

ENVS 6503 – Biogeochemistry of Wetlands

University of Guelph, School of Environmental Sciences

Fall 2024

Instructor: Dr. Nicole Balliston, nballist@uoguelph.ca. Office hours: Virtual by appointment

Meeting time: Wed 1:00pm -4:00pm, ALEX 337

Course Overview:

Wetlands are land areas with persistent saturation resulting in distinct soils, biochemical processes, and vegetation adapted to wet conditions. There is a great variety of wetland types, since they are subject to the particular geomorphic setting in the landscape and the local climate. These high-level controls dictate the hydrological regime, biogeochemistry and ultimately the ecology. Resultantly, wetlands provide a number of important ecological functions to both human and natural environments, including but not limited to flood protection, water quality amelioration, carbon sequestration and habitat. Human activities including resource development, climate change and accidental contamination affect wetland function. Can these systems be restored? Can they be better managed? If so, only if they are well understood. This course characterizes the biophysical and geochemical processes associated with wetlands and wetland development, methods to identify, classify and characterize, and examines human impacts on wetland functions. This course will provide the essential information for your future career as environmental scientists, consultants, educators, regulators or policy-makers dealing with landscapes that include wetlands.

Intended Learning Outcomes

1. Identify classes of wetlands as described by the Canadian Wetland Classification System (bogs, fens, swamps, marshes, shallow water)
2. Describe the hydrological, biogeochemical, carbon and ecological character of each wetland class.
3. Understand and use (parts of) wetland evaluation and designation systems (i.e. Ontario Wetland Evaluation System, Provincially Significant Wetland, Ramsar, Wetlands of Distinction)
4. Recognize natural and anthropogenic disturbances to wetlands and potential wetland trajectories and interventions
5. Synthesize field and secondary data to make a logical, science-based assessment of selected local wetland systems.

Reference Materials:

Required: Wetland Ecology, Principles and Conservation, 3rd edition, by Paul A. Keddy. Cambridge University Press 2010

Recommended: Wetlands, 5th edition, Mitsch and Gosselink

Other assigned readings will be posted on Courselink

Course Requirements and Evaluation:

Lectures/ Discussions:

We will discuss topics covered in the readings. I expect you to do the reading **before** class so we don't waste time on transferring rote information from me to you.

Field Trips:

There are three required field trips; two take place during class time (Ignatius Jesuit Centre and Fletcher Creek), and we may get back to campus slightly after 4:00 on those days. **The third trip to West Gormley Kettlehole Fen is all day on Saturday, Oct. 19.** As part of the field trips, we will be analyzing the water samples back in Guelph during class the following week.

Quizzes: 15%

Almost every class period will start with a short quiz based on the reading for that week. These quizzes are designed to test your understanding of the concepts and connect your knowledge with real world systems. The quizzes are open book, and you may use hand-written or typed notes. No computers, tablets or phones allowed! I will count the best 8 of 10 quizzes for each student.

Assignments: 85%

1-3. Field trip wetland reports: 15% each

During each of the three field trips you will be expected take notes on important observations about wetland classification, vegetation, hydrology, soils, biogeochemistry, fauna and any other pertinent information. Water samples will be collected during each trip and analyzed in class the following week for additional biogeochemical information. Each student will then submit a summary of which main factors controlling wetland biogeochemistry and ecology are most relevant to that particular wetland. Final deliverables include the main written report (max 5000 words), wetland characterization map, wetland vegetation map, supporting data, and references.

2. Ramsar Wetland Report and Presentation: 30%

You will write a ~2500 word report on the characteristics and functions of a designated Ramsar wetland to the class. Before starting this report you must submit the name of your chosen wetland and 3 primary references on the topic that you will be using. On the presentation day each student will summarize the main findings of this report in a 10 minute presentation+ five minute question period.

3. Application for a Wetland of Distinction 10%

The goal of this assignment is to put the West Gormley Fen on the map of internationally significant wetlands. Wetland of Distinction is a recognized designation from the Society of Wetland Scientists. We will use existing information on this distinctive wetland and the information from our field trip to prepare this application. You will be evaluated on your contribution to this project by your classmates.

