University of Florida
Soil, Water, and Ecosystem Sciences Department
Fall 2024

Soil Health and Data
SWS 6406

Instructor:

Dr. Yang Lin
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University of Florida – Gainesville
Email: ylin2@ufl.edu
Office hours: Tuesdays 12:30 to 1:30 pm

Course credits: 3

Teaching Format and Course Communications:

- Exclusively online.
- Pre-recorded lectures, weekly data tutorials and assignments, weekly chat sessions, group projects, assignments, and exams.
- Canvas eLearning Login: http://elearning.ufl.edu/
- Contact instructor through Canvas messaging system or email.
    - Allow 24 hours for a response during the week.
    - Questions posted over the weekend will not receive a response until Monday.

Pre-Requisites: N/A

Required Textbook: None

- Required readings are available on Canvas. Students will discuss the following papers in the journal club:
    - Amsili, J.P., van Es, H.M. and Schindelbeck, R.R. Soil Security 4, 100012 (2021).
    - Bagnall, D.K., et al. Agronomy Journal *113*, 4581-4589 (2021).
    - Culman, S. W. et al. Soil Sci Soc Am J 76, 494–504 (2012).
    - Fine, A. K., Es, H. M. & Schindelbeck, R. R. Soil Sci Soc Am J 81, 589–601 (2017).
    - Lehmann, J. et al. Nat Rev Earth Environ 1–10 (2020)
    - Liptzin, D. et al. Soil Biology Biochem 172, 108708 (2022).
    - Nunes, M.R., Karlen, D.L. and Moorman, T.B. Sustainability *12*, 2071 (2020).
    - Stewart, R. D. et al. Agricultural & Environmental Letters 3 (2018).
    - Sanderman, J., Hengl, T. & Fiske, G. J. Proc National Acad Sci 114 (2017).
    - Wittwer, R.A., et al. Science Advances 7, eabg6995 (2021).

Course Description (50 words limit for catalog): Examine the concept, history, and underlying science of soil health; Apply basic statistical methods to analyze soil data and

assess soil health in the R programming environment; Compare and select soil health indicators; Discuss the management practices for enhancing soil health.

Course Details: Soil health has emerged as a unifying concept with broad endorsement from the agriculture enterprise to sustain and promote long-term sustainability of soil sources. How to translate soil data into actionable management practices and policy recommendations remains a key challenge. This course couples the underlying science behind the concept of soil health with the analytical methods of soil data. In the lectures, we will study the fundamentals of soil health and introduce the general framework of soil health assessment. Using hands-on data tutorials, students will learn how to interact with soil health data including data structure, data management, and programming for data analysis and visualization. No prior experience in R programming is needed, as the tutorials will be self-guided to provide the necessary knowledge on these topics. Students' learning will be supported via peer discussion over Canvas, weekly chat sessions, and appointments with the instructor.

Course Learning Objectives:

After successfully completing the course, students will be able to:

- Define and critique the concept of soil health
- Compare and select soil health indicators for field evaluation
- Develop basic programming proficiency in R
- Apply statistical methods to describe, visualize, and interpret soil health data
- Identify common management practices for enhancing soil health and evaluate their potentials and limitations
- Assess the unique challenges in quantifying and managing soil health in the state of Florida

Tentative Course Schedule:

Week	Lecture topics	Data tutorials	Journal club	Assignment/Project
8/22	Introduction			
8/26	Definition of soil health	Introduction to R and Rstudio	Lehmann et al. 2020	Assignment 1 due 8/31
9/3	History of soil health	Data tables in R	Bagnall et al. 2021	Assignment 2 due 9/7
9/9	Trajectories of soil health: degradation vs restoration	Descriptive statistics with `dplyr` package	Sanderman et al. 2017	Assignment 3 due 9/14
9/16	Physical indicators	Plotting data with `ggplot2` package	Nunes et al. 2020	Assignment 4 due 9/21
9/23	Chemical indicators	ANOVA in soil health	Stewart et al. 2018	Assignment 5 due 9/28
9/30	Biological indicators	Regression in soil health	Culman et al. 2012	Assignment 6 due 10/5
10/7	Exam 1			

