

Environmental Studies 80
Integrated Assessment Modeling of Global Climate Change
Spring 2008

Tuesday, Thursday 2-3:50; X hour: Wednesday 4:15-5:05
Location: 008 Steele

Instructor:

Professor Karen Fisher-Vanden
Environmental Studies
Office: Fairchild 104, 646-0213
Office hours: Fridays, 3:00-4:00 or by appointment

Teaching Assistant:

Kathryn Clark, '07
Office hours: Wednesdays, 4:15-5:05
Location for office hours: Fairchild 107A

Required Readings

Global Warming: The Complete Briefing, by John Houghton, Cambridge University Press, Cambridge, UK, 2004. (Available at Wheelock Books)

Managing the Global Commons, by William Nordhaus, MIT Press, Cambridge, MA, 1994. (No longer in print, but electronically available on the library website. Also on reserve at Kresge library).

Course reader available at Wheelock books

Other readings (in .pdf format) posted on Blackboard

Course Description

Integrated assessment models—models that combine simplified representations of the socioeconomic determinants of greenhouse gas emissions, the atmosphere and oceans, and impacts on human activities and ecosystems—have been used extensively to analyze the impacts of a warmer climate and possible mitigation policies. In addition, these models seek to combine knowledge from multiple disciplines in formal integrated representations; inform policy-making, structure knowledge, and prioritize key uncertainties; and advance knowledge of broad system linkages and feedbacks, particularly between socioeconomic and biophysical processes. This seminar will examine the scientific, socioeconomic, and ecological issues that modelers face when building integrated assessment models of global climate change. This course is modeling intensive and students will be required to complete a number of model building exercises using Excel.

Course Requirements

1. Class Participation: The success of any seminar course depends on active class participation. This requires each student to read carefully and think critically about the assigned readings each week. A portion of a student's grade will be based on attendance, preparedness, and participation in class.
2. Model building assignments: The goal of this seminar is for students to gain experience building integrated assessment models of global climate change. Students will be assigned seven model building exercises over the course of the term. Assignments and due dates are provided below. **Late assignments will not be accepted.**
3. Final Project and Oral Presentation (Assignment #7): Students will be tasked with proposing a climate policy for the next round of the FCCC negotiations. Each student will present his or her climate policy proposal on the last day of class.
4. Take-home Final Exam: A take-home final exam covering the assigned readings of the course can be picked up anytime **before 4:00 pm on Friday, May 30th** and will be due on or before the scheduled final exam date and time (**i.e., 11:30 am on Monday, June 2nd**).

Grading

Class participation:	10 pts	(5%)
Assignment #1:	10	(5%)
Assignment #2:	20	(10%)
Assignment #3:	20	(10%)
Assignment #4:	20	(10%)
Assignment #5:	20	(10%)
Assignment #6:	20	(10%)
Assignment #7:	40	(20%)
Take-home Final:	<u>40</u>	<u>(20%)</u>
Total:	200	(100%)

Academic honor

Students are encouraged to work together on assignments and interpreting assigned readings; however, each student must submit his or her own work. No assistance is allowed with the take-home final exam. Each student is expected to conduct his or herself in accordance with Dartmouth's Academic Honor Principle. Please consult the current ORC or the instructor with any questions regarding the Academic Honor Principle.

Disabilities

Students with disabilities should contact the instructor by the second week of classes in order that appropriate accommodations can be made.

X-hours

X-hours are optional and devoted to Excel instruction and providing additional help with modeling assignments.

Course Schedule

WEEK 1

Tuesday, March 25 – Course Overview / Introduction to Modeling

Stokey E. and R. Zeckhauser, "Models: a General Discussion," Chapter 2 in *A Primer for Policy Analysis*, 1978, pp. 8-21. (READING PACKET)

Handout: Assignment #1—Flow Diagram of DICE

Wednesday, March 26—X-hour: Introduction to Excel

Thursday, March 27 –The Greenhouse Effect and Greenhouse Gases

Houghton, J., 1997, "The Greenhouse Effect," Chapter 2 in *Global Warming: The Complete Briefing*, 1997, pp. 10-21.

Houghton, J., 1997, "The Greenhouse Gases," Chapter 3 in *Global Warming: The Complete Briefing*, 1997, pp. 22-45.

