

ABE 454
Environmental Soil Physics
SPRING 2024

"We know more about the movement of celestial bodies than about the soil underfoot."

Leonardo Da Vinci, circa 1500



WELCOME!

Do you know that SOIL provides many benefits that humans need to survive? Soil is responsible for at least six (6) ecosystem services that make life possible on Earth. In **ABE 454**, we study soil's physical properties and the processes that must occur in the soil to deliver the benefits needed by humankind.

Course Description:

ABE 454 provides the theoretical basis for understanding and quantifying the physical, hydrological, geotechnical, and thermal properties of soil in relation to environmental processes. Topics include general soil properties as a porous medium, fluid properties, energy state, soil-water relationship, transport processes in soil, and heat flow in porous media.

Learning Objectives:

- To recognize, understand, and learn basic soil physics concepts and to apply them in solving soil and water related problems.
- To enhance your overall scientific, quantitative, and analytical skills.

Credit: 3 hours for undergraduate and graduate students; 3 hours for graduate students

Pre-requisite: TAM 335 or with consent of instructor

Weekly meeting schedule: 9:00 – 10:20 MW AESB TBD

Office hours: Open door policy

Course Materials:

- Class notes (Canvas)
- Textbook: Hillel, D., 1998. *Environmental Soil Physics*. Elsevier

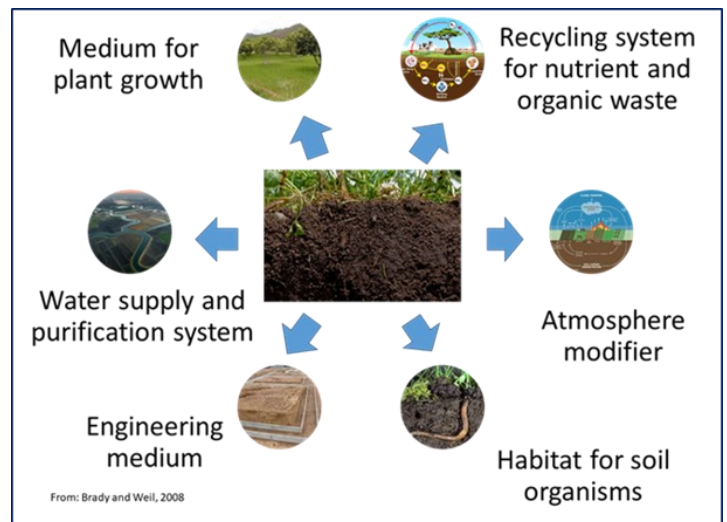


Figure 1. The benefits that we get from the soil.



Instructor:

I am an associate professor in the Department of Agricultural and Biological Engineering. My research area of specialty is watershed-ecosystem dynamics where I study the intricate interactions between natural and human drivers and the ecosystem

to achieve a sustainable agro-production system where productivity, environmental soundness, and social relevancy are optimized.

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Tentative Schedule:

Week	Date	Day	Topics	Evaluation	
1	January	17	W	Introduction	
		22	M	Soil properties: General	
2		24	W	Soil properties: Mass-volume relationship	
		29	M	Soil properties: Soil texture	Q1
3		31	W	Soil properties: Soil texture	HW1
		5	M	Soil properties: Soil strength	Q2
4		7	W	Soil properties: Soil strength	
		12	M	Soil properties: Soil strength	Q3
5		14	W	Soil moisture: Fluid properties	HW2
		19	M	Soil moisture: Energy state	Q4
6		21	W	Soil moisture: Energy state	
		26	M	Water potential and components	Q5
7		28	W	Water potential and components	HW3
		4	M	Water potential and components	
8		6	W	Midterm Examination	MTE
		11	M	<i>Spring break</i>	
9		14	W	<i>Spring break</i>	
		18	M	Saturated flow	
10		20	W	Saturated flow	
		25	M	Unsaturated Flow (Richards)	
11		27	W	Unsaturated Flow (Richards)	Q6
		1	M	Unsaturated Flow (Green-Ampt)	
12		3	W	Unsaturated Flow (Green-Ampt)	Q7
		8	M	Solute/contaminant transport in soil	HW4
13		10	W	Solute/contaminant transport in soil	Q8
		15	M	Solute/contaminant transport in soil	
14		17	W	Soil thermal properties	Q9
		22	M	Heat flow in soil	
15		23	W	Heat flow in soil	Q10
		29	M	Bare soil evaporation	HW5
16		31	W	Bare soil evaporation	
		May	TBD	Final Examination	FTE

Class Structure: ABE 454 is a 16-week lecture/discussion course delivered in-person with supplementary on-line component (through Canvas) for introductory videos, review quizzes, and homework submission. Discussions and problem solving will be done in class.

Class Policies:**Homework:**

Homework assignments should be done neatly with the problem defined and solution clearly outlined. Final answers should have appropriate units and should be circled or underlined. Include/attach all materials that will substantiate your answers. The more clearly a problem is presented and solved, the more likely you will receive partial credit. Late homework will be deducted 10 points for each day of being late. Submission must be done through Canvas.

The homework problems are designed to help you learn the topics by applying them in real life settings. Please work independently and make sure that what you turn in as your work is really your work and not a copy of another student's homework. Breach of this policy will result in a zero for all involved parties.

Quizzes:

Short qualitative quizzes will be given periodically throughout the semester (usually every Monday). Quizzes will consist of qualitative questions including definitions, concept questions, and writing expressions or equations and simple computations. Review quizzes follow instructional videos of concepts and topic introductions. Review quizzes are to be taken online after watching the instructional videos.

