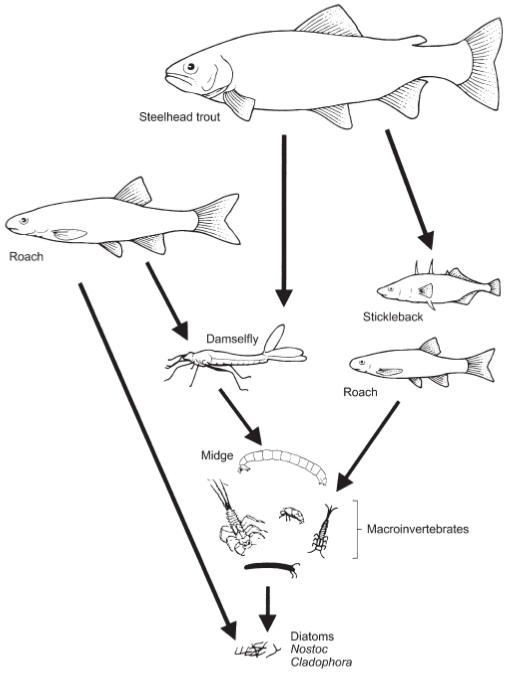
BIOL 4650 – Freshwater Ecology

CSU Stanislaus
Fall 2015



I. General Information

Time: Tues. 12:30-4:50 pm; Thurs. 12:30-1:45 pm
Location: N210 (**not N221)
Instructor: Dr. Matthew Cover
Office Hours: Friday 1:00-3:00 pm (N273), or by appointment. (If you know you would like to meet, it is best to confirm a time via email.)
Email: mcover@csustan.edu
Email is the best way to reach me. I usually respond to email within 24-48 hours. I am trying to only check and respond to email during the work day (8:00 am-5:00 pm). Please write "BIOL 4650" in the subject line, and include your full name in the email- otherwise your email may get mis-filed and I will not respond.
Personal Website: http://www.matthewrcover.com
Twitter: https://twitter.com/matthewrcover
Course Website: Blackboard (http://www.csustan.edu/blackboard)
Communication: Please check your csustan email and the blackboard site on a regular basis, ideally every day. You can easily set up your csustan email address to forward to another email address you check more frequently. Also, there is a new mobile app for blackboard.

II. Course Description

From the course catalog: (4 Units) The biota of fresh water with emphasis on the ecology, identification, physiology, and behavior of aquatic organisms. (Formerly Aquatic Biology) Prerequisites: BIOL 1050, BIOL 1150, CHEM 1100, and CHEM 1110, or equivalents. (Lecture, 3 hours; laboratory, 3 hours; field trips) (Fall)

This course will focus on the ecology of freshwater ecosystems, as opposed to marine or brackish water habitats (which are covered in marine biology courses). In particular, we will focus our time on lotic (flowing water) habitats, such as rivers and streams, while briefly mentioning lentic (still-water) habitats, such as lakes and ponds. Rivers and streams are among the most dynamic and heterogeneous of ecosystems on earth, making them very exciting habitats to study. Flowing water is the fundamental process structuring lotic ecosystems, and a large part of our time will be spent trying to understand the ways in which stream hydrology affects the ecology and evolution of aquatic biota.

If your catalog year is before 2011, this course satisfies the Ecology requirement for all Biological Sciences majors. If your catalog year is 2011 or later, this course satisfies the

Ecology requirement for the Education, Molecular/Microbial, and Organismal Concentrations. It also satisfies the second Ecology course requirement for the Ecology concentration. **Note: this course does not meet any requirements of the General Biology concentration!

Because it is focused on the particular biota, habitats, and ecological processes in freshwater ecosystems, this course necessarily does not cover basic ecological concepts in as much detail as Ecology (BIOL 4680), and pays scant attention to terrestrial ecosystems. Thus, students interested in learning about general ecological concepts are encouraged to take BIOL 4680 as well.

