

ENVIRON 89S: Climate Change

MW: 10.05-11.20 am; Environment Hall 1101

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Office Hours: by appointment

Course Description

Climate change is one of the defining challenges facing humanity today. The goal of this first-year seminar is to develop a comprehensive and integrated view of contemporary climate change issues. We will discuss the latest understanding of the science of climate change, and explore the potential societal consequences of a changing climate. We will then examine global patterns of current energy production and consumption, and explore the potential of alternative low-carbon and carbon-free energy sources in the context of stabilizing atmospheric greenhouse gas concentrations. Finally, we will focus on the economic and policy aspects of mitigating climate change, and analyze progress towards a comprehensive international agreement to mitigate climate change.

Format

The course seeks to develop intellectual, academic, and learning skills by engaging students in active inquiry, critical analysis, and discussion of competing ideas. With this in mind, the course will consist of in-depth, intellectually rigorous in-class discussions based on pre-assigned readings as well as independent student research. These discussions will be supplemented by in-class group activities involving students working in small groups. Four targeted assignments will provide the opportunity to explore specific topics in more detail. Three of the assignments will consist of short essays in which students will be expected to provide a personal perspective on an assigned topic above and beyond the class discussions. One assignment will be in the form of quantitative problem that focus on applying specific concepts learned in class. Students are expected to be proficient with basic algebra and statistics, and comfortable with use of a spreadsheet program (e.g. Excel) on a personal computer.

Course Website

All relevant course materials will be posted on the Sakai course web site, and students will submit all assignments on-line. Please minimize printing to save paper.

Readings

Each topic has a set of pre-assigned readings. Most readings are drawn from the following two books available in electronic format through the Duke library system:

Mathez, E. A., *Climate Change: The Science of Global Warming and our Energy*

Future, Columbia University Press, 2009.
(<http://search.library.duke.edu/search?id=DUKE006320749>)

Richter, B., Beyond Smoke and Mirrors: Climate Change and Energy in the 21st Century, Cambridge University Press, 2014.
(<http://search.library.duke.edu/search?id=DUKE006288053>)

Additional readings are assigned from other sources as appropriate and are posted on the course website. In addition, students are expected to independently research and discuss relevant material beyond the assigned readings.

Assignments

Assignments must be submitted online by 10 a.m. on the dates indicated below. Late submissions will be penalized 20% of the maximum possible score for each day (or part of day) late.

Assignment 1: Short essay – Mon, 9/12

Assignment 2: Quantitative problem set – Mon 9/26

Assignment 3: Short essay – Mon 10/31

Assignment 4: Short essay – Wed 12/7

Midterm Exams

There will be 2 in-class midterm exams that will consist of short questions designed to assess factual understanding of class topics.

Midterm 1: Wed, 10/5

Midterm 2: Mon, 11/21

Final Synthesis Paper

A final synthesis paper (single-space, 12-point font, 6-8 pages excluding references) will be due by 5 pm on Fri, 12/16. The topic for the final paper will be assigned in November.

Evaluation

4 assignments	30% (7.5% each)
2 in-class midterms	20% (10% each)
In-class discussions	25%
Final synthesis paper	25%

Final Grade

Final grade will be based on the final cumulative numerical score as follows:
A+: 97.5-100; A: 92.5-97.5; A-: 90-92.5; B+: 87.5-90; B: 82.5-87.5; B-: 80-82.5;
C+: 77.5-80; C: 72.5-77.5; C-: 70-72.5; D: below 70 but above 60; F: below 60

