

Princeton University
Woodrow Wilson School of Public and International Affairs
Spring 2009

WWS/ENV 334
Global Environmental Issues
Robertson Hall Room 011
Mondays 1:30-4:20 PM

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Office Hours: Tuesdays 1:30 – 4:00pm or by appointment
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Overview:

As the world population grows and becomes more industrialized, human impact on the global environment also increases. This course examines a set of global environmental issues such as population growth, climate change, ozone layer depletion, air pollution, loss of biological diversity, depletion of global fisheries, and the environmental consequences of energy supply and demand decisions. It provides an overview of the scientific basis for these problems and examines current and possible future policy responses.

Course Format:

Course topics will usually be covered in modules with the first part of the module covering the key scientific concepts surrounding the environmental issue and the second describing the present and possible future policy responses. Class meetings will be divided, very roughly, into half lecture and half discussion. **All students are expected to do all the required weekly reading which will form the basis for classroom discussion.** Most of the reading is on the course Blackboard site with some available over the internet. Web addresses are noted below in the syllabus. A substantial portion of the course grade will be based on class participation.

Grading:

Grades will be based on class participation, a presentation and a mid-term and final paper. The following percentages will be used:

Class participation: 30%

Midterm presentation: 5%

Paper in lieu of midterm: 20%

Presentation of final paper: 10%

Final paper: 35%

SCHEDULE OF CLASSES

Week 1: February 2, 2009. Course Overview and Introduction.

Drivers influencing global environmental problems – growth in population and consumption, increasing global energy consumption, habitat loss. Disparity in wealth and consumption between developed and developing countries.

Reading:

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

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

James Gustave Speth, The Bridge at the Edge of the World: Capitalism, the Environment and Crossing from Crisis to Sustainability, pp.xx-xxi; 17-45, 2008.

Thomas Friedman. Hot, Flat and Crowded: Why we need a green revolution and how it can renew America, pp. 26-49, 2008.

McDevitt, TM., World Population Profile: 1998, U.S. Census Bureau, 1999, pp. 1-2, 9-18 (in course packet). The complete document is available at <http://blue.census.gov/ipc/prod/wp98/wp98.pdf>.

Week 2. February 9, 2009. Stratospheric Ozone Depletion – Science

Ozone in the stratosphere protects life on earth from excess ultra-violet (UV) radiation. It has been depleted at all latitudes except the tropics by the emission of anthropogenic (human produced) chlorofluorocarbons (CFCs) and related substances. Increases in UV radiation at the earth's surface result in an increase in the incidence of skin cancer, eye cataracts, decrease in productivity of some ecosystems, and a decrease in air quality. A near global phase-out of the production of CFCs is expected to permit a partial recovery of the ozone layer later this century.

Reading:

An introduction to the science of stratospheric ozone depletion and reasons behind the global phase-out of chlorofluorocarbons (CFCs) has been compiled by the U.S. Environmental Protection Agency and is posted at:

http://www.epa.gov/ozone/science/sc_fact.html

An international assessment evaluating the scientific understanding of ozone depletion is conducted every four years. The executive summary for the most recent report completed in 2006 is available at:

http://ozone.unep.org/Assessment_Panels/SAP/Scientific_Assessment_2006/02-Executive_Summary.pdf

An excellent compilation by the 2002 international assessment committee of twenty questions and answers regarding the science of stratospheric ozone depletion is at:

<http://www.al.noaa.gov/WWWHD/pubdocs/assessment02/Q&As.pdf> .

Week 3. February 16, 2009. Stratospheric Ozone Depletion – International policy response – the success of the Montreal Protocol.

The Montreal Protocol, an international treaty to protect stratospheric ozone, has resulted in a near global phase-out of CFCs and related substances. This treaty is considered one of the world's global environmental success stories. We'll explore what made it possible and the lessons that can be taken from it to address other global environmental problems.

