GE 312 River Restoration and Management

Lecture: T/Th 12 – 1:15 PM

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Course Description:

This course focuses on one of our most fundamental resources, rivers, and the science behind management and restoration. Rivers, floodplains, and wetlands transfer sediment, nutrients, and contaminants, while providing ecosystem services such as species habitat, clean water resources, hydroelectricity, transportation, and recreation. Subsequently, there are many stakeholders and goals for management and restoration projects. We will investigate qualitative, quantitative, and statistical methods used to understand the exciting complexity of river processes and applications of these methods to management plans. Furthermore, we will explore how restoration of river form is related to aquatic habitat restoration in the channel and surrounding wetlands.

Course Goals:

1. Gain the ability to develop a stream restoration project and be able to discuss how to implement and monitor the project
2. Describe stream and river behavior and response to alterations across different spatial and temporal scales using quantitative and qualitative models
3. Understand and be conversant in describing interactions between physical and ecological processes in streams and rivers
4. Improved speaking, writing, and critical thinking skills in the context of interdisciplinary water resources issues
5. Exposure to the primary scientific literature and current themes in river restoration research

Tentative Class Schedule

*R&B refers to your main textbook for the course by Roni and Beechie (2013).

Week	Day	Topic	Readings	Homework
Part I: Watershed and Fluvial Processes				
1	Sept 3	Introduction		
	Sept 5	History of stream and watershed restoration	*R&B(Ch. 1)	
2	Sept 10	Watershed Processes I	R&B (Ch. 2)	
	Sept 12	**No Class – BC Mass from noon to 1:15**		
3	Sept 17	Watershed Processes II: article discussion	Poff et al., 1997 (Group A); Wondzell and King, 2003 (Group B); Dunne and Black, 1970 (Group C); Jones and Grant, 1996 (Group D)	Article Summary I Due
	Sept 19	Fluvial Processes I: hydraulics, river character and sediment transport	R&B (Ch. 2)	Problem Set I Due
River Restoration Field Trip I on **Sunday, Sept 22nd**				
4	Sept 24	Fluvial Processes III: banks, channel evolution, and complex response	R&B (Ch. 2)	
	Sept 26	Process domains, the river continuum (and discontinuum), and historical range of variability	Vannote et al., 1980 (Group A); Montgomery, 1999 (Group B); Burchsted et al. 2010 (Group C); Rubin et al., 2012 (Group D)	Article Summary II Due
5	Oct 1	Floodplains, Wetlands, and Ecology	R&B (Ch. 2); Robinson et al., 2002	
	Oct 3	Riparian vegetation,wood, and stream restoration	Montgomery et al., 2003	Problem Set II Due
6	Oct 8	Floodplains, channel planform and change	R&B Ch. 3	
	Oct 10	Predicting river behavior: article discussion	Simon and Downs, 1995 (Group A); Watson et al., 2002 (Group B); Wohl, 2011 (Group C); Rinaldi et al.,	Article Summary III Due

			2012 (Group D)	
7	Oct 15	Identifying restoration opportunities	R&B (Ch. 3)	
	Oct 17	**Midterm Exam**		
Part II: River Restoration Goals and Methods				
8	Oct 22	Human dimension of stream restoration	R&B (Ch. 4)	
	Oct 24	Human dimension of stream restoration – class discussion	Dufour and Piegay, 2009 (Group A); Richter et al., 1997 (Group B); Wohl, 2005 (Group C); Wohl, 2012 (Group D)	
9	Oct 29	TBA	TBA	
	Oct 31	Restoration Techniques I	R&B (Ch. 5); Seedang et al., 2008	Part I and II: Background and Watershed Assessment for Restoration Project
10	Nov 5	Restoration Techniques II	R&B (Ch. 5); Shields et al., 2012	
	Nov 7	Restoration Techniques III	R&B (Ch. 5)	Part II: Stakeholders and setting restoration goals
River Restoration Field Trip II on **Saturday, Nov 9**				
11	Nov 12	Prioritization and Design of Restoration Projects	R&B (Ch. 6)	
	Nov 14	Development, design, and implementation of restoration projects I	R&B (Ch. 7)	Part III: Applying restoration techniques
Part III: River Restoration Design and Monitoring				
12	Nov 19	Development, design, and implementation of restoration projects II	R&B (Ch. 7)	
	Nov 21	Group Discussions of Restoration Designs		Draft of restoration project due with budget and references
13	Nov 26	Monitoring of restoration projects	R&B (Ch. 8)	
Nov 28 Thanksgiving – No Class!				

