GEO 548: Stream Restoration

Course Information and Syllabus, Fall 2014

Schedule: W, 3:00-5:40pm
Location: 135 Wilkeson
Email: seanb@buffalo.edu

Instructor: Dr. Sean J. Bennett
Office: 126 Wilkeson Quad
Office Hours: M 12:00-1:00pm, W 1:00-2:00pm

Course Description: Stream restoration seeks to return an impaired or degraded river corridor ecosystem to a close approximation of its remaining natural potential, as defined by such indices as ecologic habitat, water quality, biodiversity, functionality, and dynamic stability. This course examines the scientific basis of stream restoration programs in the U.S. and worldwide through consideration of interdisciplinary theories and practices. Participants will actively discuss river processes, aquatic ecology, restoration needs and goals, restoration approaches, the social dimensions of restoration, and the uncertainty and sustainability of restoration designs. Students will be exposed to a variety of stream restoration principles and practices through lectures, seminars, and independent projects.

Course Learning Objectives

No.	*Program Learning Outcome*	*Depth**	*Specific outcome objectives for GEO 548*	*Assessment instrument*
1	Provide breadth of knowledge of basic principles and concepts	2	Students will learn about the scientific basis of stream restoration programs worldwide through the consideration of interdisciplinary theories and practices	Seminars and Project
2	Provide depth within specialized areas	2	Learn and master the fundamentals of stream mechanics and stream ecology and habitat	Student-presented Seminars
			Learn and master the fundamentals of the need for stream restoration	
			Learn and master the fundamentals of stream restoration approaches	
			Learn and master the fundamentals of the current shifting paradigms of stream restoration	
3	Provide an understanding of experimental/research design and methodology	2	The scientific method will be presented and consistently applied in each written assignment	Seminars and Project
4	Develop approaches for integration of information	2	Students must conduct an independent project that entails the collection of data, the reduction and analysis of previously collected data, the testing of new hypotheses, and/or the formulation or application of conceptual or numerical models	Project
5	Encourage critical thinking and hypothesis building	2	Students will learn to critically assess published literature, as well as the collection, reduction, and presentation of their own data	Seminars and Project
6	Provide skills in writing and communication	2	Each student will be required to write one (1) long paper, and present five (5) seminars	Seminars and Project
7	Provide contemporary information	2	All student seminars are based on recently published literature, selected to align with the theme presented in class	Seminars
8	Encourage appreciation of scientific values	2	Apply the basic principles of ecology, biogeochemistry, physics, river hydraulics, open channel flow, and geotechnical engineering to the collection, processing, analysis, and presentation of data	Project

*Depth: 0 - not covered; 1 - moderately covered; 2 - extensively covered

Course Syllabus and Presenter Schedule

Dates	*Topic*	*Presentation*
8/27	Introduction & Stream Mechanics I	Lecture
9/3	Stream Mechanics II	Lecture
9/10	Stream Ecology and Habitat	Lecture
9/17	*Stream Ecology and Habitat Case Studies*	*Student seminars*
9/24	The Need for Stream Restoration and its History	Lecture
10/1	*The Need for Restoration and its History Case Studies*	*Student seminars*
10/8	Engineering of Stream Corridors	Lecture
10/15	*Engineering of Stream Corridors Case Studies*	*Student seminars*
10/22	Stream Channel Design	Lecture
10/29	*Stream Channel Design Case Studies*	*Student seminars*
11/5	Emerging Areas of Stream Restoration	Lecture
11/12	*Emerging Areas of Stream Restoration Case Studies*	*Student seminars*
11/19	Final Project Presentations I	*Student seminars*
12/3	Final Project Presentations II	*Student seminars*

Primary literature to be used per topic will include the following, supplemented by scientific publications.

River Mechanics

Bridge, J.S., *Rivers and Floodplains: Forms, Processes, and Sedimentary Record*, Blackwell Publishing, Oxford, 491 pp., 2003.

Knighton, D., *Fluvial Forms and Processes: A New Perspective*, Arnold, London, 383 pp., 1998.

