

ENV 410/LSC 598: Soil Science

Fall 2021

Lecture/Lab: M W 3:00-4:15 PM in Sands 235

Work sessions: Fr 3:00-4:15 PM, or self-scheduled

Instructor

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CLCC 315D

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Office hours: M W 12-1 PM, or by appointment

Class info

Semester hours: 4

Pre-requisites: BIO 320, CHM 116, PHY 101

Co-requisites: None

Course Webpage: <https://asu.instructure.com/>

Course Description

This course introduces the fundamental principles of soil science, including physical, chemical, biological, and ecological properties. These principles will be applied to explain the importance of soil as both a natural resource and ecosystem. We will discuss the role of soils as the heart of terrestrial ecosystems, both natural and managed, and the importance of this key natural resource to environmental health and biological productivity. We will also explore how human activity and global change are impacting this vital natural resource and ecosystem that is crucial to life on earth. The laboratory component will also introduce applications and standard methodology for investigating these principles.

Course Objectives / Learning Outcomes

Students completing this course will be able to:

- Describe the chemical, physical, and biological characteristics of soil and the soil formation processes that create the diversity of soils across the planet.
- Explain the role of key soil processes in overall ecosystem function.
- Demonstrate facility with laboratory methods to analyze soil chemical, biological and physical properties, as well as major soil ecological processes.

Technology Requirements

This course will utilize two pieces of technology that require you to have an internet connection:

iClicker. You will participate in class activities using iClicker. This may be done from a web browser on your computer or via the app on your smart phone. The subscription is free for ASU students, and you do NOT need to purchase the official remote. You are able to log into iClicker (www.iclicker.com) using your ASU information. Please establish your account prior to the first class. The process for connecting to this specific class and methods for interaction will be reviewed on the first day of class. Information on how to set up your account: <https://uto.asu.edu/services/tools/clickers/students/KBA>

Canvas. The Canvas site for this course will be our hub for sharing course materials, downloading and submitting assignments, and grading and feedback. Check the site regularly.

Course Reading

Required Text

Weil, R. and Brady, N. 2017. *The Nature and Property of Soils*. 15th Edition. Pearson Prentice Hall.

Journal articles

Journal articles are listed in the "Reading Links" module on Canvas and available online through ASU's library's electronic journals. A demonstration on how to access and use electronic journals will be made during class.

| Grading | | Grading Scale |
|-----------------------|-----|----------------------|
| Lab Assignments | 30% | 90% ≤ A ≤ 100% |
| Discussion/Journaling | 20% | 80% ≤ B ≤ 89.9% |
| Exams | 30% | 70% ≤ C ≤ 79.9% |
| Term paper | 20% | 60% ≤ D ≤ 69.9% |
| | | E ≤ 59.9% |

Laboratory Assignments

There are 6 laboratory assignments that will introduce and practice basic concepts in soil science to reinforce topics covered in lecture. Assignments will be explained in class during laboratory exercises. Students may discuss the assignments with one another, but written work must be completed individually. Written assignments must be word-processed and spell-checked. Please submit your work electronically as a PDF or a Word (.doc or .docx) document using the Assignments feature on Canvas. Lab assignments are *due by 12:00 P.M. (Arizona Standard Time) on the day specified in the syllabus*. All assignments must be turned in on time for full credit; 10% of your grade will be automatically deducted *per day* for days 1 and 2 late. Assignments will not be accepted more than 2 days late. No late assignments will be accepted for full credit without *prior* permission of the instructor. Each assignment is worth 5% of your final grade, for a total of 30%.

Discussion / Journaling via iClicker

Learning is not a spectator sport! You will document your understanding of lecture material and participation in class discussion by answering questions posed during class via iClicker (aka "journaling"). Therefore, you should bring an internet-ready device each class to answer questions, as questions must be answered during class when discussions are being held. Questions posed in this medium are often checking your understanding of complex concepts, as well as challenging you to think beyond the material. Therefore, these questions are numerous, but individually low-stakes. Questions are asked each class, though the number varies among class periods. Your grade in this category will be calculated as the percent of total possible points earned over the course of the semester, accounting for 20% of your final grade.

