

University of Florida  
Soil and Water Sciences Department  
Fall 2023

# Soil Health and Data

## SWS 6932

### Instructor:

Dr. Yang Lin  
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### 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:** SWS 3022 or equivalent or approved by the instructor.

**Required Textbook:** None

- Required readings are available on Canvas. Students will discuss the following papers in the journal club:
  - Chahal, I. & Eerd, L. L. V. *Geoderma* 352, 38–48 (2019).
  - 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).
  - Karlen, D. L., et al. *Electronic Journal of Integrative Biology* (2008).
  - Lehmann, J. et al. *Nat Rev Earth Environ* 1–10 (2020)
  - Liptzin, D. et al. *Soil Biology Biochem* 172, 108708 (2022).
  - Mohammed, A. K. et al. 2020. *Geoderma* 357:113945.
  - Nunes, M. R. et al. *Soil Sci Soc Am J* 85, 1196–1213 (2021).
  - Stewart, R. D. et al. *Agricultural & Environmental Letters* 3 (2018).
  - Sanderman, J., Hengl, T. & Fiske, G. J. *Proc National Acad Sci* 114 (2017).
  - Wade, J. et al. *Soil Biology Biochem* 170, 108710 (2022).

**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 programming or statistics 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
- Gain 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
8/23	Introduction		
8/28	Definition of soil health	Introduction to R and Rstudio	Lehmann et al. 2020
9/5	History of soil health	Data tables	Karlen et al. 2008
9/11	Trajectories of soil health: degradation vs restoration	Descriptive statistics	Sanderman et al. 2017
9/18	Chemical indicators	Plotting data	Stewart et al. 2018
9/25	Physical indicators	ANOVA	Mohammed et al. 2020
10/2	Biological indicators	Regression	Culman et al. 2012
10/9	Exam 1		
10/16	Introduction to soil health assessment	Scoring functions	Fine et al. 2017
10/23	Scoring functions	Dimension reduction	Nunes et al. 2021
10/30	Weighing functions and integration	Factor analysis	Chahal and Eerd 2019
11/6	Soil health management	Case studies	Liptzin et al. 2022
11/13	Soil health in Florida	Meta-analysis	Wade et al. 2022

11/27	Review		Group presentation
12/4	Exam 2		Group presentation

**Chat Sessions:** Chat sessions are scheduled on Wednesdays 7 pm to 8:30 pm over zoom. 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.

**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. More guidelines will be provided on Canvas.

**Journal Club:** Each week, students will discuss a paper during the 2<sup>nd</sup> 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. Further tips will be posted 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. 4. Additional details on the exam will be provided on Canvas.

**Group project:**

- Proposal due: 10/21
- Paper due: 11/18
- Presentations: 11/29 and 12/6

**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:** \$5 per student to cover the expense associated with using Posit.cloud.

**Grading Structure**

Assessment Type	Percent of Final Grade
Exams (2 total)	30
Weekly Assignments	40
Group projects	20
Chat Participation	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:** Each student has two “personal days”, after which each absence that does not meet university criteria for “excused” will be penalized. Late submission of assignments and assessments must be approved by instructors in advance, or they will lose 10% of their values for each day they are late. Items will not be graded if they are late for over 3 days. 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/>.

**Online Course Evaluation:** Students are expected to provide feedback on the quality of instruction in this course by completing online evaluations at <https://evaluations.ufl.edu>. Evaluations are typically open during the last two or three weeks of the semesters, but students will be given specific times when they are open. Summary results of these assessments are available to students at <https://evaluations.ufl.edu/results>.

**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.ua.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: <http://www.dso.ufl.edu/sccr/process/student-conduct-honor-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](http://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/](http://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>