

**ECONOMICS OF NATURAL RESOURCE MANAGEMENT**  
**Monday and Wednesday: 10:00-11:20 pm, Bowers Auditorium, Sage Hall**

**Course Syllabus**

***Course Description:***

This course provides a survey, from the perspective of economics, of issues regarding the use and management of natural resources. The course covers both general methodological principles and specific applications. We will begin with an introduction to the principles of natural resource economics, developing the basic theory and methods required to understand the concept of economic efficiency and the conditions under which markets can and cannot be expected to result in efficient management of natural resources. We will also study the methods economists use to estimate the value of environmental and natural resource amenities. Then we will start to apply these concepts, beginning with the topics of non-renewable resources (like oil and minerals) and land use. After the midterm examination, we will cover many interesting applications of economics to the management of renewable resources, including water, fisheries, forests and wildlife. We will conclude with discussions of the economic approach to growth and sustainability.

***Instructor:*** Sheila Olmstead  
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Office hours: Tuesday, Wednesday: 2:30-4:00pm

***Teaching Assistants:*** Ulrich Wagner (ulrich.wagner@yale.edu)  
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Bruce Ho (bruce.ho@yale.edu)

***Prerequisites, Course Requirements and Grading:***

There are no formal prerequisites for this course. I will cover all of the economic concepts you will need in the course, and the text will be a useful reference. However, if you have never had an introductory microeconomics course, you may find it helpful to refer to a good basic textbook, like Gregory Mankiw's *Principles of Economics*, from time to time.

We will meet for a total of 26 class sessions. Because this is a large survey course, it will be conducted as a lecture. While class attendance is critical, class participation will not be part of your grade. There will be quantitative and qualitative problem sets, an in-class midterm exam, and a final exam during the exam period. Course grading will be on the following basis:

Problem sets	25%
Midterm exam	30%
Final exam	45%

### ***Reading Material:***

We will use one main textbook for the course, a course reading packet, and a secondary text. The reading packet is available through Yale RIS. The main text is Tom Tietenberg's *Environmental and Natural Resource Economics*, Sixth Edition, which is available at the Yale Bookstore. When selections from Tietenberg are assigned, the chapter appendices will always be optional reading for the mathematically inclined.

We will also read several selections (some of them optional) from a secondary text, Robert N. Stavins, ed., *Economics of the Environment: Selected Readings*. You are **not** required to purchase this text, although there are three required readings from it on the syllabus. However, if you plan to take F&ES 733, Economics of Pollution, during your time at Yale, you may want to purchase the Stavins text now – it is typically required for that course, and purchasing it now will save you some trips to the library to obtain a copy on reserve this spring. Copies of the course texts will also be on reserve at the Yale F&ES library on the fourth floor of Sage Hall.

Readings for each course meeting are listed below. Ideally, these should be read in advance of the relevant lecture(s). At flush left for each reading, I refer to readings from Tietenberg as (TXT1), readings from Stavins as (TXT2), and readings from the packet as (PCK). All readings are required, except those marked with an asterisk (\*), which are optional.

### ***Review Sessions:***

The teaching assistants will conduct weekly review sessions. Your attendance is optional. These sessions may be particularly helpful if you have never taken an economics course.

### ***Academic Integrity:***

You are expected and required to adhere to the highest standards of academic integrity. *Any violations of the Yale F&ES Professional and Academic Ethics Code will immediately be referred to the F&ES Disciplinary Committee for consideration.* The School and the University take such violations very seriously, and they can result in your expulsion from the degree program. If you are not familiar with this Code, please re-read the academic integrity material in the F&ES Student Handbook.

With particular reference to the assignments you will complete for this course:

1. In F&ES 734a, you are permitted and encouraged to work on *problem sets* in groups. However, each student must turn in her/his own problem set – direct use of a group's work or another person's work, either through copying by hand or by photocopying, is not permitted.
2. Any written materials that you turn in for course credit, including qualitative essay questions on problem sets and the "policy memos" that will be required on problem sets in the later portion of the course, must be properly cited. To quote from the F&ES student handbook, "failure to acknowledge ideas and phrases used in an essay or report that were gained from another writer, including the Internet," will be considered plagiarism. Note that this includes *concepts* taken from another source, *even if you express them in your own words.*
3. There will be two exams – a mid-term and a final. Use of prepared notes or texts, or communicating with another person during an examination, will be understood as cheating.

## **COURSE OUTLINE AND READING LIST:**

### **PART I: BASIC ECONOMIC CONCEPTS**

#### **January 10 (Monday): Introduction, Course Overview**

TXT 2 Fullerton, Don and Robert N. Stavins (1998), "How Economists See the Environment," *Nature* 395: 6701. Reprinted in Stavins, *Economics of the Environment*, pp. 3-8.

PCK "The invisible green hand," in "How many planets? A survey of the global environment," *The Economist* 6 July 2002: 15-17.

- \* TXT 1 Tietenberg, *Environmental and Natural Resource Economics*, Chapter 1 (pp. 1-15).