Examinations

There will be three exams given: Two mid-term exams during the semester and a comprehensive final exam. Each exam is worth 10% of your final grade, for a total of 30%. The format of the exams will be a combination of short answer and applications from the problem sets.

Term Paper: Independent Soil Investigation Project

You will demonstrate your skill in soils investigation and interpretation through an independent project undertaken in groups of one to three students and presented in class using visual aids. Groups will explore a soil ecosystem of interest and demonstrate the ability to describe and interpret soils in terms of key processes. Details on this project will be presented during the semester. A detailed rubric for this project, including grading criteria, will be provided on the Canvas site. Papers should be written professionally, and use of the Writing Center is strongly encouraged (<http://studentsuccess.asu.edu/writingcenters>). Your final group project will be 20% of your grade.

Graduate Credit: All students seeking graduate credit for this course will be required to do the following:

- Deliver one guest-lecture covering the relevance of soil science to their graduate research, as well as their own journey from undergraduate to graduate student and answer questions from students curious about graduate school.
- Offer study groups / review sessions at key points during the semester (e.g., before the exams).
- Term paper will be written individually, rather than in a group, and graded with a graduate-level rubric.

Instructor communication:

The best way to contact me is by email. I will typically respond within 24-48 hours. If I do not respond in 2 days, call or email again. A lack of response should never be interpreted as agreeing to your request! If I have not responded, it is because I did not receive your email, and you need to try again.

ASU email is an official means of communication among students, faculty, and staff. Students are expected to read and act upon email in a timely fashion. Students bear the responsibility of missed

messages and should check their ASU-assigned email regularly. **All instructor correspondence will be sent to your ASU email account.**

Community of Care Guidelines

ASU's response to COVID-19 and for the preservation and protection of every community member's health will continue to be dynamically adjusted to keep our community healthy and well. In certain indoor settings face coverings will be required. Those settings include all classrooms and teaching or research labs. In addition, face coverings will be required in close-quarter environments where physical distancing may not be possible. These include the following:

- All ASU clinical programs and centers that serve the general public, such as the ASU Health Centers, Child Development Laboratory, and Counselor Training Center (the "Programs"), whether on- or off-campus.
- Meeting rooms, workshop, design or production studios, and other indoor settings where social distancing is not possible.
- Office hours
- All other indoor areas designated by posted signage

As the information on status, current risk, and appropriate response continues to evolve, please consult the following websites for the latest guidance and information:

<https://eoss.asu.edu/communityofcare>

<https://www.asu.edu/about/fall-2021#face-coverings>

<https://wellness.asu.edu/community-of-care-coming-to-campus>

Course Policies and Expectations:

Attendance/absence policy. Attendance and participation in class activities is an essential part of the learning process, and students are expected to attend class regularly. Some absences are, however, unavoidable. In addition to the instructor's general policy on absences and missed work, excused absences and conditions for making up work include (1) a university-sanctioned event [ACD 304-02]; (2) religious holidays [ACD 304-04; a list can be found here <https://eoss.asu.edu/cora/holidays>]; (3) work performed in the line-of-duty according [SSM 201-18]; and (4) illness, quarantine or self-isolation related to illness as documented by a health professional. Students must notify their instructors of these absences as early as possible in the semester. However, if an emergency arises that causes you to miss class, **communication is key!** Contact the professor and/or classmates to learn what you missed, and **you will be required to provide evidence of the emergency** (e.g., doctor's note, obituaries, police report, etc.) if your absence caused you to miss an exam or assignment. Please note that work schedules, vacation travel, meetings on other campuses, homework load, and sleepiness *do not* count as emergencies. Excused absences do not relieve students from responsibility for any part of the course work required during the period of absence.

