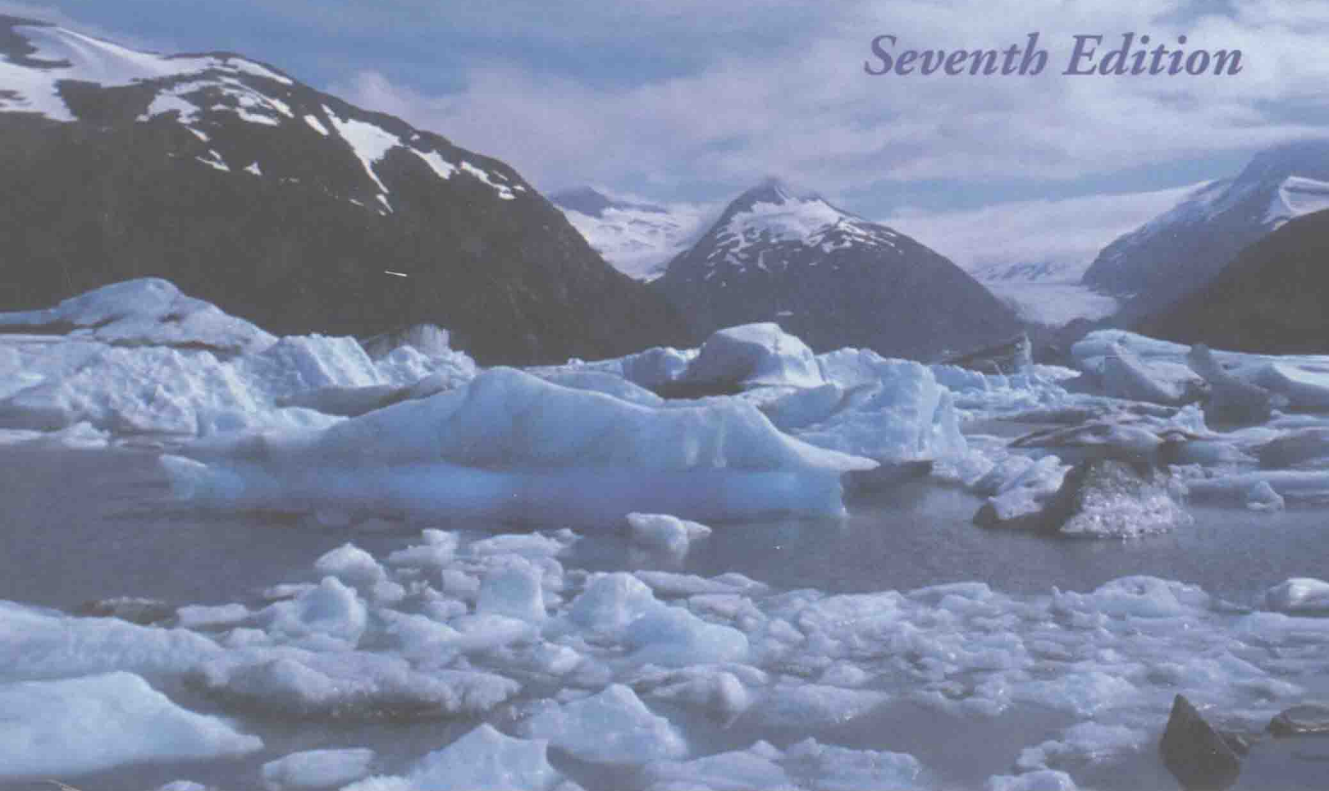


Environmental and Natural Resource Economics

Seventh Edition



TOM TIETENBERG

Environmental and Natural Resource Economics

Seventh Edition



T O M T I E T E N B E R G

Colby College



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*To Florence M. and Harry H. Tietenberg,
who provided me with a healthy
environment conducive
to development.*

Publisher: Daryl Fox
Editor-in-Chief: Denise Clinton
Acquisitions Editor: Roxanne Hoch
Editorial Assistant: Julia Boyles
Senior Production Supervisor: Katherine Watson
Executive Marketing Manager: Stephen Frail
Design Manager: Gina Hagen-Kolenda, Charles Spaulding
Associate Media Producer: Bridget Page
Production Coordination and Electronic Page Makeup: Elm Street Publishing
Services, Inc.
Manufacturing Buyer: Carol Melville
Cover Image: John Warden/AlaskaStock.com.

