

## Geosciences 460: Process Geomorphology

Fall 2009

University of Montana

4 credits

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Office: CHCB 355  
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**Class Meetings:** TR 1:10 – 3 PM, CHCB 348

**Office Hours:** TW 3:10 – 4 PM, or by appointment

*Process Geomorphology* will provide an in-depth investigation of the processes that determine the form and evolution of glaciers, hillslopes, and rivers. The course will combine lectures, discussions, field data collection, and modeling activities. This is not a straight lecture class! Active learning and student participation will be an essential component.

**Course Objectives** - To provide students with:

- a strong understanding of the linkages between landscape form and process
- in-depth knowledge of hillslope, river channel, and glacial processes
- familiarity and experience applying fundamental concepts in physical systems
- experience collecting and analyzing field data
- opportunities for developing scientific writing skills
- opportunities to develop and apply skills in physics and mathematics
- experience in interpreting and analyzing literature from both secondary and primary sources
- practice in using models, data, and logical reasoning to critically evaluate and connect information about geomorphic processes
- experience communicating an understanding of the interrelationships among geomorphic concepts and theories to peers and others
- experience working as members of productive, collaborative teams, including experience working in a group on a professional consulting project

**Course Website:** This course will use Blackboard (<http://courseware.umt.edu/>). You should get in the habit of checking the course website DAILY for course announcements, notes, and assignments. Some of the class lecture notes will be posted (after lecture).

### Course Evaluation:

30	Problem sets, lab exercises, reading summaries, class participation, quizzes
20	Stream restoration professional report
20	Landslide analysis report
10	Midterm Exam
20	Final exam
100	Total points possible

## Field trips

There will be numerous field trips in this class, including Thursday afternoon field trips and 3 all-day weekend field trips. Because the data collected in the field will be the basis for much of your work in this class, *each of these field trips, with the exception of the Wednesday Sept. 30 trip, is required*. See me right away if you have scheduling conflict. You will need a field book, so purchase one now if you don't have one.

Thursday, Sept. 10, 1-3: Field observations and surveying

Saturday, Sept. 12, all day: Glacial Lake Missoula field trip (led by Marc Hendrix as part of Winston-Thompson Symposium)

Saturday, Sept. 26, all day: Mattie V Creek

Wednesday, Sept. 30, 1-5 pm: River Center conference field trip to Milltown (recommended)

Saturday, Oct. 24, all day: Sleeping Child Creek hillslope process exercise  
(Likely one additional Thursday afternoon field trip TBA)

**Readings:** We will use the textbook *Process Geomorphology*, 4<sup>th</sup> ed., by D.F. Ritter, C.R. Kochel, J.R. Miller (Waveland Press). There are assigned readings, but at times the course will not rely heavily on the text. Journal papers and supplemental readings will also be assigned; see the end of the syllabus for a partial list.

**Academic Integrity:** All students need to be familiar with and abide by the Student Conduct Code and its definitions of academic misconduct. The Code is available for review online at <http://life.umt.edu/SA/documents/fromWeb/StudentConductCode1.pdf>.

## Other notes

1. Prerequisites: Contrary to what the UM catalogue states, there are no *formal* prerequisites, but some background in calculus, physics, and earth sciences, as well as computer literacy are expected. Assignments will be given involving computations, the use of spreadsheets and retrieval of data over the internet.
2. Attendance is critical. Much of the material covered in class will not be in the assigned reading. There will be occasional in-class activities, typically not announced in advance but also typically open note, that you won't get credit for if you are not in class
3. Email. Feel free to communicate with me by email, but 1) I'm not an online help service for homeworks, i.e., don't email me when you get stuck on a homework question- come to office hours or ask questions at the beginning of class; 2) if you miss class, please do not email me to ask what you missed- check Blackboard and/or talk to classmates; 3) if you hand in assignments electronically, they must be well organized and consolidated into at most two files; you will lose points otherwise.
4. This class will be a lot of work.
5. Exams are open note and open book.
6. Late policy: 1 assignment can be handed in late without penalty, reason, or prior communication. Otherwise 2% of total points are deducted per day late (I'll waive this in certain cases with prior communication). No credit allowed after answer key posted (this will usually be ~ 1 week after due date).

