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NRSM 211N.01: Soils and Water

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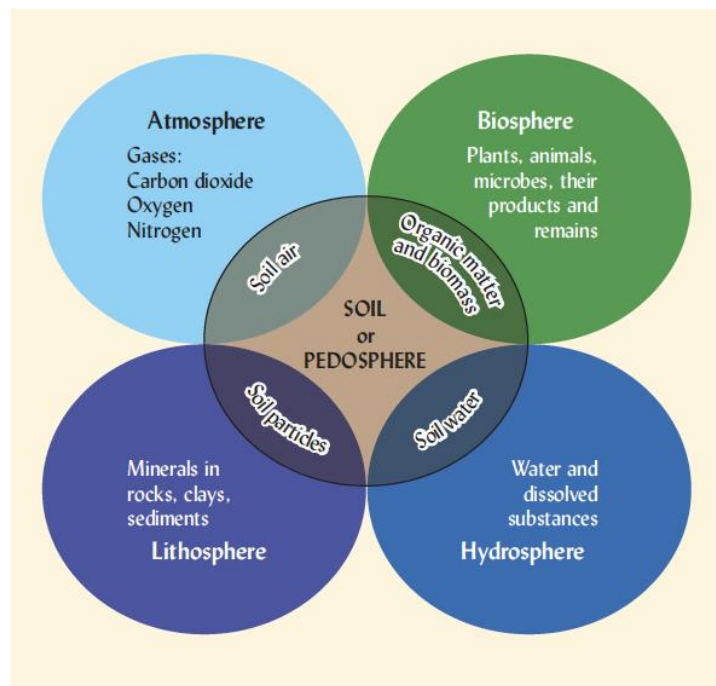
NRSM 211N – Soils & Water

The soil is the great connector of lives, the source and destination of all. It is the healer and restorer and resurrector, by which disease passes into health, age into youth, death into life. Without proper care for it we can have no community, because without proper care for it we can have no life. — Wendell Berry

Course Description

This course introduces students with a basic science background to the physical, chemical, and biological properties of soils, and on how water moves into and out of soils. The course explores many fundamental soil science concepts, with an emphasis on how soils govern water movement in ecosystems. Students demonstrate learning through participation in lectures, discussions, written reflections, and quizzes.

Soils and Water explores topics such as soil formation, soil physics, soil chemistry and soil hydrology, and how soils regulate many important ecosystem processes. Students examine interconnections among soils, water, and vegetation and how they can be predicted from a suite of ecosystem state factors (climate, organisms, relief, parent material, time, and humans). In this course, students will explore how soils, water, and climate interact to shape Earth's biosphere. We will introduce students to a number of fundamental concepts in soil science, hydrology, and climate to gain a comprehensive view on factors shaping and affecting all terrestrial ecosystems. Through a series of lectures and field-based laboratories, students will be introduced to the important climate factors that influence soil development, how they vary across spatial scales, how variations in the main drivers of soil development affect water retention and water movement in soils, the dynamics of chemical movement in soils, soil morphology, and the interactions between climate, water, soils, and vegetation on the landscape.



Soil, or the *pedosphere*, is where the worlds of rocks (lithosphere), air (atmosphere), water (hydrosphere), and life (biosphere) all meet. Figure from Brady & Weil (2017)

Learning Outcomes

Students will assess properties and processes of Earth's soils, differentiate between different soils, and be able to describe the causes and consequences of variations in soils and soil properties and how they influence soil water quantity and quality. Over the course of the semester, students will consider a number of fundamental soil science concepts, and will be able to describe and understand the relationships among soils, water, nutrients and vegetation on the landscape. Students will demonstrate learning through a series of quizzes, exams and other assignments.

Upon completion of the course students will understand the how soils vary across the landscape, how they regulate ecosystem function, how they influence ecosystem water availability. Students will understand how soils are formed, and how soils, water, and vegetation interact in ways that are important for understanding how terrestrial ecosystems may respond to global environmental change.

Course Details

Instructors:

Name: Dr. Kelsey Jencso

Department: Department of Forest Management

Office: CHCB 423A (The Science Complex)

Phone: 243-6793

Email: kelsey.jencso@umontana.edu

Office Hours: Tuesday 10:30 – 11:30 AM and by appointment via email

Name: Dr. Cory Cleveland

Department: Department of Ecosystem & Conservation Sciences

Office: CHCB 423B (The Science Complex)

Phone: 243-6018

Email: Cory.Cleveland@umontana.edu

Office Hours: Tuesday 10:20 – 11:00 AM and by appointment via email

Lecture Location & Time:

The course will meet 9:30 AM – 10:20 AM on Tuesdays and Thursdays in Forestry 305.

