

**GEOG 3215/5215
Impacts of Climate Change**

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Gardner Commons, 4845
Office Hours: Mon-Wed 1:15-2:45pm

Class time and location: Mon/Wed: 11:50am-1:10pm; GC 1855

Course Description: One of the most widely discussed issues today is the future change in the Earth's climate, with predicted increases in global temperature and resulting effects on climate regimes world-wide. These changes will impact both natural and human systems through sea level rise, the displacement of populations, health issues and changing availability of resources. In this class we will review the expected future shifts in climate and study the expected impacts of these changes on physical, biological and social systems. With this knowledge, we will look at some of the methods that have been proposed to adapt to or mitigate these changes, including management and geoengineering of the Earth System. We will concentrate critically on the knowns and unknowns of future change and our ability to deal with it. In addition to the lecture component, the class will include interactive sessions using simple tools to study expected future impacts. Students will use this information to develop a report describing climate change and its impacts for a single region of the planet.

Course objectives: This course will introduce students to the range of issues related to the impacts of climate change on human and natural systems. The course will cover:

- A short review of the expected climatic changes for the next century and the models that are used for prediction
- A discussion of the impacts of climate changes both present and future at global and regional scales
- Proposed methods for coping with (adaptation) or reducing (mitigation) these impacts

Course materials:

- Suggested textbook:
 - Pittock, A.B. (2009). Climate change: the science, impacts and solutions, 2nd ed. CSIRO Publ., Collingwood, Australia.
- Additional material will be presented from:
 - Lomborg, B., (ed.) (2010). Smart solutions to climate change: comparing costs and benefits. Cambridge University Press, Cambridge, UK.
 - Nicolls, R.J., (2011). Planning for the impacts of sea level rise. *Oceanography*, 24(2), 144-157

- IPCC, 2013: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 1535 pp
- IPCC, 2014: Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Field, C.B., V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 1132 pp.
- IPCC, 2014: Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part B: Regional Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Barros, V.R., C.B. Field, D.J. Dokken, M.D. Mastrandrea, K.J. Mach, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 688 pp.
- IPCC, 2014: Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Edenhofer, O., R. Pichs-Madruga, Y. Sokona, E. Farahani, S. Kadner, K. Seyboth, A. Adler, I. Baum, S. Brunner, P. Eickemeier, B. Kriemann, J. Savolainen, S. Schlömer, C. von Stechow, T. Zwickel and J.C. Minx (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA. 1436 pp.
- Other reading assignments may be given as the course progresses
- Online materials
 - This course will use the Canvas system to provide students with access to course announcements, lecture note outlines, and other course-related materials, and for assignment submission. It is your own responsibility to check the site periodically to obtain necessary information in a timely manner.

Assessment:

- Lab exercises (20 pts.)
 - The class will include 6 hands-on lab sessions, introducing some simple tools used to study climate change and its impacts, using a variety of online and offline software. The R programming language will be used in some of the lab exercises, but no previous programming experience is required. There will be four follow-up

exercises based on the material in the lab, each worth 5 points. Lab exercises will be due two weeks after the lab session.

- Climate change report
 - Students will be required to put together a report describing the impacts of future climate change for a single region of the planet, based on material covered in class and in the interactive lab session.
 - The report should include the following elements for the region of choice:
 - Estimates of changes in demographics and emissions
 - Estimates of future changes in temperature and precipitation
 - Description of future changes in one or more climate extremes
 - A discussion of one physical, biological impact or social impact linked to these changes
 - A discussion of possible adaptation strategies to this impact
 - Assessment will take part in two parts
 - An in-class presentation (10pts; currently scheduled for the last week of class). Presentations should be in powerpoint or equivalent. A computer will be provided
 - A written report (30 pts; due December 11th). Reports should be 8-10 pages, including figures and citations.
 - Material and methods for each of the portfolio elements will be introduced over the course of the semester. In particular, the interactive labs provide access to some of the data needed to estimate climate changes. It is the student's responsibility to attend these labs
- Exam (2 x 20 pts.)
 - There will be two exams: the first exam in week before Fall break, and the second during exam week. This latter one is currently scheduled for the week of December 9-13th, and the date will be finalized at least two weeks in advance.
 - Both exams will be based on multiple-choice questions and short answers, and will cover material presented during the semester.
 - No "make-up" exams will be given; notify the instructor at least two weeks in advance of a scheduled exam date if an alternative date is necessary.
- Letter grades will be assigned following the scheme provided below, using .5 as the break point:

A	95+	C+	70~74
A-	90~94	C	65~69
B+	85~89	C-	60~64
B	80~84	D	50~59
B-	75~79	E	~49

Course schedule:

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The tentative schedule of the course and associated reading assignments are listed in the table below. Please note that this schedule is subject to change in the event of extenuating circumstances.

Date	Topic	Subjects
08/19 (M)	Introduction	Introduction to course and course goals
08/21 (W)	Climate change	Climate change: what do we know?
08/26 (M)		Climate models
08/28 (W)		Emission scenarios
09/02 (M)	<i>Labor Day</i>	
09/04 (W)		<i>Lab 1: population and emission changes</i>
09/09 (M)		Projected future climate
09/11 (W)		<i>Lab 2: Projected future climate</i>
09/16 (M)		Uncertainty
09/18 (W)		<i>Lab 1 and 2: continued</i>
09/23 (M)	Impacts	Sea level rise
09/25 (W)		Hydrology
09/30 (M)		Ecosystems
10/02 (W)		Exam 1
10/07 (M)	<i>Fall break</i>	
10/09 (W)	<i>Fall break</i>	
10/14 (M)		Agriculture
10/16 (W)		<i>Lab 3: biological and physical impacts</i>
10/21 (M)		Human health
10/23 (W)		Energy/Security
10/28 (M)		Economics
10/30 (W)		<i>Lab 4: social impacts</i>
11/04 (M)	Solutions	Adaptation strategies
11/06 (W)		<i>Lab 3 and 4: continued</i>
11/11 (M)		<i>Lab 5: adaptation cost-benefit</i>
11/13 (W)		Mitigation strategies
11/18 (M)		Mitigation policies
11/20 (W)		<i>Lab 6: mitigating climate change</i>
11/25 (M)		Geoengineering I: Radiative
11/27 (W)		Geoengineering II: Sequestration
12/02 (M)		Student presentations
12/04 (W)		Student presentations
12/09 (M)	<i>Exam week</i>	

Class policies:

- Evaluation-related policies
 - Individual extra credit will not be assigned.
 - There will be no “make-up” exams, quizzes, or assignments.
 - An “incomplete” grade will be given only in extreme cases when

conditions beyond the student's control require an extended period of absence.

- Any assignments, including the final project report, submitted to the instructor after its due date will be worth only half of the earned points.
- Materials to be turned into the instructor must be typed.
- Students are encouraged to help each other in their work. However, final products turned into the instructor must display evidence of individual initiative and creativity. If not, no credits will be given to the particular work.
- Attendance
 - Full attendance is strongly recommended. The content of the course is often progressive, meaning you must know the material from previous class meetings in order to understand subsequent material. When missing classes, students are responsible for seeking for help to catch up with the class progress in a timely manner, if they need to.
- Email correspondence
 - Students must copy themselves on any email to the instructor to ensure documentation of submission date and time. Doing so will assist the student when system outages occur.
 - Senders must also validate that all files are in readable format. Corrupted files are the responsibility of the sender and corrupted-file assignments will be marked as late
- Cell phones
 - Please turn off your cell phones or use vibrate/silence mode during class meetings.
- Student responsibilities
 - All students are expected to maintain professional behavior in the classroom setting, according to the Student Code, spelled out in the Student Handbook of the University of Utah (<http://www.acs.utah.edu/sched/handbook/toc.htm>). Students have specific rights in the classroom as detailed in Article III of the Code. The Code also specifies proscribed conduct (Article XI) that involves cheating on tests, plagiarism, and/or collusion, as well as fraud, theft, etc. Students should read the Code carefully and know they are responsible for the content. According to Faculty Rules and Regulations, it is the faculty responsibility to enforce responsible classroom behaviors, beginning with verbal warnings and progressing to dismissal from class and a failing grade. Students have the right to appeal such action to the Student Behavior Committee.
- Liability warning
 - Students are responsible for all activities on their computer accounts. Keep your user name and password confidential.

