



SYLLABUS

ENR 7530

SOILS AND CARBON: STABILIZATION AND PERMANENCE

Autumn 2022 (full term)

3 credit hours

Lecture (#35849 or #35850 for Wooster section) – in person
Lab (#35851) - in person

Course Information

- **Course times and location:**
 - Class lectures will be held in person Tuesday and Thursday from 10:20 a.m.-11:15 a.m. in Kottman Hall 333C (available remote link to Wooster)
 - Labs will be held in person Thursday from 12:40 p.m.-3:40 p.m. in Kottman Hall 423
- **Credit hours:** 3
- **Mode of delivery:** in person

COURSE OVERVIEW

Instructor

Instructor: Dr. M. Scott Demyan

Email address: (preferred contact method): demyan.4@osu.edu

Office hours: Immediately following lecture Tuesday and Thursday or by arrangement.

Prerequisites

Graduate student standing or instructor permission.

Course description

Soil carbon, globally, is larger than both atmospheric and terrestrial biomass carbon stocks, but how permanent is soil carbon and in what forms? Minerals play an important role in carbon stability and permanence and how microbes interact with them and organic residues. Students gain experience on methods to investigate soil carbon stabilization, mineralogy and soil carbon permanence, and mechanistic understanding of organo-mineral interactions.

Applied: We will undertake proper field sampling and sample preparation. In the lab analytical techniques will include x-ray diffraction (XRD), thermogravimetric analysis/differential scanning calorimetry (EGA/DSC), infrared spectroscopy (IR), total and external surface area, heavy liquid density separation, and elemental analysis along with routine soil/environmental sample characterization. We will also undertake multivariate statistical modeling for rapid predictions of soil properties along with process-based simulations of soil organic matter turnover using Daisy or another commonly used compartmental soil organic matter model.

Motivations: In completing this course students will be able to apply soil carbon stabilization and permanence concepts and methods to their own work resulting in a project proposal which with proper formatting could be submitted for funding consideration to a relevant funding source and/or be used as part of thesis/dissertation chapter. Laboratory data generated during the course could also be used to strengthen the proposal.

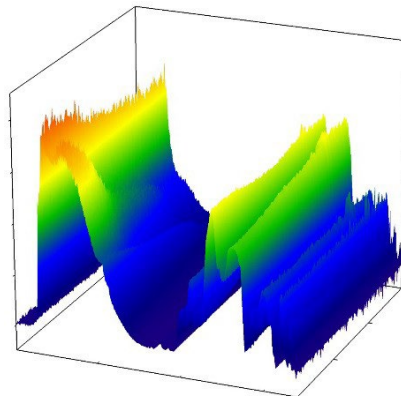


Figure 1.A) Soil exhibiting well developed E, Bh, and Bs horizons. B) temperature resolved mid-infrared thermogram of soil sample during heating from 25-700°C .

Course learning outcomes

By the end of this course, students will:

- know the stabilization mechanisms of soil carbon and about organo-mineral interactions.
- appreciate how soil carbon is linked to different environmental cycles and processes.
- learn the theoretical principals behind and undertake the main approaches for soil carbon quality and compositional investigations.
- critically read scientific literature, reports (e.g. soil surveys, lab reports), and own generated data to draw appropriate conclusions.
- differentiate how different minerals in the soil may affect soil carbon stability and how these minerals vary in space and time.
- know and distinguish the major classes of minerals and their genesis relevant to soil carbon stability.
- gain experience using process-based models for modeling soil carbon dynamics.
- integrate the methods and principals of soil carbon stabilization and permanence into their own research topic(s).

HOW THIS IN-PERSON COURSE WORKS

Mode of delivery: This course will be delivered in person for both lectures and lab. You will find a sequence of materials and activities each week in Carmen.

Pace of online activities: This course is divided into approximately **weekly modules** that are released one week ahead of time. You should log in to Carmen to check for posted readings/lab procedures prior to the lecture/lab that day.

