Geomorphology
Schedule Fall 2015
GEOL 151 A 91430
GEOG 144 A 92103

(8/14/15 version)

Class meets in ROOM 219 DELEHANTY (M,W, F)
and in the GEOLOGY 3d floor COMPUTER LAB (on occasion)

Class leaders: Paul Bierman and Al Denn, Geology Department and School of Natural Resources.

Professor: Paul Bierman, 307 Delehanty, 656-4411 (office) and (802) 238-6826 (cell), pbierman@uvm.edu

Teaching Assistant: Al Denn, 314 Delehanty, (617) 947-2250 (cell), adenn@uvm.edu

Office hours: Please stop by and see us if you have any questions about the class or class material. Email is the best way to find us!

Paul: Friday, 10:30-11:30 am, Room 307 Delehanty
Al: Monday, 11:00 am -12:00 pm, Room 314 Delehanty

Class Website: All of the readings for this class (except the textbook) as well as other communal resources will be available for viewing and downloading on our 2015 Geomorphology website. Get there by visiting Paul's "classes I teach" site.

http://www.uvm.edu/~pbierman/classes/

or as

http://www.uvm.edu/~geomorph/geol151/2015

There are two of us involved with teaching the course. Paul, as the professor, is leading the class. Al, as part of her master's training at UVM, is co-teaching under Paul's mentorship. You should feel free to come to either of us for advice and assistance.

Textbook*:* (with required readings): Bierman and Montgomery, *Key Concepts in Geomorphology*, you can use either the US print edition available at the bookstore or the on-line edition, downloadable from: http://www.coursesmart.com/ at about half the cost.

Why Geomorphology?

Landscapes surround us all and often seem to be static, unchanging backdrops for our day-to-day activities. Yet, if we begin to look closely, landscapes are anything but static features; they are continually evolving at a variety of time and spatial scales.

So, what then is Geomorphology? It is the study of landscapes, their forms and the history and processes of their development. Geomorphology is one of the most synthetic of all geologic sub-disciplines. Properly done, it must consider any number of processes and Earth characteristics: structure, lithology, tectonics, weathering, hydrology, and in New England, as over most of the world today, humans.

My goal for you as students was best expressed by one of my colleagues, "After this class you'll never look at a landscape the same way again. You'll always stop and wonder how and why the land looks the way it does..."

In 2015, Geomorphology at UVM will be a survey of global surface processes guided by considering sources and sinks of sediment and the processes that move material across Earth's dynamic surface.

Class Schedule and Structure

Monday: 12:00 - 1:15 PM
Wednesday: 12:00 – 4:00 PM
Friday: 12:00 - 1:15 PM

Over the next 15 weeks, we will use a variety of tools and approaches to learn more about Earth's surface. Monday classes will be devoted to a mixture of short quizzes, lecture, activities, and some preparation for Wednesday fieldtrips and labs. Wednesday, we will do lab work and/or take fieldtrips and gather data. On Friday, we will reduce the data that we collected on Wednesday as well as do additional hands-on activities and sometimes have short lectures.

After the first 9 weeks, you and a partner will do a mid-term assignment.

At the end of the 13th week, you and your partner will complete a final assignment that synthesizes the semester's work.

The class will conclude in the middle of the 15th week, after Thanksgiving. Please make sure not to schedule your Thanksgiving break departure before late afternoon on Friday, November 20 and make sure that you are back for Monday November 30 at class time. There is no final examination.

Field Trips

Field trips make up an integral part of this course. All trips will include some amount of walking and sturdy shoes are a necessity. Of course, since it will be fall in Vermont, the weather will be cool and clear but make sure you are prepared for cold, wet conditions. Unless the weather is extreme enough to present a hazard, we will go out in the, rain, fog, snow, and wind. For each trip you MUST have:

waterproof raingear
sturdy footwear
a sweater or fleece for warmth
a waterproof field notebook and pencil
money for bakery and store stops
some food to stave off hunger pangs
hat for sun and for cold
perhaps a small knapsack to carry all this

Expectations And Responsibilities For The Course

Al and I will be responsible for providing you a well-organized, clearly presented view of Earth's surface and how it works. We will strive to have all assignments returned to you in a timely fashion. We will strive to be available to help you with reasonable notice either in person or by email. As long as the email system is functioning or it's not a weekend, you should expect a response within 24 hours to an emailed question.

You will be responsible for completing a variety of assignments including readings over the course of the semester. These readings will mostly be in the textbook, which we expect you to purchase (it's very reasonably priced as an ebook). Other readings will be posted to the class web site as PDF files for you to download.

Attendance in class is expected. If you know in advance that you will miss a class, please let us know ahead of time. Also, we will abide by the Arts and Sciences guidelines for classroom behavior. Respect and courtesy are top priorities.

Group Projects

There are two projects in the class that serve to help you synthesize your learning and present what you know. Both projects will be done in pairs (two students working together) and the projects will build one upon the other.

The first project will be done over the week of November 2 and submitted electronically November 6 by the end of class time. The second project will be submitted December 4 by the end of class time (also electronically) and presented to your peers on December 7 during class.