River Ecology and Habitat

Allan, J.D., and M.M. Castillo, *Stream Ecology: Structure and Function of Running Waters*, 2nd ed., Springer, The Netherlands, 436 pp., 2008.

Dorava, J.M., D.R. Montgomery, B.B. Palcsak, and F.A. Fitzpatrick, eds., *Geomorphic Processes and Riverine Habitat*, Water Science and Application, Volume 4, 250 pp., 2001.

The Need for River Restoration

Brierley, G., and K. Fryirs, eds., *River Futures: An Integrative Scientific Approach to River Repair*, Island Press, 328 pp., 2008.

Restoration Ecology, Special Section: Restoring Rivers: A Synthesis of Findings from Project Records and Interviews, vol. 15(3), pp. 472-591, 2007.

Thorp, J., M. Thoms, and M. Delong, *The Riverine Ecosystem Synthesis: Toward Conceptual Cohesiveness in River Science*, Academic Press, Oxford, 232 pp., 2008.

River Restoration Approaches

Brookes, A., and F.D. Shields, Jr., eds., *River Channel Restoration: Guiding Principles for Sustainable Projects*, John Wiley and Sons, Chichester, 23-74, 1996.

Darby, S., and D. Sear, eds., *River Restoration: Managing the Uncertainty in Restoring Physical Habitat*, John Wiley & Sons, Chichester, 315 pp., 2008.

Philip, R., and T. Beechie, eds., *Stream and Watershed Restoration: A Guide to Restoring Riverine Processes and Habitats*, John Wiley & Sons, Chichester, 316 pp., 2013.

Simon, A., S.J. Bennett, and J. M. Castro, eds., *Stream Restoration in Dynamic Fluvial Systems: Scientific Approaches*, Analyses, and Tools, Geophysical Monograph Series vol. 194, American Geophysical Union, 544 pp., 2011.

United States Department of Agriculture-Natural Resources Conservation Service, *Stream Restoration Design*, Part 654 National Engineering Handbook, 2007.

Watson, C.C., D.S. Biedenharn, and C.R. Thorne, *Stream Rehabilitation Version 1.0*, Cottonwood Research LLC, Fort Collins, Colorado, 201 pp., 2005.

Resources: Students are encouraged to purchase those books of close interest to their studies. All graphics and PowerPoint presentations shown in class, as well as pertinent papers, reports, and manuals, will be posted on UB*learns* in PDF format prior to lectures and seminars.

Student Assessment: Three (3) topical seminars with abstract, one (1) term project seminar with abstract, and one (1) term project.

Topical seminars presented by students will be based on a paper selected by them with assistance of and approval from the instructor. Note that only those papers published in 2012-14 in an accepted journal (see list below) are eligible to be presented. Students should email the instructor a PDF of the paper chosen, as these will be loaded to UB*learns* for the benefit of the class. Each seminar meeting will comprise up to eight (8) student presentations, with up to 15 minutes allotted per presentation, which includes 3 minutes for discussion. All students shall present their seminars in PowerPoint, and a computer with projector will be available. In addition, each student presenter must prepare a 250-word abstract of the chosen paper, written in their own words. General guidelines for the seminar presentations are provided below. Late or email submissions of abstracts will not be accepted (a "0" grade will be assigned).

Each seminar will be worth 12 points, subdivided as follows: 7 points for scientific content and delivery, 2 points for seminar format and organization, 1 point for time management, and 2 points for abstract quality.

The term project is a relatively long discussion (~15 pages long, 12-point font, and single-spaced in addition to figures, tables, and references) of a topic, focusing on its critical evaluation. It will include a brief literature review, identified gaps in current knowledge, stated hypotheses or objectives, and insight into new research opportunities. This paper must entail the collection of field or experimental data (actual, synthetic, or qualitative), the reduction and analysis of previously collected data, the testing of new hypotheses, and/or the formulation or application of conceptual or numerical models. Topics must be approved by the instructor by October 8. Each student shall present their project and results to the class as a seminar, with up to 20 minutes allotted per presentation, which includes 5 minutes for discussion. General guidelines for the projects are provided below. Late papers or email submissions will not be accepted (a "0" grade will be assigned). Example topics will be provided by the instructor throughout the semester. All term papers are due by 4:30 pm on December 10.