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Library of Congress Cataloging-in-Publication Data

Tietenberg, Thomas H.

Environmental and natural resource economics / Tom Tietenberg.—7th ed.
p. cm.

Includes index.

ISBN 0-321-30504-3 (alk. paper)

1. Environmental economics. 2. Environmental policy. 3. Natural resources—
Government policy. 4. Raw materials—Government policy. I. Title.

HC79.E5T525 2006

333.7—dc22

2005015019

2 3 4 5 6 7 8 9—CRW—09 08 07 06

Preface

When I wrote the First Edition of *Environmental and Natural Resource Economics* in 1981, environmental and natural resource economics was a well-developed, but underutilized, field. Its impact on environmental policy could most generously be described as “emerging.” That is no longer the case. Economics has become an indispensable part of the education of anyone dealing with environmental policy. As *Our Common Future* put it in 1987, “Economics and ecology bind us in ever-tightening networks. . . . Economics and ecology must be completely integrated in decision-making and law-making processes.”¹

Signs of maturation abound. A number of journals are now devoted either exclusively or mostly to the topics covered in this book. One, *Ecological Economics*, is a journal dedicated to bringing economists and ecologists closer together in a common search for appropriate solutions for environmental challenges. Interested readers can also find advanced work in the field in *Land Economics*, *Journal of Environmental Economics and Management*, *Environmental and Resource Economics*, *Environment and Development Economics*, *Resource and Energy Economics*, and *Natural Resources Journal*, among others.

New resources for student research projects have been made available in response to the growing popularity of the field. Original research on topics related to international environmental and natural resource issues was formerly very difficult for students because of the paucity of data. A number of good sources now exist, including *World Resources* (Washington, DC: Oxford University Press, published annually), which has an extensive data appendix, and *OECD Environmental Data* (Paris: Organization for Economic Cooperation and Development, published periodically).

A few Internet sources will be mentioned because they are so closely related to the focus of environmental and natural resource economics. Two discussion lists that involve material covered by this book are RES-ECON and ECOL-ECON. The former is a more academically inclined list focusing on problems related to natural resource management, whereas the latter is a more wide-ranging discussion list dealing with sustainable development.

Services on the Internet are changing so rapidly that some of this information may become obsolete. One way to keep up to date on the various Web options is to visit my Web site at <http://www.colby.edu/~thtieten/>. That site has links to other sites, including the site sponsored by the Association of Environmental and Resource Economists, which has information on graduate programs in this field.

Environmental and Natural Resource Economics attempts to bring those who are beginning the study of environmental and natural resource economics close to the

¹The World Commission on Environment and Development, *Our Common Future* (New York: Oxford University Press, 1987): 27, 37.

frontiers of knowledge. Although it is designed to be accessible to students who have completed only a two-semester introductory course in economics or a one-semester introductory microeconomics course, it has been successfully used in several institutions in lower-level and upper-level undergraduate courses as well as lower-level graduate courses.

Intertemporal optimization is handled within a discrete-time, mathematical programming framework, and all mathematics, other than simple algebra, are relegated to chapter appendixes. Graphs and numerical examples are used to provide an intuitive understanding of the principles suggested by the math and the reasons for their validity. In the Seventh Edition, I have tried to retain the strengths that seem particularly valued by users, while expanding the number of applications of economic principles, clarifying some of the more difficult arguments, and updating the material to include the very latest global developments.

The structure and topical coverage of this book facilitate its use in a variety of contexts. For a survey course in environmental and natural resource economics, all chapters are appropriate, though many of us have found that the book contains somewhat more material than can be covered adequately in a quarter or even a semester. This surplus of material provides flexibility for the instructor to choose those topics that best fit his or her course design. A one-term course in natural resource economics could be based on Chapters 1 to 14 and 22 to 24. A brief introduction to environmental economics could be added by including Chapter 15. A single-term course in environmental economics could be structured around Chapters 1 to 5 and 15 to 21. Chapter 7 could be added if a brief introduction to natural economics seems desirable.

New to This Edition

This edition contains a series of completely new debates on controversies in the field and many new application examples, all described below. In addition to containing a greatly expanded glossary (over 60 new terms), new art work, and completely updated data, the text references over 100 new studies, covers a host of new topics, and expands on several previously introduced topics.