The projects will both be presented as concept sketches, which are annotated illustrations in which the annotations explain both form and process.

The first project will focus on how sediment moves from source to sink. The second project will build on the first and consider landscapes from a broader overview including interactions with climate and tectonics. Detailed instructions as well as the rubrics we will use to evaluate the projects will be posted on the downloads subpage of the class webpage.

Course Goals

We have structured both the classroom and field portions of this course to give you the best chance of achieving the following broader goals by the end of the class.

- Understand and be able to interpret landscapes in terms of both geologic history and surface process,
- Predict how a landscape will respond to both human and natural perturbations,
- Experience the power of peer review and revision in the production of high-quality scientific presentations,
- Master data collection techniques with wide application including surveying and GPS,
- Increase your ability and comfort with quantitative calculations,
- Improve your ability to collect quantitative and qualitative field data in adverse conditions,
- Recognize the value of simple models to represent physical systems and apply such models to data we collect or situations we observe,
- Improve your ability to reduce field data and write meaningful summaries of your observations.

Grading

Field trip reports and lab exercises (drop lowest or missed lab)	35%
Mid semester Project	20%
Final Project (including revision of mid semester project)	30%
Weekly quizzes (drop lowest or missed)	15%

Al will be grading your laboratory assignments and quizzes. Al and I will both grade your projects independently and arrive at a consensus grade.

Assignment due dates and late assignments: **All readings are due** at the start of class (12:00) on Monday or the first class of the week if Monday is a holiday. All **lab assignments are due on Wednesday.** Lab assignments handed in after class starts on Wednesday will lose 10% of their grade. Assignments handed in any time on Thursday will lose 20% of their grade. Assignments handed in on Friday will lose 30% of their grade. Without permission of the instructors obtained ahead of time, assignments will not be accepted after Friday's class (this is so we can grade and return all lab assignments by Monday). Projects will lose 10% of their grade if they are handed in late and an additional 10% for every extra day late – please be in touch before things are late so we can make alternate arrangements with you.

Quizzes will be given, usually at the start of the first class of the week. They will be short answer (5-10 minutes) and will be taken verbatim from the *Knowledge Assessments* at the end of the assigned chapter of Bierman and Montgomery. To do well on the quizzes, you should make sure that you can answer each of the *Knowledge Assessment* questions..

Semester Schedule

Readings for each week are listed below and available for download on the class web site or in the textbook, *Key Concepts in Geomorphology*.

Week 1. Getting started (August 31, September 2 and 4)

This week we will get to know each other, learn what Geomorphology is all about, and start learning to describe Earth's surface.

Monday – Introductions
Wednesday – Mapping the world, Geomorphology and scale
Friday – What is Geomorphology? What are concept sketches? Quiz 1 on reading.

Readings:

- *Bierman and Montgomery, Key Concepts in Geomorphology, Chapter 1 (due Friday)*

Week 2. Geomorphology Tool Kit (September 9 and 11)

Geomorphologists use a variety of tools to understand Earth's surface both qualitatively and quantitatively. We will review those tools this week and apply some of them to geomorphic problems.

Monday – NO CLASS – Labor Day
Wednesday – Surveying and GPS, introduction and practice.
Friday – Geochronologic techniques. Quiz 2 on reading.

Readings:

- *Bierman and Montgomery, Key Concepts in Geomorphology, Chapter 2.*

Week 3. River and Stream Channels (September 14, 16, and 18)

We will learn how rivers and river channels are categorized and how they work. Rivers move water and sediment and that movement can be quantified. We will measure flow and collect data needed to model the amount and speed of flow under different conditions.

Monday – Introduction to river landforms and processes. Quiz 3 on reading.
Wednesday – Measuring flow
Friday – Reducing river flow data

Readings:

- *Manual of Field Hydrology Chapter, Chapter 3*
- *Bierman and Montgomery, Key Concepts in Geomorphology, Chapter 6*

Week 4. Geomorphic Hydrology (September 21, 23, and 25)

Water is a prime shaper of the landscape. It flows over and into the landscape following various flow paths at different rates. This week, we will measure the rate at which water infiltrates into soils and examine different flow paths.

Monday – Introduction to hillslope hydrology. Quiz 4 on reading.
Wednesday – Infiltration measurements
Friday – Infiltration data reduction

Readings:

- *Bierman and Montgomery, Key Concepts in Geomorphology, Chapter 4*

Week 5. Slopes (September 28, 30, and October 2)

Slopes, and the materials of which they are made, are amenable to measurement and modeling, both physical and mathematical. We'll do both, including doing a controversial experiment.

Monday – Introduction to slope processes and slope models. Quiz 5 on reading.
Wednesday – Field data collection and mathematical modeling
Friday – Physical modeling, beans!

