Summer Session 2017

BIOE 439 Stream Ecology

3 credits: Lectures, Labs, Field Work
Course dates: July 24–August 4, 2017
Instructor: Dr. Michelle Anderson
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http://www.umwestern.edu/academics/biology

Prerequisites: One year of college-level biology, chemistry, and mathematics, and an ecology course (can be met via BIOE342 Field Ecology at FLBS) or equivalents; or consent of instructor.

"You don't know where you are as a point of view unless you go beyond yourself."
Jim Harrison

"We call upon the waters that rim the earth, horizon to horizon, that flow in our rivers and streams, that fall upon our gardens and fields, and we ask that they teach us and show us the way."
Chinook Blessing

Course Description:

Stream Ecology (BIOE 439) addresses the unifying principles and contemporary research approaches of the highly interdisciplinary ecological processes of running waters. This course focuses on the fundamental concepts of stream/river ecology and the physical, chemical and biological processes that characterize running water ecosystems. Students learn principles, concepts and methods of study in a field setting, and obtain hands-on experience in the examination and characterization of stream systems. Over 80% of this course is taught in the field at streamside. Written and oral reports of independent or group studies as directed by the professor are required.

Required Text: (Available for purchase at the Biological Station Bookstore)
Thorp, James H. 2011. Field Guide to Freshwater Invertebrates of North America (Paperback), 1st edition, Elsevier Academic Press, ISBN-13: 978-012381426.

Reference Materials: You will be expected to read a variety of primary and secondary literature sources each day, posted on Moodle.

Course and Field Supplies/Equipment: (*Available for purchase at the FLBS Bookstore)

- Rite in the Rain field notebook*
- Permanent ink pens and a few pencils*
- Hot/cold mug*
- Water bottle*
- Lunch pack-up container (resealable)*
- Mess kit
- Bear spray*
- Wading shoes or sandal
- Binoculars
- Flashlight (headlamp) and batteries
- Camera (optional, but great scenery in this class)
- Laptop computer with MS Excel & MS Word
- Personal First Aid Kit

- REQUIRED Overnight Field Gear and Other Items to Bring Checklists: (Click to view)

Student Learning Outcomes:

Course Learning Objectives

1) Engage students in evaluating stream ecology concepts (i.e., hydrology and geomorphology, biogeochemistry, primary production, detrital processes, invertebrates, vertebrates and human-stream interactions) through active laboratory and field discussions and investigations.
2) Students collect, analyze and present stream ecology datasets from primary literature and their own research, working both independently and as a team.
3) Provide students with experience creating and implementing an authentic practice of professional ecological research.

Expected Learning Outcomes

1) Students identify and explain ecological relationships pertaining to a wide variety of stream organisms and environments. Students accomplish this task using terms, concepts, and hypotheses familiar to professional stream ecologists.
2) Students are able to conduct a series of quantitative and repeatable field and laboratory studies that answer questions of relevance to stream ecology at multiple spatial and temporal scales.
3) Students are skilled in evaluating and communicating ideas from stream ecology literature.
4) Students develop a deeper appreciation of local natural history and real-world ecological issues in the Crown of the Continent ecoregion and greater Pacific Northwest.

Evaluation and Grading:

Participation	11%	A	≥94%	A-	90–93%
Quizzes	24%	B+	87–89%	B	84–86%
Research proposal written report	35%	B-	80–83%	C+	77–79%
Research proposal presentation	30%	C	74–76%	C-	70–73%

Participation

Your participation grade is based both on the quality and quantity of class discussions and a notebook documenting field and laboratory experiences. You will keep a Rite-in-the-Rain notebook describing field and lab activities, including data collected, analyses, and notes from discussions. I will describe in class the standard formatting, elements of clarity and degree of completion to use in your notebook. Notebook daily entries are worth 1 point, with 2 points for a final course reflection on the last day of class.

Quizzes

You will study topical peer-reviewed readings in evenings to facilitate class discussions before and during field and lab sessions each day. Daily quizzes on each topic will be given the morning after we cover a topic – this gives you time to digest the material from the previous day of field and lab activities, do the reading, discuss the reading, and then communicate your understanding of the material to me and each other. QUIZZES ARE COMPLETED IN YOUR NOTEBOOK, EITHER IN THE FIELD OR CLASSROOM. Each quiz will support the work you are doing on your stream ecosystem case studies and research proposals. After completing a quiz, the entire class will be given time to go over the quiz together. Quizzes will be given on 7/25 – 7/28 and 8/1 – 8/3. Each quiz is worth 3 points.

Research Proposal – Written Report, and Presentation

As you progress in your academic and professional career, you will find the need to write proposals to guide your research, solicit funding, and meet reporting requirements. Yet many undergraduates have little or

no experience with researching and writing a proposal, including developing testable hypotheses, a project study design, and budget. During the first week of class you will review research by other stream ecologists to inspire and guide your development of an idea for your own research project. In week 2 of class you will write your proposal, incorporating baseline field data you collect during the week. The last afternoon of class you will also present a power point or prezi presentation describing your proposal for colleagues from class and at FLBS.

