

ENV1703 – Water Resource Management and Policy – Fall 2024 Syllabus

Instructor

Hamed Ibrahim
Assistant Professor
Department of Civil & Mineral Engineering
School of the Environment
Phone: 416-978-8942 | Email: hamed.ibrahim@utoronto.ca

Office Hours

Please email me to request an appointment. Meetings will occur in-person or online (Microsoft teams).

Class Schedule

LEC 0101 MO 11:00 01:00

COURSE OVERVIEW

Advanced knowledge of water management analysis with applications to water supply for society, sustainability of water resources, and environmental conservation. Basic elements of the course include the hydrological cycle, the role of water in Earth's climate, global and regional climate change, ecological limits, integrated water resource management, and water reuse and recycling. The course will include analysis of ongoing water development problems to identify common characteristics that will be applied to develop management strategies for sustainable water resources in a changing global climate. There are three parts:

A) Fundamentals: water in the natural environment and in society, the hydrological cycle, the role of water in Earth's climate system, global and regional climate change, sustainable water supply and use in society, ecological limits, integrated water resource management.

B) Water development problems

- **Cumulative water problems:** analysis of water supply and use problems that develop over a long time in different hydrologic setting, e.g., The Colorado River in the southwestern United States, seawater desalination in the Persian Gulf, ground subsidence and sea level rise in Venice and Bangladesh, and depletion of the Ogallala aquifer.
- **Recurring water problems:** floods, droughts, and water contamination, and their impact on society and the environment, e.g., on food supply, energy supply, conflict etc.

C) Developing management strategies for sustainable water resources in a changing global climate:

- Rethinking water supply, water demand, and water pricing
- Integrating climate change
- Adaptive water management

Required Readings

There is no required textbook for this course. Readings will be posted on Quercus.

Course Website

Quercus will be used for announcements, required readings, handouts, grades and any other information pertaining to the course: <https://q.utoronto.ca/>

Instructional Methods

The course will use a combination of formal lectures and active learning techniques (such as discussions on topics associated with natural water systems, water resource development, and water resource management).

Learning Outcomes

By the end of this course, students will:

- Acquire a basic knowledge of the analysis of water data
- Understand the fundamentals of sustainable water resource
- Learn to assess water resource problems at the local and regional scale
- Learn to develop strategies for managing water resources under uncertainty

EVALUATION

1) Assignments (40%)

Four assignments will be scheduled throughout the term. Each assignment (10%) is a three-page single-spaced review of, and reflection on, the readings, with supporting references.

2) Research Proposal (10%)

Each student will submit a proposal to research a water problem in a region of their choice. The proposal must include a specification of the problem, the historical or time context (e.g., cumulative versus recurring), the management approach in place during the development of the problem, and a description of available data sets and information that will be used to assess the problem.

3) Individual Presentations (15%)

Each student will present their research paper to the class.

4) Research Paper (35%)

Each student will submit a 10-page double-spaced research paper that expands on the research proposal. The paper will conclude by exploring management strategies for avoiding or improving the water problem identified in the research proposal.

Late Assessment Submissions Policy

5% per day after the due date, including weekends.

Late Assignments

Accepting late papers is solely at the discretion of the instructor. Requests for extensions must be made in office hours, or in writing or via email with your rationale explained **before the due date**. All assignments should be handed in at or before the beginning of the class on the

specified due date. Assignments should be given directly to the professor. All late assignments should be turned into the drop box located outside of the main office. You can only turn in a late assignment during business hours. The instructor is not responsible for assignments put under the office door and those assignments will be given a late penalty based on the date the instructor finds it under the door.