COURSE SCHEDULE

#	Day	Date	Topic
1	Wed	8/31	Course Organization and Introduction
2	Mon	9/5	The Climate Change Debate
3	Wed	9/7	Topic 1: Temperature Trends
4	Mon	9/12	
5	Wed	9/14	Topic 2: The Climate System: Energy Balance and Climate Forcing
6	Mon	9/19	
7	Wed	9/21	
8	Mon	9/26	Topic 3: The Carbon Cycle
9	Wed	9/28	
10	Mon	10/3	REVIEW
11	Wed	10/5	MIDTERM EXAM 1
	Mon	10/10	FALL BREAK – NO CLASS
12	Wed	10/12	Topic 4: Past and Future Climate Change
13	Mon	10/17	
14	Wed	10/19	Topic 5: Climate Change Impacts
15	Mon	10/24	Topic 6: The Anthropocene
16	Wed	10/26	
17	Mon	10/31	Topic 7: Global Energy Production and Use
18	Wed	11/2	
19	Mon	11/7	
20	Wed	11/9	
21	Mon	11/14	Topic 8: Climate Change Mitigation: Targets, Economics and Policy
22	Wed	11/16	REVIEW
23	Mon	11/21	MIDTERM EXAM 2
	Wed	11/23	THANKSGIVING – NO CLASS
24	Mon	11/28	Topic 8: Climate Change Mitigation: Targets, Economics and Policy (continued)
25	Wed	11/30	
26	Mon	12/5	Topic 9: Duke’s Climate Action Plan
27	Wed	12/7	WRAP-UP
	Fri	12/16	FINAL PAPER DUE BY 5 P.M.

ASSIGNED READINGS

The Climate Change Debate

Student teams research and debate the issue starting with the January 27, 2012 op-ed in the Wall Street Journal by C. Allegre et al.

Topic 1: Temperature Trends

IPCC AR5 WG1 Report FAQs 2.1, 2.2, 3.1

Topic 2: The Climate System: Energy Balance and Climate Forcing

Mathez, E. A., Chapter 1-3, 5

IPCC AR5 WG1 Report FAQs 5.1, 7.1, 7.2, 8.1, 10.1, 11.2

Topic 3: The Carbon Cycle

Mathez, E. A., Climate Change, Chapter 4

IPCC AR5 WG1 Report FAQs 6.2

Topic 4: Past and Future Climate Change

Mathez, E. A., Climate Change, Chapters 6 and 9

IPCC AR5 WG1 Report FAQs 1.1, 6.1, 9.1, 10.2, 11.1, 12.1, 12.3

Topic 5: Climate Change Impacts

Mathez, E. A., Climate Change, Chapters 7 and 8

IPCC AR5 WG1 Report FAQs 3.3, 4.1, 4.2, 5.2, 12.2, 13.1, 13.2, 14.1

Topic 6: The Anthropocene

Cohen, J. E., Human population grows up, *Scientific American*, 48–55, 2005.

Crutzen, P. J., Geology of mankind, *Nature*, 415, 23, 2002.

Steffan, W., et al., The Anthropocene: Are humans now overwhelming the great forces of nature?, *Ambio*, 614–621, 2007.

Topic 7: Global Energy Production and Use

Mathez, E. A., Climate Change, Chapter 10

Richter, B., *Beyond Smoke and Mirrors*, Chapters 6-15

Topic 8: Climate Change Mitigation: Targets, Economics, and Policy

Goulder, L. and W. A. Pizer, The economics of climate change, In The New Palgrave Dictionary of Economics 2nd edition. Hampshire, UK: Palgrave Macmillan, 2008.

Pacala, S. and R. Socolow, Stabilization Wedges: Solving the Climate Problem for the Next 50 Years with Current Technologies, *Science*, 968–972, 2004. (*also see update to this article at <http://www.climatecentral.org/blogs/wedges-reaffirmed/P1>*)

Raupach, M. R. et al., Sharing a quota on cumulative carbon emissions, *Nature Climate Change*, 873–879, 2014.

IPCC AR5 WG1 Report FAQs 7.3

News and articles from UNFCCC website (<http://unfccc.int/2860.php>)

Topic 9: Duke's Climate Action Plan

http://sustainability.duke.edu/climate_action/ClimateActionPlan.php