

**Princeton University
Woodrow Wilson School of Public and International Affairs
Graduate Program**

**WWS-594s, Spring 2015
Climate Change: Science and Policy (Session I)**

Sessions: Mondays, 1:30-4:30 PM

Robertson Room 015

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The course is designed to improve students' skill, confidence and judgment in the use of science in policy applications, particularly in the analysis of climate change and possible greenhouse gas mitigation options. The emphasis is on preparing both non-scientists and scientists to use, understand, and critique science in environmental policy-applications. Exercises are scaled to the student's background.

Requirements:

Paper (3000 words) in outline and final version. Choose a greenhouse gas mitigation strategy, make the case for how much of the problem it can solve and devise a policy that would encourage its deployment in the U.S., another country or globally. Try to include a back-of-the-envelope calculation. Topics can be drawn from energy supply options, improved energy efficiency, agriculture, etc. and can include any greenhouse gas (eg. carbon dioxide, methane, nitrous oxide, etc.). Talk to the professor in the first or second week about a topic.

Presentation. The last class session will be devoted to presentations and discussion of final papers.

Short problems. You will be asked to complete two short problem-sets or memo that draws on the material covered that week. The problems / memo will be due in class the week following their assignment.

Questions. By 10 AM each Monday, post two questions about the week's readings on the discussion board on Blackboard. These questions will be used to catalyze class discussion. All readings are available on Blackboard and are organized by week.

Grading:

Class participation (including turning in the weekly questions): 25%

Short problems/memos: 20%

Final presentation: 15%

Final paper: 40%

Schedule

Date	Topic
Feb. 2, 2014	1. Population growth, industrialization and global limits
Feb. 9	2. Climate science
Feb. 16	3. Climate science (cont.)
Feb. 23	4. Climate policy
March 2	5. Greenhouse gas mitigation options. Energy technology / policy. (Draft outline due.)
March 9	6. Paper presentations and discussion
March 21	Final paper due

1. Population growth, industrialization and global limits

Goal: Describe and discuss main drivers of global change and the implications of humans becoming a geological force. Important drivers include: Population growth, increased consumption leading to increased pollutant emissions and natural resource use, technology choices. Discuss differences in these drivers between developed and developing countries.

A variety of drivers influence the global environment. They include growth in population, increases in per-capita consumption, growing fossil fuel combustion, habitat and biodiversity loss. There is an enormous disparity in population growth rates and per-capita consumption between developed and developing countries. This week we will explore the implications of some of these factors.

Readings.

Exposures: Gorgeous Glimpses of Calamity, New York Times, August 19, 2013.
<http://www.nytimes.com/2013/08/18/opinion/sunday/gorgeous-glimpses-of-calamity.html?src=me&ref=general>

The NASA satellite images in this article show the planetary scale of environmental changes associated with human activities.

Wilson, E.O., 2002, *The Future of Life*, chapter 2 “The Bottleneck”, pp. 22-41, 2002.

Sachs, J., 2004, Sustainable Development, *Science*, 34, p.649

Paul Ehrlich, Peter Kareiva and Gretchen Daily, Securing natural capital and expanding equity to rescale civilization. *Nature* **486**, 68–73 (07 June 2012)
doi:10.1038/nature11157.

Steffen, Will; Crutzen, PJ; McNeill, JR. The Anthropocene: Are Humans now overwhelming the great forces of Nature? *Ambio*, vol 36, 2007.

Sustainability Report. Scientific American, April 2010.

McDevitt, T.M., World Population Profile: 1998, U.S. Census Bureau, 1999, pp. 1-2, 9-18 The complete document is available at <http://blue.census.gov/ipc/prod/wp98/wp98.pdf>. This has some interesting graphs. Feel free to skim.

You can explore current United Nations population data and projections presented at: <http://esa.un.org/unpp/index.asp?panel=3>

Population Reference Bureau – Key Findings 2010.

Weeks 2-3. Climate Science

Goal: Connect population growth, future per capita increases in energy and food consumption with our ability to stabilize and decrease GHG emissions. Estimate allowable future GHG emissions and allocations among developed and developing countries given the policy goal of limiting global average temperature increase to 2 C.

Human activities, primarily the burning of fossil fuels such as coal, oil and natural gas, deforestation and agriculture are increasing the concentrations of gases in our atmosphere which trap heat. The Intergovernmental Panel on Climate Change (IPCC), set up in 1988 by the United Nations Environment Program (UNEP) and the World Meteorological Organization, and composed of scientists from around the world, reviews the state of scientific knowledge on climate change and issues comprehensive reports approximately every 5-years. The most recent scientific assessment was released in fall 2013. We will examine the current understanding and evidence for climate change as well as its potential future impacts.

Reading:

For an accessible overview of climate change, please read:

Lee, Freudenburg, Howarth. Chapter 7. Climate Change, In: Humans in the Landscape, 2013.

Houghton, John. Global Warming: The Complete Briefing, Cambridge University Press, 2009.

This is the primary technical reference we will use for climate change. This book is written by Sir John Houghton, a former director of the science assessment of the Intergovernmental Panel on Climate Change (IPCC). It provides a definitive summary of the fourth assessment report of the IPCC in a style that is intended to be understandable to the lay person. The IPCC 4th assessment report was released in 2007 and this summary was published in 2009. The fifth assessment was released in fall 2013 (science) and the rest is due out in 2014 (impacts and mitigation). The book is available for purchase from the U-Store (and on-line book sellers).

Please skim:

Chapter 1: Global Warming and Climate Change.

