Geomorphology
Schedule Fall 2014
GEOL 151 A 91575
GEOG 144 A 92401

(8/19/14 version)

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

Class leaders: Paul Bierman and Lee Corbett, Geology Department and School of Natural Resources.

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

Co-faculty: Lee Corbett, 314 Delehanty, (802) 380-2344 (cell), Ashley.Corbett@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
Lee: Monday, 9:30-10:30 am, 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 2014 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/geol151/2014

There are two of us involved with teaching the course. Paul, as a professor, is leading the class. Lee, as part of her doctoral training at UVM, is co-teaching with Paul and under his close 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 2014, Geomorphology at UVM will be a new course, 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: 11:45 AM - 1:15 PM  
Wednesday: 11:45 AM - 3:50 PM  
Friday: 11:45 AM - 1:15 PM  

Over the next 14 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 8 weeks, you and a partner will do a mid-term assignment.

After 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, just after Thanksgiving. Please make sure not to schedule your Thanksgiving break departure before late afternoon on Friday, November 21 and make sure that you are back for Monday December 1 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.

Expected And Responsibilities For The Course

Lee 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 October 20 and submitted electronically October 24 by the end of class time. The second project will be submitted November 21 by the end of class time (also electronically) and presented to your peers on December 1 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 are 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

Fieldtrip 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%

Lee will be grading your laboratory assignments and quizzes. Lee 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 (11:45) 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 27 and 29; Paul leads)**

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

Monday – NO CLASS  
Wednesday – Mapping the world, Geomorphology and scale, Introductions  
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 3 and 5; Lee leads)**

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  
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. Slopes (September 8, 10, 12; Paul leads)**

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 3 on reading.  
Wednesday – Field data collection and mathematical modeling  
Friday – Physical modeling, beans!

Readings:  
  - *Bierman and Montgomery, Key Concepts in Geomorphology, Chapter 5*
**Week 4. Drainage Basins (September 15, 17, and 19; Paul leads)**

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 4 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 5. Weathering and Soils (September 22, 24, and 26; Lee leads)**

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 5 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 6. Geomorphic Hydrology (September 29, October 1 and 3; Paul leads)**

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 6 on reading.  
Wednesday – Infiltration measurements  
Friday – Infiltration data reduction  

Readings:  
- *Bierman and Montgomery, Key Concepts in Geomorphology, Chapter 4*
Week 7. River and Stream Channels (October 6, 8, and 10; Lee leads)

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 7 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 8. Coastal and Marine Geomorphology (October 13, 15, and 17; Paul leads)

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

Monday – Introduction to coastal and marine geomorphology. Quiz 8 on reading.
Wednesday – Coastal field trip
Friday – Continued coastal and marine geomorphology

Readings:
• Bierman and Montgomery, Key Concepts in Geomorphology, Chapter 8

Week 9. Project preparation week (October 20, 22, and 24)

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, October 24.

Monday -- Work on concept sketch poster with partner. Paul and Lee at GSA meeting and available for help by email.
Wednesday -- Work concept sketch poster with partner. Paul and Lee at GSA meeting and available for help by email.
Friday – Hand in concept sketch electronically at end of class time.
Week 10. Glaciers and Climate (October 27, 29, and 31; Lee leads)

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 – Introduction to glaciers and glacial landforms. Quiz 9 on reading.
Wednesday – Glacial sediments and landforms field trip
Friday – Glaciers and climate

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

Week 11. Volcanic Geomorphology (November 3, 5, and 7; Paul leads)

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 – Basaltic volcanic hazard exercise, Iceland and Hawaii

Readings:
- Bierman and Montgomery, Key Concepts in Geomorphology, Chapter 11

Week 12. Tectonic Geomorphology (November 10, 12, and 14; Paul leads)

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.

- Bierman and Montgomery, Key Concepts in Geomorphology, Chapter 12
Week 13. Landscape Evolution (November 17, 19, and 21; Paul leads)

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 November 21st at end of class time

Readings:
• *Bierman and Montgomery, Key Concepts in Geomorphology, Chapter 14*

Week 14. Thanksgiving Break (November 24, 26, and 28)

NO CLASS

Week 15. Final Project Presentation and give back (December 1 and 3)

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)