Freshwater Ecology

Session 3, 2013; Pymatuning Laboratory of Ecology
June 24 – July 12

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About the Course

Limnology is the study of freshwater ecosystems: lakes, streams, ponds, marshes, and swamps. Because freshwater ecosystems provide society with a number of very important services, including drinking water, recreation, and transportation, aquatic ecology has emerged as an important sub-discipline in biology. Ecologists have learned that aquatic ecosystems are highly integrated, with a number of strong and complex linkages. In order to understand how human activity will affect our drinking water, our recreation, and other values associated with lakes and streams, we must first understand the mechanisms that link components of aquatic ecosystems.

In this course, conducted at the Pymatuning Laboratory of Ecology in northwest Pennsylvania, students will explore the structure and function of aquatic ecosystems. We will conduct field investigations of streams, lakes, and marshes. Students will attend background lectures, conduct experiments and field surveys, participate in data collection and analysis, and gain experience in the interpretation and presentation of results. Students will also participate in an overnight field trip, and they will leave the course with a greater knowledge of and appreciation for Pennsylvania's rich aquatic resources. In this class we will cover the physical, chemical, and biological functioning of aquatic ecosystems. We will learn how to integrate mathematics, physics, chemistry, and biology in our study of aquatic ecosystems. In addition, we seek to expose students to current research in aquatic ecology, and we will emphasize how scientific knowledge is integrated with social values in addressing environmental concerns.

Topics Covered in this course will include:

- The physics of water
- Chemical limnology
- Quantitative methods for assessing water quality and sampling aquatic communities
- The microbial ecology of lakes and streams
- Physiological and behavioral ecology of aquatic organisms
- Trophic interactions and ecology of aquatic communities
- Biogeochemistry of aquatic ecosystems
- Current research in aquatic ecology
- Current water quality concerns in Pennsylvania

Schedule 2013

Mon. 6/24 Introduction to PLE, (Rick Relyea, Director), lab site tour. Course Introduction.
Begin Part I: Ecology of Lakes and Ponds.
Lecture: Introduction to the Actors: Plant and Invertebrate Diversity, Benthic Invertebrates in Food Webs
Lab: Plant and Invertebrate Survey, Geneva Ponds.

Tues. 6/25 Chemical and Physical Properties of Water, Light and Heat in Lakes, Thermo-Density Relationships and Lake Stratification, Hydrology and Climate, Lake Formation, Lake Morphometry
Lab: Vertical Profiles, Conneaut Lake (Skimmer)Temp., O_2, pH, Cond., Light, Alkalinity

Wed. 6/26 Salinity, pH, Dissolved Oxygen, ORP, Carbon cycling
Lab: Limnological Methods, Pymatuning Reservoir, analysis of spatial gradients
Phytoplankton standing crop, TP, TN, BOD

Thurs. 6/27 Phosphorus cycling, Nitrogen cycling, Primary Productivity
Lab: Kettle Lake Tour: Edinboro, LaBouff, Pleasant, and Canadohta Lakes

Fri. 6/28 Glacial Lakes of Pennsylvania
Lab: Comparative analysis of zooplankton in local lakes and ponds, foraging studies
Deploy and retrieve hydrolabs

Mon. 7/1 Purturbation and Recovery of an Aquatic Ecosystem: Case Study of Lake Erie
Lab: Tour of Linesville Fish Hatchery, Presque Isle Field Trip

Tues. 7/2 **Test 1: 9:00 AM**
Part II: Stream Ecology
Physical and chemical properties of streams, Linesville Creek, Conneaut Creek.

Wed. 7/3 Detrital Processing in streams
Field Trip: Little Shenango and Shenango River

Thur. 7/4 Fireworks (No Class)

Fri. 7/5 Aquatic Insect Assemblages in Streams
Field Trip: French Creek

Mon. 7/8 Food Web Interactions in Aquatic Ecosystems
Lab: Watershed exports of N and P in the Pymatuning Basin

Tues. 7/9 Allegheny River Field Trip Day I
Trout streams of the Allegheny Plateau
Limnology of large impoundments

Wed. 7/10 Allegheny River Field Trip Day II
Impact of oil and gas extraction on streams
Marcellus Shale extraction and the fate of produced water
Acid Mine Drainage and aquatic communities

Thur. 7/11 Lab: Tour of Linesville Fish Hatchery, Meet PAFBC Biologists
Afternoon: Class Projects

Fri. 7/12 **Test II: 9:00 AM**
Presentation of Class Projects: 1:00 PM

About the Course

Daily Schedule: We will begin lecture each day in the fish lab at 8:30 AM, and we will conclude the days activities by 5:30 PM. The van will leave the dining hall for the lab site at 8:15 AM. Please be on time. We may deviate from this schedule from time to time.

How to Dress: This is a course in aquatic ecology, and we will spend most of this course in the water, and sometimes in murky, muddy water. You will want to wear waders when you are electrofishing (the waders provide your only insulation from the electric current). You may borrow hip boots from PLE, or you may elect to purchase your own. I suggest wearing jeans and socks with your waders in order to avoid falling victim to the dreaded "wader rash". It is generally most comfortable to wear shorts and old but sturdy shoes when performing field activities other than electroshocking. Finally, if you own a mask, snorkel, and fins, you may want to bring them along for the Presque Isle field trip.

Safety: Nothing in more important than your personal safety. If you are uncomfortable with the water, wear a life jacket. Use caution and common sense when using the boats, electrofishing gear, etc.

Grades: You are responsible for all material covered in lecture, laboratories, and the field. In particular, you should know the names of the fish, amphibians, invertebrates, and aquatic plants we encounter. You may find that a field notebook is a useful tool. Final scores are calculated as follows:
Test I: 20%
Test II: 20%
Pop Quizzes (5) 20%
Projects 20%
Performance on individual and group activities: 20%
Grades will be assigned as 90-100 = A, 80-89 = B, etc.

Attendance: I expect that each student will attend and participate fully in all 14 class meetings. Each missed class will result in a 10% penalty to your final score. Any missed quizzes or tests can not be made up.

Class Projects: We will run the laboratory portion of the class as a series of class projects. Each day one person will be the designated "Data", and this person will be responsible for recording all information collected that day. The data person will organize the results, and insert them into the class notebook. We will then start the next day with a brief presentation of the previous day's project by "Data" and the class will spend a bit of time discussing the results. Because data collected early in the course may be used later in the course for independent projects, it is important that we carefully record and organize all data from our field trips. Indeed, a critical step in becoming a scientist is merely learning to write things down so that others can make use of your observations.

Independent Project: a substantial portion or your grade will be based on your independent project. Here you are required to conduct research aimed at answering an original question. You will present a 10-20 minute long lecture on your project the final day of the course. This project should use data collected by the entire class but analyzed and synthesized by you.

Attitude: Aquatic ecosystems are a source of endless fascination, and there is much yet to be learned about them. I expect the students in this course to approach the material with enthusiasm, and I trust that students who do so will perform well in this course. Work together as a team, help your classmates with the fieldwork, and help organize the data. This should be a fun course.