Credit hours and work expectations: This is a **3-credit-hour course**. According to Ohio State policy (go.osu.edu/credithours), students should expect around 5 hours per week of time spent on direct instruction (lecture + lab time) in addition to 6 hours of outside course work (reading, assignment preparation).

Attendance and participation requirements: Because this is an in person course, your attendance and participation in lectures and labs are required unless you are absent for an excused reason.

COURSE MATERIALS AND TECHNOLOGIES

Required

The links to the required readings and lab materials for each class are in Carmen – Weekly Modules. The resources will be available at least a week before the scheduled class. You need to familiarize yourself with the materials prior to that day's lecture or lab.

Recommended/optional

- Each weekly module includes a list of recommended and supplemental readings about the topic.

Course technology

You will need a laptop/computer with a reliable internet connection and access to OSU resources.

Technology support

For help with your password, university email, Carmen, or any other technology issues, questions, or requests, contact the Ohio State IT Service Desk. Standard support hours are available at ocio.osu.edu/help/hours, and support for urgent issues is available 24/7.

- **Self-Service and Chat support:** ocio.osu.edu/help
- **Phone:** 614-688-4357(HELP)
- **Email:** servicedesk@osu.edu
- **TDD:** 614-688-8743

Technology skills needed for this course

- Basic computer and web-browsing skills
- Navigating Carmen (go.osu.edu/canvasstudent)
- CarmenZoom virtual meetings (go.osu.edu/zoom-meetings)
- OSU University Libraries (go.osu.edu/library)
 - Using OSU Library Off-Campus Sign-In Service

Required equipment

- Computer: current Mac (MacOs) or PC (Windows 10) with high-speed internet connection
- Webcam: built-in or external webcam, fully installed and tested
- Microphone: built-in laptop or tablet mic or external microphone
- Other: a mobile device (smartphone or tablet) to use for BuckeyePass authentication

Required software

- Microsoft Office 365: All Ohio State students are now eligible for free Microsoft Office 365. Full instructions for downloading and installation can be found at go.osu.edu/office365help.

Carmen access

You will need to use BuckeyePass (buckeyepass.osu.edu) multi-factor authentication to access your courses in Carmen. To ensure that you are able to connect to Carmen at all times, it is recommended that you take the following steps:

- Register multiple devices in case something happens to your primary device. Visit the BuckeyePass - Adding a Device help article for step-by-step instructions (go.osu.edu/add-device).
- Request passcodes to keep as a backup authentication option. When you see the Duo login screen on your computer, click **Enter a Passcode** and then click the **Text me new codes** button that appears. This will text you ten passcodes good for 365 days that can each be used once.
- Download the Duo Mobile application (go.osu.edu/install-duo) to all of your registered devices for the ability to generate one-time codes in the event that you lose cell, data, or Wi-Fi service

If none of these options will meet the needs of your situation, you can contact the IT Service Desk at 614-688-4357(HELP) and IT support staff will work out a solution with you.

GRADING AND FACULTY RESPONSE

How your grade is calculated

ASSIGNMENT CATEGORY	PERCENT
Class participation	10
Lecture assignments	15
Lab reports	25
Research funding proposal	50
Total	100

See course schedule in Carmen for official due dates.

Descriptions of major course assignments

Class participation (10%)

Description: To foster an effective learning environment and to complete our learning objectives requires the presence and participation of both the instructor and students. I expect you to attend every class and lab section unless you have an unavoidable or legitimate reason as defined below. You are allowed one free absence regardless of circumstance. For your

class participation grade, you will be expected to have completed any reading prior to that day's lecture/lab, participate in in-class discussions and answer questions posed by me. Additionally, you will be assigned to lead one lab-discussion on the particular method and readings for that session. We will be using the Perusall in Carmen, an interactive annotation and group collaboration tool, for some of our assigned readings.

