THE SCIENCE OF GLOBAL WARMING: MYTHS, REALITIES AND SOLUTIONS

GEOG PS 1400
Spring 2014

Where: Social Sciences building, room 48 (SS 48)
When: Tuesdays and Thursdays, 9:00 to 10:15 AM
Instructor: Dan Bedford
Office: Social Sciences building, room 338 (SS 338)
Office Hours: Mondays and Wednesdays 11:00 AM to 12 noon; Tuesdays and Thursdays 8:00 to 8:45 AM, **or by appointment**.
Contact Information:
Phone: 626 8091
e-mail: DBEDFORD@weber.edu (this is **definitely** the best way to reach me)
Class Website: Access via http://faculty.weber.edu/dbedford

Course outline and goals

Is global warming the greatest threat to humanity since the dawn of civilization, or "the greatest hoax ever perpetrated on the American people" (in the words of U.S. Senator James Inhofe)? Are recent signs of warming the evidence of impending doom, or all just part of a natural cycle? Is it possible to reduce carbon emissions while growing the economy, or is any attempt to emit less carbon guaranteed to end in economic disaster?

These are just some of the questions surrounding the issue of global warming, which, because of its political and economic implications, has become one of the most contentious scientific issues of our time. This class aims to investigate these and other questions, and to separate facts from rhetoric, and science from ideology.

Understanding key basic physical, chemical, biological and geographical principles is central to this course, along with an in-depth examination of the scientific process. Consequently, this class counts for three credits towards the physical science general education requirement. More information on this requirement is included at the end of this syllabus (see also http://www.weber.edu/AcademicAffairs/natural_sciences.html).

I would like everyone to get at least the following three things out of this course:

- First, an improved basic knowledge of the science that explains the processes and detection of global warming: what do we know and how do we know it?
- Second, an ability to distinguish between science and punditry.
- Third, to identify ways in which individuals, communities and organizations can develop solutions to the challenges that climate change may bring. Solutions might be structural in nature (such as renewable energy), or non-structural (changes in behaviour).

Please note: this class is concerned with Earth's *climate*. If you're interested in Earth's *weather*, you should take GEO 1130 Introduction to Meteorology instead. Like this class, GEO 1130 counts for PS gen ed credit.

Readings
The following texts are **required** for this class:
Archer, D., 2012, *Global Warming: Understanding the Forecast*, John Wiley & Sons, Inc., 2^{nd} edition (paperback).

Mann, M.E., and Kump, L.R., 2009, *Dire Predictions: Understanding Global Warming, The Illustrated Guide to the Findings of the IPCC*, DK Publishing, Inc./Pearson Education (paperback).

Other readings will be assigned as the semester progresses, but these will generally be short, readable articles. These additional readings will be provided as handouts in class, and/or made available via e-reserve on the web (http://ereserve.weber.edu/).

Please bring the books to class, along with a calculator/laptop/tablet/smartphone.

Grading
Your grade will be assessed using several components: three exams, three "response papers" each based on an assigned reading, a final class presentation, and your participation in class throughout the semester. These components will be weighted as follows:

	% of final score
Exam #1	15%
Exam #2	15%
Exam #3 (final; partly cumulative)	15%
Concept sketches (3 sketches @ 1.67% each)	5%
Problem sets (3 problem sets @ 3.33% each)	10%
Response Papers (4 papers @ 7.67% each)	30%
Participation (includes end-of-semester in-class presentation)	10%
Total	**100%**

Grades will be determined based on your percentage score and related to average class performance ("curved"). I have high standards, and you should expect to be graded rigorously, but fairly, in this course.

Exams: Three exams, roughly one every five to six weeks. The basic rule for content is: yes, it will be on the test. Anything that we have covered in lecture and/or readings up to the day of the exam is fair game. The exams will emphasize material covered in class, but some questions may focus on material dealt with more fully in the class text or other readings. The final exam will be about 20% cumulative (revisiting the material from the first two exams). Mid-term exams will consist of 50 multiple choice questions. The final exam will be the same format, but will add 10 multiple choice questions on material covered earlier in the semester (total 60 questions). All exams will be taken as Chi-tester exams in the WSU Testing Centers, on the days noted in the schedule. You do not need to come to class that day, but should take the exam instead. **Exams must not be missed**. "Make-up" exams will not be provided except under the most extreme of extenuating circumstances (such as a death in the family). Some people find Chi-tester to be a difficult format for test-taking; if this applies to you, alternative formats may be possible. Talk to me about it, and we'll see what can be worked out. Exams may be taken at any of the WSU secure testing locations, as follows:

- Ogden campus (Student Services, Social Sciences, Natural Sciences, Marriott Health Professions and Union Buildings)
- Davis Campus Testing Center
- West Testing Center

Concept sketches: At the start of class on the day before each exam (or, for the final, the last day of class), you will need to complete a sketch diagram, with annotations to explain what's going on, of one key process that we have covered in class up to that point. You will have 5 minutes to do this, in class, under exam conditions. You will receive advance warning of which process you will need to sketch.

