

ESM 427/527
Watershed Biogeochemistry
Spring 2021

- Instructor:** Dr. Jamie Collins (jamco2@pdx.edu; 518-488-9666)
- Online format:** Lectures primarily synchronous (live); some asynchronous delivery per schedule below. All course materials and recordings of synchronous lectures will be available at <https://d2l.pdx.edu/d2l/home/860533>
- When/Where:** Synchronous meetings Tuesdays/Thursdays, 12:00-1:50 p.m., via Zoom at <https://pdx.zoom.us/j/9620480212>. Asynchronous materials may be viewed at any time before the *following* lecture/class meeting so long as student has time to complete the required discussion/assignment(s).
- Office hours:** Mondays, 10:00 a.m.-12:00 p.m., via Zoom at <https://pdx.zoom.us/j/9620480212> or Skype [@jamie2139](https://www.skype.com/people/jamie2139)
- Texts:** Schlesinger & Bernhardt (S&B) 2013. *Biogeochemistry: An Analysis of Global Change* (3rd ed.) Available as an [eBook](#) from the PSU library. Other readings will be posted [in D2L](#) as PDFs.
- Prerequisites:** Two courses in college chemistry (recommended); at least one course in ecology or environmental science
- Lecture slides:** Available for download from [course D2L](#) before all synchronous class meetings. Slides for asynchronous meetings/modules will be posted concurrently with recorded video.
- Homework:** Assignments will be placed online at the [course D2L](#) site at least one week before the due date. Unless otherwise indicated, assignments are due before the start of the scheduled synchronous class meeting time on the date below. If the day's topic will be delivered asynchronously, the assignment is due by midnight on the date listed. Discussion forum participation should be completed prior to 10:00 a.m. before a synchronous class meeting. *I will provide checklists [on D2L](#) to help you track/complete your deliverables for the week.*

Course Description: This course is an introduction to biogeochemistry, the study of the chemical interactions between living and non-living components of the environment and how they shape the Earth, with a focus on the watershed scale. Central to the study of biogeochemistry in the modern world is an understanding of how human activities have altered cycles of energy and matter. Biogeochemical cycles are fundamental to all forms of life; understanding the processes and controls at the watershed scale is important to managing environmental problems that can result from altered biogeochemical cycles.

This course will introduce the Earth as a chemical system and its abiotic components. With this background, we will learn about biogeochemical cycling on land, wetlands, and inland waters, with a focus on the watershed scale. This year, we will spend a bit of time at the end of the course discussing the ocean's role in biogeochemistry – with particular focus on export of carbon and other elements from the terrestrial environment to the marine.

Journal articles will provide context for content in the textbook and serve as a basis for both online and live (via Zoom) discussions during our class meetings. The course will end with a student-led survey of

case studies to reinforce and illustrate concepts learned earlier in the course.

Sustainability: This course contributes to the study of sustainability by giving students opportunities to connect scientific and ethical aspects of biogeochemistry with applications in environmental management and policy.

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Course Schedule, Grading Scheme, and Communication Guidelines

Week	Date	Delivery: Synchronous/ Asynchronous	Topic	Reading(s)	Assignment(s)/Task(s)
1	30 Mar	Synchronous	Intro. to biogeochemistry	—	—
	1 Apr	Synchronous	Review/project discussion	1, S&B Ch. 1	Discussion forum; sign up for BGC in the news slot; complete learning survey
2	6 Apr	Asynchronous	Hydrology	2	Discussion forum
	8 Apr	Synchronous	Atmospheric chemistry	3	Discussion forum; BGC in the news; form group project teams & initiate site selection discussion in D2L
3	13 Apr	Synchronous	Soils	S&B, Ch. 4	BGC in the news
	15 Apr	Synchronous	Soils	4	Discussion forum; BGC in the news
4	20 Apr	Synchronous	Carbon cycling on land	S&B, Ch. 5	BGC in the news; HW1 due by beginning of class meeting
	22 Apr	Synchronous	Carbon cycling on land	5	Discussion forum; BGC in the news; group project topics & sub-topics due via D2L
5	27 Apr	Synchronous	Biogeochemical cycles on land	S&B, Ch. 6	BGC in the news
	29 Apr	Asynchronous	Biogeochemical cycles on land	6	Discussion forum; final paper topics submitted for approval via email
6	4 May	Synchronous	Wetlands	S&B, Ch. 7	BGC in the news
	6 May	Synchronous	Wetlands	7	Discussion forum; BGC in the news
7	11 May	Synchronous	Inland waters	S&B, Ch. 8	BGC in the news; HW2 due by beginning of class meeting
	13 May	Synchronous	Inland waters	8	Discussion forum; BGC in the news; group project presentation outline due via D2L
8	18 May	Asynchronous	Urban ecosystems	9	Discussion forum
	20 May	Synchronous	Coastal systems	10	Discussion forum; BGC in the news