Lecture assignment 1: Elevator speech (5%)

Description: The assignment is to brainstorm a problem/open question in your own work and one way that soil carbon can be linked to this question. You are basically going to pitch this idea to your fellow classmates. A suggestion in formulating your speech are the following points: a specific problem/issue in your research, why should it matter to us, potential solutions looking at carbon stabilization/permanence and the benefits of fixing/investigating it. Start by writing down several potential topics, narrowing down to one main one.

Lecture Assignment 2: Lightning Talk (5%)

Description: The assignment is to build upon the problem/open question related to soil carbon that you discussed in your elevator speech. You will have **5 minutes** and will be able to use presentation slides. Suggested items to include in the talk (don't have to include all) are what the issue is, why is it important for us, what is currently known about this issue and gaps in the current knowledge, proposed methodology, and expected results and conclusions. As in a conference setting, I will signal when your 5 minutes is over. As it is a short time period, please make sure you practice it beforehand so that your message is concise and to the point.

Lecture Assignment 3: Writing a Critical review of a scientific article on stabilization/permanence of soil carbon (5%)

Description: Write a critical review of a scientific article from peer reviewed journal. The article should be related somehow to stabilization/permanence of soil carbon. Possible suggested journals are but not limited to *Soil Science Society of America Journal*, *Soil Biology and Biochemistry*, *Geoderma*, *Biogeosciences*, *Clay Minerals*, *Clay and Clay Minerals*, *Soil*.

Lab reports (5% each, total 25%)

Description: You are to compile your notes/results for the respective weeks (i.e. 1 & 2, 3 & 4, 5 & 6, 9 & 10, and synthesis) comment on concepts/procedures that maybe were somewhat difficult to comprehend or not clear, and answer a series of question prompts for the individual labs provided with the weekly lab exercises.

Funding proposal Part 1: Development of Scientific Questions and Hypotheses (2.5%)

Description: The assignment is to take the problem/open question related to **soil carbon** that you discussed in your elevator speech and lightning talk and to develop a series of objectives (what you want to do) and specific hypotheses (how you will test whether you have reached an objective). You should develop three objectives, each with at least one testable hypothesis.

Funding proposal Part 2: Literature Review of Proposed Topic in Soil Carbon Stabilization and Permanence (5%)

Purpose: In developing your research proposal regarding a topic within soil carbon stabilization and permanence, a literature review examines the background research pertinent to your topic as a snapshot of the “state-of-the-art” of the research at this moment.

Bounds of the review: Use a minimum of 6-8 sources. Focus on the most recent peer-reviewed literature. Include the parameters of your search (e.g. search terms, database used, number of total hits found, and how you narrowed down to your 6-8 sources) and also properly cite the articles. You can use any citation style, just be consistent.

Funding proposal Part 3: Formulate methodological approach to developed scientific questions with timeline (5%)

Description: As the next step in developing your research proposal regarding a topic within mineralogy, you will now develop your methodological approach. This will be the last step before developing your final full proposal.

Funding proposal Part 4: Final Project Proposal Examining Soil Carbon Stabilization/Permanence (12.5%)

Description: Taking what you have developed throughout the semester, what you have learned about different soil carbon and mineralogical concepts and methods, and instructor feedback, finalize your final proposal.

Funding proposal 5: Peer review of two final proposals (15%)

Description: In the role of a panel reviewer (e.g. NSF, NIFA, etc.) you will evaluate two of your classmates’ final proposals and provide written feedback based on a scientific merit, feasibility, qualifications of the principal investigator, does it meet the funding call, and methodology and experimental set up.

Academic integrity and collaboration: Your written assignments should be your own original work. In your research proposal, you should follow **a formal** style (your choice of style, but be consistent) to cite the ideas and words of your research sources. You are required to acknowledge in your papers if you have borrowed any ideas, terms, or phrases. You may ask a trusted person to proofread written assignments before you turn them, however no one else should revise or rewrite your work.