Problem sets: David Archer's textbook includes several thought-provoking calculation exercises at the end of each chapter. We will make use of these as the semester progresses up to spring break. Details on which questions you will need to answer for each problem set will be announced 1-2 weeks ahead of the due date. For each problem set, you will need to produce both calculated and written answers. **The calculations may be hand written, but any written answers must be typed and double-spaced.**

Response papers: In order to focus in detail on certain key issues within the study of global warming, and to sharpen your critical thinking and writing skills you will write four short response papers, each on an assigned reading or activity. These will be short papers (2-3 pages) in which you identify the key points of the reading or activity and present your thoughts and views regarding the subject it addresses. These readings and your responses to them may also be used for in-class discussions. Additional instructions will be provided with each assignment. **Note that response paper #4 addresses the computer game project discussed below**. *Late policy:* late papers will be penalized at the rate of 10% of available points per whole or partial day late. Papers are due at the beginning of class on the due date. Plagiarism is always a very important concern. Be sure to see the section below on academic honesty. *Recycling bonus:* Any papers printed on recycled paper, or using both sides, get an extra point (don't recycle your old papers from this class!).

Team projects: Early in the semester, you will form up into teams of 3-4 students each. We will be doing quite a lot of in-class team problem solving, and your team will also be the basis for two out-of-class projects. These are:

1. Tracking and trying to reduce personal greenhouse gas emissions (and, by extension, the greenhouse gas emissions for the team as a whole).
2. Computer game project. Over the course of the semester, you will need to be playing the computer game *Fate of the World* (download information will be provided in class). This game is challenging and time consuming; working as a team will help you avoid blind alleys and find a way to win. There will be

bragging rights (and bonus points) for the team with the highest score at the end of the semester.

In-class presentation: During the last week of the semester, teams will give presentations on the two team projects to the rest of the class. For each project, you will need to document your successes and failures, and describe how easy or difficult it was to cut your greenhouse gas emissions, and how easy or difficult it was to win at *Fate of the World*. What strategies did you try? What worked and what didn't? Your presentation on the two team projects will count towards your participation grade, see below.

Participation: This is necessarily a very subjective component of your grade, but the following activities will help you accumulate points for participation: regular attendance in class, careful completion of reading assignments, asking thoughtful and informed questions, providing useful contributions to classroom discussions, and constructive completion of any in-class exercises. Be aware that good participation is an easy way to boost your grade—but be aware also that **good participation means more than simply coming to class**.

Extra credit assignments: Attend any sessions of the Intermountain Sustainability Summit on March 6 (intermountainsustainabilitysummit.com; requires $10 registration fee (also includes lunch), or volunteer to help out). Get the signature of the presenter as evidence, and earn 2% bonus points per session, up to 6% bonus points maximum. Another way to get extra credit is to have the highest score at *Fate of the World*. The highest documented score gets 5% bonus points for each team member.

E-mailing assignments: Please **do not** e-mail me any of your written work. I need hard copies, not electronic ones. E-mailed assignments will not be accepted.

Approximate grading grid: Your performance in exams, homework assignments and the self-guided field trip report will contribute to an overall grade in the class based on your scores in these various course components. Please note that the following grid is **approximate and subject to variability**, especially as a result of curving.

90-100%	A
80-89%	B
66-79%	C
52-65%	D
50% or less	E

Plus and minus grades depend on where your score falls within the overall range for the grade; the high end of the range will gain a plus, the low end a minus. For example, a score of 88% is *typically* (but may not always be) a B+, 85% a straight B, and 82% a B-.

Do You Need a Minimum Grade In This Class?

If you need a certain minimum grade in this class for **any reason** (graduation requirements, scholarship, athletics, etc.), it is **up to you** to monitor your progress and approach me for advice, extra help, etc. to ensure you end the semester with the grade that you need. The time to work on this is **during the semester**, and absolutely **not** after you have taken the final exam. Requests for extra credit assignments, grade changes, etc. will not be entertained.

Class Web Site

The class web site can be accessed via http://faculty.weber.edu/dbedford. This web site will contain study guides, a writing/style guide for response papers, a copy of this syllabus, links to useful web sites, and copies of the PowerPoint presentations shown in class. This web site is the central repository for information about the class.
If you have a question, please check the web site and/or syllabus first.

