Global Cycles and Climate

NRSM 408 Spring 2016

Course and Instructor Info:

Time & Location: Tuesday/Thursday, 12:40 – 2:00 pm, Liberal Arts 201

Professor: Cory Cleveland **Email:** Cory.Cleveland@umontana.edu **Phone:** 243-6018

Course Web Site: Moodle (http://umonline.umt.edu/)

Office hours: By appointment, scheduled via email.

Course Description:

When Bob Dylan asks: "How many years can a mountain exist, before it is washed to the sea?" he echoes a question that has intrigued philosophers and geologists for centuries. The atmosphere reacts with the land surface, rivers carry eroded materials to the ocean, and deposited ocean sediments ultimately become new mountains – completing just one of many biogeochemical cycles that have been operating since the beginning of time. In this course, we will explore the Earth's major biogeochemical cycles, how they are linked, how they have been altered by human activities, and how they influence the global climate system. With that as a backdrop, we will then take a close look at a number of climate change mitigation strategies through a biogeochemical lens.

Learning Outcomes:

Students will analyze and compare each of the earth's major global biogoechemical cycles, evaluate the ways and extent to which each of the of them influences and interacts with the global climate system. We will critically examine a number of potential climate change mitigtion strategies and assess their costs, benefits, and potential consequences. Students will demonstrate their understanding through a number of written assignments and exams, and by producing an oral presentations and leading in-class discusions and debates. At the end of the course, students will understand the potential benefits and pitfalls of currently proposed strategies for mitigating global climate change, and will be able to assess their efficacy, practicality, and potential unintended consequences.

Course Format:

In most courses, you attend lectures, perhaps memorize lots of facts, occasionally ask a question or two, and study for a series of exams. This course will be a bit different. I will use the first part of the semester to make sure we are all on the same page by providing an overview of the climate system, and the major biogeochemical cycles. This will set the stage for the remaining 1/3 of the class where you will take a much more active role: leading discussions, making presentations, and helping each other work through, evaluate and learn about a complex, interdisciplinary topic. The goal of these classes is to promote thoughtful reasoning, critical evaluation of "fact" from "the hype," and to help you develop skills that will serve you well in the "real world" - no matter what profession you choose. To that end, in this class you will be expected to *think*, and to do so in a critical way.

Each student will be expected to do independent research into a suite of topics, write a series of one-page papers, participate in group projects and presentations, and be active participants in the class. Ultimately, the goal is to have fun digging into a set topics that are relevant to all of us, and to work as a group to achieve a better understanding that will allow you, as educated citizens, to make more

informed decisions about the science of climate change, and some of the potential solutions.

How Will it Work?:

As a class, we will explore how the major biogeochemical cycles operate, how they influence climate, and how they underlie some of the potential solutions to this important problem. We will do this in three general ways:

First, there will be a series of lecture/discussion days led by me in which the major biogeochemical cycles and their major climate interactions are presented and discussed. These lectures will be augmented by reading from the text or other sources and from a number of important recent scientific papers.

Second, you will spend a few weeks (in groups) researching a variety of climate change mitigation strategies as though you were a panel of experts, with each group ultimately presenting an overview of the science behind each strategy, with "subcommittees" of 2-4 students each taking the lead responsibility for a given area.

Third, you will use that background information to prepare written Congressional Testimony statements about a climate change mitigation strategy. These will be modeled after the real thing, and each student will be asked to prepare a written testimonial.

Please Note: This class will rely heavily on classroom discussion and debate, thus we all must work to foster an environment in which all students feel comfortable sharing their opinions. You can challenge opinions and disagree, but you must be respectful.

Class Responsibilities and Preparation:

This class is about active learning. That means everyone must do research, present and discuss material, debate topics and articulate opinions verbally and in writing. Regular attendance and participation are essential, and thus these will be part of your formal grade (10%). They are easy points! Just show up and participate. In addition, while you will only have 2-3 days in which you are a lead presenter of some kind, everyone is expected to do research before each class, even on topics you are not leading, and come ready to participate each day.