Stream Ecology Research Proposal Written Report

What: Individually you will select a topic in stream ecology that could be developed and implemented as a research project. You will write a short proposal describing your proposed research, including baseline data collected at one or more local stream sites. I will provide general example projects and supplies which you will modify. You will collect and record data in a field notebook, then present the research proposal and associated baseline data to the class orally and to me in written proposal form.

Why: Technical reviews such as project plans, final reports, and journal articles are the foundation of written scientific communication between wetland scientists, managers and the public. This is particularly true when projects involve public funds and lands. Whether you work for a government agency, a nonprofit, a consulting firm, or manage wetlands in the private sector, you will be expected to write proposals to guide your work and solicit funding.

Who: Write your proposal to someone who is generally familiar with stream ecology and management. The document should be readable to fellow stream ecologists who might be reviewing your proposal.

How: You will develop individual projects but work collaboratively to:

- develop a clear question and hypotheses to test your question
- propose a study design
- implement baseline elements of the study design in the field
- collect, record, and analyze field data
- describe results (written report, presentation).

This will require in-class discussion of course content, extensive in-class and independent internet and literature searches, and collaboration with group members in and out of class to collect data, and research, write and edit the proposals.

When: You will work on preproposals and discuss your ideas with your instructor during the first week of class. Baseline data collection will occur July 24–27. Proposal presentations and the written report are due July 28.

How long should it be?	Report: Approximately 1,500 to 2,500 words, single spaced, 12 point Times New Roman font, 1" margins, tables and/or figures *with legends* after the references section (see below) Presentation: see rubric below
Can I use quotations?	Quotations are hardly ever used in a technical review or journal article; paraphrasing is the norm. If you have a compelling reason for adding a quotation, check it with me.
Can I use my opinion?	Yes. The review requires you to express your expert objective, scientific opinion to interpret your findings in the discussion section of your report and presentation.
Do I need a References section?	Yes. You will include a minimum of 6 references, all of which must be journal articles. Most groups will also need to cite a variety of website databases, technical reports, and books in excess of the 6 required journal articles.

	References should be formatted using the style of "Freshwater Biology".
Do I need in-text citations?	Yes. Use the format from the journal "Freshwater Biology".

I. **Project Summary** – First, describe your general research questions and hypotheses. Then describe how your project relates to the wider field of stream ecology, providing context for the project in relation to other studies of stream ecology, the conservation and management or stream ecosystems, and broader impacts of the research on society. **(10 points)**

II. **Project Description** – This section provides a more detailed description of your research. Include information on the location where work will be/has been conducted, the type of data to be collected, why these data are needed, ways to mitigate negative impacts on study organisms, the data collection schedule, expected data analyses, how data will be shared, and the benefits of the study. Be sure to fully explain your experimental design and your protocol for collecting and analyzing data to evaluate your hypotheses, including how you evaluated data on treatment effects in relation to stream classification, hydrology, biogeochemistry, biota, etc. **(10 points)**

III. **Baseline Data Collection Results** – Explain key data collection findings including descriptions of all figures and tables. Include only data that has been analyzed and formatted to convey concise information in figures and tables that relate to your study objectives and hypotheses (i.e., no raw data or data that doesn't relate directly to your original questions). Describe your results in terms of "why?", i.e., what factors do you perceive to have caused the responses (hydrology, biota, etc.) you observed. (**10 points**)

IV. **References** – use the formatting style of the journal "Freshwater Biology" **(3 points)**

V. **Budget** – prepare a reasonable budget for your proposed activities **(2 points)**

Name: _____ Research Proposal Presentation Rubric:
(27 points for below and 3-point peer-review = 30 points)

	Below Expectation – 1 point	**Meets Expectation – 3 points**
Project	• Student's presentation is unorganized and poorly sequenced. • Student's presentation is missing significant required content and depth. • Student does not directly and clearly refer to concepts and data from references (journal articles, etc.), and cannot explain how this information supports the student's research. • Student's presentation makes no connections between the research and real-world applications, including management. • Student cannot clarify mistakes or recommend future changes to the project. • Student cannot answer questions about the experiment or project background.	• Student's presentation is well organized, sequenced and easy to follow. • Student's presentation is covers all required content for their section in-depth. • Student directly and clearly refers to concepts and data from references (journal articles, etc.), exploring how information supports the student's research. • Student's presentation makes abundant connections between the research and real-world applications, including management. • Student can clarify mistakes or recommend future changes to the project. • Student can answer questions about the experiment or project background.