9	25 May	Synchronous	Land-ocean continuum	S&B, Ch. 9	HW3 due by beginning of class meeting; BGC in the news
	27 May	Synchronous	Land-ocean continuum	11	Discussion forum; polished draft of final paper due via D2L by beginning of class meeting
10	1 Jun	Synchronous	Peer review; restoration	12	Discussion forum; BGC in the news
	3 Jun	Synchronous	Group project presentations	—	Upload group project slides (.pptx) to D2L <i>by 10:00 a.m.</i>
11	8 Jun	No class meeting	—	—	—
	10 Jun	No class meeting	—	—	Revised final paper due via D2L no later than 10:00 a.m.

Communicating with Me: Online learning during the COVID-19 pandemic has reduced the number of available fora for out-of-class communication between students and instructors. The best way to contact me outside of our synchronous class meeting times is by email; I am happy to then set up a time to connect via Skype or Zoom. Alternatively, if your question is of a general nature and you feel my answer/reply might be of interest to your fellow students, you can [post to the general course discussion forum on D2L](#) so that everyone may benefit. I will do my best to reply to any posts in the general forum within a day.

If you do email me, please follow these general guidelines:

- include an informative subject line (e.g., “ESM 427/527, HW1”)
- include a salutation (e.g., Hello Dr. Collins,...) and sign your name
- do not expect an immediate reply. Some days I will be able to respond to your email within the day, while other times it may take me 1-2 days to respond.

Grading: Participation 10%, Discussions 10%, News 10%, Homework 30%, Presentation 20%, Final Paper 20%.

Attendance and Participation: (10%) Attendance at synchronous class meetings and active participation are expected, including in problem-solving, class discussions, etc. Missing a class meeting may only be excused via communication with the instructor.

Readings and Discussions: (10%) Students must be prepared to discuss the readings and ask/answer questions for all readings (textbook/articles) before each class. Each student must submit one question for discussion and one response (to someone else’s question) relating to each numbered reading (not S&B book chapters) by 10:00 a.m. on the day of class in the appropriate D2L forum. Additional questions for clarification of content must also be posted by 10:00 a.m. Two D2L discussion question/response pairs will be dropped during the term.

In addition to the online D2L discussions, students will participate in in-class small group discussions, rotating through the roles of facilitator and recorder. The composition of the groups (and the roles played by each student) will change each class meeting; discussions will take place in Zoom breakout rooms. The assigned recorder for the group will be prepared to summarize that group’s main thoughts and comments for a full class discussion to follow once students return from their breakout rooms. Details will be posted on D2L.

News: (10%) Each student will spend 10 minutes during one synchronous class session presenting and leading a discussion of a recent news article relating to biogeochemistry. The presentation will be based on a PowerPoint slide that the student will upload to D2L by 10:00 a.m. on the day of the class session. Details concerning the presentation and a sign-up list will be posted on D2L. *527 students only:* The presentation topic should relate to your graduate work.

Homework: (30%) These will be three problem-solving assignments posted on D2L. Assignments will be due before the start of the scheduled synchronous class meeting time on the date indicated in the course schedule. If the day's topic will be delivered asynchronously, the assignment will be due by midnight on the date listed. *Unless arrangements are made with the instructor in advance,* late assignments will lose 10% credit for each 24 hours they are late and will not normally be accepted 7 days after the original due date.

