GEOGRAPHY 3900 - Global Climate Change: Causes and Consequences

Class # 23822, 3 units

In person – lecture required, no prerequisites, GE Natural Science: Physical

Class times: Tue, Thu 11:10 AM – 12:30 PM

Class location: Smith Lab 1005

	Professor	**Teaching Assistant**
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"Human influence on the climate system is clear, and recent anthropogenic emissions of greenhouse gases are the highest in history. Recent climate changes have had widespread impacts on human and natural systems."

- IPCC: Climate Change 2014: Synthesis Report (2014)

"Wow, it's snowing in Israel and on the pyramids in Egypt. Are we still wasting billions on the global warming con? MAKE U.S. COMPETITIVE!"

- Donald Trump (2013)

"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 Description

Understanding the **causes** of **global climate change** requires knowledge of the **Earth system –** its climate, energy balance, and biogeochemical cycles – and both the natural and human-caused mechanisms that force climate change. Grappling with the **consequences** of climate change invokes broader political and economic dimensions related to development and **energy conversion technology**.

GEOG 3900 is a science class open to all majors. We will build upon fundamental concepts to understand Earth's changing climate over different time scales, and engage the consequences of climate changes currently facing our planet. We will examine the key evidence of climate change and learn directly from climate researchers how they conduct their science. In addition, we will study links between climate and society's energy demands, sources and usage. By the end of the class, students will be more energy literate, and able to **critically evaluate** divergent facts about climate presented in **media** sources.

There are no prerequisites for the class. We will use basic arithmetic and some algebra, but no calculus.

Students with Disabilities

The University strives to make all learning experiences as accessible as possible. If you anticipate or experience barriers based on your disability (including mental health, chronic or temporary medical conditions), please inform the instructor immediately **at the beginning of the course**. Students are also welcomed to register with Office of Student Life Disability Services (SLDS), and will be appropriately accommodated upon registration. Bring forms to the instructor as soon as possible to be sure accommodations can be implemented in a timely fashion. **SLDS contact information**: slds@osu.edu; 614-292-3307; slds.osu.edu; 098 Baker Hall, 113 W. 12th Avenue.

General Education Goals & Expected Learning Outcomes

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.

We aim to address the ***expected learning outcomes*** as follows:

1) **Students understand the basic facts, principles, theories and methods of modern science.**
   In this class, a combination of lectures, readings, and exercises (homework problem sets and in-class activities), will help students 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 climate data, practice analyses, and critically evaluate evidence.
2) **Students understand key events in the development of science and recognize that science is an evolving body of knowledge.**
   In this class, students will study the history of climate change science, with a particular focus on how we have understood ice ages, and the way the atmosphere functions.
3) **Students describe the inter-dependence of scientific and technological developments.**
   In this class, students will examine 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 recognize social and philosophical implications of scientific discoveries and understand the potential of science and technology to address problems of the contemporary world.**
   In this class, 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. Required readings will come from a primary text, and additional material provided via our class web page. Much more material is available on this topic, and can be helpful.

Required readings:

We will use Dessler (2012 or 2014) as our **primary reference textbook**. It will help organize our inquiry into global climate change AND it is a good reference to basic principles. Because students can access it in different forms, we do not require purchase; it is listed as recommended with OSU Bookstore. However, ***required readings will be assigned from this text***. We will also use have other assigned readings from additional sources (scientific articles, web pages, book sections). These will be announced in lecture, and provided as either web links or pdfs. We will indicate on the class schedule and/or in lecture what readings are required by date. Our expectation is that students complete the readings prior to class. The readings will be referenced in class, will be fare game on exams, and students will be expected to engage in discussion and occasionally face quizzes on reading materials.

Primary textbook:

Dessler, A. **Introduction to Modern Climate Change**. Cambridge University Press. A second edition 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 used copies should be available; it is on AMAZON. But it is also available for limited (2 users at a time) electronic resource through the OSU LIBRARY (accessible when on OSU computers): https://library.ohio-state.edu/record=b7011024~S7
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. Amazon or B&N for ~$40, or as an eBook on Google ~$30).

