

## **GEOL/ENVI/GEOG 120: Environmental Geology**

Instructor: Professor Kelly MacGregor ([macgregor@macalester.edu](mailto:macgregor@macalester.edu))

Office: Olin-Rice 114

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### **Course Overview:**

The physical environment has begun to show signs of our earth's expanding population and the increasing need for natural resources. Geologic materials such as soil, water, and bedrock, and geologic processes such as earthquakes, volcanic activity, and running water often pose constraints on land use. This course is designed to introduce students to the relationship between humans and their geologic environment: the Earth. We will focus on understanding the processes that shape the surface of the Earth, and how these processes affect human activity. We will use current scientific methods to collect and analyze data. Topics include surface-water dynamics and flooding, groundwater and groundwater contamination, pollution and waste management, landslides, volcanic and earthquake hazards, and global climate change. Format: Three one-hour classroom meetings per week, with occasional field excursions. Evaluation will be based on participation, homework/classroom assignments (including blog posts, in class activities, and discussions), two 8-10 page papers, and three one-hour exams. Note: This is a Q2 course, which means we will be thinking about our planet quantitatively!

### **Learning goals:**

1. Geology is a quantitative science – you will learn to use math to describe how nature works. By the end of the course, you should a) feel more confident using equations to describe our planet and concomitant processes, b) be able to use an equation to predict/model what might happen if one variable changes, and c) understand the difference between correlation and causation.
2. I expect by the end of the course you will be able to recognize how and where humans impact surface processes on our planet, including water flow (surface and groundwater) and water quality, and how we affect climate and earth hazards. You will also be able to communicate these concepts to your peers.
3. By the end of the course you should be confident identifying the potential natural hazards of the place you live (or may live after college!), and be able to find detailed resources about those hazards for almost any place in the US.

### **Texts:**

*Environmental Geology: An Earth Systems Science Approach*. Second Edition (2014). Merritts, Menking, and DeWett. W.H. Freeman and Company.

*The Control of Nature* (1989). John McPhee, Farrar, Straus, Giroux.

**Readings/Assignments:** <http://moodle.macalester.edu> is where you will find readings, assignments, helpful weblinks and announcements. You will also be able to share data with each other here, and turn in assignments. Check it frequently!

Readings (except those from the required texts) can be downloaded from the course Moodle page. I reserve the right to add/change the reading assignments during the course.

All assigned readings for the week must be completed prior to the class meeting on Wednesday, unless I tell you otherwise. You may be asked to complete a 'reading reflection', either on Moodle or during the first few minutes of class (no late reading reflections will be accepted). Discussions depend on your having read the material ahead of time!

### **Class/Field Trips/Assignments:**

I am interested in helping you with the work in the course, but I am also excited to get to know you and help support you on your amazing journey through college and beyond. I'd like to get to know you, so please feel free to come and talk (even without an agenda).

Please come to class PREPARED – I expect you will all be ready to learn and ask questions. Class will include hands-on activities and discussions. To get a lot from this course, you must invest time in the readings and assignments – this is where the synthesis of concepts will happen!!!

Collaboration on most in-class questions/activities and on assignments is encouraged, but I expect each person to turn in their own work. I strongly advise you to consult myself or each other once you have already attempted to figure something out; i.e., do not lean too heavily on others to get you through the assignments, or you will find yourself having a tough time on the exams.

I expect all of the assignments to be turned in on time, unless you have talked with me in advance. Late assignments will be docked 10% each day it is late (an assignment worth 100 points will be worth a maximum of 90 points if it is one day late). An assignment is considered a day late if it is between 1 minute and 24 hours late. If you think you have a good reason your work is late, please talk to me in advance. Assignments are worth 0 points if they are more than 1 week late.

Please turn in neat work. If you need to type or re-copy handwritten work, please do so.

We will have one overnight (camping) field trip in this course, and likely another half-day trip. The trips are OPTIONAL, but I highly encourage everyone to attend! We will have a FANTASTIC time, and you will learn so much! No camping experience or gear is required!

### **Blog:**

In an effort to make connections between earth sciences and us (the humans that hang out on the surface!), our class will be blogging during the semester. Each of you will create THREE blogs during the semester, and will get credit for posting interesting and thoughtful comments on the posts of your colleagues. I will introduce the blog rules and expectations the first week of class. The content in the blogs are fair game for exams!

