

# INTRODUCTION TO BIOGEOCHEMISTRY

**Winter2023**

## **General Information**

**Course Code: ENVS 2310**

**Course Title: Introduction to Biogeochemistry**

### **Course Description:**

This course introduces aspects of Earth science that are critical to understanding environmental issues with societal impacts. Students will gain a basic understanding of biogeochemical cycling by exploring how biological processes control element fluxes between water, air, and earth materials. Topics of current interest, such as resource extraction, climate change and geoenineering will be discussed in terms of their contributions to major element cycles. Seminars include quantitation exercises, hands-on exercises, and discussions to complement topics covered in the lectures

### **Credit Weight:**

0.5

### **Academic Department (or campus):**

School of Environmental Sciences

### **Campus:**

Guelph

### **Semester Offering:**

Winter 2023

### **Class Schedule and Location:**

Lectures MW 11:30-12:20 (MCKN225)

Seminar F 11:30-1:20 (MCKN226)

All lectures and seminars are in-person only unless the university mandates online teaching.

## **Instructor Information**

Instructor Name: Dr. Susan Glasauer

Instructor Email: [glasauer@uoguelph.ca](mailto:glasauer@uoguelph.ca)

Teaching Assistant: Kimber Munford

TA email: [kmunford@uoguelph.ca](mailto:kmunford@uoguelph.ca)

## **Office hours**

Office hours will be on Zoom or in person each week throughout the semester, to be scheduled once we discuss the time that works best for most. I'm happy to meet with students who can't make the office hours by appointment.

## **Course Content**

### **Specific Learning Outcomes:**

Students will be provided with opportunities to:

1. Understand key scientific concepts in biogeochemistry, with emphasis on the biological control of major and trace element cycling of major elements and select trace elements between terrestrial, aquatic and atmospheric reservoirs.
2. Demonstrate the development of critical thinking and problem solving skills for application in Earth science, as well as in the broader realm of environmental science and biogeochemistry;
3. Understand the benefits and challenges of interdisciplinary science in solving complex environmental issues;
4. Show improved literacy, in particular with respect to comprehension of scientific literature through assigned reading;
5. Demonstrate improved numeracy skills in an environmental Earth science context.

### **Lecture Content:**

The course will follow the schedule of lectures, assignments and midterms shown on the following page.

Week	Date	Lect#	Topic	Reading	Seminar (Fri)
1	Jan 9	1	Earth as a chemical system	BGC Ch1 3-16	How simple can a model be?
	Jan 11	2	Environmental systems	Thinking in Systems Ch 1	
2	Jan 16	3	Earth origins&chemistry	BGC Ch2 17-30	Models&estimation DUE 1/25
	Jan 18	4	Evolution of life	BGC Ch2 30-44	
3	Jan 23	5	The atmosphere: structure, composition & reactions	BGC Ch3 51-69	Residence time DUE 2/1
	Jan 25	6			
4	Jan 30	7	The lithosphere	BGC Ch4 99-109	Gaia & feedback loops DUE 2/8
	Feb 1	8	Soil reactions	BGC Ch4 110-117;126-134	
5	Feb 6	9	The biosphere	BGC Ch5 141-153	TBD (catch up on lectures & review)
	Feb 8	10	The biosphere	BGC Ch5 160-174	
6	Feb 13	11	Biogeochem cycling on land	BCH Ch6 183-199	<b>MIDTERM I 2/17</b> <i>In seminar</i>
	Feb 15	12	Biogeochem cycling on land	BGC Ch6 199-208	
<b>READING WEEK</b>		<b>READING WEEK</b>		<b>READING WEEK</b>	
7	Feb 27	13	Biogeochem cycling on land	BGC Ch6 208-217;224-229	Stable Isotopes DUE 3/8
	Mar 1	14	Mass balance	BGC Ch7 232-237; Fig 6.29	
8	Mar 6	15	Wetlands	BGC Ch7 249-260;265-277	<b>No class meeting</b> Redox worksheet DUE 3/15
	Mar 8	16	Wetlands	BGC Ch7 288-291	
9	Mar 13	17	Intro to freshwater	BGC Ch8 293-307	Trophic concepts
	Mar 15	18	Lakes and ponds	BGC Ch8 307-328	
10	Mar 20	19	Rivers and streams	BGC Ch8 328-342	Recurrence intervals DUE 3/29
	Mar 22	20	Rivers and streams		
11	Mar 27	21	Estuaries	BGC Ch9 342-350	<b>MIDTERM II 3/31</b> <i>In seminar</i>
	Mar 29	22	Ocean circulation&comp.	BGC Ch9 362-375	
12	Apr 3	23	Ocean nutrients & productivity	BGC Ch9 TBD	TBD
	Apr 5	24		BGC Ch9 TBD	

