BIOL/ENVI 344 - AQUATIC ECOLOGY - FALL 2017

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Time - Class – 1:10-2:10 MWF - Lab – 1:00-4:30 Tuesday

Text – *Freshwater Ecology: Concepts and Environmental Applications* by Walter K. Dodds. 2010. Academic Press.

Course Goals -This course is designed to investigate the major factors that structure biological communities in freshwater systems. These factors include both abiotic (physical/chemical) and biotic (organism interaction) components of the aquatic ecosystem. Right now I have organized the course to discuss these factors in the "lecture" portion of the course. I have identified specific section of your book that you should read before we discuss them in class. I will give an overview of the material then answer questions that you may have concerning the material. The success of this approach depends upon everyone being well prepared for class! I may assign some relatively recent articles to discuss in some class periods. Check Moodle for copies of the articles. In the "laboratory" portion of the class we will work on one major projects (see below) and this will influence what we discuss in class and when. It's likely we will get off of the schedule that is attached since we will certainly use some of the MWF "lecture" times to prepare for and analyze samples taken in the field. This is a work in progress!

Relationship between course goals and the Biology Departments Learning Outcomes

CORE CONCEPTS

- **Structure and Function.** This course examines how aquatic systems are structured and how they function. We will look at some specific adaptations of plants and animals for life in water.
- **Pathways of transformation of energy and matter.** We examine the movement of energy through both lake and stream ecosystems. We also discuss nutrient cycling in both types of ecosystems.
- **Systems.** We will examine river and lake systems as *systems*. The interactions among the biotic and abiotic components of these ecosystems and the feedback among these components is a major focus of the course.

CORE COMPETENCIES

- **Ability to apply the process of science.** We will conduct two research projects throughout the semester. You will be required to examine large amounts of field observation data, analyze and interpret it. In addition you'll be writing a scientific paper for one of the projects and giving a presentation on the other.
- **Ability to use quantitative reasoning.** We use graphs every day to explain the temporal and spatial relationships among the biotic an abiotic components of aquatic systems. You will obtain reams of data from our field observations and experiments and must organize and analyze these data. In addition you'll be examining data collected by government agencies. We will use JMP to a great extent.

We will be conducting one major project in the lab portion of the course on a stream near Afton MN. We will also conduct some lake sampling so that you have an introduction to lake sampling methods. In addition to the papers that included in the syllabus below there will be some papers to read for the projects. We will discuss these in lab. Again, a student will be responsible for giving a brief overview of the paper.

- We'll break up into groups and you and your group mates will be required to write a scientific paper on the stream metabolism project. This should be structured with an Introduction, Materials and Methods, Results and Discussion. The paper should include references that describe the importance of this research (mainly in the Intro), the methods used and how these results compare to others (mainly in the Discussion). The paper should be 7-10 pages plus Figures and Tables.
- During the final week of lab you will give presentations on based on this research. A group of 3 or 4 will give a 15 min presentation on the research and will lead a 15 min discussion of its importance. While we will work to divide up the analyses we've conducted so that each group can focus on a different aspect of the research we've conducted.
- We carried out a similar project in Fall 2015 and we'll spend some time comparing our results with those from 2015.

Exams - We will likely have a couple of take home exams in the course. We will decide on dates as a group (sometime in October and the end of class. Once the dates are finally set there will be no exceptions to when the exams will be given. If you miss an exam you must provide documentation for the reason for your absence. Acceptable documentation would include such items as a note from your physician, etc.

Grading - Your grade will be based on 2 exams, your paper presentation and the lab. This may be adjusted as we go through the semester.

Percentages of your final grade are as follows:

Test 1	15%
Test 2	15%
Project paper	**45%**
Presentation	10%
Participation	15%
TOTAL	**100%**

Academic Integrity

I assume all students will adhere to the College's standards of academic integrity. You can access the Dean of Academic Programs website to learn more about academic integrity - http://www.macalester.edu/academicprograms/academicpolicies/academicintegrity/. Procedures to be followed for alleged breaches of academic integrity can be found at http://www.macalester.edu/employmentservices/employeehandbook/12additionalpolicies/12-10academicintegrity.html. One of the most common breaches of academic integrity

comes through **Plagiarism** Information about ways to avoid plagiarism can be found at http://www.macalester.edu/max/writing/betterparaphrasing/.

Academic Support

The Macalester Academic Excellence (MAX) Center (www.macalester.edu/max) provides academic support (help with writing, study habits, time management, etc.) to all students and also provides services to accommodate students with documented disabilities. The MAX Center is located on the first floor of Kagin Commons.

Accommodations

I am committed to providing assistance to help you be successful in this course. Accommodations are available for students with documented disabilities. Contact information about how to document disabilities can be found at https://www.macalester.edu/max/disability/. It is important to meet early in the semester to ensure your accommodations are approved to ensure you begin the semester successfully.

Attendance

In my experience students who come to class do better than those that don't – so come to class. You'll find that the vast majority of the material on the exams will come from the topics presented and discussed in class. This is another good reason to attend. The lab is a major component of the course and thus you should plan to come to all the labs. Please let me know ASAP if you can't attend.

Incompletes

I do not give incompletes in the course unless there are extraordinary circumstances that prevent you from completing the course (e.g. illness, a death in the family, etc.). I encourage keeping on top of the material in the class, especially the labs. You'll find that a lot of the analysis of the data collected in the lab takes place during the last few weeks. This means that you should do any writing possible, especially for the longer report, earlier in the semester. If you put it off working on the lab report until all of the data are collected, you'll find the last few weeks to be VERY busy.