**Papers:**

You will have two 8-10 page paper in this course. The first paper will be related to our field data collection on rivers, and the second paper will focus on identifying and discussing the environmental hazards of your home (or another place of your choosing!). Details on these assignments will follow.

**Exams:**

In this course you will have three, one hour exams. The exams will be primarily short answer and essay questions, with some computational questions. I try to write exams that will allow you to show me your understanding of the presented concepts and not simply your ability to memorize an answer.

I do not allow students to take exams at times other than those posted. This is because it is not fair to the students in the class who take the exam on time. Some reasons I WILL reschedule: 1) You will be out of town on a Macalester-related event (sports, music, etc.), 2) You are genuinely ill, 3) You must leave town for a family emergency. If you are dealing with a long-term crisis or illness (either you or a family member), I encourage you to come and talk to me so I can better support your work in class and accommodate you.

**Success in this course:**

There are several things that you can do to be successful in this course. They include:

Please attend class. Readings are meant as a supplement, not a substitute, for the lecture and discussion material. In class I will focus your attention on the parts of the reading assignments that I think are important. It will be difficult to do well on exams if you do not regularly attend class. Having said that, I don't want you to come to class if you are very sick. If you can't be in class, please let me know in advance, if possible. In all cases of a class absence, you will be responsible for getting notes from your colleagues. If you have additional questions that your colleagues cannot answer, I am happy to talk with you.

**BE ON TIME!** If you are a couple of minutes late to class a few times, I understand. If you are chronically late to class, you will get to see a highly irritated Kelly. You don't want to see a highly irritated Kelly.

Do not get behind in your reading and studying. It is very difficult to cram for exams, and you will learn much more if you can ask questions along the way, rather than just at the exam review!

Studying in groups is incredibly useful – talk with your colleagues (and me!) about the material you are learning! You will learn a lot of vocabulary in this class, and you need to adopt some language skills to be successful. In addition, you can help each other – one person's weakness is another's strength. Group work also allows you to find out what you don't know.

**Grades:**

Class assignments/reading reflections/class participation: 10%

Research papers/writing assignments: 40%

Blogs: 5%

Hour exam I: 15%

Hour exam II: 15%

Hour exam III: 15%

I will assign a final grade by taking the following percentages into account:

90-100% = A's

80-89% = B's

60-79% = C's

50-59% = D's

The top 2% of each category will typically receive a "+" (i.e., a score of 88-89% will receive a B+), and the lower 3% of each category will receive a "-" (91% is an A-).

**Other details:**

During class you have my undivided attention. Please use it! I am available during my office hours and by appointment. You are welcome to stop by my office, but I can't guarantee I'll have time at that moment! I also encourage you to contact me via email – I am happy to talk with you outside of the "normal" workday! I will be using moodle as a tool for answering questions and disseminating information – please check this regularly!

***Cheating:*** Cheating is obviously not allowed. As per the Academic Honesty statement (found in the Student Handbook), a first offense will cause you to get a failing grade on the assignment, and a second offense means you fail the class. If in doubt about what constitutes cheating or plagiarism, or if stress is causing you to consider this route, please come to my office to talk with me.

***Electronics:*** Phones must be turned off and not used during class. Texting, emailing, and web browsing is not allowed, unless I ask you to do so! This policy holds during lectures, discussions, class activities, presentations, field trips, and computer lab exercises. If you feel you must use your computer in class to take notes efficiently, I will consider requests made to me in person during the first week and you will be asked to sign an agreement about proper use of computers during class.

***Students with disabilities:*** I am committed to ensuring access to course content for all students, including those with disabilities. If you are a student with a disability, please contact the Disability Services office by email [disabilityservices@macalester.edu](mailto:disabilityservices@macalester.edu), or calling 651-696-6974 to schedule an appointment to discuss your individual needs. It is important to meet with me as early in the semester as possible to discuss accommodations for this course to ensure they can be implemented early on. Additional information regarding the accommodations process for students with disabilities can be found at: <https://www.macalester.edu/disabilityservices/information-for-students/>

***Health and Well-Being:*** Here at Macalester, you are encouraged to make your well-being a priority throughout this semester and your career here. Investing time into taking care of yourself will help you engage more fully in your academic experience. Remember that beyond being a student, you are a human being carrying your own experiences, thoughts, emotions, and identities with you. It is important to acknowledge any stressors you may be facing, which can be mental, emotional, physical, financial, etc., and how they can have an academic impact. I encourage you to remember that you have a body with needs. In the classroom, eat when you are hungry, drink water, make tea or coffee, use the restroom, and step out if you are upset and/or need a break. Please do what is necessary so long as it does not impede your or others' ability to be mentally and emotionally present in the course. Outside of the classroom, sleep, moving your body, and connecting with others can be strategies to help you be resilient at Macalester. If you are having difficulties maintaining your well-being, **please don't hesitate** to contact me and/or find support from other campus resources. I can provide a list of these resources to you, and they are also posted on my office door and in the classroom.