#### **January 12 (Wednesday): Economic Efficiency**

TXT 1 Tietenberg, *Environmental and Natural Resource Economics*, Chapter 2 (pp. 16-32).

- \* TXT 2 Kelman, Steven (1981), "Cost-Benefit Analysis: An Ethical Critique (with replies)," *AEI Journal on Government and Society Regulation* (Jan/Feb): 33-40. Reprinted in Stavins, *Economics of the Environment*, pp. 355-370.

#### **January 17 (Monday): Martin Luther King, Jr., Holiday – NO CLASS**

#### **January 19 (Wednesday): Property Rights, Externalities and Public Goods**

TXT 1 Tietenberg, *Environmental and Natural Resource Economics*, Chapter 4 (pp. 61-87).

- \* TXT 2 Coase, Ronald (1969), "The Problem of Social Cost," *Journal of Law and Economics* (October). Reprinted in Stavins, *Economics of the Environment*, pp. 23-49.

### **PART II: VALUING ENVIRONMENTAL BENEFITS**

#### **January 24 (Monday): Overview, Estimating Use Value**

**\*\*PSI DUE\*\***

TXT 1 Tietenberg, *Environmental and Natural Resource Economics*, Chapter 3 (pp. 34-54).

### **January 26 (Wednesday): Non-use Value and Contingent Valuation**

TXT 2 Portney, Paul R., (1994) “The Contingent Valuation Debate: Why Economists Should Care,” *Journal of Economic Perspectives* 8(4): 3-17. Reprinted in Stavins, ed., *Economics of the Environment*, pp. 253-267.

PCK Freeman, Myrick A. III (1993) “Nonuse Values,” in Freeman, Myrick A. III, *The Measurement of Environmental and Resource Values: Theory and Methods*, Resources for the Future, Washington, D.C.: 141-147.

- \* TXT 2 Diamond, Peter A. and Jerry A. Hausman (1994), “Contingent Valuation: Is Some Number Better than No Number?”, *Journal of Economic Perspectives* 8(4): 45-64. Reprinted in Stavins, ed., *Economics of the Environment*, pp. 295-315.

### **January 31 (Monday): Practice and Politics of Valuing Environmental Benefits**

PCK Rubin et al. (1991), “A Benefit-Cost Analysis of the Northern Spotted Owl,” *Journal of Forestry* 89 (December): 25-30.

PCK Carson et al. (1992), “A Contingent Valuation Study of Lost Passive Use Values Resulting from the Exxon Valdez Oil Spill,” A Report to the Attorney General of the State of Alaska, Natural Resource Damage Assessment, Inc. pp. 1-1 – 1-11.

## **PART III. ECONOMICS OF NON-RENEWABLE RESOURCE MANAGEMENT**

### **February 2 (Wednesday): Non-renewable Resources I – Optimal Extraction \*\*PS2 DUE\*\***

TXT 1 Tietenberg, *Environmental and Natural Resource Economics*, Chapter 5 (pp. 88-100).

### **February 7 (Monday): Non-renewable Resources II – Twists on the Basic Model**

TXT 1 Tietenberg, *Environmental and Natural Resource Economics*, Chapter 7 (pp. 127-145).

PCK Solow, Robert M. (1974), “The Economics of Resources or the Resources of Economics,” *American Economic Review* 64(2): 1-14.

### **February 9 (Wednesday): Non-Renewable Resources III – Empirical Evidence of Scarcity\*\*PS3 DUE\*\***

TXT 1 Tietenberg, *Environmental and Natural Resource Economics*, Chapter 14 (pp. 312-335).

- \* Nordhaus, William D. (1992), “Lethal Model 2: The Limits to Growth Revisited”, *Brookings Papers on Economic Activity* 1992(2):1-59, with comments and discussion by Robert N. Stavins and Martin L. Weitzman. Two copies of this paper are on reserve at the F&ES library, for those interested in the “Limits to Growth” debate.

## **PART IV: LAND ECONOMICS**

### **February 14 (Monday): Land Economics I – The Basic Model**

PCK Field, Barry C. (2001), “Land Economics,” in: *Natural Resource Economics: An Introduction*, McGraw-Hill, New York: 265-292.

### **February 16 (Wednesday): Land Economics II – Applications to Land Use Change**

PCK Nechyba, Thomas J. and Randall P. Walsh (2004), “Urban Sprawl,” *Journal of Economic Perspectives* 18(4): 177-200.

### **February 21 (Monday): In-Class Midterm Examination**

## **PART V: ECONOMICS OF RENEWABLE RESOURCE MANAGEMENT**

### **February 23 (Wednesday): Land Economics III – Land Use Change and the Environment**

*Guest Speaker:* Ruben Lubowski  
Economist  
U.S. Department of Agriculture, Economic Research Service

Readings to be announced.

### **February 28 (Monday): Introduction to Renewable Resources**

**\*\*PS4 DUE\*\***

PCK H. Scott Gordon (1954), “The Economic Theory of a Common-Property Resource: The Fishery,” *Journal of Political Economy* 62(2): 124-142. We will read only the excerpt of Gordon (1954) reprinted in Dorfman, Robert and Nancy S. Dorfman, eds. (1993), *Economics of the Environment* (Norton and Company, New York), pp. 97-108.

