Geomorphology: Landscape Process and Form
GEO 365Q (27580) / 385Q (27690)

Syllabus, Spring 2013
Class meets 2-3 MWF, EPS 1.126

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Class website: Blackboard. Lectures, assignments, announcements will be posted here.

Required readings:

Textbook: Anderson and Anderson, *Geomorphology: the Mechanics and Chemistry of Landscapes*. Campus bookstore, Amazon, etc. First published July 2010. The class will use this book, including for some homework questions.

Free: Anderson, *The little book of Geomorphology: Exercising the Principle of Conservation.* http://instaar.colorado.edu/~andersrs/The_little_book_010708_web.pdf

Recommended readings:

Free: MIT online course ware, 12.163/463: Surface processes and Landscape Evolution. Download the Lecture Note PDFs in particular. http://ocw.mit.edu/courses/earth-atmospheric-and-planetary-sciences/12-163-surface-processes-and-landscape-evolution-fall-2004/index.htm

Free: Parker ebook. Great for open channel flow, sediment transport and channel feedbacks, particularly if you prefer equations to English. Includes Excel visual basic codes that implement many of the equations. http://vtchl.uiuc.edu/people/parkerg/morphodynamics_e-book.htm

Other textbooks I recommend in general, even though I won't directly reference them:

Leopold, Wolman and Miller, *Fluvial Processes in Geomorphology.* This is a small, cheap and classic book, published in 1964, written by legendary geomorphologists who did some of the most influential 20th century research in the field. The authors were way ahead of their time and the book is still readable and relevant.

Ritter, Kochel and Miller, *Process Geomorphology*

Covers almost every topic, in almost enough detail to be useful. I use it to quickly look up basic information.

Undergraduate Grading (365Q):

2 exams, 13% each: 26% total
Approximately 6 assignments, not weighted equally: 50% total
Field trip participation + assignments, or makeup assignments (3): 8% each, 24% total

Graduate Grading (385Q):

2 exams, 13% each: 26% total
Approximately 5 assignments, not weighted equally: 30% total
Final project: 20%
Field trip participation + assignments, or makeup assignments (3): 8% each, 24% total

Plus/minus grades *will* be used. Expectations will differ for undergraduate and graduate students, and assignments will be graded accordingly. Some assignments will have additional questions that are mandatory for grads, extra credit for undergrads.

Two EXAMS: Midterm on March 6 (Wednesday before Spring Break), and non-comprehensive "final" on the last day of class (Friday May 3). No final during finals week.

3 mandatory Saturday **FIELD TRIPS**, locations might change, dates won't. Expect them to take all day (8-5).

February 9, Saturday.	Hillslopes (St. Edwards Park, Austin)
March 6, Saturday	Bedrock rivers (Pedernales Falls S.P.)
April 6, Saturday	Alluvial river morphology (Colorado River, Austin)

Mandatory field trip attendance, active participation, and a short field trip assignment will be worth 8% of your grade for each field trip, 24% total. **If you cannot attend**, provided that you notify me in advance, you will have the option of completing a makeup written assignment. Completing the makeup assignments will take more time and effort than attending the field trip.

Graduate final project: **Graduate final project**: Do a small research project related to topics covered in the course. This project must be new work done for this class, i.e. not research you've already done. It can be related to your PhD/Masters research, as long as it is new work. Possible directions could be developing a simple numerical model for a landform or process (e.g., scarp retreat as a function of rock strength and weatherability), DEM/GIS analysis to infer something (uplift, rock properties) about a particular landscape, or laboratory flume experiments on sediment transport.

Summarize your project in approximately five pages of writing (not much more, not much less, not including abstract). Part of effective scientific writing is expressing ideas effectively yet efficiently. To this end, the minimum and maximum length limits will be enforced, with 1.5 line spacing, 10-12 point font. Include at least one figure, and references (not included in the five page length). Write it as a short research paper, including hypotheses, results, combined discussion/conclusion sections, and suggestions for future research. You will be required to talk to me about your project ideas to get feedback and approval.

Undergraduate assignment 6 (final project): Pick a topic of interest within geomorphology, find and read at least 3 peer-reviewed research papers related to this topic, and write a critical evaluation of these papers. I am less interested in reading a summary of the papers than in a thoughtful analysis of their results. Include a discussion of what overall hypotheses the papers were testing, what assumptions (especially unstated ones) went into their analysis and interpretations, the limitations of their work and proposed areas/approaches for future research on the topic.

Length requirements: 3.5-4 pages. Part of effective scientific writing is expressing ideas effectively yet efficiently. To this end, the minimum and maximum length limits will be enforced, with 1.5 line spacing, 10-12 point font, not including references and figures. Figures (presumably taken from the papers) can be included if they are needed to get your point across effectively, but are not required and might lower your grade if they are deemed to be unnecessary or are minimally discussed in your paper.

Please turn the assignment in on paper, not digitally. Also turn in paper copies of the papers you read and discuss.

Topics: You may choose any topic within geomorphology. It can be something we discussed in class, but does not need to be. Talk to me if you are unsure your topic would qualify, or for additional recommendations. I recommend using library databases to find papers. Web of Science is a good one (available through UT libraries). You can also talk to me about what specific papers might be good on a particular topic. Possible topics could include: feedbacks between bed roughness and sediment transport capacity, glacial erosion models, river channel width (bedrock or alluvial), controls on downstream sediment fining, cosmogenic dating techniques, scaling of drainage area and discharge, models for river avulsions, hillslope sensitivity to climate, etc.

You may pick a topic that is relevant to research that you are conducting. However, (1) all of the writing for this assignment must be new, and (2) at least half of the papers you discuss must be works that you have not read before.

