**Course Syllabus**

Ecology and Conservation of Streams and Rivers (ENV 744) - Fall 2012
3 Credits – Class meetings: T Th 1:25-2:40PM; TH 11:45-1:00 (Lab)
Course website: sakai.duke.edu

Instructor: Dr. Jim Heffernan
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***Course objectives:***

This course will provide an overview of ecological processes in flowing waters and their application to conservation and management of these ecosystems, and is intended for both PhD and MEM students. Presentation of basic scientific principles governing physical, chemical, and biological structure of streams will coincide with discussion of anthropogenic drivers of change as well as relevant policy and management tools. This structure is intended to provide greater integration of these topics than is typical for comparable courses, in which applied issues are addressed at the end of the course. Self-directed field and literature projects (in conjunction with the lab component of the course) will enable MEM and PhD students to tailor the course to better fit their needs.

By the end of the class, you should:

-have an understanding of physical, chemical, and biological processes of streams and rivers
-know important concepts that shaped the development and current state of stream ecology
-be familiar with field and laboratory methods commonly used by stream ecologists and water resource managers
-be able to analyze data relevant to stream and river ecology and environmental assessment

***Course materials:***

- Required Text: Allan, J.D. and Castillo, M. M. Stream Ecology: The Structure and Function of Flowing Waters. 2007. Springer. 2nd Edition.
- Readings from the primary literature (see lecture schedule) will be distributed via Sakai.

***Course Structure:***

This course consists of a lecture/discussion component and a laboratory. Lectures will mostly address basic ideas, observations, and approaches to understanding the ecology of flowing water systems. Semi-weekly discussions during lecture will provide students with opportunities to reflect on, critique, and synthesize material presented in lecture; most discussions will focus on the application of important concepts to assessment, management, and conservation of streams and rivers. My expectation is that students will arrive in class having read assigned chapters and papers, so that lecture can focus on particularly difficult or significant concepts. Short synthesis assignments and a longer paper at the end of term will be the major form of assessment of student learning.

Laboratory periods will provide students with hands on experience in collection and analysis of physical, chemical, and biological data. Lab sessions will generally alternate between field trips to local streams and rivers and laboratory sessions during which we will process samples and analyze data. Worksheets will introduce students to the mechanics of data analysis, and a mid-semester group project will give experience with experimental design and data interpretation.