PCK Berkes, F. et al. (1989), “The benefits of the commons,” *Nature* 340(6229): 91-93.

### **March 2 (Wednesday): Fisheries**

TXT 1 Tietenberg, *Environmental and Natural Resource Economics*, Chapter 13 (pp. 281-308).

PCK Safina, Carl (1995), “The World’s Imperiled Fish,” *Scientific American* (November): 46-53.

### **Spring Break, March 5-20**

**March 21 (Monday): Forests and the Optimal Rotation Problem**

**\*\*PS5 DUE\*\***

- PCK Samuelson, Paul (1976), "Economics of Forestry in an Evolving Society," *Economic Inquiry* XIV(Dec.): 466-492. Reprinted in Sedjo, Roger A., ed., (2003), *Economics of Forestry* (Ashgate, Burlington, VT): 103-129. We will read only pp. 103-110, as printed in the course packet.

**March 23 (Wednesday): Forests, Continued**

- PCK Hartwick, John and Nancy Olewiler (1998), *The Economics of Natural Resource Use*, 2<sup>nd</sup> Edition, Addison-Wesley, Chapter 10, "Forest Use," pp. 330-341 only.

**March 28 (Monday): Species Preservation and Biodiversity**

**\*\*PS6 DUE\*\***

- PCK Metrick, Andrew and Martin L. Weitzman (1996), "Patterns of Behavior in Endangered Species Preservation," *Land Economics* 72(Fall): 1-16.
- PCK Simpson, David R. (1997), "Biodiversity Prospecting: Shopping the Wilds Is Not the Key to Conservation," *Resources* 126 (Winter).

**March 30 (Wednesday): Species Preservation and Biodiversity, continued**

- PCK Metrick, Andrew and Martin L. Weitzman (1998), "Conflicts and Choices in Biodiversity Preservation," *Journal of Economic Perspectives* 12(3): 21-34.

**April 4 (Monday): Water Resources**

**\*\*PS7 DUE\*\***

- TXT 1 Tietenberg, *Environmental and Natural Resource Economics*, Chapter 10 (pp. 209-229).
- PCK Stavins, Robert N. (1999), "How to Stop Squandering Water? Raise Its Price," *New York Times*, 4 August.

**April 6 (Wednesday): Water Resources, Continued**

- PCK Howe, Charles W. (1997), "Increasing Efficiency in Water Markets: Examples from the Western United States," in: Terry L. Anderson and Peter J. Hill, eds., *Water Marketing -- The Next Generation*, Rowman and Littlefield, Lanham, MD: 79-100.
- PCK Jehl, Douglas (2002), "Thirsty Cities of Southern California Covet the Full Glass Held by Farmers," *New York Times*, 24 September: A22.
- PCK Murphy, Dean E. (2003), "In a First, U.S. Puts Limits on California's Thirst," *New York Times*, 5 January.
- PCK Rodriguez, Erik (2000), "San Antonio may end water war by buying thirsty catfish farm," *Austin American-Statesman*, 5 December: A1.

**April 11 (Monday): Practice and Politics of Water Resource Economics: The Ogallala Aquifer**

**Guest speaker:** David Cash  
Director, Air Policy  
State of Massachusetts

Readings to be announced.

**PART VI: ECONOMIC GROWTH AND SUSTAINABILITY**

**April 13 (Wednesday): Economic Growth and Sustainability**

**\*\*PS8 DUE\*\***

TXT 1 Tietenberg, *Environmental and Natural Resource Economics*, Chapter 23 (pp. 553-560). \*Note: you are not required to read the whole chapter, only the specified pages.

TXT 2 Solow, Robert M. (1991), "Sustainability: An Economist's Perspective," J. Seward Johnson Lecture to the Marine Policy Center, 14 June, Woods Hole Oceanographic Institution, Woods Hole, Massachusetts. Reprinted in Stavins, *Economics of the Environment*, pp. 131-138.

**April 18 (Monday): Green Accounting**

PCK Solow, Robert (1992), "An Almost Practical Step Toward Sustainability," Lecture on the occasion of the 40<sup>th</sup> anniversary, Resources for the Future, Washington, D.C.

PCK Nordhaus, William D. and Edward C. Kokkelenberg, eds. (1999), "Executive Summary," in *Nature's Numbers: Expanding the National Economic Accounts to Include the Environment*, National Academy Press, Washington, D.C.: 1-9.

**April 20 (Wednesday)**

This is a catch-up day. If we are actually on schedule at this point in the semester, I will choose another topic to cover.

**April 25 (Monday): Defining a Role for Economic Analysis**

**\*\*PS9 DUE\*\***

PCK Hanley, Nick and Jason F. Shogren (2002), "Awkward Choices: Economics and Nature Conservation," in Daniel W. Bromley and Jouni Paavola, eds., *Economics, Ethics, and Environmental Policy: Contested Choices* (Blackwell Publishers, Oxford, UK): 120-130.

**Final Examination during exam week, May 3-10 – date, time and place to be determined.**