This course is designed for upper division biology majors, although students from other science majors or related majors (e.g., geography) should also be able to succeed provided they have passed the prerequisites (BIOL 1050, BIOL 1150, CHEM 1100, and CHEM1110). No other prerequisite courses are assumed or required, although this class assumes that students have college-level writing skills. If you are a weak writer or have not yet passed the WPST, this might not be the best class for you as we will be doing LOTS of writing. The Biology WP class is excellent preparation for this class. Proficiency in math/stats/quantitative skills and computer skills will also be useful, as we will be doing a variety of calculations and analyses during lab and as part of homework assignments. At a minimum, students should be comfortable manipulating and analyzing data in MS excel.

<u>Why take this course?</u> In a general sense, knowledge of ecology, including the ecology of organisms, communities, and ecosystems, helps to make you a well-rounded biologist. Ecological processes are a common driving force for evolutionary change, for example. More specifically, freshwater ecosystems are one of the most intriguing ecosystems to study because of their tremendous complexity. At a more practical level, this class can help to prepare you for a career as a freshwater ecologist. California (and the world) will continue to have tremendous problems balancing issues of water supply, fisheries, environmental quality, and flood control. Among ecology-related fields, there is a large demand for scientists with expertise in aquatic ecology. Potential employers include a number of federal agencies (USFWS, NMFS, USEPA, USGS, USBR), state agencies (CDFW, SWRCB, CalEPA), engineering and scientific consulting firms, and non-profit organizations. This course is designed to give you a broad foundation in the science of freshwater science, as well as the research experience and skills to allow you to become a professional scientist. Once you complete this course, I can recommend grad programs, internships, jobs, and other experiences that will prepare you for a career in the field of aquatic ecology.

III. Required Texts

There is one required text: a course reader, available for purchase on the first day of class.

IV. Course Goals

This course has two main goals. Each goal has several learning objectives.

1. Learning the Science of Freshwater Ecology

   [Assessment: Reading Responses, Quizzes, Exams]

   a. Apply and describe how major concepts from organismal, population, community, and ecosystem ecology apply to freshwater ecosystems. Describe how the physical and chemical processes of flowing water are related to the structure and function of river ecosystems and their biota.
   b. Based on the physical setting of a stream (terrain, slope, drainage area, etc.), be able to predict what a freshwater ecosystem will look like and how it will function, based on ecological theory.
   c. Describe the biology and ecology of the most common types of organisms that inhabit freshwater habitats
   d. Relate stream ecology concepts to current policy and management issues related to water resources.

2. Doing Science: Developing Research Skills

   [Assessment: Reading Responses, Taxa IDs, Quizzes, Research Paper]

   a. Effectively comprehend, analyze, and interpret scientific journal articles, with a focus on stream ecology
   b. Propose hypotheses and design research studies based on a deep understanding of ecological theory and recent research.
   c. Apply field and laboratory techniques for surveying the physical habitat, aquatic biota, and ecological condition of streams.
   d. Identify aquatic organisms in the field and in the laboratory (using stereo-microscopes and dichotomous keys)
   e. Analyze biological and environmental data using graphical and statistical techniques, and effectively display the results of these analyses using graphs, tables, and figures.
   f. Write a properly organized and referenced scientific report in the style of a scientific journal article describing the results of your research study.
   g. Communicate, orally and in writing, as a professional freshwater scientist.

V. Expectations

- This is a field-intensive course that requires a high degree of maturity, self-sufficiency, and cooperation relative to many other classes you have taken. It is easy to get caught up in the excitement of going new places, but especially in field settings it is very important to be keenly aware of your surroundings and safety. Although you will be doing activities you have never done before, you should never feel scared or unsafe. If so, please let the instructor know immediately. Although the instructor will help you prepare for your field work and make recommendations about safety, ultimately you need to take responsibility for doing everything you can to keep yourself safe and healthy.