My goal is not only to teach you the principles of my discipline, but also to stir your fascination in the way the earth works! Please to not hesitate to talk to me about how I can improve your learning environment!

## General



Lake Josephine and view up Grinnell Valley, Glacier National Park, Montana, USA

### **Welcome to Environmental Geology - Fall 2019 FYC!**

Please keep returning to this page, as I will be updating it throughout the semester. I look forward to meeting all of you on Friday, August 30th in Olin Rice 175 at 10 am!!!

"Civilization exists by geological consent, subject to change without notice"

*Will Durant (1885-1981)*



[News forum](#)



[course expectations/syllabus](#) 48.5KB



[Earth Environments - Class Blog Site](#)

**Hidden from students**



[Blog assignment - description](#) 26.7KB



[Due dates for BLOGS!](#) 9.5KB



[credit for blog #1](#)



[credit for blog #2](#)



[credit for blog #3](#)



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## September 2 - September 8

Rivers and surface water

Reading: Ch. 1 (skim this!), Ch. 9 (up to page 290)



[wednesday class](#)



[friday class](#)

## September 9 - September 15

Rivers and flooding

Readings: *Atchafalaya* (McPhee); Ch. 9 (290-309)

Friday, September 13: Library session #1 (meet in Library room 206 at 9:40am)



[Minnehaha Creek lab activities/questions](#) 173KB

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[monday class](#)



[wednesday class](#)

## September 16 - September 22

River engineering; groundwater

Readings: [Mount chapter on dams](#) (see link below); Chapter 10 (all)

FIELD TRIP (WOO HOO): Departing Friday, September 20 at ~2:30 pm, returning ~5pm on Saturday, September 21

10 minute visit by Lisa Broek, Hamre Health & Wellness Center (in class Monday)



[Manduca reading](#) 4.8MB

**Hidden from students**



[Mount chapter on dams](#) 1.7MB



[DRAFT of final paper - upload here!](#)

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[price meter conversion chart](#) 62.7KB

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[pygmy meter conversion chart](#) 7.9KB

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[Des Moines River peak annual discharge data \(1902-2016\)](#) 48.4KB

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[Raccoon River @ Des Moines flood stage data](#) 31.5KB

**Hidden from students**



 [flood frequency\\_paper \(log-log\)](#) 162.8KB


**Hidden from students**

 [peer review questions](#) 55.1KB


**Hidden from students**

 [in class flood activity](#) 70.5KB

**Hidden from students**

 [credit for in class flood activity](#)

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 [monday\\_class](#)

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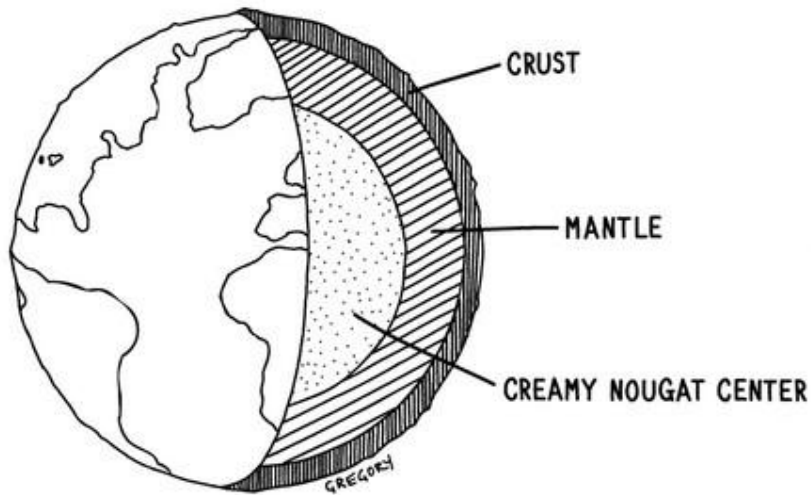
## September 23 - September 29