10/14	Introduction to soil health assessment	Scoring functions	Fine et al. 2017	Assignment 7 and Proposal due 10/19
10/21	Scoring functions	Minimal dataset for soil health assessment	Amsili et al. 2021	Assignment 8 due 10/26
10/28	Weighing functions and integration	Factor analysis	Chahal and Eerd 2019	Assignment 9 due 11/2
11/4	Soil health management	Case studies	Liptzin et al. 2022	Assignment 10 due 11/9
11/12	Soil health in Florida	Meta-analysis	Wade et al. 2022	Assignment 11 due 11/16
11/18	Review			Paper due 11/23
12/2	Exam 2			Group presentation

Data Tutorials: They are hands-on, self-paced guides to complete data wrangling, analysis, and visualization using R. Each tutorial will include several learning objectives to develop students' skills in programming, data analytics and applying these skills to solve soil health questions. Each tutorial will be accompanied with a video walk-through posted on Canvas.

Assignments: Assignments are designed based on each week's data tutorial. They include case-based questions reflecting the learning objectives of data tutorials. They are completed on Posit.Cloud. Instruments for setting up Posit.Cloud are provided on Canvas. Assignments are due on Saturday 11:59 pm (Eastern time) weekly.

Exams: They will include two types of questions: 1) case-based questions that are based on data tutorials and assignments and 2) short-answer questions on the science, assessment, and management of soil health. They are open-book but not open-peers. They will be submitted on Canvas.

Chat Sessions: Weekly chat sessions will be scheduled after a doodle pool where students indicate their availabilities. All students are expected to participate. Zoom link can be found on the course's home page. Students will need access to a computer with audio and a web camera (optional) to take this course. If you are unable to attend a chat session, chat sessions may be replaced with chat make-up assignments on Canvas at the instructors' discretion.

Journal Club: Each week, students will discuss a paper during *the 2nd half of the chat session*. The goal here is to critically evaluate some of the current literature on soil health. Students will take turns to lead the discussion. The discussion leader will provide a short summary of the paper (< 3 minutes) and develop a list of questions for discussion. The instructor will randomly assign the discussion leaders. Attendance is required as a part of the grade for participation (See grading structure). Further tips will be posted on Canvas.

Group Project: Students are required to work in a group of 2 or 3 for a group project. They will collect data from literature and/or existing databases and conduct a research project on the topic of soil health. They may repeat analyses that have been published, conduct a meta-analysis, or ask new questions. Students will communicate their research in the form of a short research paper and a presentation and work on their skills in scientific reasoning and hypothesis testing. The project will include three components, a proposal, a paper, and a presentation, which account for 20%, 40%, and 40% of the grade, respectively. More guidelines will be provided on Canvas.

Critical Dates: Assignments are due on Saturday 11:59 pm (Eastern time) weekly. Open-book exams will be held for three days in the weeks of Oct. 9 and Dec. 2. Additional details on the exam will be provided on Canvas.

Group project:

- Proposal due: 10/19
- Paper and presentations due: 12/4

Disclaimer: As we go through the semester, specific topics and activities on the syllabus may change to enhance the class learning opportunity. Such changes will be communicated clearly and in advance.

Material and Supplies Fee: N/A

Grading Structure

Assessment Type	Percent of Final Grade
Exams (2 total)	30
Weekly Assignments (10 total)	40
Group projects	20
Participation (chat and journal club)	10

Rubrics will be provided with graded activities. See Canvas assignments for individual rubrics. Exams are open book.

Grading Scale

A	90-100	B+	87-89.99	B	80-86.99	C+	77-79.99
C	70-76.99	D+	67-69.99	D	60-66.99	E	<60

For information on current UF policies for assigning grade points, see https://catalog.ufl.edu/UGRD/academic-regulations/grades-grading-policies/.