The term paper will be worth 45 points, subdivided as follows: 35 points for scientific content, 5 points for writing quality, and 5 points for format, references, and citations.

Grades: Below is a table of all required work, deadlines, and the points awarded per activity. Normal university grading procedures will be employed. An "Incomplete" grade will not be given to students who fail to submit work or submit work late.

Required Work	Date Due	% of Total Grade
Seminar Presentations (3)	TBA	10 points each (30 points total)
Seminar Abstracts (3)	Day of Seminar	2 points each (6 points total)
Term Project Seminar	TBA	10 points
Term Project Abstract	Day of Seminar	2 points
Term Project	By 4:30 pm on 12/10	45 points
Class Participation	NA	7 points

General Guidelines for Project:

- Papers should have an Abstract (250-word maximum), Introduction (with objectives of the paper), Methods (if applicable), Results, Conclusions, and References
- Papers will be assessed for content, accuracy, originality, presentation, organization, and overall quality of the writing
- Write concisely, similar in form to a journal paper
- Keep observations, measurements, and results separate from discussion and interpretations
- Use your own voice; plagiarism will not be tolerated (all students should be familiar with UB's Academic Integrity Policies and Procedures found here: http://grad.buffalo.edu/Academics/Policies-Procedures/Academic-Integrity.html)
- All figures and tables require a caption
- Equations should be numbered sequentially in order of appearance, and all variables defined

- All material presented must be accurately and correctly cited
- Citations and references should follow the style and format of the American Geophysical Union

General Guidelines for Seminars:

- Students will present seminars standing in front of the class
- Students are allotted ~15 minutes per presentation, which includes 3 minutes for questions; do not exceed this limit (20 min. is allotted for the final project presentation)
- Format should be restricted to ~10 to 12 slides, and it should include a title and author(s) slide, background information, hypotheses or objectives of the paper, select procedures or methods used, select observations (plots, graphs, or mathematical formulations), discussion of the results, and concluding statements or summary
- Ensure all visual equipment is secured, in place, and working properly with the intended presentation
- Rehearsing the presentation is strongly recommended
- "Less" is generally "more"
- Speak to the audience and not the screen, use a relaxed, confident, and authoritative tone, make eye contact with the audience, and minimize physical gestures
- Listen to the questions carefully, and respond in a courteous, relaxed manner
- Respect should be shown to the presenter and the audience at all times
- Students will be evaluated on the clarity, style, and professionalism of their presentation, their command of the topic, the effectiveness of the visual aids, and their time management
- Attendance and participation by all students is mandatory

Acceptable Journals for Seminar Papers

Advances in Water Resources
Annals of the Association of American Geographers
Aquatic Conservation: Marine and Freshwater Ecosystems
Aquatic Ecology
Bioscience
Canadian Journal of Fisheries and Aquatic Sciences
Conservation Biology
Earth Surface Processes and Landforms
Ecohydrology
Ecological Engineering
Ecosystems
Environmental Management
Environmental Science and Technology
Freshwater Biology
Frontiers in Ecology and the Environment
Geomorphology
Ground Water
Hydrobiologia
Hydrological Processes
Journal of the American Water Resources Association
Journal of Applied Ecology
Journal of Environmental Engineering
Journal of Environmental Management
Journal of Environmental Quality
Journal of Geophysical Research—Biogeosciences
Journal of Geophysical Research—Earth Surface
Journal of Hydraulic Engineering
Journal of Hydro-environment Research
Journal of Hydrologic Engineering
Journal of Hydrology
North American Journal of Fisheries Management
Restoration Ecology
River Research and Applications
Science of the Total Environment
Transactions of the American Fisheries Society
Water, Air, & Soil Pollution
Water Resources Research

Information about UB's Accessibility Resources Office can be found here: http://www.student-affairs.buffalo.edu/ods/. All students wishing to receive assistance must register with that office.