Late assignments

All assignments, unless otherwise noted, should be turned in at the beginning of class on the due date. The grade for late submissions will be lowered by 5% per calendar day unless due to an excused reason.

I recognize that life happens and there are legitimate circumstances in which you will miss lecture/lab sections. For missed course work, accommodations for makeup work will be made. This policy applies to all course requirements. You are responsible for planning your schedule to avoid excessive conflicts with course requirements.

1. I will not penalize students for absence during the academic term due to the following **unavoidable or legitimate** circumstances:

- illness, physical or mental, of you or your dependent(s);
- medical conditions related to pregnancy;
- dependent care during emergency and/or COVID-19 school closings;
- participation in intercollegiate athletic events;
- subpoenas;
- jury duty;
- military service;
- bereavement, including travel related to bereavement;
- religious observances: At the beginning of the semester, you should notify me of any religious holiday(s) that will necessitate your request for deadline extension. A week before a religious holiday, send me an email notification that you will miss a deadline to observe a religious holiday. Because religious holidays are scheduled in advance, the instructor has the right to insist, where feasible, that you complete the course work prior to the anticipated absence.
- participation in formal University system governance, including the University Senate, Student Senate, and Board of Regents meetings, by students selected as representatives to those bodies; and

- activities sponsored by the University if identified by the senior academic officer for the campus or the officer's designee as the basis for excused absences.

2. For circumstances not listed in (1), I will decide on a case-by-case basis if an absence is due to unavoidable or legitimate circumstances and grant a request for makeup work.

Notification, Verification of Absences, and Make-up Work

1. Please notify me in writing, preferably by email, of circumstances identified in (1) or other circumstances leading to a request for makeup work as soon as possible and provide information to explain the absence. Some situations will be sufficiently urgent that arrangements for makeup work cannot be made prior to the date of an absence. In such cases, we will make arrangements as soon as possible following your return.
2. I may request verification for absences, with the exception of a single episode medical absence that does not require medical services.
3. I may request verification for a single episode medical absence if (i) you have had more than one single episode medical absence in the class, or (ii) the single episode medical absence involves missing laboratory sessions, exams or important graded in-class assignments.
4. You will not be penalized, and I will provide reasonable and timely accommodation or opportunity to make up missed work, including exams or other course requirements that have an impact on the course grade if you:
 1. Were absent due to circumstances identified in (1);
 2. Have complied with the notification requirements; and
 3. Have provided verification if I have requested further information.
5. Extended absences that result in missing many critical components of the course, even for legitimate reasons, will be dealt with on a case by case basis, as arrangements for makeup work may be difficult or unreasonable to accomplish.

The instructor is not obligated to accommodate a student who has missed so much of the critical components of a course, even for legitimate reasons, that arrangements for makeup work would not be reasonable.

Students must notify me of circumstances identified above or other circumstances leading to a request for a deadline modification as soon as possible and provide information to explain the late assignments. Generally, technical glitches such as a bad internet connection, laptop and computer malfunction are not acceptable excuses for missing a deadline.

Grading scale

93–100: A
90–92.9: A-
87–89.9: B+
83–86.9: B
80–82.9: B-
77–79.9: C+
73–76.9: C
70–72.9: C-
67–69.9: D+
60–66.9: D
Below 60: E

Instructor feedback and response time

I am providing the following list to give you an idea of my intended availability throughout the course. (Remember that you can call **614-688-4357(HELP)** at any time if you have a technical problem.)

- In general, if you have additional questions or issues, please let me know immediately following our lecture or lab sessions.
- **Office hours:** immediately following lecture on Tuesdays or by appointment.
- **Email:** I will generally reply to emails sent during the week within 24 hours. Please include in the email subject line ENR 7530-keyword. The keyword should be descriptive of the general topic of the email, e.g. “assignment 2”, “question on lecture 8”.
- **Assignment feedback:** Feedback will be given via Carmen on all assignments generally within 7 days of the submission date.