Additional (optional) readings:

Many texts exist on the topic of climate change, and students are encouraged to read widely. We provide a (non-exhaustive) list of some additional texts below. Many are available to you, and some at NO COST. We also provide abundant additional readings, text chapters, media, web and reference materials via our class web page. These sources will provide greater depth on current scientific research findings since this is a very dynamic topic, and can be helpful as students write papers or want to follow up to learn more. In fact, this vast topic is so rapidly changing that we encourage students to inform us of any relevant additional sites or articles that we can share with class.

Examples of 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

Course web page:

The course syllabus, updated schedule, announcements, readings, lecture slides, exam review guides, assignments, exercises and additional links will be posted via our course page on Carmen (www.carmen.osu.edu). Login using your OSU username and password then select Geography 3900 from the list of enrolled courses.

Check our site regularly! You will be alerted about current news items, upcoming events, and any schedule changes on our Carmen page. The schedule lists by date all class lectures, readings, field trips, exercises, exams, presentations, and due dates. It will be posted as a pdf with version date in title, 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 semester progresses. 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 relevant news items or events (i.e. there are often lectures, movies, or events on or near campus related to our class) that might be of interest, and we will post them.

Evaluation

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

- Final Paper & Poster: 30%
- Midterm Exams (2): 24%
- Exercises (take-home & in-class): 21%
- Proxy paper: 15%
- Participation (quizzes, attendance): 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 quizzes*****);
- Completion of each assignment on time;
- Open-minded, critical consideration of diverse viewpoints.

**Top Hat:

We will use Top Hat to gauge participation and aid students in retaining understanding by practicing concepts presented in class (i.e. take quizzes). Top Hat is a web-based student response system that allows interactive presentations in real-time during lecture. Students can respond to Top Hat questions and prompts using digital devices (phones, tablets, laptops) that they already own while attending class, using either the app or via text messaging. There are additional resources to learn about Top Hat on this website at the OSU Office of Distance Education and eLearning:
https://resourcecenter.odee.osu.edu/top-hat

Grading scale:

A	93-100	C	73-76.9
A-	90-92.9	C-	70-72.9
B+	87-89.9	D+	67-69.9
B	83-86.9	D	60-66.9
B-	80-82.9	E	0-59.9
C+	77-79.9	EN	Too many absences to permit passing grade

Exams:
Midterm exams will be comprised of short answer, essays, diagrams and interpretation of figures. We will provide study guides for the exams. This will help narrow and focus your study time on specific terms, readings and concepts. There is no final exam. ☺

Course Policies

You are expected to adhere to all policies listed and the Ohio State University Code of Student Conduct.

Late penalties: Students who anticipate missing an exam or in class exercise for valid reasons must discuss with instructors immediately, and present valid documentation no later than **one week prior**. If you miss a quiz, exam or exercise, you must present a doctor's note demonstrating you sought medical attention for an unavoidable reason that prohibited you from attending class. The doctor's note must include a name and telephone where we can contact them. We will consider make up requests on a case-by-case basis; given the inter-active nature of the class content, it is impossible to redo certain activities. An absence related to exams or papers must be explained directly to instructors in person, and then communicated clearly via email. All assignments are due at the beginning of class, and, unless indicated otherwise, are expected to be handed in as hard copy and must be **stapled**. Non-stapled papers will be penalized. Late penalties will be applied at the discretion of instructors for exercises or papers that are not handed in on time and have not been excused.

Group project work: This class will include a number of group activities, whereby students are required to work together both during and outside class. Most prominently, the class includes a group poster presentation as part of the final project. All group work requires active participation, and can introduce logistical challenges of cooperation. Nevertheless, learning to work through challenges and negotiate individual differences adds an essential dimension to the class, as it mirrors the societal challenges of dealing with climate change. Likewise, there will not be substitutions. Students should be prepared by planning carefully. Be respectful of others.