Presentations:

Near the end of the course, there will be a series student group-led presentations/discussions. For each discussion day, leaders (~3 per topic) will decide on a few relevant sources to direct their discussion and distribute it a week in advance (these should be approved by me ahead of time as well). On days you lead a presentation you are expected to show up prepared to make a presentation on your topic and/or lead the class in discussion. Your group presentation should take up 45-60 minutes of class time – i.e., you should leave plenty of time for discussion.

Writing Assignments:

You will do a fair amount of writing in this class, but all of it will be short assignments, hopefully in formats you find enjoyable. On days that a topic is presented (and when you are not in the lead group), you will be expected to write a short op-ed piece on this topic; see below for more information). These must include a minimum of three citations (websites, newspaper articles, journal papers, NPR stories, etc.), and must be between 500 and 750 words (that's about ¾ to 1 page, single spaced). The word count does not include your list of citations you use, which can be printed after the op-ed itself. These must be printed out and handed in during class that day – email or handwritten versions will not be accepted. I may encourage some of you to submit your pieces to the Missoulian. It's important to share

good ideas with others outside of this classroom!

Prerequisites:

There are no formal prerequisites for this course, but some background in chemistry, biology and geology is expected. I also expect that each of you have a basic understanding of the science of climate and climate change. This course is highly interdisciplinary and uses as a language and framework derived from multiple disciplines. *You do not necessarily need an advanced background in science to succeed in this class, but if you are uncomfortable with the basics of any of them you should probably talk to me, and be willing to work hard in the early part of the semester to keep up.*

Textbooks and Reading

Required Texts

Treatise on Geochemistry (http://www.sciencedirect.com/science/referenceworks/9780080437514), Volume 8: Biogeochemistry (2005) William Schlesinger (Editor), Elsevier. ISBN: 978-0080446424. If you connect using a UM computer, you should be able to download all the relevant chapters as PDFs.

Bloom, A. J. (2010). Global Climate Change: Convergence of Disciplines. Sinauer Associates, Sunderland, MA. **ISBN-13:** 978-0878930272. This book should be available in the UM Bookstore, and I will place a hard copy on reserve in Mansfield Library.

We will also rely heavily on several chapters from the IPCC (AR5) Report (http://www.ipcc.ch/publications_and_data/publications_and_data_reports.shtml), published in 2013. Most of the IPCC reading is from Chapters 6 and 7 in Climate Change 2013: The Physical Science Basis: Contributions of Working Group 1 to the Fifth Assessment Report of the IPCC. However, we will also read the Summary for Policymakers sections from all three Working Groups. All can be downloaded following the link above.

Recommended Text

Blockstein D.E. and Wiegman L. (2010). The Climate Solutions Concensus: What We Know and What to do About it. Island Press, Washington. ISBN. **ISBN-13:** 978-1597266741

This textbook material will be supplemented by readings from other sources (*e.g.,* primary literature), especially in the second half of the semester when students are making presentations. These additional readings will be available as .pdf files on the course web site. You should print them out, read them, bring them with you to class every day, and be prepared to discuss them. Periodically I may prepare quizzes that cover the reading. All readings are available on the course Moodle site.

Grading:

Grades will be assigned based on the following percentages:

- Midterm exams: 50%
- Expert Presentation (1 per person in groups): 15%
- Op-ed Writing (4 of 7 topics): 15%
- Writen Congressional Testimony (1 per person): 10%
- Class Attendance & Participation: 10%

**This course is offered as traditional letter grade only. Students cannot change to credit/no credit at any*

time during the semester.

Students with Disabilities

The University of Montana assures equal access to instruction through collaboration between students with disabilities, instructors, and Disability Services for Students (DSS). If you think you may have a disability adversely affecting your academic performance, and you have not already registered with DSS, please contact DSS in Lommason 154 or 406.243.2243. I will work with you and DSS to provide an appropriate modification.

