

LIMNOLOGY (ESS/BZ 474)

SPRING 2019

LECTURE: NATURAL RESOURCES 106

T TH 1300-1350

LABORATORY: BIOLOGY 130 TH 1400-1550

Instructor: Dr. Ed Hall

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COURSE OVERVIEW

Welcome to Limnology. I hope that you will come away from this course with a better understanding of some of the fundamental challenges that are facing freshwater ecosystems today: eutrophication, overfishing, competing human uses, 'browning', global warming, invasive species and how these environmental problems affect lakes, reservoirs and other inland waters (e.g. streams and rivers). My goal for the course is to provide you with a deeper understanding of inland waters and the forces that influence them that will help you evaluate how human activities are influencing the future of freshwater on our planet.

The course will cover several themes including: how lakes are formed, the number and distribution of freshwater ecosystems globally, the inputs and cycling of energy and nutrients within lakes, and the interactions between communities and abiotic properties of lakes and challenges facing freshwater ecosystems moving forward. We will focus on the ecological patterns and processes in natural systems, as well as the causes and consequences of human-induced global changes on ecosystem functioning.

The lab portion of the course will focus on the tools and approaches that limnologists use to measure the patterns and processes we will discuss in class. In addition, you will have the opportunity to apply these tools in a group research project of your own design. Groups will design a study, collect data, analyze results, and present their findings to the class.

COURSE MATERIALS

Primary Text: Freshwater Ecology – Concepts and Environmental Applications of Limnology, 2nd Edition. Dodds & Whiles. Additional readings will be posted on the course Canvas site.

Please regularly check the *active reading list* on the course canvas site to be sure you're up to date with all readings. ***All readings must be completed before the class period to which they are assigned.***

COURSEWORK AND GRADING

Lecture

In - Class Quizzes	10%
In-Class Participation	10%
Laboratory	30%
First Exam	15%
Second Exam	15%
Final Exam	20%

Course grades will be based on the following scale:

A+	≥98%	B+	≥88%	C	≥70%
A	≥92%	B	≥82%	D	≥60%
A-	≥90%	B-	≥80%	F	<60%

DESCRIPTION OF COURSEWORK

Note: additional information and grading criteria for assignments will be posted on RamCT as assignments become available

Exams: There will be two-midterm and one final exam. Format for the exams will be a combination of multiple choice, short answer and essay. The exams will cover the material presented in class, as well as information from the assigned readings and the laboratory. The exams will be designed to test your understanding of the course content with an emphasis on concepts and ideas rather than your understanding of quantities (e.g. the pathways through which carbon (C) moves within a lake vs. the absolute pool size of C in a lake's sediment).

Primary Literature: We will spend some class periods during the term reading and reviewing primary literature that relates to topics we are covering in class. These discussions of contemporary and classic works in limnology will give you an opportunity to see how limnological research is implemented and reported. You will be asked to read the paper before coming to class and we will work in small groups to discuss and answer questions related to the paper. ***Please be sure that all assigned reading for a given class period is done before class.*** All assigned reading and material from previous lectures are possible material for quizzes to be given at the beginning of lecture or lab at the instructors discretion.

Laboratory: Most writing assignments will take place during the laboratory portion of the course. Details on the assignments, due dates and grading will be given in the laboratory portion of the syllabus.

COURSE POLICIES

Late assignments: All of the assignments are due *at the beginning of class* on the due date listed on the syllabus. All assignments will be submitted electronically via the course RamCT site. You will lose 20% of the points for submitting the assignment up to 24 hours after the due date. Assignments submitted after one week will not receive credit except in exceptional cases (which do exist). Please talk with me as soon as possible if you know you must miss an exam or any other assignment. *I only grant extensions on assignments in the case of family or medical emergencies or other exceptional cases. However, if you are not sure whether your case qualifies for an extension please ask. I am happy to work with you whenever possible. Life is happening all the time.*

Readings: The syllabus lists the book chapter (sometimes with pages) most closely related to the scheduled lecture topic. On several occasions, *I will require additional reading* for lecture and lab (primary literature articles, articles from the popular press, etc.) that I will post on RamCT. Some are already listed on the syllabus some will arrive as the semester progresses. All assigned reading must be ready to be discussed at the beginning of the class period, may be used in designing quizzes at the beginning of lecture, and will also likely appear on exams.

