

CIVE 613 – River Restoration Design Spring 2015

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Texts (the latter three are available as pdf files on RamCT Blackboard):

Roni, P. and Beechie, T. 2013. *Stream and Watershed Restoration: A Guide to Restoring Riverine Processes and Habitats*. John Wiley and Sons.

Natural Resources Conservation Service. 2007. *Stream Restoration Design Handbook NEH-654*. (National Engineering Handbook, Part 654),. 1600+ pp.

Soar, P.J., and Thorne, C.R. 2001. *Channel Restoration Design for Meandering Rivers*. ERDC/CHL CR-01-1, U.S. Army Engineer Research and Development Center, Flood Damage Reduction Research Program, Vicksburg, MS. 454 pp.

Watson, C.C., D.S. Biedenharn, C.R. Thorne. 2007. *Stream Rehabilitation*. Biedenharn Group, LLC. Fort Collins, CO. 266 pp.

Required Readings: TBA - available through RamCT.

Office Hours: Tuesdays 1:30-3:00 and Thursdays 1:30-2:30 in A205E Engineering.

Course Description: Stream restoration is the process of assisting the recovery of attributes such as ecological function, dynamic stability, habitat, water quality, and biodiversity in a river ecosystem that has been degraded, damaged, or destroyed. This course explores the field of river and stream restoration, its scientific and technical basis, its complex yet inadequate toolbox, and its social and philosophical underpinnings. Particular emphasis is placed on integrating hydrologic, geomorphological, and ecological science with engineering design to restore watershed processes that sustain habitat, rather than narrowly treating symptoms through small scale, static approaches. Students are exposed to a variety of stream restoration concepts and tools through lectures, design case studies, seminars, and independent projects. Students are expected to complete reading assignments outside the texts, complete design exercises, and participate in discussions of assigned readings and relevant topics.

Learning Objectives

- To define stream restoration
- To understand why stream restoration is important
- Familiarity with general approaches to stream restoration (overall process, planning, setting goals, envisioning)
- Familiarity with the scientific basis and appropriate application of the following stream restoration tools:
 - Hydrologic analysis
 - Dominant / effective discharge
 - Hydraulic geometry
 - Stream classification schemes and channel evolution models
 - Historical analysis
 - Sediment transport analysis
 - Analytical / regime / analog stable channel design approaches

- Grade control
- Bank processes and stabilization including geotechnical analysis and bioengineering
- Knowledge of software used in restoration / rehabilitation design such as HEC-RAS / SAM / SIAM, BAGS, Gary Parker's tools, PHABSIM, IHA, GeoTools
- Environmental flows – ELOHA, channel / riparian maintenance
- Watershed assessment and prioritizing projects
- Some basic knowledge of key concepts from applied stream ecology
- Understanding of performance monitoring / adaptive management
- Exposure to social dimensions of river restoration
- Improved communication and critical thinking in the context of interdisciplinary river science
- Exposure to the primary scientific literature and current themes in river restoration research

Grading System:

Homework / Design Practicum	30 %
Reading Quizzes	15 %
Midterm Exam	15 %
Term Project	20%
Final Exam	20 %

Term grades for this course will use the +/- grading system as described in the CSU catalog.

Reading assignments and quizzes: I will endeavor to make this a discussion-oriented course. For this approach to be meaningful and effective, it is essential that you read material as it is assigned prior to our class discussions. To encourage you to do this, I will give several short quizzes (~7) throughout the semester to assess whether the reading assignments are being completed and comprehended. You will be able to drop your two lowest quiz scores or missed quizzes from your quiz grade. In addition to assigned readings in the primary texts, there will be several additional readings that we will be discussing and critiquing during the semester. These will be announced in class well in advance of quizzes and discussions.

Potential Case Studies for Homework / Design Practicum:

- Ten Mile Creek, White River National Forest, CO
- Amite River / Coastal Louisiana Restoration
- Lulu Creek in Rocky Mountain National Park
- Eagle River at Edwards, CO and Camp Hale
- Cache la Poudre River in Fort Collins
- Central Platte River
- San Juan River
- Arkansas River below Leadville, CO

Term Project: For the term project students will individually research a stream restoration topic or case study, 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 opportunities for research and/or improving practice. Topics must be approved by the instructor. Ideally, this effort will 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, or the formulation or application of conceptual or numerical models. Each student shall present their project and results to the class as a seminar at the end of the semester, with up to 20 minutes allotted per presentation, which includes 5

minutes for discussion. Example topics will be provided by the instructor. General guidelines for seminars are as follows:

- Students will present seminars standing in front of the class
- Students are allotted ~20 minutes per presentation (TBD depending on class size), which includes 5 minutes for questions; do not exceed this limit
- Format should be restricted to ~< 15-20 slides, and it should include a title and author(s) slide, background information, hypotheses or objectives, select procedures or methods used, select observations (plots, graphs, or mathematical formulations), discussion of the results, and concluding statements or summary
- 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 understanding and command of the topic, the effectiveness of the visual aids, and time management
- Attendance and participation by all students is mandatory

Policies: I will accept late homework submissions (not term projects) up to five days after the due date or before solutions are distributed, whichever comes first. A **penalty of 20% per day** late will be assessed on these assignments. Make-up exams will be given only for university-approved excuses or when you have a note from a medical professional. Please turn off cell phones in the classroom. I will respond to emails written in a professional style (including salutation and attention to correct grammar and spelling). I encourage students to discuss and collaborate on homework and other outside assignments but the final work you turn in should be distinctly your own unless the assignment is clearly designated as a “team” assignment. The course will adhere to the Academic Integrity Policy of the Colorado State University General Catalog (Page 7) and the Student Conduct Code. CSU policies on academic integrity will be rigorously enforced in this course. Please examine the following references on academic integrity:

<http://tilt.colostate.edu/integrity/honorpledge/howDoCSU.cfm>

<http://tilt.colostate.edu/integrity/faqs/>

In accordance with CSU policies, I ask that you include and sign the following statement on all written work: “I pledge on my honor that I have not given, received, or used any unauthorized assistance _____(signature).”

Tentative Outline of Topics

1. Introduction to Restoration: Key Steps for Designing Effective Programs and Projects
2. Watershed Processes, Human Impacts, and Process-based Restoration
3. Watershed Assessments and Identification of Restoration Needs
4. Planning and Implementing Restoration Projects - Human Dimensions
5. Overview of River Restoration Techniques
6. Design Hydrology and Sediment Transport
7. Channel Design
8. Habitat Improvement and Creation Techniques
9. Environmental Flows
10. Connectivity
11. Incised Channels and Grade Control
12. Miscellaneous Restoration Techniques
13. Prioritization of Watersheds and Restoration Projects
14. Monitoring and Evaluation of Restoration Actions
15. Case Studies, Seminars, and Synthesis