GEOGRAPHY 3900
Global Climate Change: Causes and Consequences
Class # 21261, 3 units, in person – lecture required, no prerequisites, GE Natural Science: Physical

Days & times: Tu,Th 3:55 – 5:15 PM
Room: Scott Lab E040

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*"Warming of the climate system is **unequivocal**, and since the 1950s, many of the observed changes are unprecedented over decades to millennia."* (emphasis added)

- IPCC FAR (2013)

"I'm here to say that I think there's some impact of human activity on climatic change. It's not 100 percent of the climatic change, it's not zero percent, but there is no scientific consensus on what number between the two it is. And that's why there's considerable doubt."

- Representative Sensenbrenner (R-WI, 2009)

"It would be convenient if the science weren't right. If the science is right, that means we need to do something different. And change is threatening, … It is a no-brainer: Change what you tax. Get off of income, get on emissions. The biggest subsidy of all is being able to dump into the trash dump of the sky without paying a tipping fee."

- Former Republican Congressman Bob Ingliss (R-SC, 2015)

*"…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.

This course meets these goals and addresses the learning outcomes as follows:

1) With a combination of lectures, readings, and exercises (homework problem sets and in-class activities), students will comprehend the basic facts of Earth's climate system, including fundamental principles of energy balance, radiative forcing, the greenhouse effect (natural and 'enhanced'), the carbon cycle, feedbacks, natural climate variability, climate extremes and climate modeling. Students will access real climate data, practice analyses, and critically evaluate scientific evidence.
2) Students will study the history of climate change science, becoming with particular focus on how we have understood ice ages, and the way the atmosphere functions.
3) Students will examine study how technology has informed our understanding of climate, what measurements document climate change, and how technology continues to provide critical observations of these changes, from the laboratory to satellites in space. We will visit an actual ice core paleoclimatology lab, and see it in action.
4) Students will confront the evidence of climate change impacts to human and natural systems, and get exposed to the implications of these for policy makers; climate change is considered one of the leading problems facing the contemporary world. We will provide the basic facts and physical principles involved, and what processes drives climate to change over different time scales. Students will practice negotiating in a class-exercise, and get exposed to dimensions of climate change mitigation, adaptation and geo-engineeriong during their final project and group presentation.

Course Materials

There is no single textbook that covers the all material that we will discuss in class. However, many are available to you at NO COST. We will use Dessler (2012 or 2014) as our **primary reference textbook (required)**. It will help organize our enquiry into global climate change AND be a good text reference to basic principles. We will then also access other sources to delve into current, cutting edge research questions pertaining to global change. Many other reference texts exist, and students are encouraged to read widely. Additional reading, media, web and reference materials will be made available via our class Carmen page. These additional sources will allow us to access more current research findings since this is a very dynamic topic. We will also post readings that get referred to in lecture. A number of text chapters and selected journal articles will be placed on electronic reserve (eReserves) via the class Carmen page.

Primary Reference Textbook (required):

1) Dessler, A. ***Introduction to Modern Climate Change***. Cambridge University Press. A second edition that has only recently been published, so the first edition is also still valid for the class.
    a. First edition (2012): ISBN 978-0-521-17315-5. This has been ordered in previous classes and should be available used at OSU; it is on AMAZON. But it is also available as an E-BOOK at the OSU LIBRARY (accessible when on OSU computers): http://site.ebrary.com/lib/ohiostate/docDetail.action?docID=10514243
    b. Second edition (2014): ISBN 978-1-107-48067-4. This newer version has been ordered and should be available at OSU Bookstore. It is also on online sites (e.g. B&N for ~$55, or as an eBook on Google ~$31).