Midterm and Final Exams:

Two semester exams will be given over the course of the semester, each lasting one class period and covering the materials from the previous exam. The exams will each consist of qualitative and quantitative sections. The qualitative section will be closed book/closed notes, worth 15-20 points, and will consist of definitions, concept questions, and writing expressions or equations. The quantitative section will be open book/open notes, worth 80-85 points and will consist of 3-4 problems of similar nature with the assigned homework problems, class sample problems, and example in the textbooks.

***Graduate Students**

Graduate students will be required to submit a final term paper and/or will be assigned additional problems to solve in Homework and Exams.

Grading:

Homework	30%
Quizzes	30%
Midterm exam	20%
Final exam	20%
TOTAL	100%

Final grade should be **60%** or better to pass the course.

Additional Resources:

Academic Integrity. The University of Illinois at Urbana-Champaign Student Code should also be considered as a part of this syllabus. Students should pay particular attention to Article 1, Part 4: Academic Integrity. Read the Code at the following URL: <http://studentcode.illinois.edu/>.

Academic dishonesty may result in a failing grade. Every student is expected to review and abide by the Academic Integrity Policy: <https://studentcode.illinois.edu/article1/part4/1-401/>.

Ignorance is not an excuse for any academic dishonesty. It is your responsibility to read this policy to avoid any misunderstanding. Do not hesitate to ask the instructor(s) if you are ever in doubt about what constitutes plagiarism, cheating, or any other breach of academic integrity.

Mental Health. Significant stress, mood changes, excessive worry, substance/alcohol misuse or interferences in eating or sleep can have an impact on academic performance, social development, and emotional wellbeing. The University of Illinois offers a variety of confidential services including individual and group counseling, crisis intervention, psychiatric services, and specialized screenings which are covered through the Student Health Fee. If you or someone you know experiences any of the above mental health concerns, it is strongly encouraged to contact or visit any of the University's resources provided below. Getting help is a smart and courageous thing to do for yourself and for those who care about you.

- Counseling Center (217) 333-3704
- McKinley Health Center (217) 333-2700
- National Suicide Prevention Lifeline (800) 273-8255
- Rosecrance Crisis Line (217) 359-4141 (available 24/7, 365 days a year)

If you are in immediate danger, call 911.

Community of Care. As members of the Illinois community, we each have a responsibility to express care and concern for one another. If you come across a classmate whose behavior concerns you, whether in regards to their well-being or yours, we encourage you to refer this behavior to the Student Assistance Center (217-333-0050 or <http://odos.illinois.edu/community-of-care/referral/>). Based on your report, the staff in the Student Assistance Center reaches out to students to make sure they have the support they need to be healthy and safe.

Further, as a Community of Care, we want to support you in your overall wellness. We know that students sometimes face challenges that can impact academic performance (examples include mental health concerns, food insecurity, homelessness, personal emergencies). Should you find that you are managing such a challenge and that it is interfering with your coursework, you are encouraged to contact the Student Assistance Center (SAC) in the Office of the Dean of Students for support and referrals to campus and/or community resources.

Students with Disabilities. To obtain disability-related academic adjustments and/or auxiliary aids, students with disabilities must contact the course instructor as soon as possible and provide the instructor with a Letter of Academic Accommodations from Disability Resources and Educational Services (DRES). To ensure that disability-related concerns are properly addressed from the beginning, students with disabilities who require assistance to participate in this class should apply for services with DRES and see the instructor as soon as possible. If you need accommodations for any sort of disability, please speak to me after class, or make an appointment to see me or see me during my office hours. DRES provides students with academic accommodations, access, and support services.

To contact DRES, you may visit 1207 S. Oak St., Champaign, call 217-333-1970, e-mail disability@illinois.edu or visit the DRES website at <http://www.disability.illinois.edu/>. Here is the direct link to apply for services at DRES, <https://www.disability.illinois.edu/applying-services>.

Disruptive Behavior. Behavior that persistently or grossly interferes with classroom activities is considered disruptive behavior and may be subject to disciplinary action. Such behavior inhibits other students' ability to learn and an instructor's ability to teach. A student responsible for disruptive behavior may be required to leave class pending discussion and

resolution of the problem and may be reported to the Office for Student Conflict Resolution (<https://conflictresolution.illinois.edu>; conflictresolution@illinois.edu; 333-3680) for disciplinary action.

Emergency Response Recommendations. Emergency response recommendations and campus building floor plans can be found at the following website: <https://police.illinois.edu/em/run-hide-fight/>. I encourage you to review this website within the first 10 days of class.

Religious Observances. Illinois law requires the University to reasonably accommodate its students' religious beliefs, observances, and practices in regard to admissions, class attendance, and the scheduling of examinations and work requirements. Students should complete the [Request for Accommodation for Religious Observances](#) form should any instructors require an absence letter in order to manage the absence. In order to best facilitate planning and communication between students and faculty, students should make requests for absence letters as early as possible in the semester in which the request applies.

Sexual Misconduct Reporting Obligation. The University of Illinois is committed to combating sexual misconduct. Faculty and staff members are required to report any instances of sexual misconduct to the University's Title IX and Disability Office. In turn, an individual with the Title IX and Disability Office will provide information about rights and options, including accommodations, support services, the campus disciplinary process, and law enforcement options.

A list of the designated University employees who, as counselors, confidential advisors, and medical professionals, do not have this reporting responsibility and can maintain confidentiality, can be found here: wecare.illinois.edu/resources/students/#confidential.

Other information about resources and reporting is available here: wecare.illinois.edu.