FILM – "What's up with the weather?" Part I

WEEK 2

Tuesday, April 1 – Introduction to Integrated Assessment Modeling

Nordhaus, W.D., 1994, "Introduction," Chapter 1 in *Managing the Global Commons*, pp. 3-6. (WEB LINK)

Nordhaus, W.D., 1994, "The Structure and Derivation of the DICE Model," Chapter 2 in *Managing the Global Commons*, pp. 7-22. (WEB LINK)

Weyant et al. 1996. "Integrated Assessment of Climate Change: An Overview and Comparison of Approaches and Results," in *Climate Change 1995: Economic and Social Dimensions of Climate Change*, J.P. Bruce, H. Lee, E.F. Haites (eds), Cambridge University Press, Cambridge, UK, Chapter 10: Sections 10.1-10.3, pp. 374-380. (READING PACKET)

Due: Assignment #1—Flow Diagram of DICE

Handout: Assignment #2—Emissions and Economic Growth

Wednesday, April 2 – X-hour: TA office hours

Thursday, April 3 – Economic Modeling

Pindyck, R.S. and D.L. Rubinfeld. 2004. "Production," Chapter 6 in *Microeconomics*, pp. 187-211. (READING PACKET)

Nordhaus, W.D., 1994, "Geeconomics: Energy, Emissions, and the Economic Impact of Climate Change," Chapter 4 in *Managing the Global Commons*, pp. 49-74. (WEB LINK)

In-class time to work on Assignment #2

WEEK 3

Tuesday, April 8 – Optimization

Ragsdale, C.T., "Introduction to Optimization and Linear Programming," Chapter 2 in *Spreadsheet Modeling and Decision Analysis*, 1998, pp. 16-23. (****BLACKBOARD****)

Ragsdale, C.T., "Modeling and Solving LP Problems in a Spreadsheet," Chapter 3 in *Spreadsheet Modeling and Decision Analysis*, 1998, pp. 43-59. (READING PACKET)

Due: Assignment #2—Emissions and Economic Growth
Handout: Assignment #3—Output Maximization

Wednesday, April 9 – X-hour: TA office hours

Thursday, April 10 – Guest Lecture: Professor Henry Jacoby, Director of MIT Center for Energy and Environmental Policy Research, Director of MIT Joint Program on the Science and Policy of Global Change, and Professor of Management at MIT Sloan School of Management.

WEEK 4

Tuesday, April 15 – Difference Equations and Discounting

Stokey E. and R. Zeckhauser, "Difference Equations," Chapter 4 in *A Primer for Policy Analysis*, 1978, pp. 47-73. (READING PACKET)

Munger, M.C.. 2000. "Discounting II: Time," Chapter 11 in *Analyzing Politics: Choices, Conflicts and Practice*, pp. 322-351. (READING PACKET).

Weitzman, M.L., "Just Keep Discounting, but...", Chapter 3 in *Discounting and Intergenerational Equity*, pp. 23-29. (BLACKBOARD)

In-class time to work on Assignment #3

Wednesday, April 16 – X-hour: TA office hours

Thursday, April 17 – Climate Modeling

Houghton, J., 1997, "Modelling the Climate," Chapter 5 in *Global Warming: The Complete Briefing*, pp. 77-114.

Nordhaus, W.D., 1994, "Macroeconomics: Derivation of the Climate and Carbon-Cycle Equations," Chapter 3 in *Managing the Global Commons*, pp. 23-48. (WEB LINK)

Due: Assignment #3—Output Maximization

Handout: Assignment #4—Utility Maximization

WEEK 5

Tuesday, April 22 – Climate Modeling Issues

Guest Speaker: John Weatherly, Cold Regions Research and Engineering Laboratory

Stone, P.H. 1992. "Forecast Cloudy: The Limits of Global Warming Models." MIT Center for Global Change Science. (BLACKBOARD)

In-class time to work on Assignment #4

Wednesday, April 23 – X-hour: TA office hours

Thursday, April 24 – Scenario Analysis

Nordhaus, W.D., 1994, "Analysis of Policies to Slow Global Warming," Chapter 5 in *Managing the Global Commons*, pp. 77-100. (WEB LINK)

Due: Assignment #4—Utility Maximization

Handout: Assignment #5—Scenario Analysis

WEEK 6

Tuesday, April 29 – Sensitivity Analysis

Ragsdale, C.T., "Sensitivity Analysis and the Simplex Method," Chapter 4 in *Spreadsheet Modeling and Decision Analysis*, 1998, pp. 128-143. (READING PACKET)