Plagiarism and Academic Honesty

It should be basic common sense that nobody should cheat on exams. For this class, cheating means using any unauthorized aid to take an exam. Exams will be closed-book, closed-note, and no co-operating with other students will be permitted. The exams are intended to test the knowledge you have in your head. No external sources are allowed.

Plagiarism is a little more complex because it comes in many shapes and forms, but in simple terms it means copying material from somewhere else and passing it off as your own work, **either intentionally or unintentionally**. For this class, the issue of plagiarism applies mainly to your response papers. For the sake of clarity, keep in mind the following: **every word of each of your response papers is expected to be your own work, written specifically for this class** (no resubmitting work from previous classes)**.**

If you are caught submitting a copied paper, **even if you didn't mean to**, you are guilty of plagiarism and the range of penalties runs from failing the assignment (for the most minor infractions only), failing the class (the most common penalty) or expulsion from the university (for extreme repeat offenders). These penalties also apply to anyone caught cheating on exams.

Other Considerations

I am very aware that many students have work and family commitments outside the classroom. I am willing to accommodate conflicts within reason, but keep in mind that your responsibilities outside class do not excuse you from your responsibilities as a student. If you have any questions about those responsibilities, please check the Student Code, available on the web at http://documents.weber.edu/ppm/6-22.htm.

Any student requiring accommodations or services due to a disability must contact Services for Students with Disabilities (SSD) in room 181 of the Student Service Center. SSD can also arrange to provide course materials (including this syllabus) in alternative formats if necessary. The SSD office has a web page at http://departments.weber.edu/ssd/

Classroom Etiquette

Please try to remember that while you are in class, I am talking to each and every person in the room, including *you*. Please **do not** do any of the following things in class:

- Talk to other people while I am talking or while one of your classmates is talking
- Bring in a switched-on electronic device, e.g. iPod, cell phone, laptop computer.
- Read or write text messages, or otherwise tinker with a cell phone.
- Eat, or bring in food, or drinks (including coffee).
- Read *The Signpost*, or anything else.
- Start packing your books and notes before class is finished.
- Sleep.

This last one can be very tough for those of you working night shifts or with small children keeping you up late at night. However, if you sleep in class you are not learning anything, you are not contributing to class discussions, and you are distracting other students (as well as me). If you are too tired to make it through class, go home and get some sleep instead.

Quick Reference: Important Dates

Exam #1	Thursday February 6th (at the testing centers)
Exam #2	Thursday March 20th (at the testing centers)
Exam #3 (Final exam)	Tuesday April 22nd to Thursday April 20^{4h} (testing centers)
Concept sketch #1	Tuesday February 4th
Concept sketch #2	Tuesday March 18th
Concept sketch #3	Thursday April 17th
Response paper #1 due	Thursday January 30th
Response paper #2 due	Tuesday February 25th
Response paper #3 due	Tuesday April 1st
Response paper #4 due	Tuesday April 15th
Problem set #1 due	Thursday January 5th
Problem set #2 due	Tuesday February 4th
Problem set #3 due	Tuesday March 4th
Team presentations	April 15th and 17th (last week of classes)

How to Succeed in this Class

The following are some suggestions for things you can do to help you do well in this class. None of the following will guarantee success, but they will help.

1. **Attend class regularly.** This should go without saying, but if you attend class regularly, you will benefit from in-class discussions and activities, as well as hearing announcements in class about reminders of due dates, upcoming exams, etc.

2. **Take notes.** Although many students now simply sit in class and listen, there is an important connection between taking notes and recall. Successful students take notes.

3. **Read the syllabus.** This document contains important information to help you succeed, including class policies on exams, papers, and other graded work. Students occasionally miss exam deadlines simply because they did not read the syllabus.

4. **Make use of additional class materials on the website**, such as study guides.

5. **Read the textbook.** The textbook is very well written and illustrated, and provides very useful background information. Class lectures are based on material from the textbooks and e-reserve readings, so reading these will help you follow the lectures more easily.

6. **Participate in class.** If you engage in class discussions, ask and answer questions, and generally take an active approach to the class, you are learning more deeply than if you take a passive approach (where you just sit in class and say nothing). This will help you do well on exams and response papers, and fully 10% of your class grade is based on participation. Participating well in class is therefore a really easy way to raise your grade.

Natural Sciences General Education Program
Mission Statement

The mission of the natural sciences general education program is to provide students with an understanding and appreciation of the natural world from a scientific perspective.