Presentations (20%): Group presentations on case studies in watershed biogeochemistry. Students will work in groups of 2-4 members to examine a biogeochemical research topic addressed by one or more long-term ecological research studies. Presentations (20-40 minutes in length) will take place during our final synchronous class meeting on 3 June. Students will be responsible for several deliverables leading up to the final presentation date; these are listed in the syllabus. Details will be posted in D2L.

Final Paper (20%): *Students in 427* will submit an individual 5-page paper that addresses a research topic related to the group presentation described above. *Students in 527* will each submit a more detailed literature review (up to 10 pages) related to their group presentation topic — or a different topic, if it's more relevant to the student's own interest and research. All paper topics must be approved by the instructor in advance. Specific instructions will be posted in D2L. *For both 427 and 527 students:* A polished draft of the research paper will be due at the beginning of our class meeting on 27 May so it can be distributed to other students for peer review. Peer review results will be discussed in class on 1 June (5%). The revised final paper (15%) will be due via D2L at 10:00 a.m. on 10 June.

Flexibility Statement: The instructor reserves the right to modify course content and/or substitute assignments and learning activities in response to institutional, weather, or class situations.

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Spring 2021 Course Readings

All course readings will be posted to D2L as PDFs.

1. Likens, G.E. & H. Bormann, 1995. *Ecosystem Analysis*. Ch. 1 in *Biogeochemistry of a Forested Ecosystem*, pp. 1-14.
2. Covino, T., 2017. *Hydrologic connectivity as a framework for understanding biogeochemical flux through watersheds and along fluvial networks*. *Geomorphology* 277: 133-144.
3. U.S. EPA, 2001. *Frequently Asked Questions about Atmospheric Deposition*. EPA-453/R-01-009.
4. Zuo, S., et al., 2016. *Assessment of plant-driven mineral weathering in an aggrading forested watershed in subtropical China*. *Pedosphere* 26(6): 817-828.
5. Norby, R. & D. Zak, 2011. *Ecological lessons from Free-Air CO₂ Enrichment (FACE) Experiments*. *Annual Reviews of Ecology, Evolution, and Systematics* 42:181-203.
6. Yang, W.H., et al., 2017. *Cross-biome assessment of gross soil nitrogen cycling in California ecosystems*. *Soil Biology & Biochemistry* 107:144-155.
7. Neubauer, S.C., et al., 2005. *Seasonal patterns and plant-mediated controls of subsurface wetland biogeochemistry*. *Ecology* 86(12): 3334-3344.
8. Moorhouse, H., et al., 2018. *Regional versus local drivers of water quality in the Windermere catchment, Lake District, United Kingdom: The dominant influence of wastewater pollution over the past 200 years*. *Global Change Biology* 24:4009-4022
9. Fissore, C., et al., 2011. *Carbon, nitrogen, and phosphorus fluxes in household ecosystems in the Minneapolis-Saint Paul, Minnesota, urban region*. *Ecological Applications* 21(3): 619-639.
10. Kelleway, J.J., et al., 2016. *Seventy years of continuous encroachment substantially increases 'blue carbon' capacity as mangroves replace intertidal salt marshes*. *Global Change Biology* 22(3): 1097-1109.
11. Bauer, J.E., et al., 2013. *The changing carbon cycle of the coastal ocean*. *Nature* 504: 61-70.
12. Kinsman-Costello, L., et al., 2014. *Re-flooding a Historically Drained Wetland Leads to Rapid Sediment Phosphorus Release*. *Ecosystems* 17(4): 641-656.