Arid region hydrology: landscapes & challenges

Readings: Ch. 9 (309-312); excerpt from Reisner, *Cadillac Desert* (see link below)


 [Cadillac Desert \(Reisner\) Ch. 1](#) 7.2MB

## September 30 - October 6




Hour exam I: Wednesday in class


Readings: Ch. 2 (all); Ch. 4 (through 114) - read for Friday

 [friday - in class activity](#) 36.5KB

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 [friday - in-class activity \(volcano figure\)](#) 66.1KB

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 [credit for in class tectonics activity](#)

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## October 7 - October 13

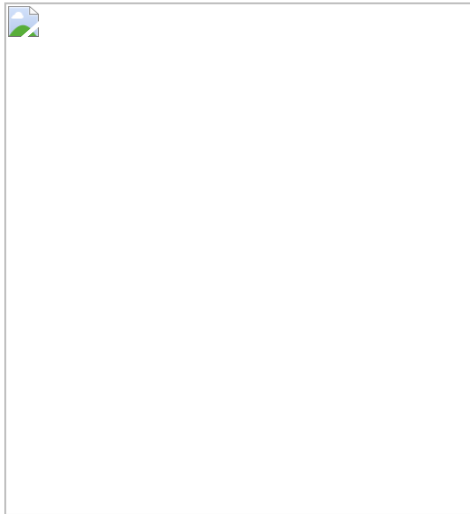
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Solid Earth Hazards: Earthquakes & Tsunamis

Readings: Ch. 3 (all); Ch. 12 (431-436)


10 minute visit by Lisa Broek, Hamre Health & Wellness Center (in class Friday)

 [USGS Earthquake hazards site](#)


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 [earthquake disaster preparedness \(US government\)](#)

**Hidden from students**


 [tsunami survivor accounts](#)

**Hidden from students**


 [good video summarizing Banda Aceh earthquake & tsunami event and death toll](#)

**Hidden from students**


 [Short story/fiction by T. Coraghessan Boyle: Chicxulub](#)

 [friday activity - earthquakes!](#) 134KB


**Hidden from students**

 [friday activity - figures!](#) 746.8KB

**Hidden from students**

 [credit for peer review of rivers paper](#)

**Hidden from students**

 [credit for earthquake activity](#)

**Hidden from students**

## October 14 - October 20

Solid Earth Hazards: Volcanoes

Readings: Ch. 5 (all); *Cooling the Lava* (McPhee)

Final draft: River research paper due Monday October 14 in class

Friday class: *In the Path of a Killer Volcano* (location TBD)

Navigation



[credit for rivers paper](#)



[lab questions - Pinatubo](#) 19.7KB

**Hidden from students**



[credit for Pinatubo worksheet](#)

**Hidden from students**



[top ten countries for volcanic hazards](#)

**Hidden from students**



[hot springs you don't want to swim in....](#)

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## October 21 - October 27

Hillslopes: creep, slump, slide

Readings: Ch. 8 (all)

Wednesday, October 23 - Library session #2 (in our classroom, bring laptops if you have them)

NO CLASS ON FRIDAY: Fall Break

Recent activity

## October 28 - November 3

Hillslope failures and debris flows

Readings: *Los Angeles against the Mountains* (McPhee)



[debris flow questions \(class conversation\)](#) 61.3KB

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[US Energy Information Administration](#)

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[US Energy Data](#)

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## November 4 - November 10

Energy and mineral resources

Readings: Ch. 4 (114-137 on mineral resources); Ch. 13 (through page 495); Washington Post article (see below)

Hour exam II: Monday November 4 in class



[credit for hour exam II](#)



[final research paper - 1 page topic summary - due FRIDAY](#)

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[layout of wastewater treatment plant](#) 10.1MB



Hidden from students



[United States of Oil and Gas \(Washington Post\)](#) 6.4MB



[hydraulic fracturing \(fracking\) video](#)

Hidden from students



[Another fracking video \(different producer!!!\)](#)

Hidden from students



[energy\\_grid \(NPR - showed this in class\)](#)

Hidden from students



[Lake Peigneur video](#)

Hidden from students



[wastewater treatment plant - video with JAY!!!](#)

Hidden from students



[conflict minerals - cell phones \(2016\)](#)

Hidden from students



[conflict minerals used in cell phones \(2013\)](#)

