Geomorphology
Schedule Fall 2011
GEOL 151 A 92825

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

Class leaders: Paul Bierman and Ben DeJong, Geology Department and School of Natural Resources.

Paul: 307 Delehanty, 656-4411 (office) and (802) 238-6826 (cel), pbierman@uvm.edu
Ben: 314 Delehanty, 656-3398 (office) and 435-760-5440 (cel), bdejong@uvm.edu

Office hours: Please stop by and see us if you have any questions about the class or class material.

Paul: Friday, 10:30-11:30 am, Room 307 Delehanty
Ben: Monday, 10:00-11:00 am, Room 314 Delehanty

Class Website: All of the readings for this class as well as other communal resources will be available for viewing and downloading on our 2011 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/geol151/2011/

You will notice that there are two of us involved with teaching the course. Paul, as a professor, is leading the class. Ben DeJong, a doctoral student, will be teaching several classes under Paul's mentoring and when Paul is out of town. You should feel free to come to either of us for advice and assistance.

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. I'll argue that 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 2011, 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 6 weeks, we will take a break from class while Paul is at the Geological Society of America National Meeting and you and a partner will do a mid-term assignment.

After the 11th week, you and the different partner will complete a final assignment that synthesizes the semester's work.

The class will conclude at the end of the 12th week, on November 18. There is no final examination.

Special Dates:

Friday, Sept. 30th through Sunday, October 2nd the New England Intercollegiate Geological Conference will be run out of Middlebury, Vermont. There are geomorphology related fieldtrips each of the three days. I strongly encourage you to attend at least one of the trips.

On **Monday October 3^{d}**, Dylan Rood, a geomorphologist from UC Santa Barbara will be presenting in the UVM Geology seminar series, 4:15-5:15. Attendance is required unless you have a class scheduled at this time. I will provide you a paper of Dylan's to read before the talk. There will be **dinner** at my house (86 Brookes, right after the talk, 863-3609) for everyone afterwards during which we'll talk about one of Dylan's papers and you can speak to him about his career and science interests.

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

Ben 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.

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 10 and submitted October 14 at class time. The second project will be done at the end of class (week of November 14) and presented to your peers on November 18 during class. Please make sure to schedule your Thanksgiving departure after Friday's 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 as well as considering a glacial overprint to the landscape.

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 you 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,

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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%

Ben will be grading your laboratory assignments and quizzes. Ben and I will both grade your projects.

Assignment due dates and late assignments: **All lab assignments and readings are due** at the start of class (1145 pm) on Monday or the first class of the week if Monday is a holiday. Assignments handed in after class starts on Monday will lose 10% of their grade. Assignments handed in any time on Tuesday will lose 20% of their grade. Without permission of the instructors obtained ahead of time, assignments will not be accepted after Tuesday evening (this is so we can grade and return all assignments by Friday).

Quizzes will be given at the start of the first class of the week. They will be short (5 minutes) and will be taken verbatim from the knowledge surveys for each chapter of Bierman and Montgomery. To do well on the quizzes, you should make sure that you can answer each of the knowledge survey questions!

Semester Schedule

Readings for each week are listed below and available for download on the class web site. There is no book to purchase.

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

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.

Wednesday – About Geomorphology and introductions
Friday – Quiz on reading, Mapping the world, Geomorphology and scale, and concept sketches

Readings:

- *Bierman and Montgomery, Key Concepts in Geomorphology, Chapter 1.*

Week 2. Geomorphology Tool Kit (September 7 and 9)

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 – Tools geomorphologists use. Quiz 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 12, 14, and 16)

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

Monday – Fluvial landforms and processes. Quiz on reading.
Wednesday – Floating the Winooski
Friday – Reducing float trip data

Readings:

- *Bierman and Montgomery, Key Concepts in Geomorphology, Chapter 6*

Week 4. River Flow and Fluxes (September 19, 21, and 23)

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 flow. Quiz on reading.
Wednesday – Measuring flow (Ben)
Friday – Reducing river flow data (Ben)

Readings:

- *Manual of Field Hydrology Chapter, Chapter 3*
- *Bierman and Montgomery, Key Concepts in Geomorphology, Chapter 7*

Week 5. River History (September 26, 28, and 30)

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 (Ben). Quiz 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 6. Soils (October 3, 5, and 7)

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 soils and geomorphology. Quiz on reading. Talk by Rood at 415 and dinner at Paul's house after the talk.
Wednesday – Huntington River terrace soils
Friday – Soils data reduction

Readings:

- *Bierman and Montgomery, Key Concepts in Geomorphology, Chapter 3.*
- *Bierman, Henry's Land, 47-56*
- *Dylan H. Rood, Douglas W. Burbank, Robert C. Finkel, Spatiotemporal patterns of fault slip rates across the Central Sierra Nevada frontal fault zone.*

Week 7. Mid-term Report Preparation (October 10, 12 and 14)

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 class time on Friday, October 14.

Monday -- Work on concept sketch poster with partner
Wednesday -- Work concept sketch poster with partner
Friday – Hand in concept sketch at class time

Week 8. Hillslope Hydrology (October 17, 19, and 21)

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 on reading.
Wednesday – Infiltration measurements
Friday – Infiltration data reductions

Readings:

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

Week 9. Hillslope Failures (October 24, 26, and 28)

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 – Introduction to slope processes. Quiz on reading.
Wednesday – Landslide field trip.
Friday – Landslide data reduction.

Readings:

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

Week 10. Glacial Geomorphology (October 31, November 2, and 4)

Monday – Review of glacial form and processes. Quiz on reading.
Wednesday – Glacial features of the Champlain lowland and Green Mountains
Friday – Modeling of glaciers

Readings:

- *Bierman and Montgomery, Key Concepts in Geomorphology, Chapter 9*

Week 11. Hillslope Modeling (November 7, 9, and 11)

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 on reading.
Wednesday – 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 12. Summary Preparation and Presentation (November 14, 16, and 18)

The first part of this week will be spent working with your partner to prepare a poster that is your concept sketch of how rivers and hillslopes work and how they interact. You will present your poster during Friday afternoon's class period.

Monday – Work on Poster with partner
Wednesday -- Work on Poster with partner
Friday -- Poster Presentation (Delehanty lobby)