

Princeton University
Woodrow Wilson School of Public and International Affairs
Spring 2005

WWS-475
Global Environmental Issues
Robertson Room 005
Mondays 1:30-4:20 PM

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Overview:

As the global population grows and the world becomes more industrialized the human impact on the global environment also increases. This class will examine a set of global environmental issues. Topics will include those which affect the global commons such as ozone layer depletion and climate change including the implications of energy technology choices, and those which are of widespread regional importance such as the impacts of air pollution on human health and welfare, loss of biological diversity and ecosystem services, and issues of sustainable development. For each topic the course will first examine the scientific basis of the problems and will then examine 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 the required weekly reading which will form the basis for classroom discussion. Most of the reading is in a course packet available for purchase and the rest is available over the internet with web addresses 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: September 19, 2005. 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:

Protecting Our Planet, Securing Our Future – Linkages among Global Environmental Issues and Human Needs, UNEP, NASA, World Bank, 1998. Read the Executive summary: pp. xv-xvii, Part 1, Introduction and Part 2, Global Environmental Issues: pp. 1-30.

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

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. September 26, 2005. 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 2002 is available at: <http://www.unep.org/ozone/pdf/execsumm-sap2002.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>

and is also included in your course packet.

Week 3. October 3, 2005. 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.

If you are interested in reading more of the book, I have put several chapters on course E-reserve.

Week 4. October 10, 2005. 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:

The Great Global Experiment, Jonathan Shaw, *Harvard Alumni Magazine*, December 2002. 13 pages.

The entire three part report on climate change written by the Intergovernmental Panel on Climate Change (IPCC) is available on the web at: <http://www.ipcc.ch/> However, for class, please focus on: Climate Change 2001: Synthesis Report, Summary for Policymakers by the Intergovernmental Panel on Climate Change (IPCC), in your course packet. If you'd like more scientific information, you can read the Technical summary at: <http://www.ipcc.ch/pub/wg1TARtechsum.pdf> .

The Arctic Climate Impact Assessment was released in 2004 and key findings are summarized in the Highlights included in your packet. Impacts of a Warming Arctic: Arctic Climate Impact Assessment. Highlights [2004]. Brochure (18 pages) produced by the Arctic Climate Impact Assessment (ACIA).

Week 5. October 17, 2005. Climate Change – Technology Options and International policy response – Framework Convention, Kyoto Protocol

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:

Valuing the Global Environment: Actions and Investments for a 21st Century, Global Environment Facility, 1998: The Climate Challenge and Opportunity, pp. 92-109.

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

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.

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

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

Week 6. October 24, 2005. Mid-term presentations

Mid-term paper due: Thursday October 27, 2005 by noon.

Fall Break

Week 7. November 7, 2005. Air Pollution -- Science and Impacts on 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. (on e-reserve at Stokes library)

Wilkening, K.E., Barrie, L.A., Engle, M. Trans-Pacific Air Pollution, *Science*, 2000 October 6; 290: 65-67.

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

Cifuentes, L, et al., Hidden Health Benefits of Greenhouse Gas Mitigation, *Science*, 293, 2001.

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. November 14, 2005. Policy responses to air pollution and acid rain -- Command and control versus market based mechanisms, Long Range Transboundary Air Pollution treaty, etc.

Readings:

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. November 21, 2005. 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. November 28, 2005. 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:

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

Valuing the Global Environment: Actions and Investments for a 21st Century, Global Environment Facility, 1998: *The Biodiversity Agenda*, pp. 67-91.

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

Week 11. December 5, 2005 Sustainable Development

This class may be postponed to December 12, 2005.

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.

Protecting Our Planet, Securing Our Future – Linkages among Global Environmental Issues and Human Needs, UNEP, NASA, World Bank, 1998, Available at: <http://www-esd.worldbank.org/planet/> Read in packet Part 3: Meeting Human Needs within the Environmental Envelope, pp. 31-51; and Part 4: Policies for Linking Human and Environmental Needs, pp. 53-74.

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

Week 12 December 12, 2005 Summary and Final Discussion

Reading Period: Oral reports by students of term projects. Monday January 9 and a second date to be determined.

Final term papers due: Monday January 16, 2003.