14	Dec 3	**Presentation of restoration project plans**		
	Dec 5	**Presentation of restoration project plans**		
15	Dec 10	Synthesis: Developing comprehensive restoration programs	R&B (Ch. 9)	**Final Project Due**
Final Exam Friday, December 20, 12:30 PM				

Approach and Evaluation

This course heavily emphasizes group work and discussions. Stream restoration work is completed when an interdisciplinary team comes together to plan and implement the project. Therefore, learning to collaborate on these projects is a key life skill. You will learn the importance and benefits of group work through class discussions and through the final project which involves coming up with your own stream restoration plan for a local watershed.

Class participation and in-class assignments (10%): Class time will be split between lectures and hands-on activities.
2 Problem Sets (20%): You will be given the opportunity to apply the material discussed in lecture with 2 problem sets. The first problem set will emphasize watershed processes and the second will emphasize fluvial processes.
3 article summaries (15%): River restoration project plans balance scientific knowledge with both societal and political needs. To better understand restoration work it is essential that managers are able to read and comprehend scientific journal articles. Therefore, throughout the semester you will read and learn how to better discuss scientific research related to river restoration work. You will be required to write three 1-page article summaries and come prepared to discuss the articles in class.
River Restoration Group Project (30%): An essential part of restoration work is being to work successfully with an interdisciplinary group. Throughout the semester, you will work in groups of five and develop a proposal to restore a local river. The details related to this project will be handed out in the next couple of weeks.
Midterm (10%) and Final Exam (15%): There will be one midterm and one comprehensive final exam.

Readings

Main Textbook:

Roni, P. and Beechie, T., 2013. Stream and watershed restoration: a guide to restoring riverine processes and habitat. John Wiley and Sons, Ltd., West Sussex, UK, 300 pp.

Readings for class lectures:

Montgomery, D.R., Collins, B.D., Buffington, J.M., Abbe, T.B., 2003. Geomorphic effects of wood in rivers. In: Gregory, S.V., Boyer, K.L., Gurnell, A.M. (Eds.), The Ecology and Management of Wood in World Rivers. American Fisheries Society, Bethesda, MD, pp. 21–47.

Robinson, C.T., Tockner, K., Ward, J.V., 2002. The fauna of dynamic riverine landscapes. Freshwater Biology, 47, 661 – 677.

Seedang, S., Gernald, A.G., Adams, R.M., Landers, D.H., 2008. Economic analysis of water temperature reduction practices in a large river floodplain: an exploratory study of the Willamette River, Oregon. River Research and Applications, 24, 941 – 959.

Shields Jr., F.D., Knight. S.S., Lizotte Jr., R., Wren, D.G., Connectivity and variability: metrics for riverin floodplain backwater rehabilitation. In: Simon, A., Bennett, S.J., Castor, J.M. (Eds.), Stream restoration in dynamic fluvial systems: scientific approaches, analyses, and tools. American Geophysical Union, Washington, D.C., pp. 233 – 246.

Readings for Group Discussions:

Burchsted, D., Daniels, M., Thorson, R., Vokoun, J., 2010. The river disontinuum: applying beaver modifications to baseline conditions for restoration of forested headwaters. Bioscience, 60, 908 – 922. doi: 10.1525/bio.2010.60.11.7.

Dufour S., Piégay H., 2009. The myth of the lost paradise to target river restoration : forget natural reference, focus on human benefits. River Research and Applications 25(5), 568 – 581.

Dunne, T., Black, R.D., 1970. Partial area contributions to storm runoff in a small New England watershed. Water Resources Research, 6(5), 1296 – 1311.

Jones, J.A., Grant, G.E., 1996. Peak flow responses to clear-cutting and roads in small and large basins, western Cascade, Oregon. Water Resources Research, 32(4), 959 – 974.

