

## Syllabus

### Course information

Lectures: Mondays and Wednesdays, 4:30-5:45 pm, ES&T L1118

Labs: Wednesdays, 11:15 am – 2 pm, ES&T L1114

### Course instructors

Professor: Ken Ferrier

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**Course overview:** Quantitative overview of the mechanical, chemical, and biological processes that shape topography, including river incision, glacial erosion, regolith development, soil transport, tectonic uplift, planetary surface processes, and channel network evolution.

**Course goal and description:** Landscapes are one of the most accessible and striking parts of a planet's geologic record. Because we live on Earth's surface, landscapes and the forces that shape them are also of considerable societal relevance. This course introduces students to the quantitative study of processes that shape Earth's surface. We will use a combination of theory and field observations to investigate major components of continental geomorphic systems, including hillslopes, rivers, and glaciers. Our ultimate goal will be to understand how the major factors that shape Earth's surface – tectonics, climate, and life – create the landscapes we observe. The course is designed to be accessible to graduate and advanced undergraduate students from a range of disciplines, including geoscience, engineering, environmental science and planning, and ecology. As such, we do not assume an extensive geology background. The only requirements are proficiency in mechanics, a basic familiarity with calculus and differential equations, and a willingness to roll up your sleeves and make some measurements.

**Prerequisites:** Familiarity with the fundamentals of mechanics and calculus are needed for this class. Familiarity with basic geologic principles will be helpful, but not necessary, as this class focuses on physical principles rather than geologic history. Courses that fulfill these requirements include EAS 2600 and PHYS 2211. Students with questions are encouraged to contact the instructor.

**Recommended textbook:** There is no required textbook, but I recommend Anderson and Anderson, *Geomorphology: The Mechanics and Chemistry of Landscapes*, Cambridge University Press, 1<sup>st</sup> edition.

**Grading differences between undergraduate and graduate students:** Grades will be based entirely on four projects completed over the course of the semester. The relative weight of each project on the final grade is the same for undergraduate and graduate students. Gaining experience with scientific writing is a critical component of this class. Two of the four projects involve geomorphic mapping and require writing a report in the style of a formal scientific journal article, and for these projects grades are

partly based on the correctness and quality of the maps, and partly on the written reports. The other two projects are extended numerical modeling projects. During lab sessions, students will learn how to complete the projects and will work together on group components. On each project, graduate students will be required to address additional questions beyond those required of undergraduate students, with the goal of framing the material in terms of the current literature on each subject.

Project 1: Glaciers (30%)

Project 2: Alluvial rivers and flood frequency (20%)

Project 3: Hillslope evolution (20%)

Project 4: Bedrock rivers and Southern Appalachians (30%)

**Grading scale:** >90% = A, 80-90% = B, 70-80% = C, 60-70% = D, <60% = F.

Extra credit is not offered. An unexcused grade of zero on any project will result in a final course grade of F. Requests to adjust project grades must be resolved with 14 days of the due date of the project.

**Learning outcomes:** Upon completion of this course, students will be able to:

1. Determine the dominant geomorphic processes shaping topography.
2. Construct conservation of mass and momentum frameworks for modeling topographic evolution.
3. Apply mathematical laws for mass transport that govern topographic evolution.
4. Make field observations that can be used to constrain multiple geomorphic processes.
5. Write scientific reports in the form of a short journal article.

**Important dates:** Saturday, February 3 (Field trip #1)  
Friday-Sunday, April 6-8 (Field trip #2)

All field trips are mandatory. Two of the projects require analyzing measurements you make during these field trips, and so will require your participation in the field. Students with unavoidable conflicts should see the professor as early as possible before the field trip to develop an alternative project to make up the missed field trip.

Projects are due at the beginning of lab period sharp on the given date. Late projects will be penalized 10% per day late (e.g., a project handed in an hour after the due date and time will be penalized 10%; a project handed in 25 hours after the due date and time will be penalized 20%, etc.).

Due dates:	Project 1:	Wednesday, February 7, 11:15 am
	Project 2:	Wednesday, February 28, 11:15 am
	Project 3:	Wednesday, March 28, 11:15 am
	Project 4:	Monday, April 30, 11:15 am

**Course material:** Announcements, lecture slides, upcoming projects, and grades will be posted on the course website.

**Academic integrity:** The instructors and students are bound by the Georgia Tech honor code (<http://honor.gatech.edu/content/2/the-honor-code>). Most importantly, during the preparation of projects, students are encouraged to collaborate with their fellow students, but the project reports must be written up entirely on your own. No copying. The penalty for plagiarism on any assignment is a score of zero on the assignment.

**Excused absences:** You may be excused from projects or field trips for valid reasons, such as illness, job interviews, etc. However, you must obtain the appropriate approval in advance and you must provide documentation for the absence. The Institute Absence policy is available at: [www.catalog.gatech.edu/rules/4/](http://www.catalog.gatech.edu/rules/4/).