Readings:

- Hillslope Evolution by Bedrock Landslides, Alexander L. Densmore, *et al*., *Science* ***275****, 369 (1997)* and *Reply* by Alto et al.
- *Bierman and Montgomery, Key Concepts in Geomorphology, Chapter 5*

Week 6. Weathering and Soils (October 5, 7, and 9)

Soils are a marker of time on the landscape. Knowing how they form and how they change can allow you to decipher landscape history.

Monday – Introduction to weathering. Quiz 6 on reading.
Wednesday – Huntington River terrace soils
Friday – Soils and soil data reduction

Readings:

- *Bierman and Montgomery, Key Concepts in Geomorphology, Chapter 3*.
- *Bierman, Henry's Land, (download from class website)*

Week 7. Drainage Basins (October 12, 14, and 16)

Rivers and the water in them leave a mark on the landscape. Reading the clues that rivers leave behind, we can ferret out the history of the land and of the response of channels to changing boundary conditions including climate and base level.

Monday – Introduction to drainage basins and change over time. Quiz 7 on reading.
Wednesday – Huntington River terraces
Friday – Terrace data reduction

Readings:

- Late Pleistocene-Holocene History: Huntington River and Miller Brook Valleys, Northern Vermont, Wright et al., p. C4-12 to C4-28
- *Bierman and Montgomery, Key Concepts in Geomorphology, Chapter 7*

Week 8. Coastal and Marine Geomorphology (October 19, 21, and 23)

Coastal environments are geomorphically active and are the sink for sediments that have moved across the landscape.

Monday – Coastal and marine geomorphology. Quiz 8 on reading.
Wednesday – No class, Paul at NSF
Friday – No class, Paul at NSF

Readings:

- *Bierman and Montgomery, Key Concepts in Geomorphology, Chapter 8*

Week 9. Glaciers and Climate (October 26, 28, and 30) Paul gone FRIDAY 30th

Glaciers are powerful geomorphic agents; they can move sediments, shape landscapes, and sculpt Earth's surface over long timescales. This week we will explore how glaciers act as agents of geomorphic change and how Earth's climate regulates glaciation.

Monday – Glaciers and glacial landforms. Quiz 9 on reading.
Wednesday – Glacial and coastal landforms field trip
Friday – No Class, Paul at GSA meeting

Readings:

- *Bierman and Montgomery, Key Concepts in Geomorphology, Chapters 9 and 13*

Week 10. Project preparation week (November 2, 4, and 6)

This week, you will work with a partner of your choosing to design and complete the mid-term concept sketch. Your concept sketch will be due at the end of class time on Friday, November 6. Paul and Al at GSA meeting and available for help by email.

Monday – Work on concept sketch poster with partner.
Wednesday – Work concept sketch poster with partner.
Friday – Hand in concept sketch electronically at end of class time.

Week 11. Volcanic Geomorphology (November 9, 11, and 13)

Volcanoes are dynamic landforms that influence geomorphology both near and far. This week we will consider both the direct and indirect effects of volcanic eruptions on Earth's surface.

Monday – Introduction to volcanic geomorphology. Quiz 10 on reading.
Wednesday – Mt. St. Helens exercise and air photographs
Friday – Poster give backs, 10 minutes per group

Readings:

- *Bierman and Montgomery, Key Concepts in Geomorphology, Chapter 11*
- *Potential hazards from future eruptions of Mount St. Helens Volcano, Washington, 1978, Crandell et al. USGS Bulletin: 1383-C*

Week 12. Tectonic Geomorphology (November 16, 18, and 20)

Solid Earth processes strongly influence geomorphology and the shape of landscapes. This week we will consider not only the influence of plate tectonics on landscapes but also the effects of isostatic response to erosion and glaciation.

Monday – Plate tectonics and geomorphology. Quiz 11 on reading.
Wednesday – Neotectonic analysis of landscapes.
Friday – Isostatic response and landscape development.

Readings:

- *Bierman and Montgomery, Key Concepts in Geomorphology, Chapter 12*

Week 14. Thanksgiving Break (November 23, 25, and 27)

NO CLASS

Week 13. Landscape Evolution (November 30 and December 2 and 4)

We will bring together the semester by considering the factors that drive the evolution of landscapes and will review the tools used to estimate the rate at which landscapes evolve over time.

Monday – Landscape evolution and humans as a geomorphic agent. Quiz 12 on reading.
Wednesday – Fieldtrip to cosmogenic laboratory; review of isotopic means of determining rates of landscape change.
Friday - Poster due electronically on December 4th at end of class time.

Readings:

- Hooke, R. L., 1994, *On the efficacy of humans as geomorphic agents*: GSA Today, v. 4, no. 9, p. 217, 224-225.
- Hooke, R. L., 2000, *On the history of humans as geomorphic agents*: Geology, v. 28, no. 9, p. 843-846.
- *Bierman and Montgomery, Key Concepts in Geomorphology, Chapter 14*

Week 15. Final Project Presentation and give back (December 7 and 9)

This week you will present your poster in a public poster session on Monday and then we will meet with each team on Wednesday to give back their graded posters and discuss the posters.

Monday – Poster Presentation with revised poster.
Wednesday – Giveback of posters (10 minute slots)