Clarity & Interest	• Student appears disengaged and unenthusiastic about the project, showing unprofessional mannerisms (gum, back to the audience, leaning on tables, etc.). • Student mumbles, incorrectly pronounces terms, or speaks too quietly for audience to hear. • Student reads report from notes, is unable to convey information otherwise, making minimal eye contact with the audience.	• Student appears engaged and enthusiastic about the project, presenting a professional appearance and demeanor. • Student speaks loudly and clearly, pronouncing terms correctly. • Student uses minimal notes to convey information about the project, making frequent eye contact with audience.
Comments		

Final Reflection Essay Rubric:

	Meets expectations	**Does not meet expectations**
Reflective Thinking	Student explains their own thinking and learning processes, **as well as implications for future learning**.	The student attempts to demonstrate thinking about learning but is **vague and/or unclear** about the personal learning process.
Analysis	Student gives **in-depth** analysis of the **learning experience**, the value of the learning to self and others, **and the relationship to the student's views of the discipline.**	Student attempts to analyze the learning experience, **but in vague terms or inconsistent analysis**.
Making Connections	The student articulates **multiple insightful connections** between this learning experience and content from **other courses, past learning, life experiences and/or future goals.**	The student makes a **vague or unclear connection** between this learning experience and content from other courses, past learning, life experiences and/or future goals.

Course Policies:

A reliable secure wireless connection to the Internet is available in selected areas. A Moodle website is used to provide electronic versions of course assignments and readings and provide for the electronic sharing of data, photos and other information with the entire class. Each student will also have access to a secure personal folder on the FLBS network. File formatting and naming protocols will be covered in class.

I support students in learning processes as they decide how knowledge will shape their personal and professional lives. I design my courses around two principles: 1) exploring biology collaboratively is more worthwhile, 2) teaching informs research and research informs teaching. These principles are reinforced by metacognition (how you learn) concepts I emphasize in my classes:

- Pursue studies rich in meaning and purpose – big questions connect to our lives
- We learn by linking new information to prior learning through elaboration, a process supported by presenting new information in "chunks" which are spaced out and then revisited (i.e. "interleaving")

- Minimize lecture and instead utilize images (images = big chunks) and engaging activities, which we discuss and then you read about it (curiosity stimulates longer interactions with problems, reading is for deepening knowledge)
- Creativity is a challenge that excites different parts of the brain – I try to help students generate genuine hypotheses, solve realistic and relatable problems, and when possible incorporate humanities into scientific studies
- Foster desirable difficulties, risk-friendly environments, and choice – failure is acceptable when it is part of a learning environment that fosters growth (failures as a challenge, not as a dead end)
- Testing (done well) can help you learn

The #1 rule of conduct in this class – treat all organisms (including each other) with respect and compassion. You are preparing for a career in biology – a discipline which demands hard work, ethical behavior, and respect for diversity in ideas, people and resources. My top priority in class is to create a safe, inclusive and productive learning environment. You are responsible for contributing to that environment. We do a lot of group work in this class, which requires frequent collaboration within and among groups to successfully complete assignments. I expect you to treat me and each other with a professional level of civility and courtesy, regardless of your personal opinions. If conflicts arise, consult me immediately to resolve issues before a problematic situation is created. I expect everyone to abide by all UM campus standards for student codes of conduct, civility, academic integrity and personal behavior (including Title IX guidelines on unacceptable sexual conduct, harassment and violence).

Also for our collective welfare: Act responsibly! Don't go out in the field or lab unless you are prepared for both expected work and emergencies. Assess the weather, inspect vehicle condition, bring adequate food, water, safety equipment and field gear, and make sure you are mentally prepared for a day (or more) in the field. In the lab, inspect and continuously monitor equipment and be aware of and able to use safety protocols and supplies as needed. Show consideration for other people participating in legitimate outdoor or laboratory activities and be respectful of active animal dens, display areas, feeding sites and gathering places–stay with your group and keep a safe distance between you and the wildlife. Do not bring firearms, alcohol or hazardous materials into university buildings or vehicles – including field trips.

Schedule: (Tentative to be revised late Spring 2017.)

Date	Lectures – Labs – Field Work
24-Jul-17	Introduction, general global climate, alpine climate, morphological and physiological adaptations to the alpine climate, community ecology of alpine environment, plant ID lab
25-Jul-17	Field Trip to Glacier National Park: Siyeh Pass (plant interactions)
26-Jul-17	Grinnell Glacier (glacial succession)
27-Jul-17	Iceburg Lake
28-Jul-17	Written exam; work on 1st draft of scientific paper
31-Jul-17	Field trip, Glacier National Park: Avalanche Lake (biomes)
1-Aug-17	Scenic Point; (community interactions)
2-Aug-17	Dawson-Pitamakin Loop
3-Aug-17	Work on scientific paper
4-Aug-17	Final presentations and final draft of paper due