**Learning accommodations:** If you are a student with a documented short-term or permanent disability seeking reasonable accommodations in this course, please contact The Office of Disability Services ([disabilityservices.gatech.edu](http://disabilityservices.gatech.edu)). Advance notice and appropriate documentation are required for accommodations.

**Support services and resources:** In your time at Georgia Tech, you may find yourself in need of support. Below you will find some resources to support you both as a student and as a person.

### ***Academic support***

- Center for Academic Success <http://success.gatech.edu>
  - 1-to-1 tutoring <http://success.gatech.edu/1-1-tutoring>
  - Peer-Led Undergraduate Study (PLUS) <http://success.gatech.edu/tutoring/plus>
  - Academic coaching <http://success.gatech.edu/coaching>
- Residence Life's Learning Assistance Program <https://housing.gatech.edu/learning-assistance-program>
  - Drop-in tutoring for many 1000 level courses
- OMED: Educational Services (<http://omed.gatech.edu/programs/academic-support>)
  - Group study sessions and tutoring programs
- Communication Center (<http://www.communicationcenter.gatech.edu>)
  - Individualized help with writing and multimedia projects

### ***Personal support***

#### Georgia Tech Resources

- The Office of the Dean of Students: <http://studentlife.gatech.edu/content/services>; 404-894-6367; Smithgall Student Services Building 2<sup>nd</sup> floor
  - You also may request assistance at [https://gatech-advocate.symplicity.com/care\\_report/index.php/pid383662?](https://gatech-advocate.symplicity.com/care_report/index.php/pid383662?)
- Counseling Center: <http://counseling.gatech.edu>; 404-894-2575; Smithgall Student Services Building 2<sup>nd</sup> floor
  - Services include short-term individual counseling, group counseling, couples counseling, testing and assessment, referral services, and crisis intervention. Their website also includes links to state and national resources.

- Students in crisis may walk in during business hours (8am-5pm, Monday through Friday) or contact the counselor on call after hours at 404-894-2204.
- Students' Temporary Assistance and Resources (STAR):  
<http://studentlife.gatech.edu/content/need-help>
  - Can assist with interview clothing, food, and housing needs.
- Stamps Health Services: <https://health.gatech.edu>; 404-894-1420
  - Primary care, pharmacy, women's health, psychiatry, immunization and allergy, health promotion, and nutrition
- OMED: Educational Services: <http://www.omed.gatech.edu>
- Women's Resource Center: <http://www.womenscenter.gatech.edu>; 404-385-0230
- LGBTQIA Resource Center: <http://lgbtqia.gatech.edu/>; 404-385-2679
- Veteran's Resource Center: <http://veterans.gatech.edu/>; 404-385-2067
- Georgia Tech Police: 404-894-2500

**Schedule**

<b>Date</b>	<b>Lecture topics</b>	<b>Reading</b>	<b>Projects</b>
Jan. 8	Introduction, Glaciers I	Gilbert, 1877, Ch. V	
Jan. 10	Glaciers II	Ch. 1, 8, 9, Appendices	Project 1: Glaciers
Jan. 15	<i>No class – MLK Jr. Day</i>		
Jan. 17	Alluvial channels	Ch. 12	Project 1: Glaciers
Jan. 22	Flow mechanics I		
Jan. 24	Flow mechanics II		Project 1: Glaciers
Jan. 29	Meanders		
Jan. 31	Sediment transport I	Ch. 14	Project 1: Glaciers
<b>Feb. 3 (Saturday) Panola State Park field trip</b>			
Feb. 5	Sediment transport II		
Feb. 7	Alluvial longitudinal profiles		<b>Project 1 due (30%)</b> Project 2: Rivers
Feb. 12	Bedrock channels I	Ch. 13	
Feb. 14	Bedrock channels II		Project 2: Rivers
Feb. 19	Hillslopes I	Ch. 10	
Feb. 21	Hillslopes II		Project 2: Rivers
Feb. 26	Hillslopes III		
Feb. 28	Landslides		<b>Project 2 due (20%)</b> Project 3: Hillslopes
Mar. 5	Debris flows		
Mar. 7	Landscape evolution I	Ch. 18	Project 3: Hillslopes
Mar. 12	Landscape evolution II		
Mar. 14	Channel networks		Project 3: Hillslopes
Mar. 19-21	<i>No class – spring break</i>		
Mar. 26	Tectonic geomorphology		
Mar. 28	Weathering and soils		<b>Project 3 due (20%)</b> Project 4: Bedrock channels
Apr. 2	Chronologic methods	Ch. 6	
Apr. 4	Large scale topography		Project 4: Bedrock channels
<b>Apr. 6-8 (Friday-Sunday) Southern Appalachians field trip</b>			
Apr. 9	<i>No class – post-trip recovery</i>		
Apr. 11	Island landscapes		Project 4: Bedrock channels
Apr. 16	Topography and life		
Apr. 18	Sea level		Project 4: Bedrock channels
Apr. 23	Planetary geomorphology		
Apr. 25	<i>No class – reading period</i>		
Apr. 30			<b>Project 4 due (30%)</b>

\* Unless otherwise noted, readings refer to chapters in Anderson & Anderson.