Class participation: Active participation in mandatory field trips is required. While you are not required to come to lectures, you will do better in the class if you do, and I will not feel particularly obligated to help you understand material I presented in class that you missed. Some

lectures will have blackboard components (literally written on the blackboard) that are not part of the digital lectures posted to Blackboard.

Late assignment policy: Assignments will be due in class, and will be considered late once the lecture begins on that day. Each day (24 hour period) that an assignment is late will reduce the maximum attainable grade by 1/2 of a letter. i.e., a perfect assignment 1 day late would be worth 95%, 5 days late 75%, etc. But, the maximum attainable grade will stop decreasing at 60%, which means it will always be worthwhile to turn in late assignments, accepted until class time on the last Wednesday of the semester (May 1).

Working together policy: I encourage you to learn from each other by working together on many aspects of these assignments, including discussing ideas and data analysis. However, I expect everyone to make their own plots and figures, and the content of the final written reports and answers to specific questions must be completed on your own, and should not be similar in wording to other people's work. Everyone must turn in their own separate assignments.

Students with disabilities may request appropriate academic accommodations from the Division of Diversity and Community Engagement, Services for Students with Disabilities, 471-6259.

The two exams, three field trips, and final project/assignment 6 dates are fixed, but other assignment dates and lecture topics may change.

Date	Lecture Topic	Reading	Assignment/field trip
1/14/13	Introduction, History of Geomorphology		
1/16/13	Tectonics	Chapter 2, pp 21-24	
1/18/13	Hillslopes and diffusion	Chapter 10	
1/23/13	Bedrock slope stability		
1/25/13	Weathering 1		
1/28/13	Weathering 2	Chapter 7	
1/30/13	Weathering 3		
2/1/13	Climate, erosion, nonlinear diffusion		
2/4/13	Wildfires and hillslope processes 1		
2/6/13	Wildfires and hillslope processes 2		
2/8/13	Advection/diffusion, valley spacing		Hillslope homework #1 due 2/8
			2/9, Saturday: Field Trip #1
2/11/13	Cosmogenic dating 1	Chapter 6, 131-146	
2/13/13	Cosmogenic dating and hillslope processes		
2/15/13	Other dating techniques		Field trip #1 writeup due 2/15

2/18/13	Debris flows		
2/20/13	Mass wasting	Ch. 10, 330-344	
2/22/13	Mass wasting and valley form		Assignment #2 due 2/22
2/25/13	Bedrock channels 1	Chapter 13	
2/27/13	Bedrock channels 2		
3/1/13	Bedrock channels 3		
			3/2, Saturday: Field trip #2
3/4/13	Review		
3/6/13	**Exam 1**		**Exam 1**
3/8/13	Open channel flow 1	Chapter 12	
3/11 -3/16	Spring Break Week		
3/18/13	Open channel flow 2	Chapter 12	
3/20/13	Open channel flow 3		
3/22/13	Sediment size distributions		Assignment #3 due 3/23
3/25/13	Sediment transport 1	Chapter 14	
3/27/13	Sediment transport 2		
3/29/13	Sediment transport 3		Graduate student final project proposal due
4/1/13	Longitudinal river profiles	Chapter 12	
4/3/13	Hydraulic geometry		
4/5/13	Mountain river morphology 1		Assignment #4 due 4/5
			4/6, Saturday: Field trip #3
4/8/13	Mountain river morphology 2		
4/10/13	Alluvial rivers 1	Chapter 12	
4/12/13	Alluvial rivers 2		
4/15/13	Alluvial rivers 3	Chapter 12	
4/17/13	Floodplains		
4/19/13	Levees and avulsions		River data assignment #5 due 4/19
4/22/13	Tectonics/climate/geomorphology #1	Chapter 3	
4/24/13	Tectonics/climate/geomorphology #1		
4/26/13	Tectonics/climate/geomorphology #1		**Final project/assignment 6 due, 4/26**
4/29/13	Tectonics/climate/geomorphology #1		
5/1/13	Review		Last day late homeworks accepted
5/3/13	**Exam 2**		**Exam 2**

WHY: The NSF-supported Earth Science Literacy Principles: The Big Ideas and Supporting Concepts of Earth Science (www.earthscienceliteracy.org) is a list of nine "big ideas" and seventy-five "supporting concepts" considered to be essential geosciences knowledge. A large fraction of these interdisciplinary ideas are directly relevant to earth surface processes, including linkages between hydrology, ecology, and the land surface, complex feedbacks "within and

between Earth's systems", glacial erosion, and bedrock weathering and sediment transport. Key examples given verbatim from the list include:

Big Idea 4. Earth is continuously changing.

> **4.7 Landscapes result from the dynamic interplay between processes that form and uplift new crust and processes that destroy and depress the crust.** This interplay is affected by gravity, density differences, plate tectonics, climate, water, the actions of living organisms, and the resistance of Earth materials to weathering and erosion.

Big Idea 5. Earth is the water planet.

> **5.6 Water shapes landscapes.** Flowing water in streams strongly shapes the land surface through weathering, erosion, transport, and deposition. Water participates in both the dissolution and formation of Earth's materials.

Big Idea 8. Natural hazards pose risks to humans.

> **8.3 Human activities can contribute to the frequency and intensity of some natural hazards.** These hazards include floods, landslides, droughts, forest fires, and erosion.

Big Idea 9. Humans significantly alter the Earth.

> **9.6 Human activities accelerate land erosion.** At present, the rate of global land erosion caused by human activities exceeds all natural processes by a factor of ten. These activities include urban paving, removal of vegetation, surface mining, stream diversions, and increased rain acidity.