- Rather than passively taking in information, in this course we will be actively doing science: observing, measuring, comparing, and analyzing. Lecture periods will be a mix of lecture, discussion, and group work. Laboratory periods will include field and laboratory activities where you work both individually and in small groups. Do not expect to sit passively and listen to lecture; nearly every day you will be expected to work with your classmates, do brainstorm exercises, take part in discussion, peer review, etc. To succeed at this course, you need to actively engage with the material in the field, lab, classroom, and in your readings. You are expected to attend every class session and participate fully. When instructions are given, pay especially close attention and jot down notes.
- You are expected to treat everyone in our class with respect and kindness. In order to create a thriving learning community it is important that we encourage one another to do our best and not put anyone down. In order to avoid distracting yourself and others, please do not text, email, surf the web, or do work from other classes when we are working on in-class activities. If you have other responsibilities that can't wait until class is over please discretely step outside the classroom.
- Most learning of new material occurs outside of the classroom as you carefully read and re-read the assigned texts. Class periods will be focused on reinforcing the concepts covered in readings through discussions and applying the concepts during various assignments. It is very important that you come to class properly prepared by doing the required readings. You cannot gain the necessary knowledge without spending many hours each week doing the readings.
- Part of being a good scientist is making good observations. Your success in this course will depend on how well you can make observations, efficiently and accurately record your data, and relate your observations to other physical, chemical, and biological information. This requires constantly switching your focus between different organisms and processes at a huge range of spatial (microns to kilometers) and temporal scales (milliseconds to millennia). The only way to gain these observational and critical thinking skills is through dedicated practice.

VI. Other Required Materials

There are no laboratory fees for this course. However, there are several items you'll need to purchase.

1. A pair of sharp-pointed forceps. These are indispensible for manipulation of specimens under the dissection microscope, and will be available for purchase for $6.

2. A rite-in-the-rain field notebook. Rite-in-the-rain is special paper that you can use and won't break down when wet. Field notebooks will be available for purchase for $6.

3. A standard size spiral notebook for classroom, lab, and home use. All of your class notes, notes taken on readings, notes taken during laboratory exercises, etc. will all go in one place. Any standard-ruled spiral notebook with at least 80 pages in it should be fine.

We will be taking several field trips in this course. On field days you should bring clothes that are suitable for working outdoors: good walking shoes (preferably boots or hiking shoes), a hat, and clothes suitable for the weather. Some days we will outside for 3-4 hours, so bring snacks, at least one liter of water, sunscreen, and whatever else you need to be comfortable out of doors.

Most days we will be doing work in water, usually less than 1 foot deep. For this course you will need shoes that can get wet. Many options will work, including sport sandals, water shoes, rubber boots, or athletic shoes that you don't mind getting wet.

VII. Assessment and Grading

Assessment of your learning will be based on your reading response homework, quizzes, lab assignments, invertebrate taxa identifications, two exams, and a research Paper.

Reading Responses (10x20)	200
Quizzes, lab assignments, taxa IDs	100
Exam 1	150
Exam 2	200
Research Paper	250
Participation	100
	1000

- Grades will be assigned based on standard percentage cutoffs (93-100 = A, 90-93 = A-, 87-90 = B+, etc.). It is unlikely that I will apply a curve applied to the final grades, and there are few (or no) extra credit points that will be offered.
- You may turn in assignments after the due date, but 20% of the possible points will be subtracted from the score for each day that it is late.
- Missed in-class exams, quizzes, or assignments can only be made up if you notify the instructor prior to missing class and you have a valid excuse.

Reading Responses

For each reading that is assigned, you will bring in to class a Reading Response (RR). This should be typed and printed out. For each reading, you should answer the following questions:

1. What from the reading stays with you? After you put the reading down and go for a walk, or the next day, what particular points or examples do you remember? These may or may not be important guiding concepts (question 2); they may in fact be relatively minor methodological approaches, names, new terminology, etc. Whatever strikes you as particularly interesting.

2. What are the important take-home guiding concepts in this reading? What are the 1-3 most important over-arching concepts?