Course Withdrawal Deadlines

Date	Description	Date Range
To 15th instructional day	Students can drop classes on Cyberbear with refund	February 12 through last day
16th to 45th instructional day	A class drop requires a form with instructor and advisor signature, a $10 fee from registrar's office, student will receive a 'W' on transcript, no refund.	February 13 through March 28
Beginning 46th instructional day	Students are only allowed to drop a class under very limited and unusual circumstances. Not doing well in the class, deciding you are concerned about how the class grade might affect your GPA, deciding you did not want to take the class after all, and similar reasons are not among those limited and unusual circumstances. If you want to drop the class for these sorts of reasons, make sure you do so by the end of the 45th instructional day of the semester. Requests to drop must be signed by the instructor, advisor, and Associate Dean and a $10 fee applies.	March 29 through May 6

Finally, the usual rules concerning academic honesty apply in this course.

All students must practice academic honesty. Academic misconduct is subject to an academic penalty by the course instructor and/or a disciplinary sanction by the University. All students need to be familiar with the Student Conduct Code (http://www.umt.edu/vpsa/policies/student_conduct.php). Academic misconduct includes plagiarism. Don't plagiarize someone else's work, period.

Some resources that may be useful for assignments

There is a very useful document on Moodle that describes how to write an effective op-ed.

NOTE: There are many "How to write a good op-ed" sites on the internet which may be valuable. Portions of these op-ed overviews will not apply to your assignment (e.g. where to send them, if you need a cover letter, etc), but the general rules for how to write them are excellent guidance. Read them.

They will help you complete the assignments more easily and effectively. **Bottom line? Op-eds are about expressing an opinion, and defending it with facts.** You'll find them in newspapers all over the country, all the time, on all sorts of topics. Dig up a few and you'll get the idea. Here are a bunch of examples of environmentally-related op-eds from the New York Times.

NOTE: To access many of these, you may need to register on the NYT site, but it's free and it's quick…

Murky Waters (Swanson and Conover)
That's Life (EO Wilson)
The Iceman Cometh (Friedman)
It's Time to Spray DDT (Kristof)
Let the Antelope Roam (Berger and Berger) (UM's own Joel Berger!)
Biological Hazards Ahead (David Lodge)
Moving Beyond Kyoto (Al Gore)
A Tuna Meltdown (Paul Greenberg)
Eating Our Future (John McMurray)
Dumb as We Want to Be (Friedman)
Home on the Rainforest (Powers and Hurowitz)
Cold, Hard Facts (Peter Doran - interesting scientist's response to getting his work misquoted and misused)
In America, Let's Clear the Air (Bob Herbert)

Some *Info on Writing Effective Mock Congressional Testimony*

The Written Statement

General info: **The written testimony should be roughly 1500-2000 words long**, and must be handed in the day you testify. Practice in advance! Your testimony must no more than 5 minutes long when you give it out loud. If you go over, I will cut you off! ***See below for some examples of some real testimony.***

Write simply, clearly and concisely. Remember that your audience is not a group of experts (assuming they are not experts). Think of it as writing for about a 6th grade level, or for your parents.

Write in a newspaper style. This means put the punch line up front, then highlight no more than 2-3 main points, then fill in the details.

Present your most compelling data early and what course of action, if any, you are proposing.

Use specific, real data when possible, but don't get bogged down in the details.

Make sure your facts are correct!

Where appropriate, characterize the nature of the uncertainty in the problem you are addressing. Betting odds or analogies are useful approaches here.

Some *examples of real testimony:*

Note: Some of these are longer than what you need to do, but they give you a sense of what to aim for. Also, searching just with google, or on the Congressional websites (Congressional Web Page 1 http://www.house.gov/ or Congressional Web Page 2 http://www.senate.gov/) can lead you to hundreds of more examples on all kinds of topics.

CDC testimony on climate change and disease
Schlesinger testimony on forest carbon storage

Williams testimony representing Trout Ulimited on water issues
Hansen testimony on climate change and recent presidential administration
Howarth testimony on nutrient issues
Pielke testimony on climate change
Crockett testimony on ocean fisheries
Wilson testimony on carp invasion
Chalk testimony on energy efficiency