Geomorphology
Schedule Fall 2020
(8/29/20 version)

Class meets online using Teams

Class leaders:

Paul Bierman, pbierman@uvm.edu, Bella Bennett, isabella.bennett@uvm.edu, Chris Halsted, Christopher.Halsted@uvm.edu

Class Website: https://site.uvm.edu/geomorphology/

Textbook*:* (with required readings, you must have the book for the class) Bierman and Montgomery, *Key Concepts in Geomorphology*, SECOND EDITION. You can use either the US print edition available at the bookstore or from on line retailers. Beware overseas sellers…it can take months to get your book! Edition 1 is obsolete. Please don't order it.

Here are the details: Key Concepts in Geomorphology
Second Edition 2020
Paul R. Bierman; David R. Montgomery

Book can be purchased or rented from:
https://store.macmillanlearning.com/us/product/Key-Concepts-in-Geomorphology/p/1319059805

Why Geomorphology?

Landscapes surround us 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 2020 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. We will focus on local examples.

Class Schedule and Structure

Mush of class will be asynchronous but you will learn more and do better if you join us for Team's meetings on Wednesday and Friday (review sessions).

Monday: 12:00 - 1:15 PM (mostly asynchronous)
Wednesday: 12:00 – 4:00 PM (faculty available on Teams 12-2 pm ET)
Friday: 12:00 - 1:15 PM (faculty available on Teams 12-1230 pm ET)

Over the next 15 weeks, we will use a variety of tools and approaches to learn more about Earth's surface. Monday classes will usually be asynchronous lectures. Wednesday, we will do lab work and gather data. On Friday, we will reduce the data that we collected on Wednesday as well as do additional hands-on activities to build web portfolios. On Wednesday and Friday, at least one and usually two or three faculty will be available on Teams at the start of class time. We expect everyone to join us for a review session on Friday from 12-12:30 on Teams.

Expectations and Responsibilities for the Course

We are 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 by email. As long as the email system is functioning and it is 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 so that you have your own copy to read and work with. Other readings will be posted to the class web site as PDF files for you to download. We will abide by the Arts and Sciences guidelines for behavior. Respect and courtesy are top priorities.

Course Goals

We have structured 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,
- Increase your ability and comfort with quantitative calculations,
- Recognize the value of simple models to represent physical systems, and
- Improve your ability to collect data and write meaningful summaries
- Grow comfortable creating webpages to express your findings.

Assessment

30% Weekly quizzes on Blackboard (we drop the lowest of 11 quizzes)
10% Rough draft of final paper
10% Final draft of final paper
45% web pages (we drop the lowest of 11 webpages)
5% critical reviews of other group's papers

Assignment due dates and late assignments: Due dates are stated below. Assignments will lose 10% for each day they are late. After 3 days, they will not be accepted unless you have contacted one of us ahead of time.

Quizzes will be short answer (15 minutes) and questions 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. Quizzes not taken by Friday midnight will get a zero unless arrangements have been made well ahead of time.

All written work will be graded with rubrics we will publish on the class website.
Any issues with grading should first be taken up with Bella and Chris. If that does not resolve the issue, Paul will make the final determination.

Honesty matters (UVM academic integrity code)

1. **Students may not plagiarize.**
   All ideas, arguments, and phrases, submitted without attribution to other sources must be the creative product of the student. Thus, all text passages taken from the works of other authors (published or unpublished) must be properly cited. The same applies to paraphrased text, opinions, data, examples, illustrations, and all other creative work. Violations of this standard constitute plagiarism.
2. **Students may not fabricate.**
   All experimental data, observations, interviews, statistical surveys, and other information collected and reported as part of academic work must be authentic. Any alteration, e.g., the removal of statistical outliers, must be clearly documented. Data must not be falsified in any way. Violations of this standard constitute fabrication.
3. **Students may work cooperatively, but not collude.**
   Students are encouraged to collaborate on academic work within any limits that may be prescribed by their instructors. Students may only provide, seek or accept information about any academic work that will be submitted for a grade, to or from another student, with the authorization of the instructor. Violations of this standard constitute collusion.
4. **Students may not cheat.**
   Students must adhere to the guidelines provided by their instructors for completing academic work. Students may not claim as their own work any portion of academic work that was completed by another person. Students may only use materials approved