OTHER COURSE POLICIES

Field and Lab guidelines

Notes on Field work:

For our first three lab sessions, we will meet at Waterman Farm (meeting point will be given in Carmen) for field investigations and soil sampling. For the field work you will need to wear appropriate clothes and footwear in potentially hot or wet conditions.

Notes on Lab work:

For lab sessions that will be held in the lab, we will be meeting in Kottman Hall 423. Proper attire in the lab is closed-toe shoes and pants. You will be provided with personal safety equipment (e.g. gloves, lab coat, safety glasses) when required. Please follow all safety requirements given by the instructor. You should also bring to class a notebook and something to write with to take notes and record measurements. You will be provided with hard copies of the lab procedure materials prior to or during the lab, so there is no need to print those out. They will also be available on Carmen.

You will need to follow any COVID-19 related safety precautions as given by the instructor. Masks may be required in the lab.

Lab cleaning: As we do procedures in the lab, we will be practicing clean-as-we-go, including sanitizing touch surfaces between users and pre-rinsing labware after use.

Academic integrity policy

Ohio State's academic integrity policy

Academic integrity is essential to maintaining an environment that fosters excellence in teaching, research, and other educational and scholarly activities. Thus, The Ohio State University and the Committee on Academic Misconduct (COAM) expect that all students have read and understand the university's *Code of Student Conduct* (studentconduct.osu.edu), and that all students will complete all academic and scholarly assignments with fairness and honesty. Students must recognize that failure to follow the rules and guidelines established in the university's *Code of Student Conduct* and this syllabus may constitute "Academic Misconduct."

The Ohio State University's *Code of Student Conduct* (Section 3335-23-04) defines academic misconduct as: "Any activity that tends to compromise the academic integrity of the university or subvert the educational process." Examples of academic misconduct include (but are not limited to) plagiarism, collusion (unauthorized collaboration), copying the work of another student, and possession of unauthorized materials during an examination. Ignorance of the university's *Code of Student Conduct* is never considered an excuse for academic misconduct, so I recommend that you review the *Code of Student Conduct* and, specifically, the sections dealing with academic misconduct.

If I suspect that a student has committed academic misconduct in this course, I am obligated by university rules to report my suspicions to the Committee on Academic Misconduct. If COAM determines that you have violated the university's *Code of Student Conduct* (i.e., committed academic misconduct), the sanctions for the misconduct could include a failing grade in this course and suspension or dismissal from the university.

If you have any questions about the above policy or what constitutes academic misconduct in this course, please contact me.

Other sources of information on academic misconduct (integrity) to which you can refer include:

- Committee on Academic Misconduct web page (go.osu.edu/coam)
- Ten Suggestions for Preserving Academic Integrity (go.osu.edu/ten-suggestions)
- Eight Cardinal Rules of Academic Integrity (go.osu.edu/cardinal-rules)

Copyright for instructional materials

The materials used in connection with this course may be subject to copyright protection and are only for the use of students officially enrolled in the course for the educational purposes associated with the course. Copyright law must be considered before copying, retaining, or disseminating materials outside of the course.

Creating an environment free from harassment, discrimination, and sexual misconduct

The Ohio State University is committed to building and maintaining a community to reflect diversity and to improve opportunities for all. All Buckeyes have the right to be free from harassment, discrimination, and sexual misconduct. Ohio State does not discriminate on the basis of age, ancestry, color, disability, ethnicity, gender, gender identity or expression, genetic information, HIV/AIDS status, military status, national origin, pregnancy (childbirth, false pregnancy, termination of pregnancy, or recovery therefrom), race, religion, sex, sexual orientation, or protected veteran status, or any other bases under the law, in its activities, academic programs, admission, and employment. Members of the university community also have the right to be free from all forms of sexual misconduct: sexual harassment, sexual assault, relationship violence, stalking, and sexual exploitation.

