GEOGRAPHY 3900
Global Climate Change: Causes and Consequences
Days & times: Tuesdays and Thursdays 2:20 to 3:40 PM
Room: Scott Lab E040

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*"Warming of the climate system is **unequivocal**, as is now evident from the observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level."* (emphasis added)

- IPCC (2007)

"Much of the debate over global warming is predicated on fear, rather than science. I called the threat of catastrophic global warming the greatest hoax ever perpetrated on the American people."

- Senator Inhofe (R-OK, 2005)

*"...it has become increasingly clear that **energy** is the core of the environmental problem; environment is the core of the energy problem; and the energy-environment intersection is the core of the sustainable development problem."*

- John Holdren, former President of AAAS, advisor to President Obama (2003)

Course Objectives

This interactive class challenges students to understand the climatic and environmental changes currently facing our planet. Understanding the causes of global climate and environmental change requires knowledge of the **Earth system**, its climate, the mechanisms that force climate and the human activities that affect the magnitude and direction of some of these forcing mechanisms.

Yet grappling with the consequences of human-induced climate change implicates broader political realities and energy conversion technology. The issue of **global warming** is central to the class, and forms a context for students to develop and apply critical thinking. This will be fostered in class by careful reading, lectures, discussion, films, exercises, and presentations. We will address the fundamentals of climate science theory, concepts, key evidence, and methodology. In addition, we will focus on developing **energy** literacy, as arguably this issue is grounded in the broader context of our society's energy demands, sources and usage. A key learning outcome is to develop the knowledge base and insight to critically evaluate information presented from various media sources.

This course meets **General Education (GE) requirements** in one area - ***Natural Science, Physical Science*** (i.e. http://asccas.osu.edu/curriculum/ge-goals-and-learning-outcomes).
Specifically this means we aspire to the following ***goals***:
Students understand the principles, theories, and methods of modern science, the relationship between science and technology, the implications of scientific discoveries and the potential of science and technology to address problems of the contemporary world.
The ***expected learning outcomes*** include:

. 1) Students understand the basic facts, principles, theories and methods of modern science.
. 2) Students understand key events in the development of science and recognize that science is an evolving body of knowledge.
. 3) Students describe the inter-dependence of scientific and technological developments.
. 4) Students recognize social and philosophical implications of scientific discoveries and understand the potential of science and technology to address problems of the contemporary world.

Course Materials

There is no single textbook that covers the material that we will discuss in class. However, many are available to you at NO COST. We will use Dessler (2012) primarily to organize our enquiry into global climate change AND also to serve as a jumping off point to delve into current, cutting edge research questions pertaining to global change. Other reference texts exist, and I include links below. Throughout the term additional reading and reference materials will likely be required. This will accommodate the very dynamic current literature and at least one planned external lecture (there might be more). Selected journal articles and book chapters will be placed on electronic reserve (eReserves) for the class. The list of these readings will be maintained on the class Carmen web page under Content, Reserve Materials.
Reference Textbooks:

. 1) Dessler, A. 2012. *Introduction to Modern Climate Change*. Cambridge University Press. ISBN 978- 0-521-17315-5. ***THIS IS IN AVAILABLE AT OSU BOOKSTORE, AND AS E-BOOK AT OSU LIBRARY*** (accessible when on OSU computers): http://site.ebrary.com/lib/ohiostate/docDetail.action?docID=10514243 Also available for free pdf download: http://bookos.org/book/1458008/1b18c0
. 2) Dessler, A. and E. A. Parsons 2010. The Science and Politics of Global Climate Change: A Guide to the Debate. Cambridge University Press. 231 pp. Available for free pdf download: http://bookos.org/book/1397801/42059b
. 3) Mathez, E. A. 2009. *Climate Change: The Science of Global Warming and Our Energy Future*. Columbia University Press, NY, 318 pp.
. 4) Cronin, T. M. 2009. *Paleoclimates: Understanding Climate Change Past and Present* Columbia University Press, NY, 440 pp.
. 5) Sir John Houghton 2009. *Global Warming: The Complete Briefing*, 4th Ed. Cambridge University Press, 458 pp. Free pdf: http://bookos.org/book/695250/fdc7a3
. 6) Mann, Michael and Krump, Lee 2008. *Dire Predictions: Understanding Global Warming*. DK Publishers, NY, 208 pp.
. 7) Weart, S. 2003. *The Discovery of Global Warming*. Harvard University Press, 240 pp. Online: http://www.aip.org/history/climate/index.htm

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Carmen web page:

You will be alerted in class about updates on our Carmen class web page. The schedule of activities (lectures, group discussions, field trips, presentations, papers, and films) will be posted on the Carmen class web page and will be updated as the class progresses. Lecture slides will be compiled into pdf and posted. Readings are assigned in the week prior to the presentation of the material. Note that the class schedule may change slightly as the semester progresses and you will be alerted to these changes. Remember that this is a lecture/ seminar style course and thus you need to ***remain flexible*** so that we may capitalize on climate- and/or environment-related events and special speakers on campus.

Evaluation

Homework and in-class exercises and quizzes:	20%
Report on a paleoclimate proxy:	15%
Exams (2):	30%
Term project:	25%
In-class participation:	10%

In class activities: These will be handed in individually. Collaboration between students is allowed (in fact encouraged) in the case of homework and class exercises but not allowed in quizzes. All activities have the same weight on the final category grade.