Students should be prepared to take notes during class.

I will post course materials on Courselink. This includes the notes that I take during lectures and the seminar, and any other materials such as powerpoint slides and handouts.

**The lectures will not be recorded.**

Seminars take place on Fridays and reinforce the topics of the course lectures. Work and assignments that aren't completed during the seminar period must be handed in by the following Wednesday.

## Course Assignments and Exams:

Assignment or Test	Due Date	Contribution to Final Mark (%)	Learning Outcomes Assessed
Models & estimation	January 25	Best 5 out of 6 marks; each is worth 4%, for a total of 20%.	1,2,3,5
Residence time	February 1		1,2,5
Gaia & feedback loops	February 8		1,2,5
Stable isotopes	March 8		1,2,3,5
Redox worksheet	March 15		1,2,3,5
Recurrence intervals	March 29		1,2, 3,4,5
Midterm 1	February 17	25	1,2,3,4,5
Midterm 2	March 31	25	1,2,3,4,5
Final	April 22	30	1,2,3,4,5

### Additional Notes (if required):

Assignments complement the seminar discussions and are due in lecture on the Wednesday that follows the Friday seminar.

Midterms take place during seminar periods. Students may use the entire period (1 hr 50 minutes) to complete the exam.

### Final examination date and time:

April 20, 8:30-10:30.

### Final exam weighting:

30%

THE FINAL EXAM IS COMPREHENSIVE

## Course Resources

### Required Text:

**Biogeochemistry: An Analysis of Global Change, 4th edition. W. H Schlesinger and E. S. Bernhardt. Academic Press, 2020**

This textbook will NOT be available on library reserve.

### Other Resources:

Additional reading will be posted on Courselink by week. Electronic materials from the lectures and seminars will be posted on Courselink after the lecture, by week.

## **Course Policies**

### **Grading Policies:**

Assignments must be handed in electronically on the due dates before 5 pm to the class Dropbox on CourseLink.

**Policy on Late Assignments:** Making up a missed exam or assignment requires a doctor's note or equivalent. Late assignments will be penalized at a rate of 5% markdown per day after the due date.

**Copies of out-of-class assignments:** Keep paper and/or other reliable electronic back-up copies of all out-of-class assignments: you may be asked to resubmit work at any time.

### **Course Policy on Group Work:**

Group work will be allowed only where explicitly assigned by the instructor.

### **Course Policy regarding use of electronic devices and recording of lectures:**

Presentations which are made in relation to course work—including lectures—cannot be recorded or copied without the written permission of the presenter, whether the instructor, a classmate or guest lecturer. Material recorded with permission is restricted to use for that course unless further permission is granted.

## **University Policies**

### **Email Communication**

As per university regulations, all students are required to check their e-mail account regularly: e-mail is the official route of communication between the University and its students.

### **When You Cannot Meet a Course Requirement**

When you find yourself unable to meet an in-course requirement because of illness or compassionate reasons please advise the course instructor (or designated person, such as a teaching assistant) in writing, with your name, id#, and e-mail contact. The grounds for Academic Consideration are detailed in the Undergraduate and Graduate Calendars. Undergraduate Calendar - Academic Consideration and Appeals <https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml> Graduate Calendar - Grounds for Academic Consideration <https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/index.shtml> Associate Diploma Calendar - Academic Consideration, Appeals and Petitions <https://www.uoguelph.ca/registrar/calendars/diploma/current/index.shtml>

