and support accessible education. If there are aspects of this course that result in barriers to your learning and participation, I encourage you to contact me so that we can strategize solutions. If you have special needs, such as test accommodations, note-taking, and sign language interpretation, please contact the Accessible Education Center (AEC) so that their personnel and I can work together to help you learn comfortably in this class. The AEC office is located in 164 Oregon Hall. Telephone 541 346-1155. On the web: http://aec.uoregon.edu/index.html E-mail: uoaec@uoregon.edu

How to succeed in this class

- Attend and participate actively in all lectures, labs and field trips.
- Ask questions.
- Learn the language. Soil science is inherently a jargon-filled discipline and to communicate effectively with other soil scientists, one must learn the terminology.
- Do the assigned reading and answer the review questions at the end of each chapter. This will reinforce concepts covered in lecture and lab.
- Get together in small study groups regularly. Go over concepts together. Try to do this without referring to the book or your notes. This will let you know where the gaps in your knowledge are. There is no better way to learn than teaching others.
- Get 'dirty'. As you walk around campus and Eugene, grab samples of soil and try to describe them using the methods we've discussed in class.
- Don't get bogged down in the details, but instead ask yourself what is the big picture and how can I apply these concepts.

Useful Web Links

- Glossary of soil science terms: https://www.soils.org/publications/soils-glossary
- Soil taxonomy in the U.S., keys and maps: http://www.nrcs.usda.gov/wps/portal/nrcs/site/soils/home/
- Description and distribution maps of soil orders: http://www.cals.uidaho.edu/soilorders/
- Official soil series descriptions: http://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/soils/survey/class/data/?cid=nrcs142p2_053587
- Natural Resources Conservation Service homepage: http://www.nrcs.usda.gov/
- Soil Science Society of America: https://www.soils.org/ (Professional society of 6,000+ members whose goal is to advance soil science.)
- Soil biological communities, informative website about the abundant life in soil, run by National Science and Technology Center and Bureau of Land Management: http://www.blm.gov/nstc/soil/index.html
- Smithsonian Soil Exhibit: http://www.soils.org/smithsonian/
- Soil Science Education: http://soil.gsfc.nasa.gov/
- International Union of Soil Scientists: http://www.iuss.org/
- World Soil Resources http://soils.usda.gov/use/worldsoils/