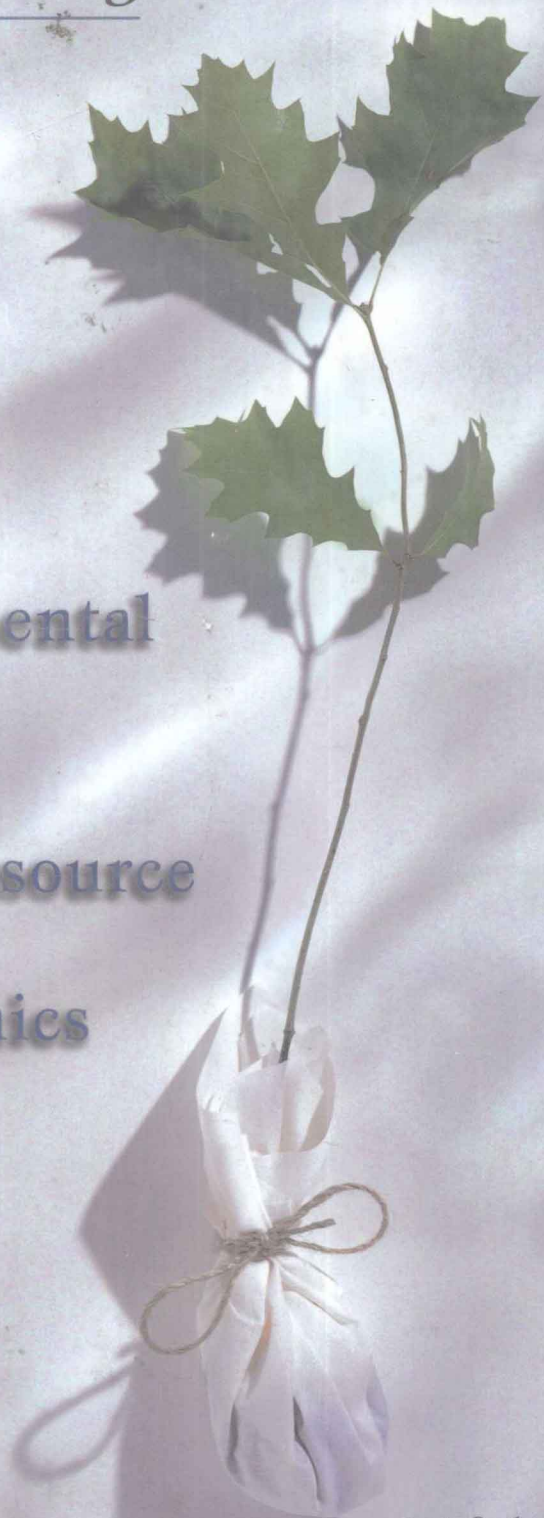


*Tom Tietenberg*

**Environmental  
and  
Natural Resource  
Economics**



*Fifth Edition*



# ENVIRONMENTAL AND NATURAL RESOURCE ECONOMICS

FIFTH EDITION

Tom Tietenberg  
*Colby College*



**ADDISON-WESLEY**

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

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# PREFACE

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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.”<sup>1</sup>

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*, *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).

Three 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/personal/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 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

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

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 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 fifth 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 developments around the world.

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 some 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

The fifth edition continues the trend started in the last edition toward a more international focus. Additional attention has been paid to environmental problems and policies in Eastern and Western Europe, China, and the developing nations than was the case in previous editions. Economic valuation of the environment is now addressed with two chapters, rather than one. While the first deals with the concepts that lie behind economic valuation, the second focuses on measurement concepts. Both chapters contain several practical illustrations.

The introductory material on sustainable development now appears in a separate chapter; new mathematical appendices have been added for the fisheries and forestry chapters; and a new glossary of terms defines and explains over 200 terms.

New boxed examples highlight special topics, including: (1) Does Reducing Pollution Make Economic Sense? (2) Choosing Between Preservation and Development in Australia; (3) Valuing Damage from Groundwater Contamination Using Averting Expenditures, (4) Valuing Diesel Odor Reduction by Contingent Ranking; (5) The Value of Wildlife Viewing; (6) Income-Generating Activities as Fertility Control: Bangladesh; (7) Implementing the “Take-Back” Principle; (8) Trust Funds for Habitat Preservation; (9) Free-Access Harvesting of the Minke Whale; (10) Local Approaches to Wildlife Protection: Zimbabwe; (11) Environmental Taxation in China; (12) The Sulfur Allowance Program; (13) Why and How Do Environmentalists Buy Pollution? (14) Tradeable Permits for Ozone-Depleting Chemicals; (15) Car Sharing: Better Use of Automotive Capital; (16) Getting the Lead Out: The

Lead Phaseout Program; (17) Counterproductive Policy Design; (18) Jobs Versus the Environment: What is the Evidence; (19) Resource Depletion and Economic Sustainability: Malaysia; (20) Controlling Land use Development with TDRs; and (21) Reputational Strategies for Pollution Control in Indonesia.

New topics covered include:

- electricity deregulation
- Web sites of interest
- The relative costs of risk reduction options
- Environmental Kuznets curves
- Averting expenditures
- Contingent ranking
- Disclosure strategies
- Kyoto Protocol and emissions trading of greenhouse gases

Some complete new data and artwork have been added.

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. The many insights gleaned from other disciplines have an important role to play in overcoming the typical textbooks' tendency to accept the material uncritically at a superficial level; instead, this text highlights those characteristics that make the economics approach unique.

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.

## 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.



Valuable assistance was received during various stages of the writing from the following:

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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.

Tom Tietenberg  
Prospect Harbor, Maine



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