3. Identify a connection between this reading and another reading we have done for the class or something from another class.

4. What is one question you have for the author? Is there something that you felt like the author could have written more about or delved deeper into?

5. What from this reading can you apply to your own research? It could be a method, an important concept or finding, a new way of looking at a freshwater ecosystem…

6. Draw (by hand) a figure, image, or concept map that summarizes on or more of the important guiding concepts you identified in #2.

Quizzes, Labs, and In-class Activities

Quizzes may or may not be announced ahead of time. Selected lab assignments and in-class activities will be turned in for credit.

Exams

Questions will generally be mini-essay or conceptual drawing questions.

Research Paper

Perhaps the most important component of this class is the independent research study that you will carry out and write up. This is an independent project, meaning that you will be the sole author. However, you will study a freshwater ecosystem with other members of a group, and collectively you may address one research question. This class is designed to give you all of the tools and support you will need to produce a high quality research paper.

Participation

You are required to attend all of the field trips that your group is signed up for. If you miss a field trip you will lose 20 participation points.

You are also asked to fully engage with the in-class activities during the course. Many of our activities, especially field project and discussions, can only succeed if each and every student contributes fully. You will be judged and graded based on how fully you are committed to the class and to staying on-task for in-class assignments.

VIII. Schedule

Week	Date	Topic/Activity	**Readings-** complete by this date
1	T 8/25	Introduction, Syllabus Major Concepts in Ecology Lab: Campus Stream field trip	
2	R 8/27	Intro to Freshwater Ecosystems and Biota	Intro to Fluvial Systems
2	T 9/1	Landscapes and Riverscapes Lab: bring laptops	Landscapes and Riverscapes
3	R 9/3	River form and function	CA Rivers and Streams
4	T 9/8	Class Field Trip: Tuolumne River at Waterford Meet in parking lot at 12:30; back by 5:00	
4	R 9/10	Climate	Intro to Water
5	T 9/15	Hydrology and Geomorphology Lab: bring laptops	Fluvial Geomorphic Processes
5	R 9/17	Wrap-up: Physical Environments	Overview of Freshwater…
6	T 9/22	Red Hills Groups: field trip Other groups: no class	
6	R 9/24	Exam 1	
7	T 9/29	Aquatic Invertebrates Lab: Dichotomous keys	1. Macroinvertebrates 2. General Morphology
7	R 10/1	Fish	Inland Fishes: Ecology
8	T 10/6	Habitat and Life History Lab: Aquatic Insects	Habitat, Life History…
8	R 10/8	Aquatic Insect Ecology	Ecology and Distribution…
9	T 10/13	NO CLASS	
9	R 10/15	Reading journal articles	Riparian vegetation loss…

10	T 10/20	Red Hills Groups: field trip Other groups: no class	
10	R 10/22	Cal-SFS Meeting, UC Davis, all day	
11	T 10/27	River continuum concept Movie: RiverWebs	River Continuum Concept
11	R 10/29	Food webs	Reciprocal subsidies
12	T 11/3	Life history Lab: Aquatic insect ID	Life history differences…
12	R 11/5	Life history and climate change	Why life history information…
13	T 11/10	Aquatic insect genetics and DNA barcoding Lab: DNA barcoding	Genes in streams
13	R 11/12	Aquatic insect genetics and DNA barcoding	
14	T 11/17	Disturbance Lab: aquatic invertebrate ID	Catastrophic disturbances in headwater streams…
14	R 11/19	Sediment	How fine sediment…
15	T 11/24	Drought and streamflow Lab: finish ID and data entry	Flow intermittency…
15	R 11/26	No class: Thanksgiving	
16	T 12/1	Stream Ecology Wrap-Up Lab: Data analysis	Foundations of stream ecology
16	R 12/3	Exam 2	
17	T 12/8	Writing scientific papers	
17	R 12/10	Draft reports due, peer review	
	R 12/17	Final Exam period 11:15-1:15 No Exam	