To report harassment, discrimination, sexual misconduct, or retaliation and/or seek confidential and non-confidential resources and supportive measures, contact the Office of Institutional Equity:

1. Online reporting form at equity.osu.edu,
2. Call 614-247-5838 or TTY 614-688-8605,
3. Or Email equity@osu.edu

The university is committed to stopping sexual misconduct, preventing its recurrence, eliminating any hostile environment, and remedying its discriminatory effects. All university

employees have reporting responsibilities to the Office of Institutional Equity to ensure the university can take appropriate action:

- All university employees, except those exempted by legal privilege of confidentiality or expressly identified as a confidential reporter, have an obligation to report incidents of sexual assault immediately.
- The following employees have an obligation to report all other forms of sexual misconduct as soon as practicable but at most within five workdays of becoming aware of such information: 1. Any human resource professional (HRP); 2. Anyone who supervises faculty, staff, students, or volunteers; 3. Chair/director; and 4. Faculty member.

This course adheres to The Principles of Community adopted by the College of Food, Agricultural, and Environmental Sciences. These principles are located on the Carmen site for this course; and can also be found at <https://go.osu.edu/principlesofcommunity>. For additional information on Diversity, Equity, and Inclusion in CFAES, contact the CFAES Office for Diversity, Equity, and Inclusion (<https://equityandinclusion.cfaes.ohio-state.edu/>). If you have been a victim of or a witness to a bias incident, you can report it online and anonymously (if you choose) at <https://studentlife.osu.edu/bias/report-a-bias-incident.aspx>.

Your mental health

As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance or reduce a student's ability to participate in daily activities. No matter where you are engaged in distance learning, The Ohio State University's Student Life Counseling and Consultation Service (CCS) is here to support you. If you find yourself feeling isolated, anxious or overwhelmed, on-demand resources are available at go.osu.edu/ccsondemand. You can reach an on-call counselor when CCS is closed at 614-292-5766, and 24-hour emergency help is also available through the 24/7 National Prevention Hotline at 1-800-273-TALK or at suicidepreventionlifeline.org. The Ohio State Wellness app is also a great resource available at go.osu.edu/wellnessapp.

David Wirt, wirt.9@osu.edu, is the CFAES embedded mental health counselor. He is available for new consultations and to establish routine care. To schedule with David, please call 614-292-5766. Students should mention their affiliation with CFAES when setting up a phone screening.

ACCESSIBILITY ACCOMMODATIONS FOR STUDENTS WITH DISABILITIES

Requesting accommodations

The university strives to make all learning experiences as accessible as possible. In light of the current pandemic, students seeking to request COVID-related accommodations may do so through the university's request process, managed by Student Life Disability Services. If you anticipate or experience academic barriers based on your disability (including mental health, chronic, or temporary medical conditions), please let me know immediately so that we can privately discuss options. To establish reasonable accommodations, I may request that you register with Student Life Disability Services. After registration, make arrangements with me as soon as possible to discuss your accommodations so that they may be implemented in a timely fashion. SLDS contact information: slds@osu.edu; 614-292-3307; slds.osu.edu; 098 Baker Hall, 113 W. 12th Avenue.

Accessibility of course technology

This online course requires use of CarmenCanvas (Ohio State's learning management system) and other online communication and multimedia tools. If you need additional services to use these technologies, please request accommodations with your instructor.

- Canvas accessibility (go.osu.edu/canvas-accessibility)
- Streaming audio and video
- CarmenZoom accessibility (go.osu.edu/zoom-accessibility)
- OSU Library Services

COURSE SCHEDULE

This is a provisional schedule. Please refer to the Carmen course for up-to-date topics and assignment due dates.