In case you cannot attend class in person as a result of illness or possible exposure to infectious disease, contact the professor to arrange remote participation and/or makeup work, which will be handled on a case-by-case basis. Absences for illness, quarantine or self-isolation related to illness should be documented by a health professional and communicated to the instructor as soon as possible by email.

Study and Preparation Time. The Arizona Board of Regents specifies that students are expected to spend at least two hours per week on course-related research and scholarly activities per course credit. This means that each week you should expect to spend at least eight hours preparing for class.

Academic Integrity. <https://provost.asu.edu/academic-integrity> Each student has an obligation to act with honesty and integrity, and to respect the rights of others in carrying out all academic assignments. Violations of the University Academic Integrity policy will not be ignored. Penalties include reduced or no credit for submitted work, a failing grade in the class, a note on your official transcript that shows you were punished for cheating, suspension, expulsion and revocation of already awarded degrees. The university requires that the implementation of any of these penalties for violations of the academic integrity policy be reported to the College's Academic Integrity Officer. The Academic Integrity Policy defines the process to be used if the student wishes to appeal this action.

ASU Student Code of Conduct. <https://eoss.asu.edu/dos/srr/codeofconduct> Students are expected to follow the student code of conduct, especially when communicating with your peers and instructors. Violations of the student code of conduct may result in withdrawal from the class.

Reasonable Accommodations for Students with Disabilities. The Disability Resource Center (DRC) provides information and services to students with any documented disability who are attending ASU West. Individualized program strategies and recommendations are available for each student as well as current information regarding community resources. Students also may have access to specialized equipment and supportive services and should contact the instructor for accommodations that are necessary for course completion.

Final Exam Make-up Policy. The final exam schedule listed in the Schedule of Classes will be strictly followed. Exceptions to the schedule and requests for make-up examinations can be granted only by the Associate Director of the School of Mathematical and Natural Sciences for one of the following reasons: 1) religious conflict; 2) the student has more than three exams scheduled on the same day; 3) two finals are scheduled to occur at the same time. Make-up exams will NOT be given for reasons of non-refundable airline tickets, vacation plans, work schedules, weddings, family reunions, or other such activities. Students should consult the final exam schedule before making end-of-semester travel plans. If there is a last-minute personal or medical emergency, the student may receive a grade of Incomplete and make up the final within one calendar month. The student must provide written documentation and be passing the class at the time to receive an Incomplete. A signed "Request for Grade of Incomplete" must be submitted by the student and approved by the student's instructor and the Associate Director of the School of Mathematical and Natural Sciences.

The Grade of Incomplete. A grade of incomplete will be awarded only in the event that a documented emergency or illness prevents a student who is doing acceptable work from completing a small percentage of the course requirements at the end of the semester. The guidelines in the current general ASU catalog regarding a grade of incomplete will be strictly followed. **A grade of incomplete will NOT be awarded unless there is documented evidence of extreme personal or immediate family hardship.** Changes in work hours, child-care emergencies, or other similar personal problems will not be approved as reasons for awarding incompletes. The Director of the School of Mathematical and Natural Sciences must approve all incomplete grade requests.

Course/Instructor Evaluation. The course/instructor evaluation for this course will be conducted online 7-10 days before the last official day of classes of each semester or summer session. Your response(s) to the course/instructor are anonymous and will not be returned to your instructor until after grades have been submitted. The use of a course/instructor evaluation is an important process that allows our college to (1) help faculty improve their instruction, (2) help administrators evaluate instructional quality, (3) ensure high standards of teaching, and (4) ultimately improve instruction and student learning over time. Completion of the evaluation is not required for you to pass this class and will not affect your grade, but your cooperation and participation in this process is critical. About two weeks before the class finishes, watch for an e-mail with "NCIAS Course/Instructor Evaluation" in the subject heading. The email will be sent to your official ASU e-mail address.

