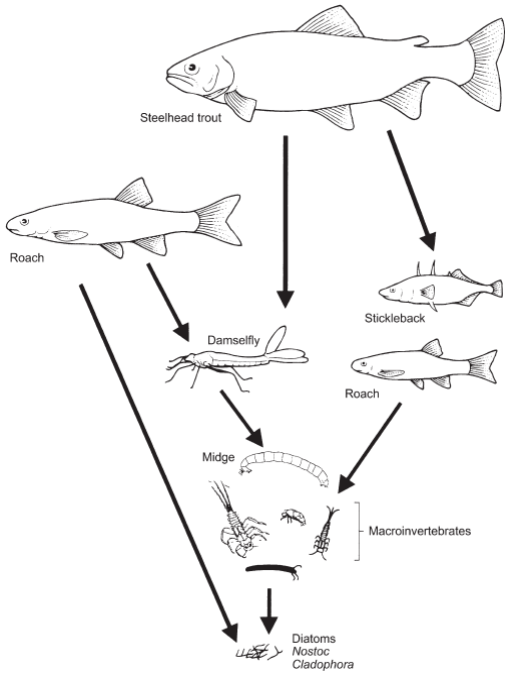
BIOL 4650 – Freshwater Ecology

CSU Stanislaus
Fall 2013



I. General Information

Time: Tues. 12:30-4:50 pm; Thurs. 12:30-1:45 pm
Location: N210 (Tuesday), N221 (Thursday)
Instructor: Dr. Matthew Cover
Office Hours: Thursday 4:00-5:00 pm, Friday 9:00-10:00 am (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
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) Satisfies the ecology elective for the major. 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.

This course satisfies the Ecology requirement for the Biological Sciences major. 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 specializing in ecology 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. In particular, we will be writing a lengthy report in the style of a scientific journal article. 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.

Why take this course? In a general sense, knowledge of ecology, including the ecology of organisms, communities, and ecosystems, helps to make you a well-rounded biologist. 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. Experience with the lab and field methods we will use in this class will give you a huge advantage in finding employment. Once you complete this course, I can recommend other internships and experiences that will prepare you for a career in the field of aquatic ecology.

III. Required Texts

There are two required texts.

1. Methods in Stream Ecology (2nd edition). By F. Richard Hauer and Gary A. Lamberti. 2006. Academic Press. 877 pages. ISBN: 978-012332907
2. Stream Ecology: Structure and Function of Running Waters (2nd edition). By J. David Alan and Maria M. Castillo. 2007. Springer. 436 pages. ISBN: 978-1402055829

You should buy a copy of Methods in Stream Ecology since we will be using this both for readings and in the lab.

Stream Ecology is an excellent reference book that is highly recommended if you will be studying or working in the field of aquatic ecology in the future.

There will also be additional readings (mainly journal articles) that will either be posted electronically or distributed as hard copies.

IV. Course Goals

This course has two main goals. Each goal has several sub-goals.

1. <u>Learning the Science of Ecology: A Conceptual Understanding of Stream Ecosystems</u>
    a. 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 the ecosystem will look like and how it will function, based on ecological theory.
    c. Relate ecological theories of stream ecology to current policy and management issues related to water resources.
2. <u>Doing Science: Developing Research Skills</u>
    a. Apply field and laboratory techniques for measuring the physical, chemical, and biological conditions of streams. Use these methods to collect data on the structure and function of a stream ecosystem, the distribution of biota, and water quality conditions.
    b. Analyze biological and environmental data using graphical and statistical techniques, and effectively display the results of these analyses using graphs, tables, and figures.
    c. Write a properly organized and referenced scientific report in the style of a scientific journal article describing the results of your research study.

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 or a good conversation, 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 presentations, discussions, and group work. Laboratory periods will include field and laboratory activities working individually or 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

Field attire and supplies

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. It is always good to bring one more layer than you think will be necessary. Some days we will outside for 3-4 hours, so bring snacks, 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 a pair of waterproof boots or waders, that should come up to at least your upper calf (>12 inches tall). Rubber boots will do the trick, and are usually available at hardware stores for less than $15. A limited number of pairs of rubber boots will be available to borrow; check with the instructor.

