

GPP584/RES 520
**Climate Change: Science, Technology and Sustainable
Development**

Room 107/108 AERL building; Term 1, Tues 9-12 am

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COURSE OVERVIEW

This course will introduce climate change, its drivers, impacts, and policies to address these. Climate change will be contextualized within global change, and the interplay of socio-economic development and technical change with climate policies. This course is about understanding the complexity of these interactions and identifying policy responses that are more likely to succeed. Changes in global climate will have a range of impacts across different geographies, ecosystems, and societies. Some will benefit while others will face devastation. The challenge lies in finding solutions that address this diversity of outcomes without thwarting the rights of different peoples to “develop”.

PREREQUISITES

Undergraduate course in environmental science or physical geography, or with permission of instructor.

LEARNING OUTCOMES

By the end of the course, students will be able to:

1. Explain basic scientific and economic concepts related to climate policy;
2. Critically read papers and synthesize key contributions and remaining questions;
3. Analyze and describe key policy debates and their technical, economic, political, social, and/or ethical underpinnings;
4. Critically evaluate the technical, economic, and socio-political opportunities and challenges associated with implementing different climate solutions.

ASSESSMENT

You will be assessed on the following criteria:

- Plagiarism tutorial and test [5%; individual grade]
- Paper presentation [10%; individual grade]
- Discussion contribution and class participation [10%; individual grade]
- Short writing assignments (n=5) [5 x 10% = 50%; group grade with individual variations]
- Term project [25%; group grade with individual variations]

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LEARNING OUTCOMES, ASSESSMENT & TEACHING/LEARNING STRATEGIES

Outcomes	Assessment	Teaching and Learning Strategy
Explain basic scientific and economic concepts related to climate policy	<ul style="list-style-type: none"> • Assignments 	<ul style="list-style-type: none"> • Lectures • Assigning readings and facilitating discussion
Critically read papers and synthesize key contributions and remaining questions;	<ul style="list-style-type: none"> • Leading paper discussions • Evaluation of discussion contributions 	<ul style="list-style-type: none"> • Assigning readings and facilitating discussion
Analyze and describe key policy debates and their technical, economic, political, social, and/or ethical underpinnings;		
Critically evaluate the technical, economic, and socio-political opportunities and challenges associated with implementing different climate solutions.	<ul style="list-style-type: none"> • Term project evaluation 	<ul style="list-style-type: none"> • Helping students design and conduct term project research

COURSE ACTIVITIES

1) Paper presentation

Each student will be asked to review and present one of the suggested readings for the course. You are expected to summarize the paper and critique its findings. The presentation should take no longer than 20 minutes and will be followed by a 10 minute Q&A session. Resources for how to present papers are [here](http://web.stanford.edu/~jacksonm/present.pdf) (<http://web.stanford.edu/~jacksonm/present.pdf>) and [here](http://www.cs.rpi.edu/courses/spring99/robotics/paperdiss.html) (<http://www.cs.rpi.edu/courses/spring99/robotics/paperdiss.html>).

Role of discussion leader

- Give a short (2-3 min) overview of the paper (key questions, methods, findings).
- Present 2 questions for the class to discuss.
- Summarize the key points learnt from the discussion.

Grading. See rubric at the back for guidance on how this will be assessed.

2) Reading and discussing journal articles each week

Each week, you will read 2 assigned papers. [One of you will be responsible for preparing and leading the discussion of each paper each week, as described above]. This is a graduate seminar course, and the spirit is to have student-led learning. The success of this course depends on regular attendance and engagement in class. Learning occurs through discussing ideas with your peers, as facilitated by the course instructor.

Format for paper discussions

- Discussion leader will give a short (2-3 min) overview of the paper (key questions, methods, findings).
- Next, the discussion leader will present 2 questions for the class to discuss. Open discussion at this point [I might intervene to reframe the questions or ask them differently, depending on how the discussion goes].
- Finally, the discussion leader will summarize the key points learnt from the discussion.

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Ground rules (from NWABR and Ryerson University Teaching & Learning Office)

- Do not expect everyone to speak every time
- Not expected to “perform”, but rather, share opinions and observations
- Don’t be afraid to be stupid; will not grade everything you say”
- Listen carefully
- Address one another respectfully
- Clarify if a comment is your opinion, or based on a paper or other evidence
- Address comments to the group (no side conversations)
- Use sensitivity to take turns and not interrupt others
- Be courageous in presenting your own thoughts and reasoning, but be flexible and willing to change your mind in the face of new and compelling evidence

Grading. Preliminary grades may be given during the course of the semester. See rubric at the back for guidance on how this will be assessed.

