

## Geosciences 587: Fluvial Geomorphology and Riverine Ecosystems

Fall 2009

University of Montana

1 credit

**Instructor:** Andrew Wilcox  
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**Class Meetings:** W 1:10 – 2 PM, CHCB 333  
**Office Hours:** TW 3:10 – 4 PM, or by appointment

*Fluvial Geomorphology and Riverine Ecosystems* will be a graduate seminar focused on reading, discussion, and analysis of journal papers. The course will focus on topics related to two broad themes: 1) ecogeomorphic feedbacks and 2) effects of flow regimes on geomorphic and ecosystem processes. We will investigate interactions of geomorphic processes with riparian vegetation, fish, and other biota, as well as applications to river management issues.

**Goals :** As a result of your experiences in G587, you will have the opportunity to:

- gain understanding of physical and ecosystem processes in rivers and of the feedbacks between them
- improve your skills in critically reading and interpreting journal papers
- communicate an understanding of the interrelationships among fluvial geomorphic and ecological concepts and theories to peers and others
- develop your oral communication skills, including gaining confidence in speaking up with your ideas (and learning to hold back and let others contribute)

**Prerequisites:** There are no formal prerequisites for this course, although you will get more out of the papers with some background in geomorphology and/or ecology. Students in geosciences, biology, geography, forestry, EVST, and related fields are encouraged to take part.

**Readings:** We will read 1-2 papers each week; pdf's will be posted on ERes (<http://eres.lib.umt.edu/eres/courseindex.aspx?error=&page=search>). Password is FGRE.

**Discussion responsibilities:** Students are expected to carefully and critically read assigned papers; come to class prepared to discuss and demonstrate comprehension of the papers; and participate in discussions. Before noon on Wednesday each week (i.e., 1 hour before class), I ask that students send me a short email with a sentence or two describing one aspect of each paper that they understood least- the “muddiest point” of the paper. I also ask that students come to class with one discussion question prepared for the class; there can be overlap between your prepared discussion question and your muddy points. There will not be formal discussion leaders; we will collectively drive and contribute to discussions each week. The following is a list of potential discussion questions and things to think about as you read each paper.

- What are a few key points / take-home messages from the paper?

- What was the major contribution of paper; why was it published?
- What were the objectives of the paper?
- Key hypotheses?
- What were the weaknesses of the paper?
- What methods were used, and were they appropriate for addressing the research objectives or hypotheses?
- Were the conclusions justified?
- How can we use the information in this paper (e.g., in our research or in river management)?
- Connections- how can we think about material in one paper based on what we've learned elsewhere (another paper / class / other experience)?
- Muddiest points- did you find any aspects of the paper unclear or confusing?

I also strongly recommend maintaining a cumulative annotated bibliography of notes on the papers as the semester goes along that you can refer back to in the future.

**Grading:** The course is Credit/No Credit. To receive credit for the course, students must meet the discussion responsibilities described above, including submitting “muddiest point” emails to me before class, coming to class, and participating. This adds up to performance at a good to exceptional level, consistent with a letter grade of B or higher.

A “No Credit” will be assigned to students that do not meet the discussion responsibilities outlined above, including those that participate minimally or not at all in discussion, obviously have not read papers (i.e., consistently only contribute general points to discussions that do not reflect any knowledge of paper content), and do not turn in “muddiest point” emails or turn in only minimal number. If you are on track for or in danger of a “No pass”, I will provide feedback as the semester progresses.

### **Tentative schedule**

Week 1 (9/2): Introduction

Week 2 (9/9): Conceptual models

Murray, A.B., Knaapen, M.A.F., Tal, M. and Kirwan, M.L., 2008. Biomorphodynamics: Physical-biological feedbacks that shape landscapes. *Water Resources Research* 44(11), doi:10.1029/2007WR006410. (18 p.)

Week 3 (9/16): Geomorphic thresholds

Church, M. 2002. Geomorphic thresholds in riverine environments. *Freshwater Biology* 47: 541-557.

Week 4 (9/23): River flows and ecogeomorphic processes I

Poff, N.L., J.D. Allan, M.B. Bain, J.R. Karr, K.J. Prestegard, B.D. Richter, R.E. Sparks and J.C. Stromberg. 1997. The natural flow regime. *Bioscience* 47:769-784.

