BIOL/ENST/GEOL/UNIV 298 – STREAM RESTORATION
Syllabus and Schedule – Spring 2009

Meeting times: Lecture 9:30-10:52 AM, TTh, O'Leary 103; Lab 1-5 PM, Th, O'Leary 103

Course website:
http://www.departments.bucknell.edu/environmental_center/StreamRestorationCourse/FrontPageStreamRestoration.html

Instructors:
Dr. Craig Kochel – 228 O'Leary, 577-3032 (Env. Ctr. 577-1490), kochel@bucknell.edu, open door or by appt.
Dr. Matthew McTammany – 311 Biology, 577-3975, mmctamma@bucknell.edu, open door or by appt.

Consultants:
Dina El-Mogazi (Environmental Center, landscape architect)
Dr. Benjamin Hayes (Environmental Center, fluvial geomorphologist)
Christine Kassab (Environmental Center, geologist, Course Assistant, ckassab@bucknell.edu)

Required materials:
In lieu of a specific text, we will be using primary literature to guide our course and discussions. Readings will either be found in blackboard (Readings folder) or will be available in hard copy in O' Leary 102 (Geology Seminar Room – bin labeled Stream Restoration UNIV 298). Note: You may sign out a key from the Geology Secretary (Linda Mertz) for anytime access this semester (small deposit required). At no time, are materials allowed to be taken from the seminar room. Prior to in-class discussions, each student is expected to email the instructors at least 1 question per reading related to that topic.

Grading policy:
Assignments – 15% 3 short tests – 15% Semester project – 60%
Class participation – 5% Lab participation – 5%

Course objective:
Stream and river ecosystems suffer from many human-caused disturbances, including urbanization, agriculture, mining, and logging. Active management can be performed in many cases to reduce the impact of human activities on receiving waters. Stream management and restoration has become a multi-billion dollar industry and promises to continue growing. Unfortunately, many restoration practices are applied without proper scientific understanding of processes underlying the supposed impairments, which leads to failure of restoration projects and wasted time and money. In our course, we plan to educate our students in the physical and biological processes operating at different spatial scales (from in-stream microhabitat to whole watershed) that interact to cause patterns of structure and impairment in stream ecosystems. On this solid foundation, we will then develop an integrated watershed management system and apply it to a local stream ecosystem impacted by human activity.

To accomplish these goals, our course will present material on hydrology, water quality, freshwater biology, geomorphology, and landscape architecture through lectures, reading assignments, guest speakers, field and lab experiences, and major course projects. Initially, we hope to have students understand the context and philosophy of "restoration" and what purposes, ethics, and reasonable expectations guide most active management. We plan to use many examples of successful and unsuccessful stream restoration projects, initially designed for several different purposes, in our lectures, labs, and discussions.

Semester project:
You will develop a restoration plan for Miller Run, the stream flowing from Bucknell's Golf Course through campus to Bull Run near St. George St., with suggestions for specific management opportunities. Throughout the semester, we will meet with stakeholders to discuss Miller Run, tour the watershed, and collect data from the stream to gather information critical for the restoration plan. Our hope is to present your project to President Mitchell and the Bucknell Administration and to include this restoration plan in the Campus Master

Plan to reduce Bucknell's impact on Miller Run and to restore as much of the natural ecology and hydrology of Miller Run as possible.

Policies:

The syllabus will almost certainly change, and it is not the final word on assignments. Changes will be announced in class, lab *or* by email. You will be responsible for being aware of such changes whether or not you attend class when they are announced. Students are responsible for acquiring all handouts distributed in class.

All work on tests must be solely your own. Some writing, discussion and laboratory assignments will be at least partially cooperative efforts; such assignments will be clearly designated during class.

Assignments will be described in class, and will be due at the end of class. Late assignments will not be accepted. Rare exceptions may be made for special circumstances, especially in case of emergency or serious illness. Please do not ask us to accept late papers "because I left it in my room" or for similar reasons.

All tests will be closed book. Material covered in the laboratory is fair game for the tests.

Only if you have a serious illness (sick enough to be in bed) or other emergency (serious enough to get an excuse from your dean) *and* if you arrange beforehand with an instructor will you be allowed to take a makeup exam.

Lab attendance is required.

Keys to success in this course:

If any of you need special accommodations for your successful completion of this class, feel free to discuss them with one of the instructors.

Field work, class discussion, small group work, and assignments will be an essential part of the learning process in this course. Active participation in group work and class exercises is expected: you will be teaching and learning from each other a great deal. Class discussion and small group work will depend on the reading/writing being done thoroughly. We strongly encourage you to ask questions in class, in lab, in our offices or in the hallway. We strongly encourage the formation of informal study groups. You will likely understand the material more thoroughly due to participation in such a group. We will take attendance, and although it will not count toward your grades, grades do correlate very strongly with class attendance. Come to class unless you are really sick.

We expect you to work hard and participate. We expect you to read the assigned material before class and lab, take notes, and participate in class activities. You can expect that we will strive to evaluate you fairly. To succeed on tests, after reading and attending class, we suggest that you review your notes and reading materials, go over assignments and keys, ask questions of other students and us, and repeat these steps as necessary. Put concepts in your own words (on paper or aloud to others) for better understanding; attempt to tie concepts and terms together that relate. Practice using the terminology from the course material for greater familiarity.

In lieu of specific office hours, we have an open door policy. If we're in our offices, 99% of the time, we'll be happy and able to speak with you. It is best to ask in person, call, or email to set up a time to make sure we haven't stepped out of the office. We will try to leave a note by our doors if we've stepped out.

Stay engaged. Your grades will probably reflect your interest. Let's have fun learning about the Earth.

