INTRODUCTION TO BIOGEOCHEMISTRY

Winter 2022

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 geoengineering 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 2022

Class Schedule and Location:
Lectures MW 11:30-12:20 (Zoom or Alex 218)
Seminar F 11:30-1:20 ONLINE (Zoom or Alex 218)

We will follow university protocols for meeting in person. In other words, when U. of Guelph says we can return to the classroom, we will. There is no hybrid option (simultaneous classroom and online teaching).

Instructor Information

Instructor Name: Dr. Susan Glasauer
Instructor Email: glasauer@uoguelph.ca

Teaching Assistant: Kimber Munford
TA email: kmunford@uoguelph.ca
Office hours

Office hours will be on Zoom each week throughout the semester. I will survey students during the first week of class to choose a time that works 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.
<table>
<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Lect#</th>
<th>Topic</th>
<th>Reading</th>
<th>Seminar (Fri)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Jan 10</td>
<td>1</td>
<td>Earth as a chemical system</td>
<td>BGC Ch7 3-16</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Jan 12</td>
<td>2</td>
<td>Scientific uncertainty</td>
<td>Boan2018; UncertainScience</td>
<td>Dealing with uncertainty</td>
</tr>
<tr>
<td>2</td>
<td>Jan 17</td>
<td>3</td>
<td>Earth origins&amp;chemistry</td>
<td>BGC Ch2 17-30</td>
<td>Models&amp;estimation DUE 1/26</td>
</tr>
<tr>
<td></td>
<td>Jan 19</td>
<td>4</td>
<td>Evolution of life</td>
<td>BGC Ch2 30-44</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Jan 24</td>
<td>5</td>
<td>The atmosphere</td>
<td>BGC Ch3 51-67</td>
<td>Gaia &amp; feedback loops DUE 2/2</td>
</tr>
<tr>
<td></td>
<td>Jan 26</td>
<td>6</td>
<td>Atmospheric chemistry</td>
<td>BGC C 3 67-71</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Jan 31</td>
<td>7</td>
<td>The lithosphere</td>
<td>BGC Ch4 99-109</td>
<td>Residence time DUE 2/9</td>
</tr>
<tr>
<td></td>
<td>Feb 2</td>
<td>8</td>
<td>Soil reactions</td>
<td>BGC Ch4 110-117;126-134</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Feb 7</td>
<td>9</td>
<td>The biosphere</td>
<td>BGC Ch5 141-153</td>
<td>Lecture: finish soil reactions</td>
</tr>
<tr>
<td></td>
<td>Feb 9</td>
<td>10</td>
<td>The biosphere</td>
<td>BGC Ch5 160-174</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Feb 14</td>
<td>11</td>
<td>Biogeochem cycling on land</td>
<td>BCH Ch6 183-199</td>
<td>MIDTERM I 2/18</td>
</tr>
<tr>
<td></td>
<td>Feb 16</td>
<td>12</td>
<td>Biogeochem cycling on land</td>
<td>BGC Ch6 199-208</td>
<td>In seminar</td>
</tr>
<tr>
<td>7</td>
<td>Feb 28</td>
<td>13</td>
<td>Biogeochem cycling on land</td>
<td>BGC Ch6 208-217;224-229</td>
<td>Stable Isotopes DUE 3/9</td>
</tr>
<tr>
<td></td>
<td>Mar 2</td>
<td>14</td>
<td>Mass balance</td>
<td>BGC Ch7 232-245; fig6.29</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Mar 7</td>
<td>15</td>
<td>Wetlands</td>
<td>BGC Ch7 249-265;265-277</td>
<td>Soil cycling</td>
</tr>
<tr>
<td></td>
<td>Mar 9</td>
<td>16</td>
<td>Wetlands</td>
<td>BGC Ch7 288-291</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Mar 14</td>
<td>17</td>
<td>Intro to freshwater</td>
<td>BGC Ch8 293-307</td>
<td>Wetlands</td>
</tr>
<tr>
<td></td>
<td>Mar 16</td>
<td>18</td>
<td>Lakes and ponds</td>
<td>BGC Ch8 307-323</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Mar 21</td>
<td>19</td>
<td>Lakes and ponds</td>
<td>BGC Ch8 323-328</td>
<td>Recurrence intervals DUE 3/30</td>
</tr>
<tr>
<td></td>
<td>Mar 22</td>
<td>20</td>
<td>Rivers and streams</td>
<td>BGC Ch8 328-342</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Mar 28</td>
<td>21</td>
<td>Estuaries</td>
<td>BGC Ch9 342-350</td>
<td>MIDTERM II 4/1</td>
</tr>
<tr>
<td></td>
<td>Mar 30</td>
<td>22</td>
<td>Ocean circulation&amp;comp.</td>
<td>BGC Ch9 362-375</td>
<td>In seminar</td>
</tr>
<tr>
<td>12</td>
<td>Apr 4</td>
<td>23</td>
<td>Ocean nutrients &amp; productivity</td>
<td>BGC Ch9 TBD</td>
<td>TBD</td>
</tr>
<tr>
<td></td>
<td>Apr 6</td>
<td>24</td>
<td></td>
<td>BGC Ch9 TBD</td>
<td></td>
</tr>
</tbody>
</table>