Itinerary: Assignments, quizzes, and lectures dates (unless notified otherwise). Additional readings may be posted closer to quiz date

*All non-textbook materials are posted on Courselink

Week	Activities	Concepts to Cover	Deadlines/ Quizzes	Required Readings for next week
1 September 11 th	No in-person classes for the first two weeks. Independent reading period	<ul style="list-style-type: none"> • Six wetland classifications by hydrology, vegetation and nutrients (Canadian Wetland Classification System) • Primary and secondary constraints in wetlands • Ontario Wetland Evaluation System • Wetland designation systems (Provincially Significant Wetland, Ramsar, Wetlands of Distinction) 	none	Chapter 1 in <i>Wetland Ecology</i>
2 September 18 th				<ul style="list-style-type: none"> *2022 Southern Ontario Wetland Evaluation System manual pp.1-35 *Canadian Wetland Classification System pp.1-9
3 September 25 th	In-person class ALEX 337	<ul style="list-style-type: none"> • Official introduction • Review of weeks 1 and 2 	In-class quiz covering Chapter 1 of <i>Wetland Ecology</i>	Chapter 2 in <i>Wetland Ecology</i>
4 October 2 nd	In-person class ALEX 337 field trip to Ignatius Jesuit Centre	<ul style="list-style-type: none"> • wetland hydrology and soils • review quiz 1 	In-class quiz covering Chapter 2 of <i>Wetland Ecology</i>	Chapter 3 in <i>Wetland Ecology</i>
5 October 9 th	In-person class ALEX 337 Analyze water samples from Ignatius	<ul style="list-style-type: none"> • wetland hydrology and fertility • review quiz 2 • introduce Ramsar assignment 	In-class quiz covering Chapter 3 of <i>Wetland Ecology</i>	Chapter 4 in <i>Wetland Ecology</i>

6 October 16 th	Field trip to Fletcher Creek Field trip to West Gormley fen (October 19th)	<ul style="list-style-type: none"> ● disturbance ● review quiz 3 	Field report for Ignatius due <i>In-class quiz covering Chapter 4 of Wetland Ecology</i>	Chapter 5 in <i>Wetland Ecology</i>
7 October 23 rd	In-person class ALEX 337 Analyze water samples from Fletcher, West Gormley	<ul style="list-style-type: none"> ● competition ● review quiz 4 	<i>In-class quiz covering Chapter 5 of Wetland Ecology</i>	Chapter 6 in <i>Wetland Ecology</i>
8 October 30 th	In-person class ALEX 337	<ul style="list-style-type: none"> ● herbivory ● review quiz 5 	<i>In-class quiz covering Chapter 6 of Wetland Ecology</i> Name of Ramsar wetland and 3 references due	Chapter 7 in <i>Wetland Ecology</i>
9 November 6 th	In-person class ALEX 337	<ul style="list-style-type: none"> ● burial ● review quiz 6 	<i>In-class quiz covering Chapter 7 of Wetland Ecology</i> Field report for Fletcher due	Chapter 8 in <i>Wetland Ecology</i>
10 November 13 th	In-person class ALEX 337	<ul style="list-style-type: none"> ● other factors that impact wetlands ● review quiz 7 	<i>In-class quiz covering Chapter 8 of Wetland Ecology</i> Field report for West Gormley due	Chapter 11 in <i>Wetland Ecology</i>
11 November 20 th	In-person class ALEX 337 Ramsar presentations	<ul style="list-style-type: none"> ● human relationships with wetlands ● review quiz 8 	<i>In-class quiz covering Chapter 11 of Wetland Ecology</i> Ramsar Report Due	Chapter 13 in <i>Wetland Ecology</i>
12 November 27 th	In-person class ALEX 337	<ul style="list-style-type: none"> ● wetland conservation and restoration ● review quiz 9 	<i>In-class quiz covering Chapter 13 of Wetland Ecology</i> Wetland Application of Distinction due	none