

Hydrology (ENVP U6116) – SYLLABUS

Instructor Information

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Office Hours: Mondays from 11-1 pm in the SIPA Cafe

Accessibility: Please contact me via e-mail. I will typically respond to you within 24 hours (with a delay on weekends). If you don't hear from me, then please resend.

Teaching Assistants: Joshua Browne and Augusta Williams

Course Overview

The sustainability of freshwater resources is a critical issue facing society over the coming decades. To manage these precious water resources, a fundamental understanding of hydrology is essential as practitioners attempt to navigate the challenges associated with designing sustainable policy and management approaches. This course is therefore designed to introduce students to the basics of *hydrology*, the science that encompasses the occurrence, distribution, movement, and properties of Earth's water and its relationship with people and the environment. Students will use this understanding to explore policy and management issues related to the water resources using critical thinking and basic quantitative skills. Multiple case studies will be highlighted throughout the course to illustrate contemporary threats to water sustainability.

Learning Objectives

You are expected to understand the key components of the water cycle (including precipitation, evapotranspiration, groundwater, and surface water) and the basics of water quality. Sustainability issues in water management will be explored for various regions – including those in developing and developed countries – and at various scales (local to global). You should be prepared to apply your understanding of hydrology to specific cases studies.

Course Content

The course consists of five 3-hour lectures. These sessions are listed below:

1. **Hydrology, Climate, and Water Budgets (July 15, 2014)**
 - I. Why policy students should care about hydrology?

- II. How are hydrologic processes linked to the climate system? How will a changing climate affect these processes?
- III. What is 'water-resource sustainability'?
- IV. Understanding hydrologic budgets and precipitation

2. Water on the Land (July 22, 2014)

- I. What happens to precipitation when it reaches the land? *Watersheds, river networks, and runoff*
- II. What are the characteristics of water flow in rivers, and how do we measure and model this flow?
- III. What happens to water once it infiltrates into the soil?
- IV. How does vegetation interact with the water cycle?
- V. How can we estimate water use for agriculture?

3. Water Quality and Groundwater (July 29, 2014)

Field trip to the Stamford Water Pollution Control Facility

- I. What are the major water pollutants in rivers, lakes, and aquifers?
- II. How do we monitor and improve water quality?
Abbreviated lecture (in place of lab) upon return to campus
- III. What are the characteristics of groundwater flow?
- IV. How can we manage groundwater sustainably?

4. Probability, Risk, and Uncertainty in Hydrology (August 5, 2014)

- I. How do we deal with probabilities in hydrology?
- II. How do we quantify risk and uncertainty for sustainable design?
- III. What are the design criteria for hydrologic systems?

5. Water and Our Global Society (August 12, 2014)

- I. How will future climate and socioeconomic conditions impact water resources across scales (local to global)?
- II. What is the water-food-energy-climate nexus, and why is it important for sustainable water?

Textbook and Readings

All readings will be posted on Courseworks on the 'Calendar'. You should read this material before each class (i.e. the readings should be done by start of lecture that it is associated with).

1. When the rivers run dry: water, the defining crisis of the twenty-first century, Fred Pearce. 2006;
 2. Introduction to Physical Hydrology, M.R. Hendriks, 2010
 3. Multiple articles will be posted on Courseworks.
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Course Requirements – Assignments

The major assignments of the course will include *four lab assignments*, an *in-class quiz*, and a *final term project* (paper + presentation).

Lab Assignments

The lab assignments are designed to reinforce the basic concepts presented in class and to ensure that you master them. The labs will be available for the Lab Session on Tuesday morning and are due the Friday of that week (11:55 pm on Courseworks).

40 minute, In-Class Quiz

The written in-class quiz will cover the basic concepts of the course. It will be a mix of short answer and multiple-choice questions based on the lecture material and the assigned readings. (You must be sure to complete the readings to do well.) *Grading:* The quiz will be graded on a numerical grade scale from 0 to 100.

Term Project

The term project is a group effort, in which you apply hydrologic concepts from class to a sustainability case study. Evaluation of the project will be based on how well you incorporate hydrologic concepts covered in the course into the projects and how effectively you communicate your findings in your presentation and written report. In particular, you should include some type of data analysis based on methods introduced in class.

You will prepare a paper (about 10 pages, double spaced not including figures and references). You should aim to form a *group of 3 students* (groups of 2 are acceptable but not preferred). Group size should not exceed 3 students. Details on topics will be discussed in class.

The final **project paper** should include analyses and discussions that build on ideas discussed in the course. The paper *should* contain the following sections:

- A. Abstract (150 word limit)
- B. Introduction (problem statement, stakeholders ID, etc.)
- C. Methodology (analysis approach, data description, etc.)
- D. Results & Discussion
- E. Recommendations and Conclusions

Each group is asked to prepare a 5-7 minute **PowerPoint (or equivalent) presentation** based on the research paper. (I imposing a 5-slide limit not including the title slide; you should be concise and not go over the time limit to receive full credit.) *The presentations will be during the time-slot reserved for the class's final exam.* See the Courseworks calendar for updated due dates and times.

Evaluation/Grading

The relative contribution of each of the assignments to a student's total grade for the course is as follows:

4 hydrology labs	= 35%
Term paper and presentation	= 35%
In-class quiz	= 25%
Attendance	= 5%

Labs are graded on a scale ranging from 0 to 100. The project (including the presentation) will be graded on a letter grade scale from A+ to F. The final course grade will be computed using a weighted average of these scores.

Resources and Software Packages

Courseworks will be used for communication of assignments, exams, course material, and other information throughout the course. Students should be familiar with Microsoft Excel or equivalent software. The Columbia University Libraries will be primary resources for course material.

Policies and Expectations

Attendance, Late Assignments, and Missed Exam

You are expected to attend and participate in class. Assignments should be submitted in a timely manner, so that you will be able to understand and benefit from course content. *Late assignments will be penalized 10% per day of lateness.* A missed quiz will result in no credit for the quiz. Extenuating circumstances should be brought to my attention and will be handled on a case-by-case basis.

Academic Integrity and Community Standards

Students are required to comply with SIPA's policies related to Academic Integrity and Community Standards. An excerpt is as follows:

"The School of International & Public Affairs does not tolerate cheating and/or plagiarism. Those students who violate the Code of Academic & Professional Conduct will be subject to the Dean's Disciplinary Procedures. The Code of Academic & Professional Conduct is available online at:
http://sipa.columbia.edu/resources_services/student_affairs/academic_policies/deans_discipline_policy.html

The School provides useful resources online related to plagiarism; we strongly encourage students to familiarize themselves with various attribution styles before conducting their research:

http://sipa.columbia.edu/resources_services/student_affairs/academic_policies/code_of_conduct.html"

APPENDIX A

Accessibility Statement

Columbia is committed to providing equal access to qualified students with documented disabilities. A student's disability status and reasonable accommodations are individually determined based upon disability documentation and related information gathered through the intake process.

For more information regarding this service, please visit the University's Health Services website:
<http://health.columbia.edu/services/ods/support>