Week 5 (9/30): Field trip, 1 pm-5 pm. This field trip will be to the Milltown Dam area as part of the annual River Center conference. We will be discussing science and management issues associated with the removal of Milltown Dam.

Oct 1-2: UM River Center conference (joint with MT AWRA)

See conference website for more information: <http://www.umt.edu/rivercenter/conf.html>

Week 6 (10/7): River flows and ecogeomorphic processes II

Doyle, M.W., E.H. Stanley, D. Strayer, R. Jacobson, and J.C. Schmidt. 2005. Effective discharge analysis of ecological processes in streams. *Water Resources Research* 41: W1141.

Week 7 (10/14): Salmonid geomorphology

Hassan, M.A., Gottesfeld, A.S., Montgomery, D.R., Tunnicliffe, J.F., Clarke, G.K.C., Wynn, G., Jones-Cox, H., Poirier, R., MacIsaac, E., Herunter, H. and Macdonald, S.J. 2008. Salmon-driven bed load transport and bed morphology in mountain streams. *Geophys. Res. Lett.*, 35, L04405, doi:10.1029/2007GL032997. (6 p.)

Baxter, C.V. and F.R. Hauer. 2000. Geomorphology, hyporheic exchange, and selection of spawning habitat by bull trout (*Salvelinus confluentus*). *Canadian Journal of Fisheries and Aquatic Sciences* 57:1470-1481.

Week 8 (10/21): Case study of ecogeomorphic feedbacks, Fossil Creek, AZ

Marks J.C., R. Parnell, C. Carter, E.C. Dinger, and G.A. Haden. 2006. Interactions between geomorphology and ecosystem processes in travertine streams: Implications for decommissioning a dam on Fossil Creek, Arizona. *Geomorphology* 77: 299-307.  
*A River Reborn: The Restoration of Fossil Creek*. DVD, 57 min.

Week 9 (10/28): Riparian vegetation and geomorphic processes I

Corenblit, D., Tabacchi, E., Steiger, J. and Gurnell, A.M., 2007. Reciprocal interactions and adjustments between fluvial landforms and vegetation dynamics in river corridors: A review of complementary approaches. *Earth-Science Reviews*, 84(1-2): 56-86.

Optional review paper:

Sandercock, P.J., Hooke, J.M. and Mant, J.M., 2007. Vegetation in dryland river channels and its interaction with fluvial processes. *Progress in Physical Geography*, 31(2): 107-129.

Week 10 (11/4): Riparian vegetation and geomorphic processes II: Tamarisk

Birken, A.S. and Cooper, D.J., 2006. Processes of Tamarix invasion and floodplain development along the lower Green River, Utah. *Ecological Applications* 16(3): 1103-1120.

Vincent, K., Friedman, J. and Griffin, E., 2009. Erosional Consequence of Saltcedar Control. *Environmental Management* 44(2): 218-227.

Week 11 (11/11): Veterans Day, no class

Week 12 (11/18): Woody debris

Abbe, T.B. and Montgomery, D.R. 1996. Large woody debris jams, channel hydraulics and habitat formation in large rivers. *Regulated Rivers: Research & Management* 12: 201-221.

Week 13 (11/25): Thanksgiving break, no class

| Week 14 (12/2): Beaver

Butler, D.R. and G.P. Malanson. 2005. The geomorphic influences of beaver dams and failures of beaver dams. *Geomorphology* 71: 48-60.

Dean, C. 2009. Return of the Once-Rare Beaver? Not in My Yard. New York Times, 8 June. [http://www.nytimes.com/2009/06/09/science/earth/09beaver.html?\\_r=1&scp=1&sq=beaver&st=cse](http://www.nytimes.com/2009/06/09/science/earth/09beaver.html?_r=1&scp=1&sq=beaver&st=cse)

Optional review paper:

Gurnell, A.M. 1998. The hydrogeomorphological effects of beaver dam-building activity. *Progress in Physical Geography* 22: 167-189.

Week 15 (12/9): Stream restoration / wrap-up

Palmer, M. A. and E. S. Bernhardt. 2006. Hydroecology and river restoration: Ripe for research and synthesis. *Water Resources Research* 42, W03S07, doi:10.1029/2005WR004354.

Harte, J. 2002. Toward a synthesis of the Newtonian and Darwinian world views. *Physics Today*, October: 29-34.

Week 16 (12/16): Finals week (no final)