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Policies and Resources

Student Conduct Code: Portland State has a well-defined conduct code. [This link takes you to the official description.](#)

Academic Integrity: Academic integrity is a vital part of the educational experience at PSU. Please see the [PSU Student Code of Conduct](#) for the university's policy on academic dishonesty. A confirmed violation of that Code in this course may result in failure of the course. In this class, academic dishonesty is broadly defined as the use of someone else's work as yours. This includes some obvious actions such as:

- Having someone take a class for you
- Having someone take or complete part of your test or an assignment for you
- Having someone else write a paper, or a section of a paper for you
- Using a quote or direct passage from some secondary source (e.g., book, article) in a paper without citing it (this does not include your responses provided on tests that are taken directly from the professor's lecture or other class material)
- Working collaboratively on assignments that are to be completed on an individual basis.
- There also other actions that are considered academically dishonest that are less obvious:
 - Submitting a paper that utilizes another person or source's theories, thoughts, ideas, concepts without proper citation
 - Using a paper or assignment, or a segment of a previous paper or assignment created by another group in which you participated.
 - Taking material off of the Internet and using it without full and proper citation.

The above list of actions is not exhaustive. If you have any question about the appropriate way to cite particular information, please contact your instructor.

Incomplete Policy: Students do not have a right to receive or demand an Incomplete grade. The option of assigning an Incomplete grade is at the discretion of the instructor when the following criteria are met.

Eligibility Criteria:

1. Required satisfactory course completion/participation.
2. Reasonable justification for the request.
3. Incomplete grade is not a substitute for a poor grade.
4. Written agreement. (See [Incomplete Contract](#))
5. Resolving the Incomplete.

For the full Incomplete Policy see <https://www.pdx.edu/regISTRATION/grading-system#/?section=incompletegradei>

Disability Access Statement: My goal is to create a learning environment that is equitable, useable, inclusive, and welcoming. If any aspects of instruction or course design result in barriers to your inclusion or learning, please notify me. The Disability Resource Center (DRC) provides reasonable accommodations for students who encounter barriers in the learning environment. If you have, or think you may have, a disability that may affect your work in this class and feel you need accommodations, contact the Disability Resource Center to schedule an appointment and initiate a conversation about reasonable accommodations. The DRC is located in 116 Smith Memorial Student Union, 503-725-4150, drc@pdx.edu, <https://www.pdx.edu/drc>.

- If you already have accommodations, please contact me to make sure that I have received a faculty notification letter and discuss your accommodations.
- Students who need accommodations for tests and quizzes are expected to schedule their tests to overlap with the time the class is taking the test.

Safe Campus Statement: Portland State University desires to create a safe campus for our students. As part of that mission, PSU requires all students to take the learning module entitled Creating a Safe Campus: Preventing Gender Discrimination, Sexual Harassment, Sexual Misconduct and Sexual Assault. If you or someone you know has been harassed or assaulted, you can find the appropriate resources on PSU's Enrollment Management & Student Affairs: Sexual Prevention & Response website at <http://www.pdx.edu/sexual-assault>

Basic Needs at Portland State: It can be challenging to do your best in class if you have trouble meeting basic needs like safe shelter, sleep, and nutrition. *This is particularly true amid the ongoing COVID-19 pandemic.* Resource centers across campus are here to provide assistance, referrals, and support. Please contact anyone on this list for assistance:

- Basic Needs Hub: basicneedshub@pdx.edu
- Portland State Food Pantry: <https://psufp.com>, pantry@pdx.edu
- C.A.R.E. Team: askdos@pdx.edu, (503) 725-4422
- Student Health & Counseling: askshac@pdx.edu, (503) 725-2800

Title IX Reporting: As an instructor, one of my responsibilities is to help create a safe learning environment for my students and for the campus as a whole. Please be aware that as a faculty member, I have the responsibility to report any instances of sexual harassment, sexual violence and/or other forms of prohibited discrimination. If you would rather share information about sexual harassment, sexual violence or discrimination to a confidential employee who does not have this reporting responsibility, you can find a list of those individuals on PSU's Enrollment Management & Student Affairs: Sexual Prevention & Response website at <http://www.pdx.edu/sexual-assault>. For more information about Title IX please complete the required student module "Creating a Safe Campus: Preventing Gender Discrimination, Sexual Harassment, Sexual Misconduct and Sexual Assault" in the "My Courses" section of D2L.