Withdrawals. It is the student's responsibility to be aware of their registration status. **The instructor will NOT withdraw students for any reason.** Specifically, students should be aware that non-attendance will NOT automatically result in their being dropped from the course. Therefore, if a student does not attend class during the first week or for any extended period of time during the semester, they should not presume that they are no longer registered.

Please note the following dates:

| | |
|-------------------------------|------------------|
| Drop/Add Deadline | August 25, 2021 |
| Course Withdrawal Deadline* | November 3, 2021 |
| Complete Withdrawal Deadline* | December 3, 2021 |

*As part of a complete session withdrawal a student must withdraw from all classes in a session.

Beginning the first day of classes, undergraduate students are required to work with a Student Retention Coordinator to facilitate the withdrawal process. Please refer to <http://students.asu.edu/StudentRetention>

Any withdrawal transaction must be completed by the deadline date in accordance to the appropriate session at the registrar's office. If not, you will still be officially enrolled and you will receive a grade based on your work completed. For additional information about ASU's withdrawal policy and the possible consequences of withdrawing from a class, contact Registration Services or your academic counselor. **Students are responsible for their registration status!**

Policy against Threatening Behavior. <http://www.asu.edu/aad/manuals/ssm/ssm104-02.html> In the classroom and out students are required to conduct themselves in a manner that promotes an environment that is safe and conducive to learning and conducting other university-related business. All incidents and allegations of violent or threatening conduct by an ASU student will be reported to the ASU Police Department (ASU PD) and the Office of the Dean of Students. Such incidents will be dealt with in accordance with the policies and procedures described in Section 104-02 of the Student Services Manual.

Title IX. Title IX is a federal law that provides that no person be excluded on the basis of sex from participation in, be denied benefits of, or be subjected to discrimination under any education program or activity. Both Title IX and university policy make clear that sexual violence and harassment based on sex is prohibited. An individual who believes they have been subjected to sexual violence or harassed on the basis of sex can seek support, including counseling and academic support, from the university. If you or someone you know has been harassed on the basis of sex or sexually assaulted, you can find information and resources at <https://sexualviolenceprevention.asu.edu/faqs>. As mandated reporters, faculty are obligated to report any information of which they become aware regarding alleged acts of sexual discrimination, including sexual violence and dating violence. ASU Counseling Services, <https://eoss.asu.edu/counseling>, is available if you wish discuss any concerns confidentially and privately.

Emergencies/Campus Power Outage. In the event of a campus power outage or other event affecting the ability of the University to deliver classes, any decision to cancel classes will be announced using the ASU emergency notification system. For this reason, it is imperative that students register with the ASU emergency notification system at: <https://cfo.asu.edu/emergency-alert>. In cases in which a limited number of buildings are affected, students should check the university website and/or call the School office at (602) 543-6050.

Evacuation Plan. Students should be aware of the evacuation route posted on the exit door of each classroom. Students who cannot walk down stairs should notify the instructor as early in the course as possible so the instructor can provide information regarding the location of the designated meeting area on each upper floor of the building (marked with a blue sign that states Emergency Evacuation Response Area).

Assessments. Please be aware that student scores on exams or other graded work may be used for assessment of program goals of degrees offered by the School of Mathematical and Natural Sciences.

Recording of Lectures. Our aim is to create a learning environment where all feel free to contribute; thus any recording of class sessions is prohibited (with the exception of those who have a DRC-approved accommodation), or the express consent of the instructor). No one should post any verbatim accounts of class discussion or say anything that could identify a class member on social media without the express permission of the class member.

Copyright Infringement. Students must refrain from uploading to any course shell, discussion board, or website used by the course instructor, or any other forum/site not owned by the instructor, material that is not the student's original work, unless the students first comply with all applicable copyright laws. Faculty members reserve the right to delete materials on the grounds of suspected copyright infringement. This right does not exempt posting to any site class notes, discussions, homework, exams, and any other course-related materials to include study materials without the instructors permission. Such posting explicitly violates copyright laws and the ASU academic integrity policy. *Subject to Change.* All class syllabi are subject to minor changes as necessary to accommodate the needs of the instructor, school, or class.