COURSE SCHEDULE

Week	Activity
1	No class
Part A: Fundamentals	
2	Introduction to course material and aims. Discussion topics: Water in the natural environment; The hydrological cycle. Readings: “Global hydrological cycles and world water resources,” (Oki and Kanae 2006); “The hydrological cycle and its influence on climate,” (Chahine 1992).
3	Discussion topic: The role of water in the climate system; Global and regional climate change. Readings: “The role of water vapour in earth’s energy flows,” (Allan 2011); “The regional impacts of climate change – an assessment of vulnerability,” (IPCC 1998).
4	Discussion topic: Sustainable water supply and use in society. Reading: ‘sustainable water resources – concept, definition, and example,’ (Eltahir 2007)
5	Discussion topics: Ecological limits; Integrated water resource management. Readings: “Integrated Water Resources Management (IWRM) in Canada,” (Roy et al. 2009); “The ecological limits of hydrologic alteration (ELOHA) – a new framework for developing regional environmental flow standards,” (Poff et al. 2010).
Part B: Water development problems	
6	Discussion topic: The Colorado River water crises. Reading: “The Colorado River water crisis: its origin and the future,” (Schmidt et al. 2023).
7	Discussion topic: Ground subsidence and sea level rise in Bangladesh and Venice. Readings: “Delta subsidence-an imminent threat to coastal populations,” (Schmidt 2015); “Water level changes, subsidence, and sea level rise in the Ganges-Brahmaputra-Meghna delta,” (Becker et al. 2020); “The 1966 Flooding of Venice: what time taught us for the future,” (Trincardi et al. 2016).
8	Discussion topic: Depletion of the Ogallala aquifer. Reading: “Conserving the Ogallala aquifer-efficiency, equity, and moral motives,” (Peterson et al. 2003); “Ogallala aquifer depletion-economic impact on the Texas high plains,” (Terell et al. 2002); “The future of agriculture over the Ogallala Aquifer-Solutions to grow crops more efficiently with limited water,” (Basso et al. 2013)
9	Discussion topic: Floods, drought, and water contamination. Readings: “Coping with variability and change: floods and droughts,” (Zbigniew et al. 2002); “Pre-disaster planning and preparedness for floods and droughts- A systematic review,” (Raikes et al. 2019); “Risk Analysis of the Walkerton Drinking Water Crisis,” (Hipel et al. 2013); “Drinking water contamination in Walkerton, Ontario: positive resolutions from a tragic event,” (Holme 2003).
Part C: Developing management strategies for sustainable water resources in a changing global climate	

10	Discussion topic: Rethinking water supply, water demand, and water pricing. Reading: “A Look at Twenty-first Century Water Resources Development,” (Gleick 2000); “Roadmap for sustainable water resources in southwestern North America,” (Gleick 2010). Student research paper presentation.
11	Discussion topic: Integrating climate change into water resource management. Readings: “Integrating risks of climate change into water management,” (Döll et al. 2015). Student research paper presentation.
12	Discussion topic: Adaptive water management. Reading: “Adaptive water management: strengthening laws and institutions to cope with uncertainty,” (Bruch 2000). Student research paper presentation.

WRITING AT THE UNIVERSITY OF TORONTO:

There are a number of College Writing Centres at the University of Toronto (<http://www.writing.utoronto.ca/writing-centres/arts-and-science>) that you can use as resources to assist you in organizing and writing your formal report and other assignments. The main Writing at the University of Toronto website can be found via the web (<http://www.writing.utoronto.ca/>). They provide a lot of useful information under the Advice section of their website, and you are encouraged to consult them for assistance with your written assignments. They also offer a series of workshops entitled “Writing Plus”. These are detailed at <http://www.writing.utoronto.ca/writing-plus>. Finally, the English Language Learning program (ELL) offers different skills development programs that may be beneficial (<http://www.artsci.utoronto.ca/current/advising/ell>).

GUIDELINES

Academic integrity

All suspected cases of academic dishonesty will be investigated following procedures outlined in the *Code of Behaviour on Academic Matters*. If you have questions or concerns about what constitutes appropriate academic behaviour or appropriate research and citation methods, please reach out to me. Note that you are expected to seek out additional information on academic integrity from me or from other institutional resources (for example, the University of Toronto website on Academic Integrity).

Equity, Diversity, Inclusion

The University of Toronto is committed to equity, human rights and respect for diversity. All members of the learning environment in this course should strive to create an atmosphere of mutual respect where all members of our community can express themselves, engage with each other, and respect one another’s differences. U of T does not condone discrimination or harassment against any persons or communities (<https://governingcouncil.utoronto.ca/secretariat/policies/equity-diversity-and-excellence-statement-december-14-2006>).