Reading:

Protecting the Ozone Layer: The United Nations History by Stephen O Andersen and K Madhava Sarma, United Nations Environment Program, 2002. Chapter 10 pp. 345-368. On E-reserve.

Anderson, S. [Chapter 2 - Contours of Technology, Chapter 3- Background of the Ozone & Climate agreement, Chapter 13 - Awareness and Capacity-Building, Chapter 14 - Lessons](#) IN Technology Transfer for the Ozone-Lessons for Climate Change, Earthscan, London, 2007, 5-22, 23-43, 269-292, 293-319.

If you are interested in reading more of these books, I have put them on review in Stokes.

The summary of the Synthesis document of the Montreal Protocol 2006 assessment committees (science, technology and effects) is available at:

http://ozone.unep.org/Meeting_Documents/oewg/27oewg/OEWG-27-3E.pdf

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

Week 4. February 23, 2009. Climate Change – Science

Human activities, primarily the burning of fossil fuels such as coal, oil and natural gas, and deforestation are increasing the concentrations of gases in our atmosphere which trap heat. The IPCC, set up in 1988 by 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 every 5-years. We will examine the current understanding and evidence for climate change as well as its potential future impacts.

Reading:

Hansen, Jim [Threat to the Planet](#) New York Review of Books, v. 53, No. 12, July 13, 2006 (e-reserve)

Rosen, R. [The Threat to the Planet: An Exchange](#) New York Review of Books, vol. 53, no. 14. Sept. 21 2006. (e-reserve)

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.

The main website of the Intergovernmental Panel on Climate Change (IPCC) is : <http://www.ipcc.ch> . For class, *please focus on: Climate Change 2007: Synthesis Report, Summary for Policymakers available on Blackboard and here: http://www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr_spm.pdf .*

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> .

Impacts of a Warming Arctic: Arctic Climate Impact Assessment (ACIA). Executive Summary, Cambridge University Press, 2004. Available on Blackboard and here: <http://amap.no/acia/>

Week 5. March 2, 2009. Climate Change – Technology Options and International policy response – Framework Convention, Kyoto Protocol, public outreach.

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. We will examine similarities and differences between the policy approach to climate change and stratospheric ozone depletion.

Reading:

Pacala S. and Socolow, R., Stabilization Wedges: Solving the Climate Problem for the Next 50 Years with Current Technologies, *Science*, 305, August 2004.

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

Hoffert, MI et al., Advanced Technology Paths to Global Climate Stability: Energy for a Greenhouse Planet, *Science*, 298, November 2002.

Marshall, E., Is the Friendly Atom Poised for a Comeback?, *Science*, 309, August 2005.

Overview of the Kyoto Protocol: http://unfccc.int/kyoto_protocol/items/2830.php

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

Week 6. March 9, 2009. Mid-term presentations

Mid-term paper due: Friday March 13 by noon.

Fall Break

Week 7. March 23, 2009. Air Pollution -- Science and Impacts on Climate, Health and Agriculture

Emissions of precursors to acid rain, ozone and particulate pollution all come from fossil fuel combustion and biomass burning and have been controlled largely due to their impacts on health. These pollutants can be transported long distances and effect regions outside the countries where they were emitted. We will examine differences between pollution levels in developed and developing countries.

Reading:

Graedel and Crutzen, Atmosphere, Climate and Change (1997). Chapter 3: Chemistry in the Air, pp. 35-57.

Shaw, J. Clearing the Air: How epidemiology, engineering and experiment fingered fine particles as airborne killers, *Harvard magazine*, May-June 2005.

Schwartz, J., B. Coull, F. Laden, and L. Ryan (2008), The Effect of Dose and Timing of Dose on the Association between Airborne Particles and Survival, *Environmental Health Perspectives*, 116.