Class Attendance: I will not take attendance in class and attendance is not required. Although I expect you to use the textbook as a reference, I will not lecture directly from the text, and any material presented in lecture will comprise the majority of the exam material. I will post my lecture slides on RamCT, but simply reading the lecture slides is not a substitute for coming to class. If you do miss lecture it is your responsibility to get the lecture notes from someone in class.

Classroom conduct: All students have the right to a civil, productive, and stimulating learning environment. In turn, instructors have a responsibility to maintain such an environment. Lively, even heated, discussion is not disruptive behavior. Both instructors and students have a fundamental obligation to respect the rights of each other and to foster civil, courteous behavior. This is particularly important during student presentations, class participation, and peer evaluation of writing. Please feel comfortable asking questions in class (the more questions the better!) and make sure that you respect your classmates' right to do the same.

Texting and using any form of social media in class are disruptive to the instructor and the other students. Thus, they are not permitted at any time, for any reason, in lecture or in lab.

CLASS SCHEDULE (*GL = Guest Lecture*)

Week	Date	Topic	Reading
1	1/22	The Lake of your Life	no assigned reading
	1/24	Origin of Lakes	D&W CH7:140-156
2	1/29	Global Distribution of Lakes	Cael et al. 2017; Cael & Seekall 2016
	1/31	Physical Characteristics of Water	D&W CH2
3	2/5	Hydrological Cycle <i>GL:TBA</i>	<i>TBD</i>
	2/7	Thermal Stratification & Mixus	D&W CH3; CH7 156-162
4	2/12	Physical Structure of Lakes	D&W CH7 162-166
	2/14	Light Gradients	D&W CH3 45-62
5	2/19	P-R and ReDox	D&W CH12
	2/21	Mid-Term Exam I	<i>TBA</i>
6	2/26	Freshwater Phytoplankton GL: Dr. Whitney Beck	D&W CH9 198-208
	2/28	Algal Physiology GL Dr. Graham Peers	
7	3/5	Carbon Cycle I (Review Mid-Term I)	D&W CH13
	3/7	Carbon Cycle II	<i>Tranvik et al. 2009</i>
8	3/12	Nitrogen Cycling	D&W CH14; Jetten 2008
	3/14	Phosphorus Cycling	D&W CH14
9	3/19		
	3/21		
10	3/26	S, Fe, Hg and other elements	D&W CH14
	3/28	Microbial Ecology of Lakes I	Fenchel; D&W19 509-512
11	4/2	Microbial Ecology of Lake II	D&W CH9 185-195
	4/4	Zooplankton Ecology	D&W CH10 221 - 252
12	4/9	Discussion/Review	Lindeman 1942
	4/11	Exam II	
13	4/16	Food Webs I	D&W CH19; Azam et al. 1986
	4/18	Food Webs II	D&W CH20
		<i>SCHEDULE CONT. NEXT PAGE</i>	

<i>SCHEDULE CONTINUED</i>			
14	4/23	Benthic – Pelagic Coupling	D&W CH24
	4/25	Biodiversity & Ecosystem Processes	
15	4/30	Inland Waters in the Face of Global Change	
	5/2	Eutrophication of Lakes	
16	5/7	The Future of Freshwater: Applying Limnology	Baron et al. 2012
	5/9	Review Session (Last Class)	Bring Questions
	5/15	Final Exam	TBD

THERE WILL BE OPPORTUNITIES FOR EXTRA CREDIT THROUGHOUT THE SEMESTER. WE WILL ANNOUNCE SOME IN CLASS PLEASE INQUIRE ABOUT OTHERS IF YOU ARE INTERSTED