Required Text:

– *The Nature and Properties of Soil, 15th Edition*. 2017. Pearson Publishing.

This can be purchased/rented as an electronic resource, or for those who prefer a tactile reading experience, a printed, hard-copy version should be available at the UM Bookstore.

Additional Course Materials & Information:

The majority of the course content will be available on UM Moodle. On the [Moodle site](#), you will need to enter your Net ID and password to access the course schedule, lab manual, and material to supplement lectures, including some outside readings. Whenever possible, lecture notes will be posted on the Moodle page before lectures but may be modified post-lecture according to how much was covered in

class. All exams and lab assignment must be uploaded to designated folders on the Moodle site. **We will not accept emailed assignments.**

Lab Instructors/TAs:

At least initially, TA's will not plan to hold regular office hours. To meet with your lab instructor/TA, please email them directly to schedule an appointment.

Fall 2022 Course TAs:

Robert Heumann (Robert.Heumann@umontana.edu)

Carly Innis (Carly.Innis@umontana.edu)

Lab location & Time:

For students also enrolled in the Soils and Water Laboratory course (NRSM 212), labs will meet from 2:00 PM – 4:50 PM on Monday, Tuesday, and Wednesday (unless otherwise noted), starting the week of September 5. September 5 is Labor Day and there are no classes. However, students in the Monday section will still be responsible for the material presented in lab 1. Stone 306 will remain open for students to review mineral specimens and complete the lab on their own time during the week.

Field labs will depart from the loading dock behind the Science Complex (south side of CHCB Building). Indoor labs will meet in Stone Hall 306. **Please be advised that all laboratory exercises start (and buses depart) promptly at 2:10 PM.** We also expect that students will attend their regularly scheduled lab. If, for some reason, you cannot attend you scheduled lab one week, please email your assigned TA and make arrangements to attend another lab.

Course Assignments and Grading*:

Grades will be computed from the following four components:

- Exam 1 (15%)
- Exam 2 (15%)
- Exam 3 (15%)
- Exam 4 (15%)
- Quizzes and homework assignments (40%)

* Please note, this class is offered for traditional letter grade only, it is not offered under the credit/no credit option.

WARNING: There will be NO MAKEUP EXAMS except under very unusual circumstances. Students with more than one failing grade on the four midterm exams will not pass the course.

Class Attendance Policies:

Students are strongly encouraged to attend all class meetings and complete all assignments for courses in which they are enrolled. Instructors may excuse brief and occasional absences for reasons of illness, injury, family emergency, religious observance or participation in a university-sponsored activity

(University sponsored activities include for example, field trips, ASUM service, music or drama performances, and intercollegiate athletics). Instructors shall excuse absences for reasons of military service or mandatory public service.

Recommended Preparation:

- Successful completion of a university-level chemistry course (e.g., CHMY 121N).
- Come to class and be prepared to participate.
- Before class, read the assigned material and be prepared to answer questions. We will conduct regular quizzes covering the reading and previous lectures.
- Check Moodle following the lecture for possible changes to posted lecture materials and to begin review.
- Turn in assignments on time.

Other, Warnings, Caveats, Red Tape, and University Considerations:

You are expected to read the assigned material, and will be responsible for its content. We will ask a lot of you in this class, and expect a high level of commitment to the course. A knowledge of the factors that determine ecosystem structure and function is integral to understanding a range of critical environmental issues the world now faces. Just like in many areas of science, to deal with those issues, you must first learn the basics of the discipline. And hopefully along the way you have some fun!

Students with Disabilities:

The University of Montana assures equal access to instruction through collaboration between students with disabilities, instructors, and the [Office for Disability Equity \(ODE\)](#). If you think you may have a disability adversely affecting your academic performance, and you have not already registered with ODE, please contact ODE in Aber Hall (1st floor) or 406.243.2243. We will work with you and ODE to provide an appropriate modification.

Course Withdrawal Deadlines and Drop/Add Policies:

[Course withdrawal deadlines](#) are published on the UM Website prior to the start of each semester. Please review them carefully.

Rules concerning academic honesty:

All students must adhere to UM policies on academic honesty. Academic misconduct is subject to an academic penalty by the course instructor and/or a disciplinary sanction by the University. All students need to be familiar with the [Student Conduct Code](#). Academic misconduct includes plagiarism. Don't plagiarize someone else's work, period.