Respectful communication. As a beacon for critical thought and the advancement of knowledge, ASU values dissenting opinions. Acknowledging that someone else's opinion matters

as much as our own is the first step to creating a respectful dialogue. However, we must also distinguish between opinion, fact, and policy. Valuing and respecting those opinions that are different from our own does not mandate acquiescence or violation of policy. We expect all communications, written, email, verbal, and otherwise to be conducted with a respectful tone and tenor, and in compliance with established protocols and the ASU Code of Conduct: (<https://eoss.asu.edu/dos/srr/codeofconduct>)

The syllabus is a statement of intent and serves as an implicit agreement between the instructor and the student. Every effort will be made to avoid changing the course schedule but the possibility exists that unforeseen events will make syllabus changes necessary. Remember to check your ASU email and the course site often.

| Week | Date | Topic | Reading Assignments Due |
|-------|---------|--|---|
| 1 | M 8/23 | Course introduction, syllabus Introduction to soils | <i>Ch 1</i> |
| | W 8/25 | Soil formation and structure | <i>Ch 2</i> |
| 2 | M 8/30 | Soils of the world (orders & classification) | <i>Ch 3, Tenneson 2014</i> |
| | W 9/1 | Soil physics: texture & structure | <i>Ch 4</i> |
| 3 | M 9/6 | NO CLASS – LABOR DAY | |
| | W 9/8 | LAB 1: Working with soil data | |
| 4 | M 9/13 | Soil physics: water dynamics | <i>Ch 5, 6</i> |
| | W 9/15 | Soil physics: air & temperature | <i>Ch 7</i> Lab 1 report due |
| 5 | M 9/20 | LAB 2: Physical properties of soil | |
| | W 9/22 | Soil chemistry: colloidal fraction | <i>Ch 8</i> |
| 6 | M 9/27 | Soil chemistry: pH | <i>Ch 9</i> |
| | W 9/29 | Soil chemistry: alkalinity and salinity | <i>Ch 10</i> Lab 2 report due |
| 7 | M 10/4 | LAB 3: Soil chemistry analysis | |
| | W 10/6 | Exam 1 | |
| 8 | M 10/11 | NO CLASS – FALL BREAK | |
| | W 10/13 | Soil biology: microbes & fauna | <i>Ch 11, Ferrenberg et al. 2017</i> Lab 3 report due |
| 9 | M 10/18 | LAB 4: Soil biology | <i>Coleman 2002</i> |
| | W 10/20 | Soil biodiversity and ecosystem function Independent investigation introduction | <i>Bardgett & van der Putten 2014</i> |
| 10 | M 10/25 | Soil biogeochemistry: nutrients | <i>Ch 13,14</i> |
| | W 10/27 | Soil biogeochemistry: nutrients cont. | <i>Ch 14,15</i> Lab 4 report due |
| 11 | M 11/1 | Organic matter dynamics | <i>Ch 12</i> |
| | W 11/3 | Lab 5: Carbon Sink Forest | |
| 12 | M 11/8 | Soil-plant interactions | <i>Ochoa-Hueso et al. 2020</i> |
| | W 11/10 | Exam 2 | |
| 13 | M 11/15 | Soil degradation: desertification, erosion, and salinization | <i>Ch 17</i> Lab 5 report due |
| | W 11/17 | Soil contamination and remediation | <i>Ch 18</i> |
| 14 | M 11/22 | Lab 6: Soil quality and soil health | |
| | W 11/24 | Global change and soils | <i>Ch 20</i> <i>Deng et al. 2021</i> |
| 15 | M 11/29 | Soil science: careers & pathways | Lab 6 report due |
| | W 12/1 | Student presentations, discussion | Independent soil investigation paper |
| Final | F 12/10 | 2:30 PM - 4:20 PM - Final exam | |