

CIV ENV 346 Ecohydrology

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Class Monday and Wednesday 12:30-1:50, Location: Tech M177

Discussion section Friday 12:30-1:50, Location: Tech M177

Office hours: After class or by appointment.

Course Description:

Interactions between water and ecosystems in freshwater, terrestrial, and urban environments. Feedbacks between ecological and hydrological processes. Engineering of ecosystems such as constructed wetlands, green roofs, and other green infrastructure for resilient and sustainable water management.

Course Objectives:

After taking this course, students will:

- Understand key interactions between water and ecosystems, including linkages and feedbacks between ecological and hydrological processes.
- Understand how coupling between physical, chemical, and biological processes controls ecosystem structure and function.
- Understand the strategies used to engineer ecosystems as green infrastructure in urban and rural environments, and the implications of conventional and green infrastructure for resilience and sustainability.
- Be able to quantitatively assess, simulate, and predict essential aspects of linkages between ecosystems and hydrology, including both natural and constructed ecosystems.
- Be able to design green infrastructure for urban water management, biodiversity, and climate adaptation.

The course contributes to the following Program Student Learning Outcomes:

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Outline of Topics

Overview of linkages between hydrology and ecosystems

Urban ecohydrology and green infrastructure for water storage and flood control

Terrestrial ecohydrology – interactions between plants, soil, and water

Watershed ecohydrology – large-scale interactions between water, topography, ecosystems, and land use

Aquatic ecohydrology – aquatic habitat and flow-vegetation-sediment interactions

Biogeochemical cycling in terrestrial and aquatic ecosystems

Ecosystem engineering and green infrastructure

Design of green roofs for sustainability and ecosystem services

Design of constructed and restored wetlands for nutrient management and ecosystem health

River restoration for geomorphic stability and ecosystem restoration

Advanced sensing approaches for real-time and adaptive monitoring of ecosystems

Assignments

Reading and discussing papers from the literature. All papers for discussion are posted on Canvas.

Three projects using software to analyze and design constructed and restored hydro-ecosystems:

- Green roofs – HYDRUS 1D software, data from green roof on the Conservation Science Center at Chicago Botanic Garden
- Wetland restoration – Wetlands by Design software, datasets covering entire state of Wisconsin.
- River restoration – Freshwater Network Floodplain Prioritization Tool, datasets covering entire Mississippi River Basin

This will require you to learn to use each set of software. Materials will be posted on Canvas, and tutorials will be scheduled during the discussion section.

Academic Integrity Statement:

Students in this course are required to comply with the policies found in the booklet, "Academic Integrity at Northwestern University: A Basic Guide". All papers submitted for credit in this course must be submitted electronically unless otherwise instructed by the professor. Your written work may be tested for plagiarized content. For details regarding academic integrity at Northwestern or to download the guide, visit:

www.northwestern.edu/provost/policies/academic-integrity/index.html

Accessibility Statement:

Northwestern University is committed to providing the most accessible learning environment as possible for students with disabilities. Should you anticipate or experience disability-related barriers in the academic setting, please contact AccessibleNU to move forward with the university's established accommodation process (email: accessiblenu@northwestern.edu; phone: 847-467-5530). If you already have established accommodations with AccessibleNU, please let me know as soon as possible, preferably within the first two weeks of the term, so we can work together to implement your disability accommodations. Disability information, including academic accommodations, is confidential under the Family Educational Rights and Privacy Act.

Classroom COVID-19 Expectations Statement:

Students, faculty and staff must comply with University expectations regarding appropriate classroom behavior, including those outlined below and in the COVID-19 Expectations for Students. With respect to classroom procedures, this includes:

- Policies regarding masking, social distancing and other public health measures evolve as the situation changes. Students are responsible for understanding and complying with current University, state and city requirements.
- In some classes, masking and/or social distancing may be required as a result of an Americans with Disabilities Act (ADA) accommodation for the instructor or a student in the class even when not generally required on campus. In such cases, the instructor will notify the class.

If a student fails to comply with the COVID-19 Expectations for Students or other University expectations related to COVID-19, the instructor may ask the student to leave the class. The instructor is asked to report the incident to the Office of Community Standards for additional follow-up.

Class Teaching Modality:

Class sessions for this course will occur in person. Individual students will not be granted permission to attend remotely except as the result of an Americans with Disabilities Act (ADA) accommodation as determined by AccessibleNU. Should public health recommendations prevent in person class from being held on a given day, the instructor or the university will notify students.

Maintaining the health of the community is our priority. **If you are experiencing any symptoms of COVID do not attend class. Follow NU guidelines for testing, isolation and reporting a positive case.**

If you experience any COVID symptoms, contact the instructor as soon as possible to arrange to complete coursework. Students who experience a personal emergency should also contact the instructor as soon as possible to arrange to complete coursework.

Class Recordings:

This class will be recorded by the instructor for educational purposes. Recordings will be available via Canvas and Panopto. Portions of the course that contain images, questions or commentary/discussion by students will be edited out of any recordings that are saved beyond the current term.

Students are prohibited from recording class sessions and are also prohibited from the distribution of class recordings. Unauthorized student recording of classroom or other academic activities (including advising sessions or office hours) is prohibited. Unauthorized recording is unethical and may also be a violation of University policy and state law. Students requesting the use of assistive technology as an accommodation should contact AccessibleNU. Unauthorized use of classroom recordings – including distributing or posting them – is also prohibited. Under the University’s Copyright Policy, faculty own the copyright to instructional materials – including those resources created specifically for the purposes of instruction, such as syllabi, lectures and lecture notes, and presentations. Students cannot copy, reproduce, display, or distribute these materials. Students who engage in unauthorized recording, unauthorized use of a recording, or unauthorized distribution of instructional materials will be referred to the appropriate University office for follow-up.

Support for Wellness and Mental Health:

Northwestern University is committed to supporting the wellness of our students. Student Affairs has multiple resources to support student wellness and mental health. If you are feeling distressed or overwhelmed, please reach out for help. Students can access confidential resources through the Counseling and Psychological Services (CAPS), Religious and Spiritual Life (RSL) and the Center for Awareness, Response and Education (CARE). Additional information on all of the resources mentioned above can be found here:

<https://www.northwestern.edu/counseling/>

<https://www.northwestern.edu/religious-life/>

<https://www.northwestern.edu/care/>