Science is a way of knowing. Its purpose is to describe and explain the natural world, to investigate the mechanisms that govern nature, and to identify ways in which all natural phenomena are interrelated. Science produces knowledge that is based on evidence and that knowledge is repeatedly tested against observations of nature. The strength of science is that ideas and explanations that are inconsistent with evidence are refined or discarded and replaced by those that are more consistent.

Science provides personal fulfillment that comes from understanding the natural world. In addition, experience with the process of science develops skills that are increasingly important in the modern world. These include creativity, critical thinking, problem solving, and communication of ideas. A person who is scientifically literate is able to evaluate and propose explanations appropriately. The scientifically literate individual can assess whether or not a claim is scientific, and distinguish scientific explanations from those that are not scientific.

Foundations of the Natural Sciences
Learning Outcomes

After completing the natural sciences general education requirements, students will demonstrate their understanding of general principles of science:

1. **Nature of science**. Scientific knowledge is based on evidence that is repeatedly examined, and can change with new information. Scientific explanations differ fundamentally from those that are not scientific.
2. **Integration of science**. All natural phenomena are interrelated and share basic organizational principles. Scientific explanations obtained from different disciplines should be cohesive and integrated.
3. **Science and society**. The study of science provides explanations that have significant impact on society, including technological advancements, improvement of human life, and better understanding of human and other influences on the earth's environment.
4. **Problem solving and data analysis.** Science relies on empirical data, and such data must be analyzed, interpreted, and generalized in a rigorous manner.

The Physical Sciences
Learning Outcomes

Students will demonstrate their understanding of the following feature of the physical world:

1. **Organization of systems**: The universe is scientifically understandable in terms of interconnected systems. The systems evolve over time according to basic physical laws.
2. **Matter**: Matter comprises an important component of the universe, and has physical properties that can be described over a range of scales.
3. **Energy**: Interactions within the universe can be described in terms of energy exchange and conservation.
4. **Forces**: Equilibrium and change are determined by forces acting at all organizational levels.

Class Schedule

Below is a tentative schedule. Exam dates will not change, but precise topics covered on particular days may vary.

Week beginning	***Tuesday***	***Thursday***	***Reading***
7-Jan	**Part 1: The climate system** Course introduction Blackbody radiation		Archer ch. 1-2 Mann 20-21
14-Jan	Why is Earth warmer than it should be? The greenhouse effect		Archer ch. 3-4 Mann 22-23 Mann 26-31
21-Jan	Earth's real-life atmosphere: basic characteristics, weather vs. climate **Problem set #1 due**		Archer ch. 5-6 Mann 10-19 Mann 60-61
28-Jan	Feedbacks in the climate system	The natural carbon cycle **RP #1 due**	Archer ch. 7-8 Mann 24-31
4-Feb	Natural climate change: the importance of carbon dioxide in Earth's climate history **Concept sketch #1** **Problem set #2 due**	**Exam 1: no class, go to Testing Centers on WSU Ogden or Davis campuses**	Archer ch. 8 Mann 40-43, 82-85, 94-97
11-Feb	**Part 2: The Anthropocene** Present and recent past climate change: isn't this all part of a natural cycle?		Archer ch. 8 Mann 62-63
18-Feb	Fossil fuels, energy, and the perturbed carbon cycle		Archer ch. 9-10 Mann 30-35, 94-97
25-Feb	Climate models and the fingerprints of human agency **RP #2 due**		Archer ch. 11 Mann 64-75 Mann 38-39, 46-59, 98-99, 138-9
4-Mar	Forecasting future climate: climate sensitivity, emissions scenarios, model validation **Problem set #3 due**		Archer ch. 12 Mann 77-105
11-Mar	**SPRING BREAK** **No classes**		
18-Mar	Impacts of possible future climate change **Concept sketch #2**	**Exam 2: no class, go to Testing Centers on WSU Ogden or Davis campuses**	Archer ch. 12 Mann 107-145
25-Mar	**Part 3: What do we do now?** Agnotology and global warming: understanding the difference between science and punditry		Peterson (e-res) Mann 44-45
1-Apr	The international framework for tackling climate change **RP #3 due**		Mann 6-8 *Economist* (e-res)
8-Apr	Mitigation and adaptation: 'solving' global warming? Clean energy and its challenges		Archer ch. 13 Mann 141-197
15-Apr	Individual initiatives: reports on class team efforts to reduce carbon footprints **RP #4 due on Tuesday**	**Concept sketch #3 on Thursday**	Mann 182-183

Final exam: April 22-24 (Tuesday-Thursday) in the Testing Centers.