by their instructor when completing an assignment or exam. Students may not present the same (or substantially the same) work for more than one course or within the same course without obtaining approval from the instructor of each course. Students must adhere to all course reserves regulations. Students may not act dishonestly or convey information that the student knows or should know to be false, by actions such as lying, forging or altering any document or record in order to gain an unfair academic advantage. Violations of this standard constitute cheating.

OURS IS AN INCLUSIVE CLASSROOM

We are committed to the creation of a virtual classroom where everyone will be treated with respect and dignity and where all individuals are provided equitable opportunity to participate, contribute, and succeed. All students are welcome in Geomorphology regardless of race/ethnicity, gender identities, gender expressions, sexual orientation, socio-economic status, age, disabilities, religion, regional background, Veteran status, citizenship status, nationality and other diverse identities that we each bring to class. The success of our inclusive classroom relies on the participation, support, and understanding of you and your peers. We encourage you to speak up and share your views, but also understand that you are doing so in a learning environment in which we all are expected to engage respectfully and with regard to the dignity of all others. Any student who has difficulty affording groceries or who lacks a safe and stable place to live, is ill or is caring for ill family members, and believes this may affect their performance in the course is urged to contact any of us who are teaching for help. If you have any questions or concerns do not hesitate to raise them with us. We are here to help you learn!

1. Week of August 31 - Earth's Dynamic Surface, introductions, and webpage portfolio

M - Quick Intro (synchronous). Paul and GTFs will introduce themselves and the course philosophy and format. Everyone in the class will do a short (30 second) intro so we can get to know each other.

W - Web page portfolio set up and first page, all about you (asynchronous with help available on class Teams channel from 12-2 pm ET). You need to create a web page using Goggle sites or Wordpress or whatever program you prefer. The main page should have the title *UVM Geomorphology* and your name and an image of Earth's surface with a caption and credit line (always credit images on your pages). Then set up a second page, entitled *About Me*, and link it to your main page. Write a paragraph about you. Include your name, what you like to do, and why you are taking this class. Add a 60-90 second video introducing yourself! Make sure permissions are set so all yours page is viewable by the public and send all three of us the URL for your main page. We will link everyone's pages to the main class page so you can see what your classmates are doing and learn from them.

F - Earth's Dynamic Surface Lecture (asynchronous); review session, 1200-1230 (Teams), strongly suggest your attendance!

Assignments due by Friday midnight
Reading: Chapter 1 in Key Concepts, second edition
Quiz 1 on blackboard (about the lecture and reading)
Webpage, *About Me*
Public webpage URL sent to Paul, Bella and Chris

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2. Week of September 7 – History and philosophy of Geomorphology

W - History and Philosophy of Geomorphology Lecture (asynchronous)

F - Investigation of a Geomorphologist (web page) – After listening to lecture and reading history of Geomorphology chapter, find a geomorphologist about whom you want to learn more. This should NOT be a person from lecture or the reading. Read about this person's life, check out the papers they have written (Google Scholar is a great place to start), read at least two of their papers, and then create your third web page and title it, *A Geomorphologist*. Your page should have a photo of the person, their name, a first paragraph summarizing the science they did over their career, and second paragraph describing why you find their work interesting. Then, give citations for the two papers you read followed by a short summary (several sentences) of each; review session, 1200-1230 (Teams), strongly suggest your attendance!