Paleoclimate proxie report: For a specific paleoclimate proxy *of your choice*, provide a detailed description of the proxy, how it is analyzed and interpreted, its strengths and weaknesses and report on a case study (i.e. example from scientific literature) making use of the proxy. The following specific content is required:

- three double-spaced pages, with proper citation of references (you can use any generally accepted citation and reference format)
- two pages of figures (proxy and case study results)
- include at least two peer-reviewed scientific references

Exams: There will be two, non-cumulative, individual, closed book in class exams worth 15% of the final grade each.

Term project: This will include a group presentation and an individual written report on topics related to climate mitigation, adaptation and geoengineering. Groups and group presentation topics are determined by the instructor. Students can select, in consultation with instructors, the particular topic for their individual written report. The individual report can (but does not have to) cover the same topic addressed by the group the student belonged to. More details about the term project will be available on Carmen.

Participation: This course will require your full participation if you expect to do well. In order or you to take full advantage of the opportunities in this course and demonstrate that you have done so, I expect the following:

- Attentive and active participation in class discussions and activities;
- Thoughtful and timely reading of assigned materials;
- Completion of each assignment on time;
- Open-minded, critical consideration of diverse viewpoints

Course Policies

You are expected to adhere to all policies listed on the Student Code of Conduct webpage: http://studentaffairs.osu.edu/resource_csc.asp.

Students who anticipate missing an exam must make arrangements with the instructor *at least one week prior*. You are allowed one un-excused absence. An excused absence requires written documentation (doctor's excuse) or prior permission to be absent. I will consider your requests on a case-by-case basis.

All assignments are due at the end class, *and are expected to be stapled*. A 40% penalty will be applied to any individual or group work handed in up to one week after the due date. *Work that is eight or more days late will not be accepted.*

In the classroom, be respectful of others, and specifically: **NO EMAIL, TEXT, PHONE, or WEB-BROWSING DURING LECTURE!** So, unless you are using them to take notes or follow along the slides, put your electronic devices away.

An Important Note about Plagiarism and Academic Misconduct: Plagiarism and other forms of cheating will not be tolerated. University rules provide severe penalties for academic misconduct, ranging from course failure to dismissal from the university. University rules are found in the handbook used in all survey courses: "University Survey - A Guidebook and Readings for New Students." Any questions about this policy, or your grade, should be brought directly to the instructor.

Disability Statement

Students with physical or learning disabilities requiring alternative accommodations for completing course requirements must make these arrangements in consultation with the University Office of Disability Services (150 Pomerene Hall, 2-3307) and the instructor *at the beginning of the quarter.*

Supplemental Readings

AAAS Atlas of Population & Environment http://atlas.aaas.org/

Alley, R. B., J. Marotzke, W. D. Nordhaus, J. T. Overpeck, D. M. Peteet, R. A. Pielke Jr., R. T. Pierrehumbert, P. B. Rhines, T. F. Stocker, L. D. Talley, J. M. Wallace. 2003. Abrupt Climate Change. *Science* 299: 2005-2010.

Bradley, R. S. 1999. Paleoclimatology: Reconstructing Climates of the Quaternary. Harcourt Press. NY. 613 pp.

Imbrie, J. and Imbire-Palmer, K. 1979. Ice Ages: Solving the Mystery. Harvard University Press. Cambridge, MA. 224 pp.

IPCC. 2007. Summary For Policy Makers: Working Groups I, II and III.

Mayewski, P. A. and 15 others. 2004. Holocene climate variability. *Quaternary Research* 62: 243– 255.

The Millennium Ecosystem Assessment http://www.maweb.org/en/index.aspx

Oppenheimer, M., O'Neill, B. Webster, M. and Agrawala, S. 2007. The Limits of Consensus. *Science* 317:1505-1506.

Pielke R, Prins G, Rayner S, et al. 2007. Lifting the taboo on adaptation. *Nature* 445: 597-598.

Plass, G. and Schmidt, G. 2010. Carbon Dioxide and the Climate. *American Scientist* 98: 58-67.

Ruddiman, W.F. 2003. The anthropogenic greenhouse era began thousands of years ago. *Climatic Change* 61, 261-293.

Ruddiman, W.F. 2005. How Did Humans First Alter Global Climate? *Scientific American*: March. Schneider, S. H.: 2001, 'What is "Dangerous" Climate Change?' *Nature* 411, 17–19.

Stenseth, N.C., Ottersen, G. Hurrell, J.W., Mysterud, A., Lima, M., Chan, K-S., Yoccoz, N.G., Adlandsvik, B. 2003. Studying climate effects on ecology through the use of climate indices: the North Atlantic Oscillation, El Nino Southern Oscillation and beyond. *Proc. R. Soc. Lond. B* 270: 2087-2096.

Swetnam, T. W., Allen, C. D., Betancourt, J. L. 1999. Applied Historical Ecology: Using the Past to Manage for the Future. *Ecological Applications* 9: 1189–1206

Sequence of lectures, exams and project dates

Theme 1: Introduction to climate dynamics and overview of recent climate change
Approximately 10 lectures

- The climate system
- Sources and pathway of energy within the system
- Greenhouse effect
- Simple models of the climate system
- Evidence and causes of recent climate change

First exam: February 26

Theme 2: Earth's climate history with emphasis on the last 2 million years
Approximately 5 lectures

- Paleoclimate proxies
- Quaternary Glaciations
- Climate of the Holocene

Paleoclimate proxy report due: March 26

Theme 3: Abrupt climate change. Potential causes and consequences
Approximately 2 lectures

Theme 4: Detailing recent climate variability and climate change
Approximately 2 lectures

Theme 5: Future climate predictions
Approximately 2 lectures

Second exam: April 16

Term project group presentations: April 21 and 23

Term project individual written report due: April 23