Geomorphology (Geol/Geog 320). Fall, 2007.

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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 and the distinctive landforms that occur within them. 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: Geol 100, 101, 106, 109 or Geog 120, 127. Familiarity with concepts and terminology covered in those courses is assumed.

Field Trips: Two one-day, Saturday field trips are required, on Oct. 6 and Oct. 20. *Be ready to leave from Weeks Hall at 8 AM, both days.* Bring a lunch and be prepared for the weather. If you have an unavoidable scheduling contact with either field trip, *let me know early in the semester.*

Lab: Lab exercises provide experience with basic tools used in geomorphology. These include a) field
observations and measurements, b) interpretation of landforms and landscapes from maps, remotely sensed images, and digital elevation models, and c) use of simple numerical models of geomorphic processes. *The lab grade also includes exercises completed during field trips, or with data collected on the field trips.* Because of the Labor Day holiday, the first lab sessions will be on September 10. The TA will provide a schedule of lab exercises.

Textbook (required): *Process Geomorphology*, by Dale F. Ritter, R. Craig Kochel, and Jerry R. Miller (Waveland Press, ISBN 13:978-1-57766-461-1). This textbook is by far the best available, although it can be difficult reading at times because it covers many topics in great depth. The exams and quiz for this course are based mainly on lecture, so use your lecture notes as a guide in deciding which parts of the text are most important for this course. However, reading all of the assigned sections carefully will undoubtedly help you understand course material, and will give you a solid background in many areas of geomorphology. A few other **required readings** will be placed on reserve in the Geography and Geology libraries (and

made available on line whenever possible). You are responsible for material covered in these required readings, and at least a few exam or quiz questions will be drawn from them.

Grading. There will be one 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 (75% total), and the final lab grade (25%). 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.

Exam format will be a mixture of multiple choice, short answer, and short essay questions. The quiz will be similar but shorter. Exam and quiz questions will deal with topics covered in lecture, with a few questions also drawn from required readings. For the second and third exam, part of your grade may be based on a *take-home essay question*, handed out during the exam and due one week later.

Course Topics and Reading Assignments. *Process Geomorphology* refers to the recommended text book.

9/4. Introduction to the course. Overview of geomorphology. Major historical developments and basic concepts. Driving and resisting forces, types of equilibrium, and thresholds. *Process Geomorphology,* Chapter 1 (the discussion of rock composition on page 10 can be skipped).

9/6, 9/11. Dating methods used in geomorphology: Radiocarbon, luminescence, cosmogenic nuclides. . *Required reading, on reserve:* Schaetzl and Anderson, *Soils: Genesis and Geomorphology*, pages 596-605 and 612-618.

9/13. Glacial processes, part 1: Types of glaciers, mass balance of glaciers, and ice flow. *Process Geomorphology:* Chapter 9.

9/18. Quiz (first part of class period)

9/18, 9/20. Glacial processes, part 2: Glacial erosion, sediment transport, and deposition. *Process Geomorphology:* Chapter 10, p. 321-338 (up to "The Depositional Framework).

9/25, 9/27, 10/2. Glacial landforms and glaciated landscapes. *Process Geomorphology:* Chapter 10, p. 338-357 (starting with "The Depositional Framework). *Required reading, on reserve:* Dott and Attig, Roadside Geology of Wisconsin, pages 21 through 28.

10/4. Weathering and soils. *Process Geomorphology:* Chapter 3 (you are *not* required to know the soil classification terminology, covered in "Soil Classification," Tables 3.7 and 3.8, and Fig. 3.17), and Chapter 4, pages 79-92 (up to "Physical Properties of Unconsolidated Debris"). *Required reading, on reserve:* Schaetzl and Anderson, *Soils: Genesis and Geomorphology*, pages 32 through 40 (You *are* responsible for knowing the master horizon definitions covered in Table 3.1; look over Table 3.2 and Figure 3.5, but you are *not* responsible for the detailed information present there).

10/6 (Saturday) Field Trip 1. 8AM to 5PM.

10/9, 10/16 Hillslope processes, part 1. Mass wasting. *Process Geomorphology:* Chapter 4, pages 92-125 (starting with "Physical Properties of Unconsolidated Debris," up to "Slope Profiles").

10/11. Exam 1.

10/18, 10/23. Hillslope processes, part 2. Runoff, rainsplash, slopewash and creep. Hillslope form. *Process Geomorphology:* Chapter 5, pages 137-141 ("Slope Hydrology and Runoff Generation"); Chapter 4, pages 125-133 (starting with "Slope Profiles"). *Required readings, on reserve:* Dunne and Leopold, *Water in Environmental Planning*, pages 255 through 274; Gilbert, *Geology of the Henry Mountains*, pages 99 through 105.

10/20 (Saturday) Field Trip 2. 8AM to 5PM.

10/25, 10/30. Fluvial processes, part 1: Discharge and the hydrograph. Floods and flood frequency. Channel initiation, and drainage network development. Drainage basin characteristics, flood hydrology, and sediment yield. *Process Geomorphology:* Chapter 5 (except the section assigned earlier, pages 137-141 on "Slope Hydrology and Runoff Generation").

11/1, 11/6. Fluvial processes, part 2: In-channel flow, sediment transport, bedforms, and channel patterns. *Process Geomorphology:* Chapter 6, pages 189-225 (up to "Rivers, Equilibrium, and Time;" I will not discuss the material covered in the "Hydraulic Geometry" section, but you can read it for more background).

11/8. Exam 2.

11/13, 11/15. Floodplains, aggradation and incision, terraces, response of the alluvial system to climate change and tectonics. *Process Geomorphology:* Chapter 6, pages 225-231 (starting with "Rivers, Equilibrium, and Time"), Chapter 7, pages 232-247.

11/20. Alluvial fans and pediments. *Process Geomorphology:* Chapter 6, pages 225-231 (starting with "Rivers, Equilibrium, and Time"), Chapter 7, pages 248-264 (up to "Deltas").

11/27, 11/29. Coastal processes and landforms. *Process Geomorphology:* Chapter 13 and Chapter 7, pages 264-269 ("Deltas").

12/4, 12/6. Eolian processes and landforms. *Process Geomorphology:* Chapter 8.

12/11. Summing up, and review.

12/13. Exam 3 (held on last class day).

No exam during final exam week.