Assignments due by Friday midnight
Reading: Chapter 2 in Key Concepts, second edition
Quiz 2 on blackboard (about the lecture and reading)
Webpage, *A Geomorphologist*

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3. Week of September 14 - Geomorphologist's Tool Kit (week 1)

M - Measuring Topography Lecture (asynchronous)

W - Mapping changing landscapes. We will be investigating landslides right near campus using remote sensing data and newspaper clippings. More details will follow. Asynchronous with help available on class Teams channel from 12-2 pm ET.
For an intro, view: https://www.wcax.com/content/news/WCAX-Investigates-Properties-in-peril-564760921.html
For maps, view:
https://uvm.maps.arcgis.com/apps/webappviewer/index.html?id=a85eccbf367944dca2d9ed01865f616e

F - Time line of Riverside Avenue topography changes (web page). Create a new web page and title it, *Riverside Avenue Topography*. Using the analysis you did on Wednesday, create a graphical time line in whatever form you think most effectively that details the topography changes that have occurred along Riverside Avenue. Be creative! Write two paragraphs describing what happened along Riverside Avenue and when and add these to your webpage. Don't worry yet about why these changes happened yet. We will get to that; review session, 1200-1230 (Teams), strongly suggest your attendance!

Assignments due by Friday midnight
Reading: Chapter 3 in Key Concepts, second edition
Quiz 3 on blackboard (about the lecture and reading)
Webpage, *Riverside Avenue Topography*

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4. Week of September 21 – Landscape Change over time

M - Using Photographs to Detect Landscape Change Lecture (asynchronous)

W - Rephotography of Riverside Avenue. You will be provided several (2-4 images) of Riverside Avenue. Your assignment is to figure out exactly where these images were taken and to reshot them from the same location. Then, upload your reshot images to the Lanscape Change Website (uvm.edu/landscape). Asynchronous with help available on class Teams channel from 12-2 pm ET.

F - Rephotography (web page). Create a webpage entitled, *Rephotography*. On your page, post the original and reshot images. For each reshot image, write a paragraph

describing the image and the change you see on the landscape from the original image; review session, 1200-1230 (Teams), strongly suggest your attendance!

Assignments due by Friday midnight
Reading: https://www.uvm.edu/landscape/about/history_folder/GSATODAY.pdf
Webpage, *Rephotography*

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5. Week of September 28 - Geomorphologist's Tool Kit (week 2)

M - Dates and Rates Lecture (asynchronous)

W - Live stream, UVM lab tours (Cosmogenic and Argon labs, synchronous, on class Teams channel from 12-2 pm ET)

F - Investigation of dating technique (web page) – After listening to lecture and reading Geomorphologist's Tool Kit chapter, pick a geochronology technique useful for geomorphology. Read more about the technique to supplement the lecture and textbook. Then build a web page that includes illustrations and is titled *Investigation of dating technique*. It should have a paragraph about how the technique works and a paragraph about how it is used to understand Earth surface processes and geomorphology. Then, give citations for the two papers you read about the technique followed by a short summary (several sentences) of each; review session, 1200-1230 (Teams), strongly suggest your attendance!

Assignments due by Friday midnight
Reading: Chapter 3 in Key Concepts, second edition
Quiz 4 on blackboard (about the lecture and reading)
Webpage, *Investigation of dating technique*

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6. Week of October 5 - Geomorphic Hydrology Lecture (asynchronous)

M - Geomorphic Hydrology Lecture (asynchronous)

W - Run-off calculations and airphoto mapping of landuse change. We will use airphotos of the area around campus to map landuse change and we will use curve numbers to calculate run off for 10-year recurrence interval storm based. Maps are available from: https://geodata.vermont.gov/pages/imagery. A useful (and cheap per day) tool for measuring areas is available at: https://www.sketchandcalc.com
More details will follow. Make sure to read: Quantifying Urban Land Use and Runoff Changes Through Service-Learning Hydrology Projects, DOI:10.5408/1089-9995-51.4.365. Asynchronous with help available on class Teams channel from 12-2 pm ET.