PLEASE CHECK THE ACTIVE READING SCHEDULE ON CANVAS TO BE SURE YOU HAVE ALL READINGS COMPLETED BEFORE CLASS STARTS

Limnology Laboratory
ESS/BZ 474
Spring 2019

Graduate Student Instructor: Jemma Fadum

Office: NESB A245

Office hours: Tuesdays 11:30-12:30

Wednesdays 3:00-4:00

or by appointment

jfadum@rams.colostate.edu

Lab Location: Biology 130

Lab Hours: 2:00 – 3:50 pm Thursday

Lab Texts: Relevant readings will be posted on canvas. Check active lab reading list regularly. Please make sure you have reviewed all posted lab material before lab and turned in any requirements before lab

Grading:	Laboratory Grade	30% (of total course grade)
	Report on Field Study	15%
	Presentation on Trophic Experiment	15%
	Analysis of Big Data (Metabolism Lab)	20%
	Sum of Additional Assignments	20%
	Lab Practicum	15%
	Class Participation	15%

Laboratory Objectives:

- Gain knowledge of field techniques used in limnology.
- Gain knowledge of laboratory and data analysis techniques used in limnology.
- Gain experience in cooperative data collection and interpretation.
- Improve skills in technical writing and presenting information (lab reports).
- Gain an understanding of limnological methods and their role in lake analyses.
- Learn how to discuss key papers from the original limnological literature.

Attendance: Laboratory participation is essential to your success in this course. If you need to miss lab, please contact me at least one week *before* the lab you need to miss a lab. If you miss a lab unexpectedly please contact me with the proper documented excuse as soon as possible. We will accommodate you to the fullest extent possible.

LAB SCHEDULE

Week	Date	Living Topic & Assignment Schedule (subject to change)	
1	Jan 24	Ex. 1 - Landforms	HW: Landforms lab due part I: Wed. Jan 24 ^h at 1 pm; Part II: Wed Jan. 30 th at 3pm.
2	Jan 31	<i>Overview of field trip and sampling methodology</i>	HW: Familiarize yourself with field sampling sheet (quiz at start of lab on Thurs. Feb. 7 th)
3	Feb 7	Ex. 2 – Stratification	HW: Stratification lab due Wed. Feb 13 th at 3 pm
3	Feb 9	<i>Field Trip to Warren Lake (Weather permitting)</i>	HW: Report on Field Study due Wed. April 17 th at 3 pm
4	Feb 14	<i>Classic Paper Discussion</i>	TBD
5	Feb 21	NEP lab and Photosynthesis/Respiration	HW: Metabolism lab due Wed. March 6 th at 3 pm
6	Feb 28	<i>No Lab this week: Work on Metabolism Lab (Due March 6th)</i>	
7	Mar 7	Ex. 4 - Chlorophyll/Organic Matter	HW: Chl a/ OM lab due Wed. March 13 th at 3 pm
8	Mar 14	<i>Classic Paper Discussion</i>	TBD
9	Mar 21	<i>No Lab this week: Spring Break!</i>	
10	Mar 28	Cell counts and visualization	HW: Cell counts lab due Wed. April 3 rd at 3 pm
11	Apr 4	Zooplankton ID	HW: Zoop ID lab due Wed. April 10 th at 3 pm
12	Apr 11	<i>No Lab this week: Finish Report on Field Study (Due April 17th)</i>	
13	Apr 18	Ex 6. - Trophic Ecology Lab Experiment	HW: None
14	Apr 25	Discussion of Classic Paper and Conclude Trophic Ecology Lab	HW: Trophic Ecology Lab write up due Wed. May 1 st at 3 pm. Presentations in lab on May 2 nd .
15	May 2	Multi-year Data Lab and Trophic Ecology Experiment Presentations.	Due: Multi-year Data Lab due Wed. May 8 th at 3 pm
16	May 9	In lab practical (overview of techniques and topics to date).	