Nordhaus, W.D., 1994, "Sensitivity Analysis of the DICE Model," Chapter 6 in *Managing the Global Commons*, pp. 101-136. (WEB LINK)

In-class time to work on Assignment #5

Wednesday, April 30 – X-hour: TA office hours

Thursday, May 1 – Uncertainty Analysis

Ragsdale, C.T., "Simulation," Chapter 12 in *Spreadsheet Modeling and Decision Analysis*, 1998, pp. 484-510. (****BLACKBOARD****)

In-class time to work on Assignment #5

WEEK 7

Tuesday, May 6 – Decision Analysis

Stokey E. and R. Zeckhauser, "Decision Analysis," Chapter 12 in *A Primer for Policy Analysis*, 1978, pp. 201-236. (READING PACKET)

Nordhaus, W.D., 1994, "Formal Sensitivity Analysis: Estimation of Uncertainty in Climate Change," Chapter 7 in *Managing the Global Commons*, pp. 137-168. (WEB LINK)

Due: Assignment #5—Scenario Analysis

Handout: Assignment #6—Uncertainty Analysis

Wednesday, May 7 – X-hour: TA office hours

Thursday, May 8 – Decision Analysis (continued)

Guest Speaker: Mort Webster, MIT

Nordhaus, W.D., 1994, "Decision Analysis and the Value of Information," Chapter 8 in *Managing the Global Commons*, pp. 169-190. (WEB LINK)

In-class time to work on Assignment #6

WEEK 8

Tuesday, May 13 – Climate Change Policy and MIT EPPA Model Demonstration by Mort Webster (MIT)

Reinhardt F., G. Trumbull, P. McGrath, and N.Z. Uludere. 2006. *Global Climate Change and Emissions Trading*. Harvard Business School, Case #9-707-015, Harvard Business School Publishing, Boston, MA, 2006. (READING PACKET)

Yamin and Depledge, "The International Response to Climate Change," Chapter 2 (pp. 22-29) and "Parties," Chapter 3 (pp. 30-48). (BLACKBOARD)

MIT EPPA model documentation (BLACKBOARD)

Due: Assignment #6—Uncertainty Analysis

Handout: Assignment #7—Final Project

Wednesday, May 14 – X-hour: TA office hours

Thursday, May 15 – Climate Change Policy (continued)

Darmstadter, J., "The Energy-CO₂ Connection," in Toman, M.A., *Climate Change Economics and Policy: An RFF Anthology*, Washington, DC : Resources for the Future, 2001. (BLACKBOARD)

Cazorla, M.V. and Toman, M.A., "International Equity and Climate Change Policy," in Toman, M.A., *Climate Change Economics and Policy: An RFF Anthology*, Washington, DC : Resources for the Future, 2001. (BLACKBOARD)

In-class time to work on Assignment #7

WEEK 9

Tuesday, May 20 – Integrated Assessment Model Studies

Clark, Edmonds, Jacoby, Pitcher, Reilly, and Richels. 2007. *Scenarios of Greenhouse Gas Emissions and Atmospheric Concentrations*, U.S. Climate Change Science Program, Synthesis and Assessment Product 2.1a, Washington D.C., pp. 1 – 31. (BLACKBOARD)

Parson, Burkett, Fisher-Vanden, Keith, Mearns, Pitcher, Rosenzweig, and Webster. 2007. *Global Change Scenarios: Their Development and Use*, U.S. Climate Change Science Program, Synthesis and Assessment Product 2.1a, Washington D.C., Chapters 1, 2, 3.1-3.2, pp. 13-44. (BLACKBOARD)

In-class time to work on Assignment #7

Wednesday, May 21 – X-hour: TA office hours

Thursday, May 22 – Scenarios for Climate Change: Challenges and Controversies

Parson, Burkett, Fisher-Vanden, Keith, Mearns, Pitcher, Rosenzweig, and Webster. 2007. *Global Change Scenarios: Their Development and Use*, U.S. Climate Change Science Program, Synthesis and Assessment Product 2.1a, Washington D.C., Chapter 4, pp. 51- 82. (BLACKBOARD)

In-class time to work on Assignment #7

WEEK 10

Tuesday, May 27 – Class presentations and Wrap-up

Due: Assignment #7—Final Project

Monday, June 2, 11:30am – Take-home final exam due