Levy, H., II, M. D. Schwarzkopf, L. Horowitz, V. Ramaswamy, and K. L. Findell (2008), Strong sensitivity of late 21st century climate to projected changes in short-lived air pollutants, *J. Geophys. Res.*, 113, D06102, doi:10.1029/2007JD009176.

Ramanathan, V. and Carmichael, G. Global and Regional Climate Changes Due to Black Carbon. *Nature-Geoscience*, 2008.

Wang, X., DL Mauzerall, Characterizing distributions of surface ozone and its impact on grain production in China, Japan and South Korea : 1990 and 2020, *Atmospheric Environment*, 38, 2004.

Week 8. March 30, 2009. Technology and Policy responses to air pollution -- Command and control versus market based mechanisms, Long Range Trans-boundary Air Pollution treaty, etc.

Readings:

Jacobson, M.Z. Review of Solutions to Global Warming, Air Pollution and Energy Security, *Energy Environ. Sci.*, doi:10.1039/b809990C, <http://www.rsc.org/Publishing/Journals/EE/article.asp?doi=b809990c>, 2009.

Cramton, Peter, A Review of Markets for Clean Air: The U.S. Acid Rain Program, *Journal of Economic Literature*, pp. 627-633, September 2000.

Mauzerall, DL, B. Sultan, N. Kim, D.F. Bradford, NOx emissions from large point sources: variability in ozone production, resulting health damages and economic costs, *Atmospheric Environment*, 39, 2005.

Bell, RG, Russell, C, Environmental Policy for Developing Countries, *Issues in Science and Technology*, Spring 2002.

Description of the Long Range Transboundary Air Pollution Treaty (LRTAP)
http://www.unece.org/env/lrtap/lrtap_h1.htm

Week 9. April 6, 2009. Biodiversity – Science

Continuing and accelerating destruction of biodiversity threatens to impair the natural ecosystem infrastructure supporting human society and economic systems. Extinction is permanent. The root causes include habitat loss, deforestation, water degradation, urban expansion, introduction of non-native species, lack of enforcement of environmental regulations, etc. We will examine the natural distribution of biodiversity on earth and the extent of biodiversity loss.

Reading:

John Terborgh, Diversity and the Tropical Rain Forest, Chapter 1: The Biological Exuberance of the Tropics, pp. 1-29; Chapter 3: The Global Diversity Gradient, pp. 53-71; Chapter 8: Conserving Biodiversity pp.185-211; Chapter 9: Managing Tropical Forests, pp. 213-232.

Pauly, Daniel, et al., Towards sustainability in world fisheries, *Nature*, 418, August 2002, pp. 689-695.

Week 10. April 13, 2009. Loss of Biological Diversity – Policy responses

Various efforts are being made to protect biodiversity including the establishment of national parks, the passage of the U.S. Endangered Species Act and the international Convention on Biological Diversity following the 1992 'Earth Summit' in Rio de Janeiro. We will examine how much these initiatives are helping stem the rapid loss of biodiversity and will explore what else might help.

Reading:

Millenium Ecosystem Assessment Panel, Ecosystems and Human Well-Being: Synthesis, A Report of the Millenium Ecosystem Assessment, 2005.

E.O. Wilson, The Future of Life, chapter 7, The Solution, pp.149-189, 2002.

Week 11. April 20, 2009. Sustainable Development

What can be done to encourage the use of natural resources in a sustainable fashion?

Reading:

World Bank. The Environment and the Millennium Development Goals.

United Nations Millennium Project, <http://unmp.forumone.com/>
Read Goals and targets, 10 key recommendations, Why the goals are important,
Country processes, International actions, Costs and benefits.

Gretchen Daily and Brian Walker, Seeking the great transition, *Nature*, pp. 243-245,
2000.

Week 12 April 27, 2009. Summary and Final Discussion

**Reading Period: Oral reports by students of term projects. Monday May 4, 2009
and a second date to be determined.**

Final term papers due: Tuesday May 12, 2009 (Dean's date).