**Course schedule:**

- Class meeting topics are subject to change
- Readings must be completed before class on the day listed
- Any updates to the syllabus will be announced in class and posted on Blackboard

Week	Date	Class meeting topic	Reading
1	Sept. 1	Introduction	Ritter 1
	Sept. 3	Landscape attributes and metrics lab	
2	Sept. 8	Glacial Lake Missoula	Alt 2000 Smith 2006
	Sept. 10	Field lab	
<i>Saturday, Sept. 13: Field trip (joint with Winston-Thompson symposium)</i>			
3	Sept. 15	Channel networks and drainage basins	Ritter 5, 6
	Sept. 17	Fluvial processes, attributes of alluvial rivers	
4	Sept. 22	Flow and sediment transport	Ritter 6
	Sept. 24	Flow and sediment transport	
<i>Saturday, Sept. 26: Field trip to Mattie V Creek</i>			
5	Sept. 29	Fluvial processes: Hydraulic geometry, channel patterns, long profiles	Ritter 6,7
	Sept. 30	Field trip to Milltown Dam, 1-5 pm (Wednesday)	
	Oct. 1	River Center conference	
6	Oct. 6	Fluvial processes: floods, dominant Q, channel adjustments, classification	Ritter 5
	Oct. 8	Hillslope hydrology	
7	Oct. 13	Hillslope hydrology	Ritter 3
	Oct. 15	Weathering & Soil formation <i>Mattie V project reports due</i>	
8	Oct. 20	<b>Midterm</b>	Ritter 4
	Oct. 22	Sediment budgets & erosion processes	
<i>Saturday, Oct. 24: Field trip to Sleeping Child Creek</i>			
9	Oct. 27	Landslides & Debris flows	Ritter 4
	Oct. 29	Landslide mechanics	
10	Nov. 3	Hillslope processes / Landscape evolution	Ritter 4
	Nov. 5	Hillslope processes / Landscape evolution	
11	Nov. 10	Glacial processes: intro	Ritter 9
	Nov. 12	Glacial processes-flow mechanics <i>Sleeping Child Creek project reports due</i>	
12	Nov. 17	Guest lecture	Ritter 10 Koppes & Montgomery
	Nov. 19	Guest lecture	
13	Nov. 24	Guest lecture	TBA
	Nov. 26	Thanksgiving-No class	
14	Dec. 1	Climate, tectonics & topography, Quaternary geomorphology	Molnar & England; TBA
	Dec. 3	Climate, tectonics & topography	
15	Dec. 8	Human effects on geomorphic processes	Dietrich & Perron; TBA
	Dec. 10	Ecogeomorphology	
16	Dec. 15	<b>Final exam; 3:20-5:20 pm</b>	

## Geomorphology-related outside speakers / events

Sept. 12, Winston-Thompson Symposium; see schedule at:

[http://umt.edu/geosciences/WinstonThompsonSymposium/Winston\\_Thompson\\_evite\\_small.pdf](http://umt.edu/geosciences/WinstonThompsonSymposium/Winston_Thompson_evite_small.pdf)

Sept. 28, 4:10-5 pm, CHCB 304: Bob Anderson (University of Colorado), “From glacial polish to valley relief: how glacial sliding and rock type matter in glacial landscape evolution”  
(*Geosciences Department seminar; required*)

Sept. 30-Oct. 2: UM River Center conference (joint with MT AWRA)

9/30, 1-5 pm: Field trip to the Milltown Dam area to discuss science and management issues associated with the removal of Milltown Dam

10/1-10/2: Keynote talks, contributed talks, poster session, Holiday Inn Parkside

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

## Journal papers (these are a few of the journal papers that will be assigned; more TBA)

Dietrich, W.E., Bellugi, D.G., Sklar, L.S., Stock, J.D., Heimsath, A.M. and Roering, J.J., 2003. Geomorphic transport laws for predicting landscape form and dynamics. In: P.R. Wilcock and R.M. Iverson (Editors), *Prediction in Geomorphology*. American Geophysical Union, Washington D.C., pp. 103-132.

Dietrich, W.E. and Perron, J.T., 2006. The search for a topographic signature of life. *Nature* 439(7075): 411-418.

Egholm, D.L., Nielsen, S.B., Pedersen, V.K. and Lesemann, J.E., 2009. Glacial effects limiting mountain height. *Nature*, 460(7257): 884-887.

Gabet, E. J., and A. Bookter (2008), A morphometric analysis of gullies scoured by post-fire progressively bulked debris flows in southwest Montana, USA, *Geomorphology*, 96(3-4), 298-309.

Koppes, M.N. and Montgomery, D.R., 2009. The relative efficacy of fluvial and glacial erosion over modern to orogenic timescales. *Nature Geosciences*, 2(9): 644-647.

Molnar, P., and England, P., 1990, Late Cenozoic uplift of mountain ranges and global climate change: Chicken or egg?: *Nature*, v. 346, p. 29–34, doi: 10.1038/346029a0.

Naylor, S. and Gabet, E.J.. 2007. Valley asymmetry and glacial vs. non-glacial erosion in the Bitterroot Range, Montana, USA. *Geology* 35(4): 375-378.

Perron, J.T., Kirchner, J.W. and Dietrich, W.E., 2009. Formation of evenly spaced ridges and valleys. *Nature*, 460(7254): 502-505.