Hidden from students



[StarTribune article about MN mining](#)

Hidden from students



[PBS video on MN mining](#)

Hidden from students



[wild rice and mining](#)

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[PCA - wild rice and sulfate rules](#)

Hidden from students



[article about MN clean energy....](#)

Hidden from students



[China and REE minerals \(2009\)](#) 319.1KB

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## November 11 - November 17

Renewable energy

Readings: Ch. 13 (495-516); see links below on Denmark & Copenhagen energy planning



[Guide to a sustainable Copenhagen](#) 11.7MB



[Copenhagen 2025 Climate plan](#) 1.6MB



[Energy Academy \(Denmark\) - link](#)

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 [video on Copenhagen garbage burner/ski hill \(Copenhills\)](#)


 [smarthomes link](#)

**Hidden from students**


 [great PBS summary of Denmark energy plan](#)

 [Bureau of Reclamation](#)


**Hidden from students**

 [monday/wednesday questions for discussion](#) 42.5KB

**Hidden from students**

 [credit for mining worksheet and conversation](#)

**Hidden from students**

 [global wind map](#)

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## November 18 - November 24


Earth's climate system: atmosphere and oceans

Readings: Ch. 11 (all); Ch. 12 (all)


10 minute visit by Lisa Broek, Hamre Health & Wellness Center (in class Monday)

 [Greenstar program](#)


**Hidden from students**

 [Geopolitics of mineral resources for renewable energy technology](#) 1.1MB


**Hidden from students**

 [carbon tax and oil industry](#)


**Hidden from students**

 [great ppt summary of solar energy from UVM \(Flomen\)](#) 4.9MB

**Hidden from students**

 [great articles about solar energy in NYTimes](#)

**Hidden from students**

 [article on future of solar energy from MIT](#)

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## November 25 - December 1

Modern environmental challenges: Climate and climate change

Readings: Ch. 14 (all)

NO CLASS WEDNESDAY OR FRIDAY: THANKSGIVING BREAK

 [IPCC on water](#) 288.7KB

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## December 2 - December 8

Modern environmental challenges: climate change & waste streams

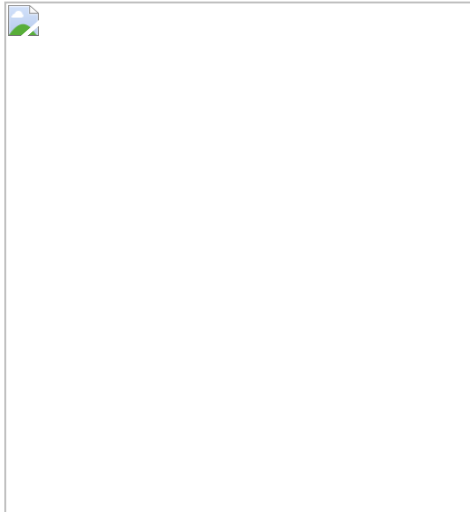
Readings: Ch. 15 (all); Kolbert (<http://www.newyorker.com/magazine/2009/05/25/the-sixth-extinction>)



[geologic constraints on US/Mexico border wall - Smithsonian magazine](#)

Hidden from students

## December 9 - December 15



HOUR EXAM III: Monday December 9 in class

Wednesday: work on revision of final paper (no class meeting)

FINAL DRAFT OF PAPERS DUE Saturday, DECEMBER 14 by 5pm



[credit for hour exam III](#)



[submit final paper HERE by Saturday 5pm](#)

## December 16 - December 22

no final exam - have a great winter break!

### Administration



Course administration

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## NYTimes Environment

[How Long Before These Salmon Are Gone? 'Maybe 20 Years'](#)

[Trump Inspires California Lawmakers to Go on Offense](#)

[Trump's Dorian Tweet Whips Up a Fight Over a Science Powerhouse](#)

[The Concept Cars Gleam, but Executive Dread Clouds the Frankfurt Auto Show](#)

[Interior Dept. Takes Next Step Toward Sale of Drilling Leases in Arctic Refuge](#)

## ScienceDaily - Environment

[Climate change expected to accelerate spread of sometimes-fatal fungal infection](#)

[Atlantic Ocean may get a jump-start from the other side of the world](#)

[Carp aquaculture in Neolithic China dating back 8,000 years](#)

## NASA Image of the Day

[Franklin Chang-Diaz Performs a Spacewalk on the STS-111 Mission](#)

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