| Week | Section | Date | 11:45-1:00 (Lab) - A156 | 1:25-2:40 (Lecture) - A312 | Readings (Chapters are in Allan and Castillo) | Lecture Assignment | Lab Assignment |
|---|---|---|---|---|---|---|---|
| 1 | Overview: What is a river? | 27-Aug | | Ecology in Streams and Ecology of Streams; the scientific method | Ch. 1; Ch. 14 | | |
| | | 29-Aug | Intro to lab; online resources | Discussion: What is a stream? | Fisher 1997; Doyle and Bernhardt 2011 | | |
| 2 | Hydrology and Geomorphology | 3-Sep | | Catchments and flow regimes | Ch. 2; Hynes 1975 | | |
| | | 5-Sep | Analysis of hydrographs | Channel morphology | Ch. 3; Stanford and Ward 1988; | Synthesis 1 due (10 pts) | |
| 3 | | 10-Sep | | Hydrology and sediment transport | Harvey and Bencala 1985; Benda et al. 2004; | | |
| | | 12-Sep | Measuring stream flow | Discussion – MFLs and the natural flow regime | Poff et al. 1997; Neubauer et al. 2008 | | Hydrograph worksheet due (10 pts) |
| 4 | | 17-Sep | | The physical and chemical environment | Ch. 4, 5; Frisell et al. 1986 | | |
| | | 19-Sep | Field Trip: Discharge and habitat | | | Synthesis 2 due (10 pts) | |
| 5 | Life in streams | 24-Sep | | Primary producers | Ch. 6; Rosemond et al. 1993 | | |
| | | 26-Sep | Introduction to stream invertebrates: taxonomy, identification, sampling | Heterotrophs | Ch. 7; reading TBD | | Streamflow worksheet due |
| 6 | | 1-Oct | | Discussion: The River Continuum Concept | Vannote et al. 1980; Wiley and Osborne 1990 | | |
| | | 3-Oct | Field trip: sampling benthic communities | Life histories and behavior | MacNeale et al. 2005; | | |
| 7 | | 8-Oct | | Species interactions | Ch. 9; | Synthesis 3 due (10 pts) | |
| | | 10-Oct | Analyzing community data | Community assembly and biodiversity | Ch. 10; Brown and Milner 2012 | | Group project design due |
| 8 | | 15-Oct | Fall Break - NO CLASS | | | | |
| | | 17-Oct | Field Trip: Group project | | | | |
| 9 | | 22-Oct | | Discussion: Assessing stream health | Woodward et al. 2012; Palmer et al. 2012; Young and Collier 2009; TBD | | Invert worksheet |
| | Stream Ecosystems | 24-Oct | Bug picking (River Center | Stream food webs | Ch. 8; Baxter et al. 2004 | | |
| 10 | | 29-Oct | | Ecosystem metabolism | Ch. 12; Odum 1957 | Synthesis 4 due (10 pts) | |
| | | 31-Oct | Measuring ecosystem metabolism | Disturbance and succession | Fisher et al. 1982;Robinson et al. 2007 | | |
| 11 | | 5-Nov | | Nutrient cycling in streams | Ch. 11; Mulholland et al. 2008 | | Group project due |
| | | 7-Nov | How to calculate nutrient spiraling | Big Rivers and Floodplains | Junk et al. 19XX; Hamilton et al. 1995 | | |
| 12 | Streams and land use change | 12-Nov | | Agriculture and legacies | Rosi-Marshall; Harding et al. 1998; | | Metabolism worksheet |
| | | 14-Nov | Field trip: stream metabolism and nutrient dynamics | | | | |
| 13 | | 19-Nov | | Urban streams and TMDL | Ch. 13; Meyer et al. 2005 | | Spiraling worksheet |
| | | 21-Nov | Tools for stream protection | Discussion: Stream restoration | Bernhardt et al. 2009; Stanley and Doyle 2003 | | |
| 14 | | 27-Nov | Thanks giving Holiday (grad classes over) | | | | |
| 15 | | 11-Dec | Final Exam (schedule for 9-12 PM) | | | Term papers due | |

***Grades***

The grade you earn is based on accumulation of points from writing assignments, lab reports, and class participation as follows:

- Synthesis assignments (4): 40 pts
- Term Paper: 30 pts
- Worksheets (5): 50 pts
- Group project: 30 pts (5/25)
- Class discussion lead: 20 pts
- Participation: 30 pts

Grades are assigned based on standard 100 pt scale:
A – 90-100% (180-200 pts)
B – 80-90% (160-179 pts)
C – 80-90% (140-159 pts)
D – 60-70% (120-139 pts)
F – 0-60% (0-119 pts)

***Expectations (mine and yours)***

I expect students to attend class, to be prepared, and to participate actively in discussions. Respectful treatment of peers, the TA, and myself is expected at all times. Use of cell phones and other mobile devices for any use other than those necessary for class is disruptive and not tolerated. Assignments should be turned in on time and neatly prepared. I expect students to ask for help when they are struggling with material, and to raise questions in time to obtain appropriate assistance. Honesty and integrity of all submitted work, as outlined in the Duke Honor Code, is expected at all times.

You can and should expect me to prepare interesting and informative lectures and discussions. I will be available during my posted office hours, and am happy to make appointments at other times as necessary. Both the lab TA and I can be reached electronically by email and via the class website. You should expect us to respond (at least by acknowledging your question) within 24 hours; full responses to more complicated questions my take a bit longer. My intent is to treat you all as colleagues – we are all learning together – and to make this class worthwhile and fun. Hold me to both.