Cultural Resource Centers: The Cultural Resource Centers (CRCs) create a student-centered inclusive environment that enriches the university experience. We honor diversity, explore social justice issues, celebrate cultural traditions, and foster student identities, success, and leadership. Our centers include the Multicultural Student Center, La Casa Latina Student Center, Native American Student & Community

Center, Pan African Commons, Pacific Islander, Asian, Asian American Student Center and the Middle Eastern, North African, South Asian program. We provide student leadership, employment, and volunteer opportunities; student resources such as computer labs, event, lounge and

Students' Right to Privacy: The Family Educational Rights and Privacy Act (FERPA) (20 U.S.C. §1232g; 34 CFR Part 99) is a Federal law that protects the privacy of student education records. Under FERPA, students have the right to inspect and review their education records maintained by the school. Schools are not required to provide copies of records unless, for reasons such as great distance, it is impossible for parents or eligible students to review the records. Schools may charge a fee for copies. Students have the right to request that a school correct records which they believe to be inaccurate or misleading. If the school decides not to amend the record, the student has the right to place a statement with the record setting forth his or her view about the contested information. Generally, schools must have written permission from the student in order to release any information from a student's education record. However, FERPA allows schools to disclose those records, without consent, to certain parties or under the specific conditions (34 CFR § 99.31): for example, school officials with legitimate educational interest; other schools to which a student is transferring; financial aid officers; state and local authorities in cases of health and safety emergencies; etc. Schools may disclose, without consent, "directory" information such as a student's name, address, telephone number, unless the student has requested that the school not disclose directory information about them. For additional information about the law and its application at PSU, see <https://www.pdx.edu/registration/ferpa-student-records-privacy-faqs>

Returning Work to Students: FERPA requires faculty to be very careful in safeguarding our students' right to privacy when returning students' exams and papers. Faculty can do one of the following:

1. Return work directly to students in class
 - Pass out assignments to students at the end of class
 - Students retrieve their work, before or at the end of class, in individual, labeled file folders or envelopes that guard the confidentiality of the work inside, under the observation of the instructor, ensuring that only the student whose name is on the label removes the material.
2. Return work and send feedback electronically.
3. Students arrange to pick up work from instructors outside of class.
4. Students provide instructors with a self-addressed and stamped envelope that instructors can use to return material directly to students.

Recording Technology Notice: We will use technology (Zoom) for virtual meetings and recordings in this course. Our use of such technology is governed by FERPA, the Acceptable Use Policy and PSU's Student Code of Conduct. A record of all meetings and recordings is kept and stored by PSU, in accordance with the Acceptable Use Policy and FERPA. Your instructor will not share recordings of your class activities outside of course participants, which include your fellow students, TAs/GAs/Mentors, and any guest faculty or community-based learning partners that we may engage with. You may not share recordings outside of this course. Doing so may result in disciplinary action.

Turnitin: Students agree that by taking this course all required papers may be subject to submission for textual similarity review to Turnitin.com for the detection of plagiarism. All submitted papers will be included as source documents in the Turnitin.com reference database solely for the purpose of detecting plagiarism of such papers. Use of Turnitin.com page service is subject to the Usage Policy and Privacy Pledge posted on the Turnitin.com site.

Other Resources & Services

Check out the ESM webpage for all sorts of info on the department: <http://www.pdx.edu/esm/>

Library research tutorials: <http://guides.library.pdx.edu/home/howto> and <http://guides.library.pdx.edu/biology>

Queer Resource Center: <https://www.pdx.edu/queer>

Veterans: If you are a Veteran and have questions about University services or need assistance with your transition from military to campus life, please begin at the [Veterans Resource Center](#). Other resources are listed at <https://www.pdx.edu/veteran>

Writing Center: For assistance with class assignments, resumes, etc. The Writing Center is currently serving students online. Schedule an appointment at <https://www.pdx.edu/writing-center/>
The Purdue OWL is a trove of excellent online resources concerning *plagiarism* and other writing topics: <https://owl.purdue.edu/>