Lecture Schedule & Reading Assignments (tentative)

The "Reading Assignment" column below refers to the assigned articles for this subject. These sections should be read before attending class. Reading assignments may be modified or added when appropriate or necessary.

Date	Lecture topic	Reading assignment
15 Jan	Goals of stream restoration	Bernhardt et al. 2005 (in class); Wohl et al. 2005; Kondolf 1995; Brookes & Shields 1996, River Channel Restoration, Ch 1 (Brookes & Shields) – Perspectives
20 Jan 22 Jan 27 Jan 29 Jan	Fluvial Geomorphology (i.e. physical operations of rivers) – watersheds, hill slopes, channels, and sediment	Ritter, Kochel, & Miller 2002, Process Geomorphology, Ch 4 (skim this one), Ch 5, 6, 7; Brookes & Shields, Ch 2 (Shields) – Hydraulic stability, Ch 6 (Sear) – Sediment System
03 Feb	QUIZ 1 Miller Run Restoration Plan discussion	
05 Feb 10 Feb 12 Feb 17 Feb	Aquatic Ecology (i.e. biological operations of rivers) – aquatic organisms, physical-biological interactions, aquatic-terrestrial interactions, water quality	Frissell et al. 1986; Ward 1989; Allan & Castillo 2007, Ch 4, 8, 10; Brookes & Shields 1996, Ch 4 (Brookes et al.) – Habitat Enhancement
19 Feb 24 Feb	Human impact on physical and biological processes	Burcher et al. 2007; Sponseller et al. 2001; Miller et al. 1993
26 Feb	QUIZ 2 Restoration plan development (intro.)	Excerpts from EPA WS Plan guide
03 Mar 05 Mar	Developing a restoration plan that works with physical & biological processes	Shields et al. 2003; Kondolf & Micheli 1995; Palmer et al. 2005
06-15 Mar	SPRING BREAK	
17 Mar 19 Mar 24 Mar 26 Mar	In-stream restoration projects Guest lecture – Dr. Jerry Miller Guest lecture – Dr. Benjamin Hayes Guest lecture – Dr. Peggy Johnson	River Doctor, Science 2004; Rosgen 1994; Miller & Ritter 1996; Rosgen 2007 – Chapter 11 USDA Rosgen Geomorphic Channel Design; Simon et al. 2007; Rosgen Response 2008; Roper et al. 2008; Doyle et al. 1999; Brookes & Shields, Ch 3 (Brookes & Sear) – Geomorphological Principles; Miller & Kochel (in press); Piégay et al. 2005
31 Mar	QUIZ 3 Restoration at broad spatial scales	Williams et al. 1997 (Ch 1); Angermeier 1997 (Ch 4); Frissell 1997 (Ch 7); Kondolf 2006; Brookes & Shields, Ch 8 (Brookes et al.) – Floodplain & Riparian
02 Apr	Engineering hydrology (guest lecture – Jessica Newlin, Rich Crago)	TBA
03-04 Apr	Optional Field Trip – VA Blue Ridge Debris Flows & Restoration Site	
07 Apr	Landscapes and stormwater management (guest lecture – Dina El-Mogazi)	TBA
09 Apr	Innovative approaches to restore Miller Run (guest lecture – HRG Consultants)	TBA
14 Apr	Constraints on restoration	Case studies from Restoration Workshop (McT)
16 Apr	Evaluating restoration projects	Zedler 2007
18 Apr	Optional Field Trip – Pine Creek Kayaking	
21 Apr	Applications to Miller Run Restoration Plan	Open discussion
23 Apr	Summary discussion on river restoration	TBA
28 Apr	Project presentations	

Lab Schedule (tentative)

Date	Lab topic
15 Jan	Walk-through of Miller Run, Q&A (overview of the research project)
22 Jan	Miller Run Project Introduction, assembly of interested partners – major discussion and Q&A
29 Jan	Hydrology (field) – Buffalo Creek, Miller Run
05 Feb	Hydrologic modeling & land-use mapping in GIS (lab)
12 Feb	Projects (field) – Miller Run
19 Feb	Algae, bugs, fish (lab)
26 Feb	Projects (field) – Miller Run
05 Mar	Flume (lab indoors)
06-15 March SPRING BREAK	
19 Mar	Projects (field) – Miller Run
26 Mar	Stream restoration projects tour (field) – Muncy Creek (Christine Kassab)
02 Apr	Stream restoration projects tour (field) –Big Bear Creek (Worobec, Zimmerman)
09 Apr	Stream restoration projects tour (field) – Fishing Creek (Larry Brannaka)
16 Apr	Projects (field) – Miller Run
23 Apr	Evaluations, Projects (oral rehearsal) – Miller Run

Field Trips

This course includes several required field trips that are an integral part of the course. Be prepared for inclement weather. ***Field trips depart the 7th Street side of O'Leary promptly at 1:00pm,*** and field trips will usually require almost four hours. ***You will not be allowed on the bus or in the field with open-toed shoes.***

It is your responsibility to arrive at the O'Leary Building fully prepared for field trip departure. Bring any water/snacks/medicine/etc. that you might need. We will be unable to stop during field trips to make purchases or use bathroom facilities in most cases. Please inform one of the instructors of conditions that might require special accommodation during field trips.

There is no way to make up outdoor labs.

Plan to wear/bring the following items for field trips:

- old clothes
- sturdy boots/shoes (no flip flops or Tevas)
- long pants (recommended)
- hat/sun screen
- rain jacket/sufficient warm clothes (layers are useul)
- notebook
- clipboard
- pen
- pencil and eraser
- drinking water

Optional items - rain pants, camera, and bug repellant.

We will provide additional field equipment such as hip-boots and instruments.
Expect that some field trips will be conducted in inclement weather.