This provides background and overview to the issue. Figure 1.5 is worth a careful look.

Chapter 2: The Greenhouse Effect.

This chapter explains what causes the greenhouse effect. Figure 2.7 is worth careful attention.

Chapter 3. The Greenhouse Gases.

This chapter discusses where the greenhouse gases (GHG) come from, how their concentrations have changed over time, and what their effect is on radiative forcing. Figure 3.11 is worth careful attention.

Chapter 4. Climates of the Past (optional).

Figures 4.1a and 4.6a are worth looking at.

Chapter 6. Climate change in the 21st century and beyond.

This chapter describes the emission scenarios used to model future climate and the resulting projections of future global and regional temperature and precipitation changes. Understand figures 6.1, 6.4, 6.6, 6.7 and 6.8.

Future of Arctic Climate and Global Impacts. <http://www.arctic.noaa.gov/future/>

Searchinger T.D. et al., 2009, Fixing a Critical Climate Accounting Error. *Science* Vol. 326. Pp. 527-528, 23 October 2009

Supplementary Material

IPCC. 2013. Science assessment summary for policymakers.

The entire four part 2007 climate change assessment report is available at:

<http://www.ipcc.ch/ipccreports/assessments-reports.htm>. Depending on your interests you may want to look at relevant sections of the detailed reports on

“Science”, <http://www.ipcc.ch/ipccreports/ar4-wg1.htm>,

“Mitigation”, <http://www.ipcc.ch/ipccreports/ar4-wg3.htm> , and

“Impacts, Adaptation and Vulnerability” <http://www.ipcc.ch/ipccreports/ar4-wg2.htm> .

US Global Change Research Program publications and reports may be more accessible than some of the IPCC reports. <http://globalchange.gov/publications>

New York Times, “Rising Acidity Is Threatening Food Web of Oceans, Science Panel Says”, <http://www.nytimes.com/2009/01/31/science/earth/31ocean.html> , February 2, 2009.

Week 4. Climate Policy

Goal: Describe past efforts at international agreements on climate change (key treaties and mechanisms within the treaties). Evaluate potential for successful future international climate agreements. Consider alternative pathways (both domestic and international) to reduce emissions of greenhouse gases.

Do technologies exist that will permit us to reduce the emission of greenhouse gases sufficiently to stabilize climate? We will examine current perspectives on this topic. The Framework Convention on Climate Change (FCCC) was signed at the 1992 Earth Summit in Rio and put the issue of climate change on the international stage. The Kyoto Protocol, negotiated in December 1997, introduced the first commitments to reduce emissions of greenhouse gases by developed countries and went into effect, without participation from the United States, February 16, 2005. In December 2009 in Copenhagen international negotiations failed to come to agreement on how climate change mitigation should be addressed internationally. Later this year in Paris the world will attempt to agree on a mechanism and time table for reducing GHG emissions globally. We will examine individual countries initiatives and bi-lateral agreements to reduce emissions. We will also touch on similarities and differences between the policy approach to climate change and stratospheric ozone depletion and consider what needs to occur in order to reduce the rate of climate change and what may be politically possible.

Reading:

Background on Framework Convention on Climate Change, Kyoto Protocol and Copenhagen Accord:

Oppenheimer, M., 2009, Memo on Global Warming. For NYU Environmental Law Seminar (available on blackboard).

Overview of the Kyoto Protocol including updates with recent developments:
http://unfccc.int/kyoto_protocol/items/2830.php

Grubb, M. et al., 1999, The Kyoto Protocol: A Guide and Assessment, Chapter 4: The Kyoto Protocol, pp. 115-152, 1999.

Parson, E.. 2002. The Technology Assessment Approach to Climate Change. *Issues in Science and Technology*, Summer 2002.

Keohane RO and Victor DG, The Regime Complex for Climate Change, *Perspectives on Politics*, March 2011.

UNEP Report (2011) “Near-term climate protection and clean air benefits: Actions for controlling short-lived climate forcers”

Economics:

Stern, N., 2007, *The Economics of Climate Change: The Stern Review*. Summary of Conclusions: pp. xv-xix., 2007.

Nordhaus, W., 2007, *Critical Assumptions in the Stern Review on Climate Change*. *Science* Vol. 317 pp. 201 – 204, 13 July 2007.

Week 5. Mitigation of Greenhouse Gas Emissions

Goal: Describe energy technology options, the relative quantity of GHG they emit, cost, availability, penetration. Describe policies which support or hinder their development and penetration.

Houghton, J. *Global Warming: The Complete Briefing*, Cambridge University Press, 2009.

Chp 10: A strategy for action to slow and stabilize climate change

Chp 11: Energy and Transport for the Future

Charles, D., 2009, *Leaping the Efficiency Gap*, *Science*, 14 August 2009.

International Energy Agency (IEA). *World Energy Outlook 2012*. Executive Summary and Factsheet.

REN21. 2013. *Renewables 2013 Global Status Report*.

Chu, S. & Majumdar A. 2012. Opportunities and challenges for a sustainable energy future. *Nature*, 488:294

Socolow R, Hotinski, R, Greenblatt, JB and Pacala S. *Solving the Climate Problem : Technologies available to curb CO2 emissions*, Environment, 2004.

McKinsey Global GHG Abatement Curves, Executive Summary, 2009.

Week 6. Paper presentations and discussion.

The goal will be to explore how best to meet future global energy demand in light of a growing global population and a need to limit carbon emissions in order to reduce the magnitude of future climate change. Students are free to research, write and present on a topic of their choice as long as it has been approved by the professor.