Because we will be collecting data in the field, you need a good field notebook. I will have professional quality, waterproof field notebooks available for purchase for $6, or you can find your own.

Lab supplies

When we are working with benthic invertebrates in the lab (and in the field) you will need a pair of forceps. If you have your dissection kit from BIOL 1050, please bring it.

VII. Grades

Grading

In-class Activities (5 points per day)	150
Exam 1	80
Exam 2	100
Major Assignments	
Article Review (Draft/Final)	10/20

Research Results (Draft/Final)	10/20
Research Paper (Draft/Final)	10/100
Total	**500 pts**

- 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.
- Late assignments will not be accepted for "Draft" versions of assignments- if it is late you will receive a score of 0. Late assignments will be accepted for all other assignments, except that 10% 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.

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.

Article Review

You will select a scientific journal article to read and summarize.

Research Study: Research Proposal/Results/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, 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 the all-day Saturday field trip and all of the Tuesday field trips. If you miss a field trip you will lose 10 participation points.

You are also asked to fully engage with the in-class activities during the course. Many of our activities, especially field projects, peer review, 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

**This schedule is subject to change, depending on the interests of the class, the logistics of field trips, etc. Changes to the schedule will be announced in class and revised versions of the syllabus will be posted on blackboard.

HL: Read the assigned sections/pages in Hauer and Lamberti, Methods in Stream Ecology
AC: Read the assigned section/pages in Allan and Castillo, Stream Ecology
I will be posting reading guides on blackboard to help you focus in on the sections that I believe are most important.

Week	**Date**	**Topic/Activity**	**Assignments**	**Readings-** complete by this date
1	R 8/22	Overview and syllabus		
2	T 8/27	Life in running waters- major concepts Mini field trip: CA Pathway "Stream"		AC 1
2	R 8/29	Water in California: climate, hydrology, watersheds, dams		HL1
3	T 9/3	Lab: Landscapes and riverscapes 1 (topographic maps)		HL2 HL 7
3	R 9/5	Fluvial geomorphology		
4	T 9/10	Lab: Hydrology, streamflow analysis		AC 2 HL 3
4	R 9/12	RiverWebs movie		
5	T 9/17	Lab: Landscapes and riverscapes II (topo maps, GIS)		AC 3 HL 20
5	R 9/19	Field trip prep		
5	Saturday 9/21	**Field trip to Clark Fork Stanislaus River**		
6	T 9/24	Lab: Field trip data entry and analysis, invertebrate processing and ID		AC 4 HL 20
6	R 9/26	Benthic macroinvertebrates		
7	T 10/1	**Field trip to Stanislaus River @ Oakdale** Sample benthic invertebrates (D-nets, sample processing), pools and riffles, pebble counts		
7	R 10/3	Stream Ecosystems: the Big Picture		AC 14
8	T 10/8	No Class: Non-Instructional Day		AC 6 HL 3
8	R 10/10	Exam 1		
9	T 10/15	Invertebrate ID		AC 7
9	R 10/17	Invertebrate ecology		HL 12 HL 13
10	T 10/22	**Field trip to Stanislaus River @ SJRNWR.** Riparian forests and restoration		AC 8 HL 5 HL 8
10	R 10/24	Bioassessment		HL 35

11	T 10/29	**All Day Field Trip: California Aquatic Bioassessment Workgroup (CABW) @ U.C. Davis**		
11	R 10/31	Bioassessment		AC 9 HL 31
12	T 11/5	Food webs 1		AC 10 HL 27
12	R 11/7	Food webs 2		
13	T 11/12	**Field Trip to Stanislaus River @ Knight's Ferry** View spawning salmon		AC 11
13	R 11/14	Salmonid ecology		
14	T 11/19	Peer review draft results CA water policy	Draft Results Due (3 copies)	AC 12
14	R 11/21	Exam 2		
15	T 11/26	CA water policy	Final Results Due	AC 13
15	R 11/28	No class: Thanksgiving		
16	T 12/3	Peer review	Draft Paper Due (3 copies)	
16	R 12/5			
17	T 12/10	Wrap Up		
	R 12/12	(No Final Exam)	Final Paper Due by Noon	