Students should be prepared to take notes during class.

I will post the notes that I take during lectures and the seminar, and any other materials such as powerpoint slides and handouts, on Courselink. The lectures will not be recorded.

Seminars take place on Mondays 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:

<table>
<thead>
<tr>
<th>Assignment or Test</th>
<th>Due Date</th>
<th>Contribution to Final Mark (%)</th>
<th>Learning Outcomes Assessed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Models &amp; estimation</td>
<td>January 26</td>
<td>Best 4 out of 5 marks; each is worth 5%, for a total of 20%.</td>
<td>1,2,3,5</td>
</tr>
<tr>
<td>Gaia and feedback</td>
<td>February 2</td>
<td>4 out of 5 marks; each is worth 5%, for a total of 20%.</td>
<td>1,2,5</td>
</tr>
<tr>
<td>Residence time</td>
<td>February 9</td>
<td>4 out of 5 marks; each is worth 5%, for a total of 20%.</td>
<td>1,2,5</td>
</tr>
<tr>
<td>Stable isotopes</td>
<td>March 9</td>
<td>4 out of 5 marks; each is worth 5%, for a total of 20%.</td>
<td>1,2,3,5</td>
</tr>
<tr>
<td>Recurrence intervals</td>
<td>March 30</td>
<td>4 out of 5 marks; each is worth 5%, for a total of 20%.</td>
<td>1,2,3,4,5</td>
</tr>
<tr>
<td>Midterm 1</td>
<td>February 18</td>
<td>25</td>
<td>1,2,3,4,5</td>
</tr>
<tr>
<td>Midterm 2</td>
<td>April 1</td>
<td>25</td>
<td>1,2,3,4,5</td>
</tr>
<tr>
<td>Final</td>
<td>April 22</td>
<td>30</td>
<td>1,2,3,4,5</td>
</tr>
</tbody>
</table>

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 them.

Final examination date and time:
April 22, 11:30-1:30.

Final exam weighting:
30%

THE FINAL EXAM IS COMPREHENSIVE

Course Resources

Required Text:

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 10% 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.

I may record and post the lectures on Courselink, at my discretion.

**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 deliv-
ery) students. The regulations and procedures for course registration are available in their respec-
tive 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/regis-
trar/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 ac-
ademic programs. To that end, the provision of academic accommodation is a shared responsibil-
ity between the University and the student. When accommodations are needed, the student is re-
quired 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 disa-
bilities. It should be noted that common illnesses such as a cold or the flu do not constitute a dis-
ability. Use of the SAS Exam Centre requires students to book their exams at least 7 days in ad-
vance 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 Ridgetown students, information can be found
on the Ridgetown SAS website https://www.ridgetownc.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 stu-
dents-to be aware of what constitutes academic misconduct and to do as much as possible to pre-
vent 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 submis-
sion of assignments does not excuse students from responsibility for verifying the academic in-
tegrity 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/regis-
trar/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](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, it’s reasonable to expect and plan for disruptions during the semester. Meeting online will allow us to have a course that is as close to meeting in person as we can make it. The success of the course will depend on your participation as well as on your discretion; interacting online with people who you may not know personally will call for tact and understanding at times. There will inevitably be technology glitches and I appreciate your support as we navigate through the new world of online teaching and learning. We will return to meeting in the physical classroom (Alex 218) as soon as we can.