Geomorphology (Geosci/Geog 320). Spring, 2015.

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Course website: Go here and log in to access the password-protected UW Moodle site:
http://ay14-15.moodle.wisc.edu
Material posted there will include the syllabus, lab materials, assigned readings, copies of lecture slides, and an online gradebook.

Overview of the course: Geomorphology is the study of landforms and landscapes and the processes that have shaped them. It is a basic science, driven in part by curiosity about the landscapes in which we live. Geomorphology also has important practical applications, however, and is essential to understanding many natural hazards and many forms of environmental change. An understanding of geomorphic processes is directly relevant to fields such as geotechnical and environmental engineering, sedimentology, soil science, and archaeology. Modern geomorphology is often highly quantitative, but direct observation of processes and landforms in the field is still an essential component of geomorphological research.

In this course, we will generally follow a sequence from process to form, starting with an in-depth look at a particular group of geomorphic processes, followed by discussion of the landforms those processes create and their importance in interpreting long-term landscape development.

Prerequisites. One of the following: Geosci [Geol] 100, 101, 106, 109 or Geog 120, 127. Familiarity with concepts and terminology covered in those courses is assumed.

Field Trips: I plan to hold two required one-day field trips, ***tentatively*** scheduled for 8AM-5PM, April 18 and May 2. We will discuss this in the first week of class to see if there are major conflicts with either of these days. The first trip will allow us to study fluvial and eolian landforms and soils in the field. **Both trips, especially the second, will be an essential part of the material we cover on glacial landforms**.

Lab: Lab exercises provide experience with basic tools used in geomorphology. These include a) visualization and interpretation of landforms and landscapes, using maps, digital elevation models and other GIS data, and remotely sensed images; b) collection of data in the field and lab; c) calculations used to interpret processes and forms from field and lab data; d) use of simple numerical models of geomorphic processes. There is also a **lab project** that you will work on in groups during the last few weeks, with a written report and a brief group presentation to the class. Your lab grade will be based on assignments and the project; there will not be lab exams or quizzes but lab material may be covered in lecture exams.

Grading: There will be a quiz and three exams during the semester, given during regular lecture periods. There will *not* be a final exam during finals week. The course grade will be based on the exams and quiz (65% total), and the overall lab and field trip assignment grade (35%). There is no extra credit. If unavoidable circumstances prevent you from taking an exam, discuss this with the

instructor beforehand, if at all possible, or immediately afterward. Make-up work can only be arranged if this is done in a timely fashion.

The ***exams*** are each focused on material covered in the previous 2.5 to 3.5 weeks of lecture and lab material, plus the required readings. Exam format will be a mixture of multiple choice, short answer, and short essay questions, usually with one to three problems that involve calculations. The ***quiz*** will be similar to the exams in terms of the type and difficulty of questions, but shorter.

Readings. The readings will be available on the course Moodle site. You are responsible for material covered in the required readings, while the optional readings are for additional background if you see a need for it. I have placed the following textbook on reserve: *Process Geomorphology*, by Dale F. Ritter, R. Craig Kochel, and Jerry R. Miller (Prentice Hall, ISBN 0-697-34411-8; Waveland Press, ISBN 13:978-1-57766-461-1). I have assigned a few readings from this text, will be available as pdf files from Library Reserves; beyond those sections, you may want to look at other parts of this book if you want more in-depth information on a topic.

Course Topics and Reading Assignments (*Exam and quiz dates are fixed*; lecture topic schedule may be adjusted as needed).

1/20, 1/22. 1. Introduction to the course and basic tools of geomorphology. Linking landforms and processes. Measuring erosion and deposition, and dating sediments and eroding land surfaces. *Required reading:* Schaetzl and Anderson, *Soils: Genesis and Geomorphology*, pages 596-605 and 612-618. *Notes on the reading:* Background on dating methods.

1/27, 1/29. Weathering and soils. *Required reading, on reserve:* Schaetzl and Anderson, *Soils: Genesis and Geomorphology*, pages 32 through 40. *Notes on reading:* This reading will give you a quick overview of how we describe and interpret soil profiles; much of this should be review if you have had Geog 120 or 127 or a basic soils course. The master horizon definitions covered in Table 3.1 will be discussed *in lab*, and you *are* responsible for knowing these; look over Table 3.2 and Figure 3.5, but you are *not* responsible for the detailed information presented there

2/3 (second part of class period). **Quiz**. Covers lecture and lab material, 1/20 through 1/29.