- Academic misconduct will not be tolerated. Penalties may include failure of an assignment, the entire course, and/or the filing of formal charges with appropriate university authorities. Academic misconduct includes, but is not limited to, cheating, misrepresenting one's work, and plagiarism:
- Cheating involves the unauthorized possession or use of information in an academic exercise, including unauthorized communication with another person during an exercise such as an examination.
- Misrepresenting one's work includes, but is not limited to, representing material prepared by another as one's own work or submitting the same work in more than one course without prior permission of all instructors.
- Plagiarism means the intentional unacknowledged use or incorporation of any other person's work in one's own work offered for academic consideration or public presentation.

As the only institution in the state classified in the highest research category (R1), at the University of Utah you will have access to state-of-the-art research facilities and be able to be part of the knowledge creation process. You will have the opportunity to do research of your own with faculty who are leading experts in their field, engaging in programs that match your research interests. Further, you will interact with and often take classes with graduate students that provide an advanced understanding of the knowledge in your field.

The University of Utah seeks to provide equal access to its programs, services and activities for people with disabilities. If you will need accommodations in this class, reasonable prior notice needs to be given to the instructor and to the Center for Disability Services, 162 Olpin Union Building, 581-5020 (V/TDD) to make arrangements for accommodations. All written information in this course can be made available in alternative format with prior notification to the Center for Disability Services.

Undocumented Student Support. *Immigration is a complex phenomenon with broad impact—those who are directly affected by it, as well as those who are indirectly affected by their relationships with family members, friends, and loved ones. If your immigration status presents obstacles to engaging in specific activities or fulfilling specific course criteria, confidential arrangements may be requested from the Dream Center. **Arrangements with the Dream Center will not jeopardize your student status, your financial aid, or any other part of your residence.** The Dream Center offers a wide range of resources to support undocumented students (with and without DACA) as well as students from mixed-status families. **To learn more, please contact the Dream Center at 801.213.3697 or visit dream.utah.edu.***

Safety & Wellness. *Your safety is our top priority. In an emergency, dial 911 or seek a nearby emergency phone (throughout campus). Report any crimes or suspicious people to **801-585-COPS (801-585-2677)**; this number will get you to a dispatch officer at the University of Utah Department of Public Safety (DPS; dps.utah.edu). If at*

any time, you would like to be escorted by a security officer to or from areas on campus, DPS will help — just give a call.

The University of Utah seeks to provide a safe and healthy experience for students, employees, and others who make use of campus facilities. In support of this goal, the University has established confidential resources and support services to assist students who may have been affected by harassment, abusive relationships, or sexual misconduct. A detailed listing of University Resources for campus safety can be found at <https://registrar.utah.edu/handbook/campussafety.php>

*Your well-being is key to your personal safety. If you are in crisis, call **801-587-3000**; help is close. The university has additional excellent resources to promote emotional and physical wellness, including the Counseling Center (<https://counselingcenter.utah.edu>), the Wellness Center (<https://wellness.utah.edu>), and the Women's Resource Center (<https://womenscenter.utah.edu>). Counselors and advocates in these centers can help guide you to other resources to address a range of issues, including substance abuse and addiction.*

*To report suspicious activity or to request a courtesy escort, call campus police at **801-585-COPS (801-585-2677)**. You will receive important emergency alerts and safety messages regarding campus safety via text message. For more information regarding safety and to view available training resources, including helpful videos, visit safeu.utah.edu.*

Evacuation map