Week	Content	Assignments	Learning Goals
1	Lectures: Defining soil organic matter stabilization and persistence, what is it and why is it important?	Lecture: Pre-test knowledge assessment on basic soil background information (Carmen quiz)	1,2 3,5

Week	Content	Assignments	Learning Goals
	<u>Lab</u> : Sampling: "SOM of the Catena" at Waterman Farm (description, composite, cores, soil sensors)	<u>Lab</u> : Pre-test knowledge assessment on basic field characteristics of soil	
2	<u>Lectures</u> : Role of soil organic matter stabilization in the global carbon cycle <u>Lab</u> : Sampling: "SOM under different land uses" at Waterman Farm (description, composite, VNIR demonstration)	<u>Lab report 1</u> : Notes/reflections from weeks 1 and 2	2 3,5
3	<u>Lectures</u> : Main theories of soil organic matter stabilization (e.g. humus/condensation theory, onion model, MEMS framework) <u>Lab</u> : Field sampling continued at Waterman Farm , prepare samples for analysis	<u>Lab</u> : student led discussion on pre-lab readings	1 3,5
4	<u>Lectures</u> : soil mineralogy-main mineral classes, how to define them <u>Lab</u> : begin Zimmermann fractionation (sonification & wet sieving)	Lecture assignment #1: Elevator speech. Brainstorm a problem/open question in own work and one way that carbon stabilization may be related and potentially how it can be studied.- <u>due Thursday</u> Lab report 2: Notes/reflections from weeks 3 and 4 -due Tuesday	5 3,5
5	<u>Lectures</u> : soil organic matter and ultisols and oxisols <u>Lab</u> : Zimmermann fractionation cont. (density separation)	Lecture assignment #2: lightning talk- due Thursday <u>Lab</u> : student led discussion on pre-lab readings	5,6 3,5
6	<u>Lectures</u> : amorphous/volcanic soils <u>Lab</u> : Zimmermann fractionation complete (chemical oxidation)	Funding proposal 1: Develop scientific questions and hypotheses – due Thursday <u>Lab report 3: Notes/reflections from weeks 5 and 6 – due Tuesday</u>	5,6 3,4
7	<u>Lectures</u> : Oxides (Fe-, Al-, Mn-), Maghemite and SOM <u>Lab</u> : Surface area (BET, EGME), magnetic susceptibility of fractions	Lecture assignment #3: Critical review. Review topical, peer-reviewed article on soil carbon stabilization/permanence- due next Tuesday <u>Lab</u> : student led discussion on pre-lab readings	5,6 3,4
8	<u>Lecture</u> : carbon interactions with depth <u>Lab</u> : Fe/Al extracts		2,5 4
9	<u>Lectures</u> : carbonates (lithogenic, pedogenic, limed, soda waste) <u>Lab</u> : Chittick apparatus/XRD I	Funding proposal 2: Literature review of proposed topic in soil carbon stabilization and permanence from week 6.- due Friday at 11:59 PM in Carmen	5,6 3,4

Week	Content	Assignments	Learning Goals
		Lab: student led discussion on pre-lab readings	
10	<u>Lectures:</u> soil organic matter-mineral interactions, carbon permanence <u>Lab:</u> TGA/DSC of fractions/XRD II	Funding proposal 3: Formulate methodological approach to developed scientific questions with timeline- due Thursday of week 11 Lab report 4: Notes/reflections from weeks 9 and 10- due Tuesday	8 8 3,4
11	<u>Lectures:</u> advanced techniques (SEM, TEM, Nano-SIMS, atomic force microscopy) <u>Lab:</u> infrared spectroscopy	Funding proposal 4: Final project proposal- due next Tuesday <u>Lab:</u> student led discussion on pre-lab readings	8 3,4
12	<u>Lectures:</u> initializing soil organic matter models <u>Lab:</u> predictive modeling of soil properties	<u>Lab:</u> student led discussion on pre-lab readings	7 3
13	<u>Lectures:</u> Climate change and soil carbon, processes and feedbacks <u>Lab:</u> dynamic modeling of soil organic matter	Lab report 5: Final synthesis	7 4
14	<u>Lectures:</u> review of funding proposals <u>Lab:</u> lab synopsis and final interpretations	Funding proposal 5: Proposal peer reviews (in-class)	4 3
Exam week	None	none	