Montgomery, D.R., 1999. Process domains and the river continuum. Journal of the American Water Resources Association, 35(2), 397 – 410.

Poff, N.L., Allan, J.D., Bain, M.B., Karr, J.R., Prestegaard, K.L., Richter, B.D., Sparks, R.E., Stromberg, J.C., 1997. The natural flow regime: a paradigm for river conservation and restoration. Bioscience, 47(11), 769 – 784.

Richter BD, Baumgartner JV, Wigington R, Braun DP. 1997. How much water does a river need? Freshwater Biology, 37, 231– 249.

Rinaldi, M., Piegay, H., Surian, N., 2011. Geomorphological approaches for river management and restoration in Italian and French rivers. In: Simon, A., Bennett, S.J., Castor, J.M. (Eds.), Stream restoration in dynamic fluvial systems: scientific approaches, analyses, and tools. American Geophysical Union, Washington, D.C., pp. 95 – 113.

Rubin, Z., Rathburn, S.L., Wohl, E., Harry, D., 2012. Historic range of variability in geomorphic processs as a context for restoration: Rocky Mountain National Park, Colorado, USA. Earth Surface Processes and Landforms, 37, 209 – 222. DOI: 10.1002/esp.2249.

Simon, A., Downs, P.W., 1995. An interdisciplinary approach to evaluation of potential instability in alluvial channels. Geomorphology, 12, 215 – 232.

Vannote, R.L., Minshall, G.W., Cummins, K.W., Sedell, J.R., Cushing, C.E., 1980. The river continuum concept. Can. J. Fish. Aquat. Sci., 37, 130 – 137.

Watson, C.C., Biedenharn, D.S., Bledsoe, B.P., 2002. Use of incised channel evolution models in understanding rehabilitation alternatives. Journal of the American Water Resources Association, 38(1), 151 – 160.

Wohl, E., 2011. What should these rivers look like? Historical range of variability and human impacts in the Colorado Front Range, USA. Earth Surface Processes and Landforms, 36, 1378 – 1390.

Wohl, E., 2012. Identifying and mitigating dam-induced declines in river health: three case studies from the western United States. International Journal of Sediment Research, 27, 271 – 287.

Wohl, E., Angermeier, P.L., Bledsoe, B., Kondolf, G.M., Macdonnell, L., Merritt, D.M., Palmer, M.A., Poff, N.L., Tarboton, D., 2005. River restoration. Water Resources Research, 41, W10301.

Wondzell, S.M., King, J.G., 2003. Post-fire erosional processes in the Pacific Northwest and Rocky Mountain Regions. Forest Ecology and Management, 178, 75 – 87.

Course Reserves:

Brierley, G.J., Fryirs, K.A., 2005. Geomorphology and river management: applications of the river styles framework. Blackwell publishing: Malden, MA, 398 pp.

Academic Integrity

You are expected to be familiar with Boston College's policy on academic integrity (http://www.bc.edu/offices/stserv/academic/integrity.html). Every author owns his/her own ideas, words, and research, therefore proper citation is essential. Plagiarism is a serious offense and will be dealt with according to the college guidelines. Plagiarism and cheating (for assignments, papers, quizzes, exams, or anything) are not acceptable. Please consult the college guidelines, or us, if you have questions.

Web Info

You will be able to access all the class material through the Blackboard page for the course. Any non-textbook readings will be posted on Blackboard under the "Assigned Readings" folder. You will find useful links, which will help with your final project here as well.

Please refrain from using portable-electronic devices, and from non-course related internet use, during classes, field trips, and office visits. These interfere with your and other students' active participation in the course.

Late or Missed Assignments

Students are expected to turn assignments in on time. If this is not possible then it is your responsibility to contact me and let me know why the assignment will be late. Points will be deducted from late assignments and no assignment will be accepted three days after the due date.

Accomodations

**If you are a student with a documented disability seeking reasonable accommodations in this course, please contact Kathy Duggan, (617) 552-8093, dugganka@bc.edu, at the Connors Family Learning Center regarding learning disabilities and ADHD, or Paulette Durrett, (617) 552-3470, paulette.durrett@bc.edu, in the Disability Services Office regarding all other types of disabilities, including temporary disabilities. Advance notice and appropriate documentation are required for accommodations.