F - Run-off and landuse change (web page). Create a new web page and title it, *Run-off and landuse change*. Using the analyses you did on Wednesday, create a web page that

shows your analysis of landuse change along one-block in Burlington near UVM and show graphically the runoff volume for a 10-year storm in 1999 and in 2018. Write two paragraphs, one describing what you did and the second describing what you found including how runoff processes changed over the 20 years between images you analyzed; review session, 1200-1230 (Teams), strongly suggest your attendance!

Assignments due by Friday midnight
Reading: Chapter 4 in Key Concepts, second edition
Reading: Quantifying Urban Land Use and Runoff Changes Through Service-Learning Hydrology Projects, DOI:10.5408/1089-9995-51.4.365
Quiz 5 on blackboard (about the lecture and reading)
Webpage, *Run-off and landuse change*

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7. Week of October 12 – Soils and Geomorphology

M - Soils and Geomorphology Lecture (asynchronous)

W – Soil pit digging and description. Today you will dig a soil pit, observe the horizons, and make a log of what you see. If you are on campus, you should work in groups of three or four and dig the pit using a shovel from Delehanty Hall. Please dig on a flat area in the woods behind Delehanty and please fill in your pit when done. If you are off campus, find an undisturbed area (field or woods) to dig your pit.

F - Soil Pit (web page). Create a webpage entitled, *Soil Pit*. On that page, include photographs of your soil pit and a log of your pit showing the different horizons that were present (such as A, O, B, C). Include a one paragraph interpretation of the history of your soil considering whether it was natural or disturbed by humans; review session, 1200-1230 (Teams), strongly suggest your attendance!

Assignments due by Friday midnight
Reading: Chapter 6 in Key Concepts, second edition
Quiz 6 on blackboard (about the lecture and reading)
Webpage, *Soil Pit*

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8. Week of October 19 – Slopes

M – Slopes Lecture (asynchronous)

W - Experimentation with infinite slope model. We will be using the infinite slope model coded in Excel to explore the effects of slope, cohesion, and saturation by infiltrating water. More details will follow. Using the maps of the Riverside Avenue slopes from the week of September 14, run the model and see if you can explain why landslides occurred in the unconsolidated fill (no cohesion, angle of repose) that was

dumped over the edge. You can get the slope from the topographic maps on line. Asynchronous with help available on class Teams channel from 12-2 pm ET.

F – Slopes (web page). Create a webpage entitled *Slopes*. On that page, include calculations (model results) for the Riverside Avenue slides. Write two paragraphs explaining if/how your model results are consistent with land use changes over time (dumping, deforestation, paving, run-off) as indicated from the air photos and what you learned in Geomorphic Hydrology week; review session, 1200-1230 (Teams), strongly suggest your attendance!

Assignments due by Friday midnight
Reading: Chapter 7 in Key Concepts, second edition
Quiz 7 on blackboard (about the lecture and reading)
Webpage, *Slopes*

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9. Week of October 26 - Channels

M - Channels Lecture (asynchronous)

W - Flow analysis, Winooski River. Use 100 years of gauging data to estimate flow and stage height along the Riverside Avenue corridor. You'll need a channel cross-section (we will provide that) and to assume a Manning's *n* value. Data from:
https://waterdata.usgs.gov/nwis/dv?referred_module=sw&site_no=04290500
Asynchronous with help available on class Teams channel from 12-2 pm ET.

F - Channels web page. Create a web page entitled *Channels*. On this, place a plot of the yearly maximum flow data over time for the Winooski gauge at Essex as well as a probability plot of recurrence interval versus discharge. Show your channel cross section with water levels at the 2, 5, 10, 50, and 100-year flood levels. Write a paragraph summary describing the size of flood and the impact on the banks of the river which you examined previously. In a second paragraph, consider how floods might impact landslide hazard and landscape evolution; review session, 1200-1230 (Teams), strongly suggest your attendance!

Assignments due by Friday midnight
Reading: Chapter 8 in Key Concepts, second edition
Quiz 8 on blackboard (about the lecture and reading)
Webpage, *Channels*

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10. Week of November 2 - Drainage Basins

M - Drainage Basins, Lecture (asynchronous)

W- Defining the Winooski basin including size, land use, and flood history including Landscape Change web site and historical change research. More details will follow.