### **Drop Date**

Students will have until the last day of classes to drop courses without academic penalty. The deadline to drop two-semester courses will be the last day of classes in the second semester. This applies to all students (undergraduate, graduate and diploma) except for Doctor of Veterinary Medicine and Associate Diploma in Veterinary Technology (conventional and alternative delivery) students. The regulations and procedures for course registration are available in their respective Academic Calendars. Undergraduate Calendar - Dropping Courses

<https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-drop.shtml> Graduate Calendar - Registration Changes <https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/genreg-regregchg.shtml> Associate Diploma Calendar - Dropping Courses <https://www.uoguelph.ca/registrar/calendars/diploma/current/c08/c08-drop.shtml>

### **Copies of Out-of-class Assignments**

Keep paper and/or other reliable back-up copies of all out-of-class assignments: you may be asked to resubmit work at any time.

### **Accessibility**

The University promotes the full participation of students who experience disabilities in their academic programs. To that end, the provision of academic accommodation is a shared responsibility between the University and the student. When accommodations are needed, the student is required to first register with Student Accessibility Services (SAS). Documentation to substantiate the existence of a disability is required; however, interim accommodations may be possible while that process is underway.

Accommodations are available for both permanent and temporary disabilities. It should be noted that common illnesses such as a cold or the flu do not constitute a disability. Use of the SAS Exam Centre requires students to book their exams at least 7 days in advance and not later than the 40th Class Day.

For Guelph students, information can be found on the SAS website <https://www.uoguelph.ca/sas> For Ridgeway students, information can be found on the Ridgeway SAS website <https://www.ridgewaync.com/services/accessibilityservices.cfm>

### **Academic Integrity**

The University of Guelph is committed to upholding the highest standards of academic integrity, and it is the responsibility of all members of the University community-faculty, staff, and students-to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring. University of Guelph students have the responsibility of abiding by the University's policy on academic misconduct regardless of their location of study; faculty, staff, and students have the responsibility of supporting an environment that encourages academic integrity. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection. Please note: Whether or not a student intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for verifying the academic integrity of their work before submitting it. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member or faculty advisor. Undergraduate Calendar - Academic Misconduct

<https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-amisconduct.shtml>

Graduate Calendar - Academic Misconduct

<https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/index.shtml>

### **Recording of Materials**

Presentations that are made in relation to course work - including lectures - cannot be recorded or copied without the permission of the presenter, whether the instructor, a student, or guest lecturer. Material recorded with permission is restricted to use for that course unless further permission is granted.

### **Resources**

The Academic Calendars are the source of information about the University of Guelph's procedures, policies, and regulations that apply to undergraduate, graduate, and diploma programs. Academic Calendars <https://www.uoguelph.ca/academics/calendars>

**Disclaimer**

Please note that the ongoing COVID-19 pandemic may necessitate a revision of the format of course offerings and academic schedules. Any such changes will be announced via CourseLink and/or class email. All University-wide decisions will be posted on the COVID-19 website (<https://news.uoguelph.ca/2019-novel-coronavirus-information/>) and circulated by email.

**Illness**

The University will not normally require verification of illness (doctor's notes) for winter 2022 courses. However, requests for Academic Consideration may still require medical documentation as appropriate.

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**Additional Course Information****Commitment to the course:**

This course is worth 0.5 credits. According to University policy, you should plan on spending up to 12 hours per week engaged with this course, including lectures and seminars. That leaves around 8 hours to complete the reading and class assignments and to study the lecture material outside of class meetings. If you have invested this amount of time and still feel like you're struggling to keep up, please make an appointment to talk to me.

**A word about the impacts of the Covid-19 pandemic:**

Given the course of the pandemic so far and what we've learned, we can expect rates of infection to go up during the winter. We can keep ourselves and others from getting sick by wearing masks and sanitizing as necessary. If you can't keep a distance of 2 m between you and the person next to you, please consider wearing a mask.

**A word about online teaching:**

In an emergency, I will provide a Zoom link to students to follow the lecture. If the weather is so bad that people can't travel safely, I may choose to provide the lecture entirely online.