Attendance and Late Policy: Make-up exams are provided only under extreme, documented circumstances. Requirements for class attendance and make-up exams, assignments and other work are consistent with university policies that can be found at: https://catalog.ufl.edu/UGRD/academic-regulations/attendance-policies/.

Privacy Disclaimer: Our discussion or class sessions may be audio visually recorded for students in the class to refer back and for enrolled students who are unable to attend live. Students who participate with their camera engaged or utilize a profile image are agreeing

to have their video or image recorded. If you are unwilling to consent to have your profile or video image recorded, be sure to keep your camera off and do not use a profile image. Likewise, students who un-mute during class and participate orally are agreeing to have their voices recorded. If you are not willing to consent to have your voice recorded during class, you will need to keep your mute button activated and communicate exclusively using the "chat" feature, which allows students to type questions and comments live. The chat will not be recorded or shared. As in all courses, unauthorized recording and unauthorized sharing of recorded materials is prohibited.

Online Course Evaluation Process: Student assessment of instruction is an important part of efforts to improve teaching and learning. At the end of the semester, students are expected to provide feedback on the quality of instruction in this course using a standard set of university and college criteria. Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at: https://gatorevals.aa.ufl.edu/students/. Students will be notified when the evaluation period opens and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via https://ufl.bluera.com/ufl/. Summaries of course evaluation results are available to students at: https://gatorevals.aa.ufl.edu/public-results/.

UF Policies

Academic Honesty: As a student at the University of Florida, you have committed yourself to uphold the Honor Code, which includes the following pledge: *"We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honesty and integrity."* You are expected to exhibit behavior consistent with this commitment to the UF academic community, and on all work submitted for credit at the University of Florida, the following pledge is either required or implied: *"On my honor, I have neither given nor received unauthorized aid in doing this assignment*."

It is assumed that you will complete all work independently in each course unless the instructor provides explicit permission for you to collaborate on course tasks (e.g. assignments, papers, quizzes, exams). Furthermore, as part of your obligation to uphold the Honor Code, you should report any condition that facilitates academic misconduct to appropriate personnel. It is your individual responsibility to know and comply with all university policies and procedures regarding academic integrity and the Student Honor Code. Violations of the Honor Code at the University of Florida will not be tolerated.

Violations will be reported to the Dean of Students Office for consideration of disciplinary action. For more information regarding the Student Honor Code, please see: https://sccr.dso.ufl.edu/process/student-conduct-code/.

Software Use: All faculty, staff and students of the university are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such

violations are also against university policies and rules, disciplinary action will be taken as appropriate.

Services for Students with Disabilities: The Disability Resource Center coordinates the needed accommodations of students with disabilities. This includes registering disabilities, recommending academic accommodations within the classroom, accessing special adaptive computer equipment, providing interpretation services and mediating faculty-student disability related issues. Students requesting classroom accommodation must first register with the Dean of Students Office. The Dean of Students Office will provide documentation to the student who must then provide this documentation to the Instructor when requesting accommodation: 0001 Reid Hall, 352-392-8565, https://disability.ufl.edu/

Campus Helping Resources: Students experiencing crises or personal problems that interfere with their general well- being are encouraged to utilize the university's counseling resources. The Counseling & Wellness Center provides confidential counseling services at no cost for currently enrolled students. Resources are available on campus for students having personal problems or lacking clear career or academic goals, which interfere with their academic performance.

- *University Counseling & Wellness Center, 3190 Radio Road, 352-392-1575,*

  www.counseling.ufl.edu Counseling Services Groups and Workshops Outreach and Consultation Self-Help Library Wellness Coaching

- U Matter We Care, www.umatter.ufl.edu/
- *Career Connections Center,* First Floor JWRU, 392-1601, https://career.ufl.edu/.
- Student Success Initiative, http://studentsuccess.ufl.edu.

Student Complaints:

- Residential Course: https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/.
- Online Course: https://distance.ufl.edu/state-authorization-status/#student-complaint