3) Assignments

You will work on 5 short assignments (~1000 words) during the course of the semester. See tentative assignment due dates in course calendar (but potentially subject to change, so dates on handed assignment will be the final ones). You will work in groups to complete these assignments.

Grading. Criteria for evaluation of your work will be provided along with each assignment.

4) Term project

Your term project will research a solution for climate change, covering the science, technological, economic, and socio-political opportunities and challenges. You will work in groups students to do your research.

Grading. Criteria for evaluation of your work will be provided along with the term project instructions.

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TENTATIVE COURSE CALENDAR AND STRUCTURE

Week	Date	Topic/Question for the week	9:00-10:00	BREAK	10:15 - 10:45	10:45 - 11:15	BREAK	11:30- Noon		
1	Sep 03	Overview of the course								
2	Sep 10	Climate science 1 (Theory & Observations); Assignment 1 handed out	Lecture			Paper 1		Paper 2		Q&A
3	Sep 17	Climate science 2 (Drivers; Carbon cycling)	Lecture			Paper 3		Paper 4		Q&A
4	Sep 24	Climate science 3 (Climate models & simulations; Human fingerprint); Assignment 1 due; Assignment 2 handed out	Lecture			Paper 5		Paper 6		Q&A
5	Oct 01	Climate science 4 (Impacts)	Lecture			Paper 7		Paper 8		Q&A
6	Oct 08	Play "Keep it cool" game; Assignment 2 due; Assignment 3 handed out								
7	Oct 15	Climate ethics & equity (Why do we need to act?)	Lecture			Paper 9		Paper 10		Project work
8	Oct 22	Climate solutions 1: energy supply and energy use; Assignment 3 due; Assignment 4 handed out	Lecture			Paper 11		Paper 12		Project work
9	Oct 29	Climate solutions 2: economics (carbon price; climate finance)	Lecture			Paper 13		Paper 14		Project work
10	Nov 05	Climate solutions 3: behavioral & political action; Assignment 4 due; Assignment 5 handed out	Lecture			Paper 15		Paper 16		Project work
11	Nov 12	Climate solutions 4: adaptation, geo-engineering	Lecture			Paper 17		Paper 18		Project work
12	Nov 19	Climate solutions 5: policy and international negotiations; Assignment 5 due	Lecture			Paper 19		Paper 20		Project work
13	Nov 26	Student presentations of term project								

Course drop deadline: Sept 17.

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READINGS [preliminary list subject to change]

Global environmental change

1. Steffen, W., J. Rockström, K. Richardson, T. M. Lenton, C. Folke, D. Liverman, C. P. Summerhayes, A. D. Barnosky, S. E. Cornell, M. Crucifix, J. F. Donges, I. Fetzer, S. J. Lade, M. Scheffer, R. Winkelmann, and H. J. Schellnhuber, Trajectories of the Earth System in the Anthropocene, *Proceedings of the National Academy of Sciences*, 115(33), 8252-8259, 10.1073/pnas.1810141115, 2018.

Science

2. Cook, J., D. Nuccitelli, S. A. Green, M. Richardson, B. Winkler, R. Painting, R. Way, P. Jacobs, and A. Skuce, Quantifying the consensus on anthropogenic global warming in the scientific literature, *Environ. Res. Lett.*, 8(2), 024024, 10.1088/1748-9326/8/2/024024, 2013.
3. Heimann, M., and M. Reichstein, Terrestrial ecosystem carbon dynamics and climate feedbacks, *Nature*, 451, 289, 10.1038/nature06591, 2008.

Impacts

4. Mora, C., B. Dousset, I. R. Caldwell, F. E. Powell, R. C. Geronimo, Coral R. Bielecki, C. W. W. Counsell, B. S. Dietrich, E. T. Johnston, L. V. Louis, M. P. Lucas, M. M. McKenzie, A. G. Shea, H. Tseng, T. W. Giambelluca, L. R. Leon, E. Hawkins, and C. Trauernicht, Global risk of deadly heat, *Nature Clim. Change*, 7, 501, 10.1038/nclimate3322, 2017.
5. Parmesan, C., and G. Yohe, A globally coherent fingerprint of climate change impacts across natural systems, *Nature*, 421(6918), 37-42, 10.1038/nature01286, 2003.

