

**Geomorphology
Schedule Fall 2013
GEOL 151 A 91729**
(8/20/13 version)

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

Class leaders: Paul Bierman and Thomas Neilson, Geology Department and School of Natural Resources.

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

Graduate Teaching Assistant: Thomas Neilson, 314 Delehanty, 656-3398 (office) and tneilson@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

Thomas: Monday, 9:00-10:00, Room 314 Delehanty

Class Website: All of the readings for this class (except the e-textbook) as well as other communal resources will be available for viewing and downloading on our 2013 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/geol151/2013>

There are two of us involved with teaching the course. Paul, as a professor, is leading the class. Thomas Neilson is the Graduate Teaching Assistant. You should feel free to come to any of us for advice and assistance. Ben DeJong, a doctoral student who has taught GEOL 151 before, will be teaching part of the class under Paul's mentoring when Paul is out of town.

Textbook: (with required readings): Bierman and Montgomery, *Key Concepts in Geomorphology*, on-line edition, download from: <http://www.coursesmart.com/>

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 2013, Geomorphology at UVM will focus on rivers and hillslopes, the elements that make up just about every sub-aerial landscape of the world.

Class Schedule and Structure

Monday: 11:45 AM - 12:35 PM
Wednesday: 11:45 AM - 4:50 PM
Friday: 11:45 AM - 1:35 PM

Over the next 12 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.

After the first 5 weeks, you and a partner will do a mid-term assignment.

After the 10th week, you and your partner will complete a final assignment that synthesizes the semester's work.

The class will conclude at the end of the 12th week, just before Thanksgiving. Please make sure not to schedule your departure before late afternoon on that Friday, November 22. 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

Thomas 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 be posted to the class web site as PDF files for you to download or as part of the e-textbook, which we expect you to purchase (it's very reasonably priced).

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 7 and submitted October 11 at the start of class. The second project will be done at the end of class (week of November 11) and presented to your peers on November 22 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 river systems and riverine landscapes work. The second project will build on the first and explain both how rivers and hillslopes work and how they interact through hydrologic processes and sediment movement.

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 the landscape of Vermont in which you live 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 reports and 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	30%
Weekly quizzes (drop lowest or missed)	15%

Thomas will be grading your laboratory assignments and quizzes. Thomas 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 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, which should be purchased from coursesmart.com.

Week 1. Getting started (September 4 and 6)

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

Monday – Labor Day NO CLASS

Wednesday – Mapping the world, Geomorphology and scale, Introductions

Friday – What is Geomorphology? and 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, 11, 13)

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 – Survey lecture and intro. Quiz 2 on reading.

Wednesday – Surveying.

Friday – Reducing survey data.

Readings:

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

Week 3. River Morphology and Process (September 16, 18, and 20)

We will learn how rivers and river channels are categorized and how they work. We will float the Winooski River to see relevant river landforms and collect data.

Monday – Fluvial landforms and processes. Quiz 3 on reading.

Wednesday – Floating the Winooski

Friday – Reducing float trip data

Readings:

- *Bierman and Montgomery, Key Concepts in Geomorphology, Chapter 6*
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Week 4. River Flow and Fluxes (September 23, 25*, and 27*)

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. *Paul at NSF workshop linking climate change and landscape impact; Thomas will be leading class and lab Wednesday and Friday.

Monday – Introduction to River flow. Quiz 4 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 7*
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Week 5. River History (September 30, October 2, and 4)

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 riverine change over time. Quiz 5 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
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Week 6. Mid-term Report Preparation (October 7, 9, and 11)

This week, you will work with a partner of your choosing to design and complete a concept sketch that details the morphology, history, and processes of rivers as you have come to know them. Your concept sketch will be due at the start of class time on Friday, October 11.

Monday -- Work on concept sketch poster with partner. Paul and Thomas available for consultation at start of class time.

Wednesday -- Work concept sketch poster with partner. Paul and Thomas available for consultation at start of class time.

Friday – Hand in concept sketch at START of class time.

Week 7. Soils (October 14, 16 and 18*)

Soils are a marker of time on the landscape. Knowing how they form and how they change can allow you to decipher landscape history. *Paul and Thomas in Scotland, Ben leading data reduction on Friday.

Monday – Introduction to soils and geomorphology. Quiz 6 on reading.

Wednesday – Huntington River terrace soils

Friday – Soils data reduction*

Readings:

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

Week 8. Hillslope Hydrology (October 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. *Paul and Thomas in Scotland, Ben leading class on Monday.

Monday – Introduction to hillslope hydrology. Quiz 7 on reading.

Wednesday – Infiltration measurements

Friday – Infiltration data reduction

Readings:

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

Week 9. Hillslope Failures (November 1)

Hillslopes are the shape of the Earth and the source of sediment to rivers. We will examine slopes where mass movements are occurring and take measurements to calculate slope stability.

Monday – No class, Paul and Thomas at GSA

Wednesday – No class, Paul and Thomas at GSA

Friday – Introduction to slope processes

Readings:

- *Bierman and Montgomery, Key Concepts in Geomorphology, Chapter 5*

Week 10. Hillslope Modeling (November 4, 6, and 8)

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 – Review of slope models. Quiz 8 on reading.

Wednesday – Field data collection and mathematical modeling

Friday – Physical modeling

Readings:

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

Week 11. Draft Final Poster Preparation - (November 11, 13, and 15)

This week, you and your partner will amend the poster you made for your first group project, adding additional information related to hillslope geomorphology and revising your riverine information based on the reviews of your first submission.

Monday and Wednesday – work on poster during class time

Friday - poster due November 15th at START of class time

Week 12. Human impact, field trip to poster area, final poster preparation and presentation (November 18, 20, and 22)

This week we will review human impact, go to the field and see the site that your poster covers, and you will make final revisions to your poster based on our feedback on your draft. You will present your poster during Friday afternoon's class period.

Monday – Humans as a geomorphic agent

Wednesday – Fieldtrip to poster site; draft final posters returned

Friday – Poster Presentation with revised poster.

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.