Debate Boxes

Textbooks often ignore the controversies in the field, but they shouldn't. Debates about methods or interpretations are a vital source of information about the state of the art.

This edition has added a number of these debates:

1. Ecological Economics Versus Environmental Economics
2. Should Humans Place an Economic Value on the Environment?
3. Is Valuing Human Life Immoral?
4. How Should the United States Deal with the Vulnerability of Its Imported Oil?
5. What Is the Value of Water?

6. Should Water Systems Be Privatized?
7. Should Genetically Modified Organisms Be Banned?
8. Should Developing Countries Rely on Market-Based Instruments to Control Pollution?
9. Should the New Source Review Program Be Changed?
10. The Particulate and Smog Ambient Standard Controversy
11. Should Carbon Sequestration Be Credited?
12. Is Global Greenhouse Gas Trading Immoral?
13. CAFE Standards or Fuel Taxes?
14. Jobs Versus the Environment: Which Side Is Right?
15. Should an Importing Country Be Able to Use Trade Restrictions to Influence Harmful Fishing Practices in an Exporting Nation?

New Example Boxes

One of the keys to the success of this text has been its rich use of examples to demonstrate how economic principles are used in actual environmental policy situations. These examples serve to ground the relevant principles in a familiar and hopefully interesting context.

This edition adds many new examples:

1. Valuing Ecological Services from Preserved Tropical Forests
2. The Alaskan Permanent Fund
3. Hubbert's Peak
4. Tradable Energy Certificates: The Texas Experience
5. Do Mandatory Labels Correct Externalities?
6. Are Consumers Willing to Pay a Premium for GMO-Free Foods?
7. The Swedish Nitrogen Charge
8. The Irish Bag Levy
9. Controlling SO₂ Emissions by Command-and-Control in Germany
10. Technology Diffusion in the Chlorine Manufacturing Sector
11. The European Emissions Trading System (EU ETS)
12. Modifying Car Insurance as an Environmental Strategy
13. Effluent Trading and the Cost of Reducing Waste Treatment Discharges into Long Island Sound
14. Does Offering Compensation for Accepting an Environmental Risk Always Increase the Willingness to Accept the Risk?
15. Has NAFTA Improved the Environment in Mexico?

New Topics Covered

One of the consequences of the popularity of both ecological economics and environmental economics is the proliferation of research in the field. This research brings new subjects under investigation and uses new techniques to generate the insights.

This edition responds to these trends by incorporating several new topics:

- Conjoint Analysis
- Boserup Hypothesis
- Downward Spiral Hypothesis
- Human Rights and the Environment
- AIDS and the Demographic Transition
- The Emerging Role for LNG
- Tradable Energy Certificates
- Renewable Portfolio Standards
- Managing E-trash (computers, TVs, etc.)
- Recycling Surcharges
- Host Fees
- Water-Extraction Land Subsidence
- Conjunctive Use of Surface Water and Groundwater
- Water Banking
- Water Desalination as a Backstop Resource
- Privatization of Water Systems and Access
- The Economics of Wildlife Poaching
- Marine Reserves
- The Impact of Technological Change on the Fishery
- Rome Declaration on World Food Scarcity
- Role of Organic Foods
- Genetically Modified Organisms
- Land Conversion Incentives
- Sustainable Forestry
- Tiered, Area, and Input Pricing Systems for Water
- Conservation Easements and Land Trusts
- Royalty Agreements to Protect Biodiversity
- NAFTA's Chapter 11 and the Environment
- EPA's 33/50 Program
- Game Theory and Climate Change Coalition Formation
- Results from the Sulfur Allowance Program
- The European Emission Trading System
- Debt Relief and the Environment
- Abrupt Climate Change
- Product Charges to Control Air Emissions
- Safety Valves in Emission Trading
- Double Dividend Effects
- Climate Change Hedging Strategies
- Ecological Footprint
- Adjusted Net Savings (Formerly Genuine Savings)
- The MTBE Story
- Pay-As-You-Drive Automobile Insurance
- Automobile Feebates
- EPA's Water Quality Trading Policy
- Successful Canadian, Japanese, and European Strategies for Locating Hazardous Waste Facilities

Major Expansions

Three areas covered in the previous edition are discussed in more depth in this text. These include:

- Climate Change Science and Policy
- Trade and the Environment
- The Land Use Conversion Threat to Forests

Expansions and Updates

And finally, many discussions have been updated to make sure readers are exposed to the latest developments. These include:

- The Role of Deep Ecology
- Environment in Russia and the Former Soviet Republics
- Hydrogen-Based Fuels
- Expanded Producer Responsibility
- Conflicts over Instream Flows of Water
- Water Pricing Systems
- Agricultural Trends
- Labeling and Certification Strategies
- Debt-Nature Swaps
- Delaney Clause
- Multilateral Fund
- ZEV Auto Sales Quotas
- Alternative Fuels
- Toxic Release Inventory
- California's Proposition 65
- Genuine Progress Indicator
- Human Development Index
- Environmental Justice and the Location of Hazardous Waste Facilities

This edition retains a strong policy orientation. Though a great deal of theory and empirical evidence is discussed, their inclusion is motivated by the desire to increase understanding of intriguing policy problems, and these aspects are discussed in the context of those problems. This explicit integration of research and policy within each chapter avoids the problem frequently encountered in applied economics textbooks—that is, in such texts the theory developed in earlier chapters is often only loosely connected to the rest of the book.

This is an economics book, but it goes beyond economics. Insights from the natural and physical sciences, literature and political science, as well as other disciplines, are scattered liberally throughout the text. In some cases these references raise unresolved issues that economic analysis can help resolve, while in others they affect the structure of the economic analysis or provide a contrasting point of view. They have an important role to play in overcoming the tendency to accept the material uncritically at a superficial level by highlighting those characteristics that make the economics approach unique.

Supplements

For each chapter in the text, the online *Instructor's Manual*, written by Lynne Lewis of Bates College, provides an overview, learning objectives, a chapter outline with key terms, common student difficulties, and suggested classroom exercises. Professors can download the *Instructor's Manual* and the PowerPoint slides, which contain the text figures, from the catalog page for this book at www.aw-bc.com.

The book's Companion Web site, www.aw-bc.com/tietenberg, features chapter-by-chapter Web links to additional readings and economic data. If you wish to supplement your course with newspaper subscriptions or economic news sources, ask your local sales representative for details about Addison-Wesley's special offers.

For the first time with the Seventh Edition, the text is accompanied by Excel-based models that can be used to numerically solve common forest-harvest problems. These examples may be presented in lecture to accentuate the intuition provided in the textbook, or they may underlie specific questions on a homework assignment. The models, developed by Arthur Caplan and John Gilbert of Utah State University, are available via the open-access Companion Web site (www.aw-bc.com/tietenberg).

Acknowledgments

Perhaps the most rewarding part of writing this book has been that it has put me in touch with so many thoughtful people I had not previously met. I very much appreciate the faculty and students who pointed out areas of particular strength or areas where coverage could be expanded in this edition. The support this book has received from faculty and students has been gratifying and energizing. One can begin to understand the magnitude of my debt to my colleagues by glancing at the several hundred names in the lists of references contained in the name index. Because their research contributions make this an exciting field, full of insights worthy of being shared, my task was easier and a lot more fun than it might otherwise have been.

My strongest debt of gratitude is to Professor Lynne Lewis of Bates College. Lynne took primary responsibility for expanding and modifying Chapters 3, 10, 11, 19, and 21. The book is stronger for her contributions and I am grateful for her assistance.

I also owe a large debt of gratitude to Professors Elena Alvarez (State University of New York at Albany); Frank Egan (Trinity College); Joseph Herriges (Iowa State University); Janet Kohlhasse (University of Houston); Patricia Norris (Michigan State University); Tesa Stegner (Idaho State University); David Terkla (University of Massachusetts at Boston); and Roger von Haefen (University of Arizona, but visiting at Stanford University at the time of his review). This group provided detailed, helpful reviews of the text and supplied many useful ideas for this revision.