Preliminary Lecture/Lab schedule – Fall 2017
Since we will be doing some "lab" work during our "lecture" time I'm sure this schedule will be changed!

Week	"Lecture" topic	Reading Assignment*	Lab work
Sept 4-8	Intro to class and aquatic systems	Dodds pp 1-18 – peruse Forbes, 1887	Discuss lab projects; begin leaf-bag construction
Sept 11-15	Hydrological cycle, properties of water, overview of factors influencing productivity	Dodds pp 19-26; 65-105; 470-476 and see Dodds index for Limnological Terms - Eutrophy, Oligotrophy, Dystrophy	Deploy leaf decomposition samplers and periphyton samplers; conduct water sampling
Sept 18-22	Physical properties of streams - geologic formation and water and sediment movements	Dodds pp 31-37; 108-135; Florsheim et al. 2008	Fish Population Sampling – Valley Creek
Sept 25-29 (On Wednesday and Friday we might do some analysis of periphyton and leaf bags)	Physical properties of lakes - geological formation, light, heat, water movements	Dodds pp 140-146; 52-61; 61-63, Heat from Wetzel pp 86-91 on Moodle; Dodds pp 156-166; 41-43	Retrieve periphyton and leaf samplers; deploy new periphyton samplers; download metabolism data

Week	"Lecture" topic	Reading Assignment*	Lab work
Oct 2-6 (On Monday we will do some analysis of samplers on Thursday)	Chemical properties for lakes - oxygen, carbon, nitrogen, phosphorus and others	Dodds pp 290-296; 301-303; 312-319; 324-337; 360-363; 294; 290-291; 357-359; 363-371; 337-341; 296-300; 346-357	Visit local lake for sampling
Oct 9-13 (On Friday we will do some analysis of samplers on Friday)	Chemical properties for streams - oxygen, carbon, nitrogen, phosphorus and others	Dodds pp 317-319; 353-354, Wetzel pp 230-235 (on Moodle)	The St. Croix River Research Rendezvous is on Tuesday. Students who wish can attend. Mark Hove will retrieve periphyton and leaf samplers on Thursday
Oct 16-20 (On Monday we will do some analysis of samplers on Thursday)	Primary Production, Photosynthesis - Lakes and Streams - Limits to primary production [Liebig's barrel – SimBio]	Dodds pp 167-218; 303-310; 438-466; 495-496; 502	Collect benthic samples from Valley Creek
Oct 23-27	Secondary Producers- Trophic status in Lakes - Fall Break Starts Thursday	Dodds pp 222-254; 477-494; 496-502	**Tuesday is Thursday** – no lab

Week	"Lecture" topic	Reading Assignment*	Lab work
Oct 30-Nov 3	Stream Ecosystems - Disturbance in streams Succession in streams	Dodds pp 650-658; Humphries et al. 2014;Hayden et al. 2016;Dodds pp 588-592; 596-598	Valley Creek – Finish up any sampling – download metabolism data – maybe measure groundwater input
Nov 6-10	Limits to secondary production - Food Webs in Lakes – Top-down control	Dodds pp 658-662; 561-568; 658-662; 561-568; 367-403	Valley Creek Analysis
Nov 13-17	Food webs, succession; stable isotopes	Dodds pp 592-596; 551-552	Examine stream samples
Nov 20-24	Thanksgiving break Weds - Friday - Catch-up on Monday		Work on analysis
Nov 27- Dec 1	Trophic cascades across ecosystems - Invasive species impact	Knight et al. 2005; Higgins and Vander Zanden 2010	Examine lake samples
Dec 4-8	Lakes, Streams and Climate Change - Comparison of Freshwater Systems	Dodds 14-16; Williamson et al. 2008; Dodds 669-672	Student presentations

Week	"Lecture" topic	Reading Assignment*	Lab work
Dec 11-15	Finish Topics - Wednesday the 13th is the last day of class		No lab

*** My best guess at dates and the pages to read.**

Possible Assigned Readings

Florsheim, J.L., Mount, J.F. and Chin, A. 2008. Bank erosion as a desirable attribute of rivers. BioScience 58(6): 519-529.

Forbes, S.A. 1887. The lake as a microcosm. *Bull. Sci. Assoc.*, Peoria, Illinois, pp 77–87. Reprinted in *Illinois Nat. Hist. Survey Bulletin* 15(9):537–550.

Hayden, B., S.M. McWilliam-Hughes and R. A. Cunjak. 2016. Evidence for limited trophic transfer of allochthonous energy in temperate river food webs. Freshwater Science 35:544–558.

Higgins, S.N. and Vander Zanden, M.J. 2010. What a difference a species makes: a meta–analysis of dreissenid mussel impacts on freshwater ecosystems. Ecological Monographs 80(2): 179-196.

Humphries, P. H. Keckeis and B. Finlayson. 2014. The River Wave Concept: Integrating river ecosystem models. BioSceince 64: 870-882.

Knight T.M., M. W. McCoy, J. M. Chase, K. A. McCoy1 and R. D. Holt. 2005. Trophic cascades across ecosystems. Nature 437: 880-883.

Williamson, C.E., Dodds, W., Kratz, T.K. and Palmer, M.A. 2008. Lakes and streams as sentinels of environmental change in terrestrial and atmospheric processes. Frontiers in Ecology and the Environment 6(5): 247–254.