Academic integrity and misconduct: Academic integrity is essential to maintaining an environment that fosters excellence in teaching, research and other educational and scholarly activities. The Ohio State University and the Committee on Academic Misconduct (COAM) expect that all students have read and understand the University's *Code of Student Conduct*, and that all students will complete all academic and scholarly assignments with fairness and honesty. Students must recognize that failure to follow the rules and guidelines established in the University's *Code of Student Conduct* and in this syllabus may constitute "Academic Misconduct."

The Ohio State University's *Code of Student Conduct* (accessible here: https://oaa.osu.edu/coam.html) defines the term "academic misconduct" as: "Any activity that tends to compromise the academic integrity of the University, or subvert the educational process." Examples of academic misconduct include (but are not limited to) cases of **plagiarism**, collusion (unauthorized collaboration), copying the work or another student and dishonest practices in connection with examinations (e.g. possession of unauthorized materials during the exam). Ignorance of the University's *Code of Student Conduct* is never

considered an "excuse" for academic misconduct, so we recommend that you review the *Code of Student Conduct* and specifically the sections dealing with academic misconduct.

If we suspect that a student has committed academic misconduct in this course, we are obliged by University Rules to report our suspicions to COAM, who will investigate or establish procedures for the investigation of all reported cases of student academic misconduct. If COAM determines that you have violated the *Code of Student Conduct* (i.e. committed academic misconduct), the sanctions for the misconduct could include a failing grade in this course and suspension or dismissal. If you have any questions about this policy or what constitutes academic misconduct in this course, please contact us.

Class protocols:

This will be an engaging and interactive class, but please read carefully the following protocols that will hold, without exception, for all students. These are designed to make your learning experience more edifying and enjoyable. We take our teaching responsibility seriously, and we hope you approach learning equally so.

- In the classroom, be respectful of others, and specifically: **NO EMAIL, TEXT, PHONE, or WEB-BROWSING DURING LECTURE!**
- The use of cell phones, smart phones, and other mobile communication or media devices in class is disruptive to your colleagues' learning. The use of these devices is prohibited during class. **Turn off your cell phone ringer before class starts.** 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. If you use your mobile device in class, or if your cell phone rings in class, we will give you a 1st warming and remind you of this class policy. If you violate this policy a 2nd time, we will ask you to immediately leave the classroom for the remainder of the lecture period and meet with us in office hours. There will be no exceptions to this rule.
- If you are using a laptop or tablet or computing device to take notes or make calculations during lecture, our expectation is that you are using it for that purpose alone. Using your portable device for other reasons (e.g. surfing, news, email, messaging, videos, games) is a distraction for you and your peers. If we detect that you are using your device for non-class related activities, we will give you a 1st warning and remind you of the class policy. If you violate this policy a 2nd time, we will ask you to immediately leave the classroom for the remainder of the lecture period and meet with us in office hours. There will be no exceptions to this rule.
- Active participation during the lecture in the form of questions and discussion of the material at hand is welcomed. It is our responsibility to ensure that students' participation in class is orderly and respectful. If your participation disrupts the class, or is not respectful to us or your peers, we will ask you to leave the classroom for the lecture period and meet with us immediately afterwards to discuss your continued enrollment in the class.
- Lecture slides will be posted in pdf form after class or by the end of the week. Note that this does not serve as an excuse to miss lecture. Lecture slides are condensed versions of material covered in class. There will be material presented, emphasized or discussed in class that will not appear on the lecture slides. Active note taking during class is strongly encouraged. Questions arise or discussions get initiated that are not anticipated or explicitly recorded on lecture slides. If you miss a class, it is recommended that you consult with a colleague who was in attendance to obtain notes on material you might have missed.
- Communication with other members of assigned group projects is very important. Students are encouraged to share multiple modes of contact (email, phone) and maintain prompt and frequent communication with all group members. Remember, there are no make-up or substitute assignments for group projects.