2/3(first part of class period), **2/5, 2/10.** Hillslope processes, part 1. Mass wasting.

2/12. Hillslope processes, part 2. Infiltration, runoff, and rainsplash. *Required reading, on reserve:* Dunne and Leopold, *Water in Environmental Planning*, pages 255 through 274. *Note on reading:* This is an excellent, straightforward summary of the different types of runoff and where they occur.

2/17, 2/19, 2/24 (first part of lecture)**.** Water flow, erosion, and sediment transport: Basic processes and physical principles.

2/24 (second part of lecture). Hillslope processes, part 3. Slopewash. Hillslope form and development over time.

2/26 Exam 1. Covers lecture and lab material, 2/3 through 2/24.

3/3, 3/5. Fluvial processes, part 1: Channel initiation and drainage network development. Discharge and the hydrograph. Floods and flood frequency. Floodplains. *Required reading, on reserve:* Leopold, L.B., Wolman, M.G., and Miller, J.P., 1964, *Fluvial Processes in Geomorphology*, p. 316-332. *Note on reading:* A detailed discussion of floodplain processes and landforms. The authors had a great deal of influence on how geomorphologists interpret floodplains. The points made here are still valid for many floodplains, although we now know that some streams and their floodplains don't fit this model. *Optional reading, on reserve:* Ritter et al., *Process Geomorphology*, p. 214-225 (start at "Channel Patterns"). *Note on reading:* Covers more or less the same material as the lectures, though with a little different emphasis and organization.

3/10, 3/12. Fluvial processes, part 2: Drainage basin characteristics, climate, tectonics, and sediment yield. *Required reading, on reserve:* Bookhagen, B., Thiede, R.C., and Strecker, M.R. 2005. Abnormal monsoon years and their control on erosion and sediment flux in the high, arid, northwest Himalaya. *Earth and Planetary Science Letters* 231: 131-146. *Note on reading:* A good case study of the effects of climate and tectonics on slope erosion and sediment yield. Also a good example of using a modern analogue to understand past changes in stream behavior. *Some parts of this article are much more important, and I will point those out in lecture. Some of the parts that are* not *that important are highly technical, and I will point those out also so you don't spend too much time on them.*

3/17, 3/19. Fluvial processes, part 3: Aggradation and incision, terraces, response of the alluvial system to climate change and tectonics. Alluvial fans and pediments. *Required reading, on reserve:* Bookhagen, B., Thiede, R.C., and Strecker, M.R. 2006. Holocene monsoonal dynamics and fluvial terrace formation in the northwest Himalaya, India. *Geology* 34: 601-604. *Note on reading:* A good case study of terrace formation, *which will be good background for the lab project.* Some of parts of this article are highly technical but not that important to understand in detail, and I will point those out also so you don't spend too much time on them.

3/24, 3/26. Wind, dunes, and dust: Eolian geomorphology. *Required reading:* Bagnold, R. A. 1941. The Physics of Blown Sand and Desert Dunes. Pages 10-13; 90-92 ("Immobility of Settled Dust and Loess"), and 167-171. *Notes on the reading:* These short excerpts from a classic work of geomorphology should give you a taste of how Bagnold used careful observations of wind-driven sand and dust, in the field and wind tunnels, to ultimately understand the formation of dunes and dust deposits. Understanding Figure 3 and the equations on the lower part of page 171 is *not* important for this course.

4/7. Exam 2. Covers lecture and lab material, 3/3 through 3/26.

4/9, 4/14, 4/16. Coastal processes: Wind-driven waves, currents, tides, coastal erosion, sediment transport in coastal environments. Coastal landforms. *Required readings, on reserve:* 1. Ritter et al., *Process Geomorphology*, p. 264-269 (start at "Deltas"), 2. Nelson, S.A., and Leclair, S.F., 2007, Katrina's unique splay deposits in a New Orleans neighborhood, *GSA Today* 16:4-10. *Note on readings:* Reading 1 provides more depth on the classification of deltas covered in lecture. Reading 2 is a case study combining concepts from fluvial and coastal geomorphology.

4/21, 4/23. Glacial processes: Types of glaciers, mass balance of glaciers, ice flow, erosion, sediment transport, and deposition.

4/28, 4/30, 5/5. Glacial landforms and glaciated landscapes. *Required reading, on reserve:* Dott and Attig, Roadside Geology of Wisconsin, pages 21 through 28.

5/7. Exam 3. Covers lecture and lab material, 4/9 through 5/5.

No exam during final exam week.