Economics

6. Arrow Kenneth, J., Global Climate Change: A Challenge to Policy, *The Economists' Voice*, 4(3), 2007.

Policy and politics

7. Keohane, R. O., The Global Politics of Climate Change: Challenge for Political Science, *PS: Political Science & Politics*, 48(1), 19-26, 10.1017/S1049096514001541, 2015.
8. Murray, B., and N. Rivers, British Columbia's revenue-neutral carbon tax: A review of the latest "grand experiment" in environmental policy, *Energy Policy*, 86, 674-683, <https://doi.org/10.1016/j.enpol.2015.08.011>, 2015.
9. Rayner, S., How to eat an elephant: a bottom-up approach to climate policy, *Clim Policy*, 10(6), 615-621, 10.3763/cpol.2010.0138, 2010.
10. Rhodes, E. J., Mark. "", vol. 39, 2013, pp. S37-S51. , A Tale of Two Climate Policies: Political Economy of British Columbia's Carbon Tax and Clean Electricity Standard, *Canadian Public Policy*, Project MUSE, muse.jhu.edu/article/520953, 39, S37-S51, 2013.
11. Grasso, M., and J. T. Roberts, A compromise to break the climate impasse, *Nature Clim. Change*, 4, 543, 10.1038/nclimate2259.
12. [This is a long paper, so I would suggest two people signing up]. Ostrom, E., A Polycentric Approach For Coping With Climate Change, *Annals of Economics and Finance*, 15(1), 71-108, 2014.

Solutions

13. Pacala, S., and R. Socolow, Stabilization Wedges: Solving the Climate Problem for the Next 50 Years with Current Technologies, *Science*, 305(5686), 968-972, 10.1126/science.1100103, 2004.
14. Griscom, B. W., J. Adams, P. W. Ellis, R. A. Houghton, G. Lomax, D. A. Miteva, W. H. Schlesinger, D. Shoch, J. V. Siikamäki, P. Smith, P. Woodbury, C. Zganjar, A. Blackman, J. Campari, R. T. Conant, C.

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- Delgado, P. Elias, T. Gopalakrishna, M. R. Hamsik, M. Herrero, J. Kiesecker, E. Landis, L. Laestadius, S. M. Leavitt, S. Minnemeyer, S. Polasky, P. Potapov, F. E. Putz, J. Sanderman, M. Silvius, E. Wollenberg, and J. Fargione, Natural climate solutions, *Proceedings of the National Academy of Sciences*, 114(44), 11645-11650, 10.1073/pnas.1710465114, 2017.
15. Le Quéré, C., J. I. Korsbakken, C. Wilson, J. Tosun, R. Andrew, R. J. Andres, J. G. Canadell, A. Jordan, G. P. Peters, and D. P. van Vuuren, Drivers of declining CO₂ emissions in 18 developed economies, *Nature Clim. Change*, 9(3), 213-217, 10.1038/s41558-019-0419-7, 2019.
16. Ripple, W. J., P. Smith, H. Haberl, S. A. Montzka, C. McAlpine, and D. H. Boucher, Ruminants, climate change and climate policy, *Nature Clim. Change*, 4, 2, 10.1038/nclimate2081, 2013.
17. Wynes, S., and K. A. Nicholas, The climate mitigation gap: education and government recommendations miss the most effective individual actions, *Environ. Res. Lett.*, 12(7), 074024, 10.1088/1748-9326/aa7541, 2017.

Adaptation

18. Conway, D., From headwater tributaries to international river: Observing and adapting to climate variability and change in the Nile basin, *Global Environmental Change*, 15(2), 99-114, <https://doi.org/10.1016/j.gloenvcha.2005.01.003>, 2005.

Ethics

19. Callagan, C., *The ethics of climate change*, Confluence, 2017.

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GRADING RUBRICS

Rubric for assessing paper presentations by discussion leaders

Points	Presenting paper overview	Designing 2 questions for class discussion	Summarizing key discussion learning outcomes
3	Excellent	Excellent	Excellent
2	Good	Good	Good
1	Fair	Fair	Fair
0	Poor	Poor	Poor

Extra point for going beyond expectations

Rubric for assessing discussion and class participation contribution (modified from Anderson & Speck 1998)