Other textbooks (these are not required to obtain; they can be helpful reference):

1) 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.
2) Mathez, E. A. 2009. *Climate Change: The Science of Global Warming and Our Energy Future*. Columbia University Press, NY, 318 pp.
3) Cronin, T. M. 2009. *Paleoclimates: Understanding Climate Change Past and Present* Columbia University Press, NY, 440 pp.
4) Sir John Houghton 2009. *Global Warming: The Complete Briefing*, 4th Ed. Cambridge University Press, 458 pp.
5) Mann, Michael and Krump, Lee 2008. *Dire Predictions: Understanding Global Warming*. DK Publishers, NY, 208 pp.
6) Weart, S. 2003. *The Discovery of Global Warming*. Harvard University Press, 240 pp. Online: http://www.aip.org/history/climate/index.htm

Carmen web page:

The single most important source of course materials will be our CARMEN class page. All readings, assignments and exercises will be posted via Carmen. You will be alerted about current news items, upcoming events, and any schedule changes on our Carmen page. The schedule of activities (lectures, group discussions, field trips, presentations, papers, and videos) will be posted as a pdf and will be ***FREQUENTLY UPDATED*** as the class progresses, so ***PAY CLOSE ATTENTION THAT YOU HAVE THE MOST CURRENT VERSION***. Lecture slides will be compiled into pdf format and posted after class. Except for the first week of the class, readings are assigned in the week prior to the presentation of the material. Again, the ***CLASS SCHEDULE & READINGS WILL CHANGE*** as the quarter progresses and you will be alerted to these changes. We will try also to inform you of climate- and/or environment-related events and special speakers on campus during the semester; please keep us informed of events, news, etc.

Evaluation

Student evaluation will be based on a combination of the following:

- Exercises: 15%
- Pop quizzes: 10%
- Short Paper on a Paleoclimate Proxy: 15%
- Midterm Exams (2): 20%
- Final Project and Presentation: 30%
- Participation: 10%

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

- Attentive and active participation in class activities;
- Thoughtful and timely reading of assigned materials (we will have pop quizzes);
- Completion of each assignment on time;
- Open-minded, critical consideration of diverse viewpoints.

Course Policies

Student Code of Conduct webpage: http://studentaffairs.osu.edu/resource_csc.asp.
You are expected to adhere to all policies listed. Students who anticipate missing an exam must make arrangements with the instructor at least **one week prior**. An excused absence requires written documentation (doctor's excuse) or prior permission to be absent. We will consider your requests on a case-by-case basis. All assignments are due at the beginning of class, and are expected to be **stapled**.

In the classroom, be respectful of others, and specifically: **NO EMAIL, TEXT, PHONE, or WEB-BROWSING DURING LECTURE! Turn off all phones in class.** If you'd rather be online than attend lecture, then make your choice and do not come to class. Students are encouraged to report anyone who is engaged in distracting use of phone, laptops or tablets, and those engaged in the distracting activity will be asked to leave. The best idea is to turn off all digital devices. If you require a laptop during lecture, advise the instructor before class.

Disability Services

Students with disabilities that have been certified by the Office for Disability Services will be appropriately accommodated, and should inform the instructor as soon as possible of their needs **at the beginning of the quarter**. The Office for Disability Services is located in 150 Pomerene Hall, 1760 Neil Avenue; tel: 292-3307, TDD 292-0901; http://www.ods.ohio-state.edu/.

An Important Note about Plagiarism and Academic Misconduct: It is the responsibility of the Committee on Academic Misconduct to investigate or establish procedures for the investigation of all reported cases of student academic misconduct. The term "academic misconduct" includes all forms of student academic misconduct wherever committed; illustrated by, but not limited to, cases of plagiarism and dishonest practices in connection with examinations. Instructors shall report all instances of alleged academic misconduct to the committee (Faculty Rule 3335-5-487). For additional information, see the Code of Student Conduct (http://studentaffairs.osu.edu/info_for_students/csc.asp).

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.

Ellis, E. C., K. Klein Goldewijk, S. Siebert, D. Lightman, and N. Ramankutty. in press. Anthropogenic transformation of the biomes, 1700 to 2000. *Global Ecology and Biogeography*, *in press.*

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.