Health and Safety

COVID is still with us, but we are learning to live with it. As such, in most cases, we will meet in person for both lecture and reading group, but will all follow all relevant UM safety protocols. In the unlikely event that we are forced to temporarily transition to remote instruction, I will provide instructions on how that will unfold. While we are in class, I would encourage everyone

to wear masks. Not required, and I may not always wear a mask while lecturing, but I would hope everyone will do their best to ensure the safety of others. If you do not feel well for any reason, please do not come to class. I will upload all my lecture materials to the course UM Box folder, so you should be able to keep up, even if you miss a lecture or two. please contact DSS for either an accommodation to be completely remote for the semester or for any safety protocol modification you may need (*depending on the needs we may or may not be able to accommodate the modification without requesting that you complete the class remotely*). If, at any point, students decide not to follow all safety protocols, I will immediately adjust any existing F2F activities and commit to full remote learning for the entire class for the remainder of the semester. More information and updates to UM's Healthy Fall plan can be found on the [UM website](#).

UM COVID Guidance

The university encourages COVID-19 vaccines and boosters, which are offered for both students and employees at the Health Services Pharmacy inside Curry Health Center.

Masks are only required inside Curry Health Center and in some medical/research laboratories on campus. This requirement will be clearly posted. Required or not, we respect those choosing to wear a mask to reduce the spread of respiratory viruses.

COVID testing for students is available at Curry Health Center. For employees, contact your primary care provider or visit a walk-in clinic. Free at-home tests can be [ordered online](#) or there may be tests available through the Health Services Pharmacy, call 243-5171.

Students who test positive need to [isolate](#) and not attend in-person classes for at least five days. (Please see link for CDC guidelines referring to isolation).

As with any other illness, please work to accommodate student absences. Consider ways to make course content available in the event of multiple student absences.

Refer to [this page](#) for additional resources and guidance on supporting students who miss classes due to illness.

UM Career Readiness Resources

The W.A. Franke of Forestry and Conservation is committed to the career success of our students. We encourage you to participate in [ElevateU](#) – UM's signature career readiness program – to ensure that you graduate career-ready, with the education, skills, and tools needed to launch, carry-on, and pivot your post-graduation career. Participation in ElevateU is free and can be started at any time, no matter where you are in your academic or career journey. Get started by creating a profile on [Handshake](#) to search for jobs and internships or by [scheduling an appointment](#) with an [Experiential Learning and Career Success \(ELCS\)](#) career coach or advisor.

Lecture Schedule

Date	Class	Topic	Reading (Instructor)
8/30	1	Course Overview and Introduction	(C)
9/1	2	The Soils Around Us	Chapter 1 (C)
9/6	3	Soil Formation – The State Factors	Chapter 2 (C)
9/8	4	Soils on the Landscape	Chapter 3: 83 – 121 (C)
9/13	5	Soils on the Landscape	Chapter 3 83 – 121 (C)
9/15	6	Soil physical properties	Chapter 4 130-139 (J)
9/20	7	Soil architecture	Chapter 4 144-148 (J)
9/22	8	Management and soil properties	Chapter 4 156-185 (J)
9/27	9	Exam 1	
9/29	10	Properties of water	Chapter 5 188-191 (J)
10/4	11	Soil water energy and capillarity	Chapter 5 191-193 (J)
10/6	12	Soil water content and potential	Chapter 5 193-199 (J)
10/11	13	Water flow in soils - Darcy's Law	Chapter 5 207-213 (J)
10/13	14	Water flow in soils - infiltration	Chapter 5 207-213 (J)
10/18	15	Plants and soil water availability	Chapter 5 222-230 (J)
10/20	16	Exam 2	
10/25	17	Soil-Plant-Atmosphere Continuum	Chapter 6 244-250 (J)
10/27	18	Soil aeration	Chapter 7 284-294 (J)
11/1	19	Ecological effects of soil aeration	Chapter 7 294-301 (J)
11/3	20	Soil temperature and thermal properties	Chapter 7 314-324 (J)
11/8	21	<i>Election Day – No Class</i>	
11/10	22	Soil Chemistry	Chapter 8: 327 - 364 (C)
11/15	23	Soil Chemistry	Chapter 8: 327 - 364 (C)
11/17	24	Exam 3	
11/22	25	Soil Acidity	Chapter 9 (C)
11/24	26	<i>Thanksgiving – No Class</i>	Chapter 11 (C)
11/29	27	Soil Ecology	Chapter 11 (C)
12/1	28	Soil Organic Matter	Chapter 12 (C)
12/6	29	Soil Nutrients	Chapin Chapter 9 (PDF on Moodle)
12/8	30	Exam 4	

*Letters denote lecturers: C = Cleveland; J = Jencso. Unless otherwise noted, all page numbers refer to the Brady and Weil textbook. Page reading is **DUE** on the days for which it is assigned.