F – Drainage Basin web page. Create a web page entitled *Winooski Drainage Basin*. In your page, include a map of the Winooski River Basin and relevant basin statistics. Write two paragraphs describing the basin including how it changes from its headwaters to the outlet of the basin covering land-use and discussing relevant geomorphic processes; review session, 1200-1230 (Teams), strongly suggest your attendance!

Assignments due by Friday midnight
Reading: Chapter 9 in Key Concepts, second edition
Quiz 9 on blackboard (about the lecture and reading)
Webpage, *Winooski Drainage Basin*

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11. Week of November 9 - Glacial and Periglacial Geomorphology

M - Glacial and Periglacial Geomorphology, Lecture (asynchronous)

W - Vermont's glacial history. We will use cosmogenic, radiocarbon, and varve data to map the history of ice retreat across Vermont. Consult maps to understand the distribution of glacial sediments and deglacial sediment to investigate how these sediments control the behavior of the Vermont landscape.

F - Vermont glacial history web page. Create a web page entitled *Vermont glacial history*. The page should include at least two figures. In two paragraphs, describe how ice left Vermont and the sediments that it left behind, their texture, distribution, and effect on landscape processes. Include two references and describe in a couple sentences what you learned from each reference; review session, 1200-1230 (Teams), strongly suggest your attendance!

Assignments due by Friday midnight
Reading: Chapter 13 in Key Concepts, second edition
Reading: http://www.uvm.edu/cosmolab/papers/Wright_1997_1171.pdf
Quiz 10 on blackboard (about the lecture and reading)
Webpage, *Vermont glacial history*

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12. Week of November 16 - Geomorphology and Climate

M - Geomorphology and Climate Lecture (*and quiz)* (asynchronous)

W - Team work on paper (groups of 4). ***Riverside Avenue Landsliding, Why?!*** Your paper should build on everything we have learned this semester to try and explain the landslides along Riverside Avenue. Why are they there? What triggers them? Are they natural? Human induced? What is the role of hydrology? Of glacial history? Your paper

should be about 1000 words and include four to six figures. It should have a title, a short abstract, and references; review session, 1200-1230 (Teams), strongly suggest your attendance! Review session, 1200-1230 (Teams), strongly suggest your attendance to discuss assignment! We will work with you to created groups for this assignment.

F - Team work on paper (groups of 4); review session, 1200-1230 (Teams), strongly suggest your attendance!

Assignments due by Friday midnight
Reading: Chapter 14 in Key Concepts, second edition
Quiz 11 on blackboard (about the lecture and reading)

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13. Week of November 23 – Final Project, Riverside Avenue report

M - Publish Draft paper, *Riverside Avenue Landsliding, Why?!* Submit your paper as a PDF to Paul by midnight. I will post to the class web page so people can review and critique your work.

W - holiday

F - holiday

Assignments due by Monday midnight
Draft of group paper sent at PDF to Paul for public posting.

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14. Week of November 30 – Final Project, Riverside Avenue report

M – Peer review of papers due to authors and reviews from faculty. Each student in each group will read and edit all the papers of other groups. Each student will post on their web site a one-page review (constructive criticism) of everyone else's papers. You will be reading and reviewing about 6 papers; review session, 1200-1230 (Teams), strongly suggest your attendance!

W - Paper revision. Work with your team to incorporate reviews and produce a revised draft for submission on Friday and prepare your five-minute presentation for Friday; review session, 1200-1230 (Teams), strongly suggest your attendance!

F – 5-minute presentations of papers; synchronous. This is our last class. Presentations by each group, maximum 5 minutes each. MANDATORY attendance, 1200-1:15 (Teams)

Assignments due this week
Reviews of all other papers posted to your web site on *Monday*
Final draft of paper posted as PDF to everyone's webpages on *Friday*