9-10	Comes to class prepared; contributes readily to the conversation but doesn't dominate it: <u>makes thoughtful contributions that advance the conversation</u> ; shows interest in and respect for others' views; participates actively in small groups. Score of 10 is reserved for truly exceptional students.
8	Comes to class prepared and makes thoughtful comments when called upon, contributes occasionally without prompting; shows interest in and respect for others' views; participates actively in small groups. A 8.0 score may also be appropriate to an active participant whose contributions are less developed or cogent than those of a 9/10 but still advance the conversation.
7	Comes to class prepared, but does not voluntarily contribute to discussions and gives only minimal answers when called upon. Nevertheless these students show interest in the discussion, listen attentively, and take notes. Students in this category may be shy or introverted. The instructor may choose to give such students a 8.0 if they participate fully in small group discussions or if they make progress in overcoming shyness as the course progresses.
6	Participates in discussion, but in a problematic way. Such students may talk too much, make rambling or tangential contributions, continually interrupt the instructor with digressive questions, bluff their way when unprepared, or otherwise dominate discussions, not acknowledging cues of annoyance from instructor or students. Students in this category often profit from a conference with the instructor.
4-5	Students in this range often seem on the margins of the class and may have a negative effect on the participation of others. Students receiving a 5 often don't participate because they <u>haven't read the material or done the homework</u> . Students receiving a 4 may be actually disruptive, radiating negative energy via hostile or bored body language, or be overtly rude.
0	Did not attend class (no permission sought to miss class)

Academic Integrity

The academic enterprise is founded on honesty, civility, and integrity. As members of this enterprise, all students are expected to know, understand, and follow the codes of conduct regarding academic integrity. At the most basic level, this means submitting only original work done by you and acknowledging all sources of information or ideas and attributing them to others as required. This also means you must not cheat, copy, or mislead others about what is your work. Violations of academic integrity (i.e., misconduct) lead to the breakdown of the academic enterprise, and therefore serious consequences arise and harsh sanctions are imposed. For example, incidences of plagiarism or cheating may result in a mark of zero on the assignment or exam and more serious consequences may apply if the matter is referred to the President's Advisory Committee on Student Discipline. Careful records are kept in order to monitor and prevent recurrences. A more detailed description of academic integrity, including the University's policies and procedures, may be found in the Academic Calendar at <http://www.calendar.ubc.ca/vancouver/index.cfm?tree=3,54,111,0>.

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Plagiarism

Plagiarism, which is intellectual theft, occurs where an individual submits or presents the oral or written work of another person as his or her own. Scholarship quite properly rests upon examining and referring to the thoughts and writings of others. However, when another person's words (i.e. phrases, sentences, or paragraphs), ideas, or entire works are used, the author must be acknowledged in the text, in footnotes, in endnotes, or in another accepted form of academic citation. Where direct quotations are made, they must be clearly delineated (for example, within quotation marks or separately indented). Failure to provide proper attribution is plagiarism because it represents someone else's work as one's own. Plagiarism should not occur in submitted drafts or final works. A student who seeks assistance from a tutor or other scholastic aids must ensure that the work submitted is the student's own. Students are responsible for ensuring that any work submitted does not constitute plagiarism. Students who are in any doubt as to what constitutes plagiarism should consult their instructor before handing in any assignments.

<http://www.calendar.ubc.ca/vancouver/index.cfm?tree=3,54,111,959>

Access & Diversity

Access & Diversity works with the university to create an inclusive living and learning environment in which all students can thrive. The university accommodates students with disabilities who have registered with the Access & Diversity unit: [<http://www.students.ubc.ca/access/drc.cfm>]. Students must register with the Disability Resource Centre to be granted special accommodations for any on-going conditions.

Religious Accommodation

The university accommodates students whose religious obligations conflict with attendance, submitting assignments, or completing scheduled tests and examinations. Students should let their instructor know in advance, preferably in the first week of class, if they will require any accommodation on these grounds. Students who plan to be absent for varsity athletics, family obligations, or other similar commitments, cannot assume they will be accommodated, and should discuss their commitments with the instructor before the course drop date. UBC policy on Religious Holidays:

<http://www.universitycounsel.ubc.ca/policies/policy65.pdf>

UBC Statement on Respectful Environment for Students, Faculty and Staff

The University of British Columbia envisions a climate in which students, faculty and staff are provided with the best possible conditions for learning, researching and working, including an environment that is dedicated to excellence, equity and mutual respect. The University of British Columbia strives to realize this vision by establishing employment and educational practices that respect the dignity of individuals and make it possible for everyone to live, work, and study in a positive and supportive environment, free from harmful behaviours such as bullying and harassment.