Syllabus
AQUATIC ECOSYSTEMS
NR 751/851, Fall 2016

Course Overview

This course will develop the principles of ecosystem ecology, with a focus on their application to freshwater ecosystems (streams, rivers, wetlands, and lakes). Ecosystem ecology is the study of energy and material flows through the living (plants, fish, microbes) and non-living (soils, rocks) components in an ecosystem. We will study the major element cycles, patterns of energy flow through ecosystems, and the links between ecosystem structure and function so that we can critically evaluate how complex processes (climate change, watershed urbanization) may directly or indirectly impact aquatic ecosystems.

Instructor

Lauren Koenig
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Office hours: Mondays 3:00 – 4:00 PM, Thursdays 11:00 AM – 12:00 PM,
James Hall G49

Lab TA

Andrew Robison
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Office hours by appointment

Schedule

Lecture: Tuesdays/Thursdays 9:40 – 11:00 AM, James Hall 144
Lab: Tuesdays 2:10 – 5:00 PM, Spaulding 160

Course Objectives

Through a combination of lecture, discussion of the primary literature, and hands-on data analysis, students in this course will come to understand: 1) the physical, chemical, and biological processes that characterize the structure and function of aquatic ecosystems; 2) how aquatic ecosystems participate in the flow of energy and material across continental landscapes; 3) how the terrestrial environment influences aquatic ecosystems; and 4) how human activities are altering aquatic ecosystem structure and function.

Lab Objectives

The main purpose of the lab section is to apply the concepts covered in lecture and in readings by working with real-world data from start to finish. Throughout the semester students will gain hands-on experience collecting and analyzing physical, chemical, and biological data through an intensive case study of College Brook on the UNH campus, as well as a full-day field trip to the Hubbard Brook Experimental Forest in the White Mountains of New Hampshire.

Course Materials
Assigned readings will be based on the textbook – Fundamentals of Ecosystem Science (edited by Weathers, Strayer, and Likens, available as an e-book via the UNH library) – as well as papers from the scientific literature posted on myCourses.

Recommended supplementary reading:
- Schlesinger, and Bernhardt. Biogeochemistry, 3rd edition (e-book, UNH library)
- Hauer and Lamberti. Methods in Stream Ecology, 2nd edition (e-book, UNH library)

Expectations
I expect students to arrive to class on time, to be prepared, and to actively participate in class activities and discussion. All students should exercise professional courtesy – cell phones and mobile devices should not be used unless necessary for class, treat peers and instructors respectfully, and use proper email etiquette. Assignments should be neatly organized and turned in on time. Academic honesty and integrity is expected at all times, and consistent with UNH policy, any student found to have cheated on exams or other submitted work will be assigned an F for the course and reported to the Dean of Students.

Student Accommodations
If you have received Accommodation Letters for this course from DSS, please let me know as soon as possible so that we may meet privately to discuss accommodations.

Course Assessment
Grades in this course will be based on the points earned from lab reports, problem sets, exams, a semester project, and class participation (total 200 points). Assignments are due at the beginning of class. Late assignments will be penalized 10% for each day late.
- Problem sets (3) – 24 pts
- Lab assignments (7) – 56 pts
- Independent research project – 40 pts
- Midterm exam – 30 pts
- Final exam – 30 pts
- Class and lab participation – 20 pts

A = 90 – 100% (180 – 200 pts)
B = 80 – 90% (160 – 179 pts)
C = 70 – 80% (140 – 159 pts)
D = 60 – 70% (120 – 139 pts)
F = 0 – 60% (0 – 119 pts)

Module	Week	Date	Lecture topic	Lab Topic	Readings	Assignments
Introduction to Ecosystem Ecology	1	8/30/16	Course overview: planetary boundaries and ecosystem services	Introduction to College Brook	How to read a scientific paper, Bormann and Likens 1967	
		9/1/16	Ecosystem budgets and the whole watershed approach		Text ch. 2 (pg. 27 - 50)	
Energy and Trophic Dynamics	2	9/6/16	Primary production in streams, rivers, and lakes	Lab 1. Streamflow, physical characteristics	Text ch. 3 (pg. 58 - 72)	Lab 1 due 9/13
		9/8/16	Factors regulating primary production		Text Box 5.1	Problem set 1 due 9/15
	3	9/13/16	Secondary production and elemental stoichiometry	Lab 2. Chemical/ biological measurements	Text ch. 4 (pg. 75 - 92)	Lab 2 due 9/20
		9/15/16	Decomposition and fates of organic matter		Vannotte et al. 1980, Text ch. 10 (pg. 197 - 201)	
	4	9/20/16	Energy dynamics and aquatic landscapes: the River Continuum Concept	Lab 3. Stream metabolism calculations	Roberts et al. 2007	Lab 3 due 9/27
		9/22/16	Stream metabolism			
Biogeochemistry/ Element Cycling	5	9/27/16	**Hubbard Brook field trip**	**Lab 4. Hubbard Brook field trip**	Text ch. 5 (pg. 97 - 108)	Lab 4 due 10/6
		9/29/16	Introduction to element cycles		Text ch. 7 (pg. 137 - 148; 152 - 157), Text Box 5.2	Problem set 2 due 10/11
	6	10/4/16	The nitrogen cycle	Lab 5. Nutrient spiraling experiment	Mulholland et al. 2008	**Research project proposals due**
		10/6/16	Human alteration to the nitrogen cycle		Text ch. 6 (pg. 109 - 116; 126 - 132)	
	7	10/11/16	The carbon cycle and redox reactions	Midterm review Lab 6. Deploy decomposition experiment	Schindler et al. 2016, Text ch. 8 (pg. 159 - 177)	
		10/13/16	The phosphorus cycle			
	8	10/18/16	**Midterm Exam**	Lab 7. Sediment redox	Text ch. 15 (pg. 259 - 264)	Lab 7 due 11/17
Ecosystem Change/ Controls on Ecosystem Structure and Function		10/20/16	Chemical regime: the carbonate system and acid rain		Text ch. 11 (pg. 215 - 230)	
	9	10/25/16	Physical regime: lake stratification and turbulence	Finish lab 5. Nutrient spiraling calculations		Lab 5 due 11/1
		10/27/16	Physical regime: hydrology and sediments		Text ch. 14 (pg. 253 - 257)	Problem set 3 due 11/3
	10	11/1/16	Chemical regime: oxygen	Work on research projects	Macleod et al. 2011	
		11/3/16	Chemical regime: salinization of fresh waters			
	11	11/8/16	Case studies	Finish lab 6. Leaf litter decomposition	Pace et al. 2004	Lab 6 due 11/15
		11/10/16	Ecosystem subsidies		Estes et al. 2011	
	12	11/15/16	Trophic cascades	Catchment salinization	Slavik et al. 2004, Text ch. 10 (pg. 201 - 211)	
		11/17/16	Resistance, resilience, regime shifts			
	13	11/22/16	**UNH follows Friday schedule - no class**	**No lab**		
		11/24/16	**Thanksgiving holiday - no class**			
Synthesis	14	11/29/16	Scaling aquatic ecosystem processes	Work on research projects	Wollheim et al. 2008	
		12/1/16	The role of aquatic ecosystems on planet Earth		Text ch. 9 (pg. 181 - 190)	
	15	12/6/16	Revisiting the ecosystem concept and frontiers in ecosystem science	**Research project presentations**	Bernhardt and Doyle 2011	Final project reports due 12/9
		12/8/16	Ecosystem services trade-offs - what is a stream?			Final Exam 12/13 10:30 - 12:30