And, finally, I want to acknowledge the valuable assistance I received during various stages of the writing of this text from:

Dan S. Alexio
 Gregory S. Amacher

U.S. Military Academy at West Point
 Virginia Polytechnic Institute and
 State University

Michael Balch	University of Iowa
Maurice Ballabon	Baruch College
Edward Barbier	University of Wyoming
A. Paul Baroutsis	Slippery Rock University of Pennsylvania
Kathleen P. Bell	University of Maine
Peter Berck	University of California, Berkeley
Fikret Berkes	Brock University
Trond Bjørndal	Norwegian School of Economics and Business Administration
Sidney M. Blumner	California State Polytechnic University, Pomona
Vic Brajer	California State University, Fullerton
Stacy Brook	University of Sioux Falls
Richard Bryant	University of Missouri, Rolla
David Burgess	University of Western Ontario
Mary A. Burke	Florida State University
Richard V. Butler	Trinity University
Trudy Cameron	University of Oregon
Jill Caviglia-Harris	Salisbury University
Duane Chapman	Cornell University
Charles J. Chicchetti	University of Wisconsin, Madison
Hal Cochrane	Colorado State University
Jon Conrad	Cornell University
John Coon	University of New Hampshire
William Corcoran	University of Nebraska, Omaha
Gregory B. Christiansen	California State University, East Bay
Maureen L. Cropper	University of Maryland
John H. Cumberland	University of Maryland
Herman E. Daly	University of Maryland
Diane P. Dupont	Brock University
Randall K. Filer	Hunter College/CUNY
Ann Fisher	Pennsylvania State University
Anthony C. Fisher	University of California, Berkeley
Marvin Frankel	University of Illinois, Urbana-Champaign
A. Myrick Freeman III	Bowdoin College
James Gale	Michigan Technological University
David E. Gallo	California State University, Chico
Haynes Goddard	University of Cincinnati
Nikolaus Gotsch	Institute of Agricultural Economics (Zurich)
Doug Greer	San José State University
Ronald Griffin	Texas A&M University
W. Eric Gustafson	University of California, Davis
A. R. Gutowsky	California State University, Sacramento
Jon D. Harford	Cleveland State University
Gloria E. Helfand	University of Michigan
Ann Helwege	Tufts University
John J. Hovis	University of Maryland

Paul Huszar	Colorado State University
Craig Infanger	University of Kentucky
Allan Jenkins	University of Nebraska at Kearney
Donn Johnson	Quinnipiac College
James R. Kahn	Washington and Lee University
Chris Kavalec	Sacramento State University
Derek Kellenberg	University of Colorado, Boulder
John O. S. Kennedy	LaTrobe University
Thomas Kinnaman	Bucknell University
Andrew Kleit	Pennsylvania State University
Richard F. Kosobud	University of Illinois, Chicago
Douglas M. Larson	University of California, Davis
Dwight Lee	University of Georgia
Joseph N. Lekakis	University of Crete
Ingemar Leksell	Göteborg University
Randolph M. Lyon	Executive Office of the President (U.S.)
Robert S. Main	Butler University
Giandomenico Majone	Harvard University
David Martin	Davidson College
Charles Mason	University of Wyoming
Ross McKittrick	University of Guelph
Nicholas Mercurio	Michigan State University
David E. Merrifield	Western Washington University
Frederic C. Menz	Clarkson University
Michael J. Mueller	Clarkson University
Kankana Mukherjee	Clarkson University
Thomas C. Noser	Western Kentucky University
Lloyd Orr	Indiana University
Peter J. Parks	Rutgers University
Alexander Pfaff	Columbia University
Raymond Prince	University of Colorado, Boulder
H. David Robison	La Salle University
J. Barkley Rosser, Jr.	James Madison University
Jonathan Rubin	University of Maine
Milton Russell	University of Tennessee
Frederic O. Sargent	University of Vermont
Salah El Serafy	World Bank
Aharon Shapiro	St. John's University
W. Douglass Shaw	University of Nevada
James S. Shortle	Pennsylvania State University
Leah J. Smith	Swarthmore College
V. Kerry Smith	North Carolina State University
Rob Stavins	Harvard University
Joe B. Stevens	Oregon State University
Gert T. Svendsen	The Aarhus School of Business
Kenneth N. Townsend	Hampden-Sydney College

Robert W. Turner	Colgate University
Wallace E. Tyner	Purdue University
Nora Underwood	Florida State University
Myles Wallace	Clemson University
Patrick Welle	Bemidji State University
Randy Wigle	Wilfred Laurier University
Richard T. Woodward	Texas A&M University
Anthony Yezer	The George Washington University

My most helpful research assistant for this edition was Emilia Tjernström. Working with all of the fine young scholars who have assisted me with this text over the years has made it all the more obvious to me why teaching is the world's most satisfying profession.

Finally, I should like to express publicly my deep appreciation to my wife Gretchen, my daughter Heidi, and my son Eric for their love and support.

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Sand Cove
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