

Environmental Economics and Natural Resource Management

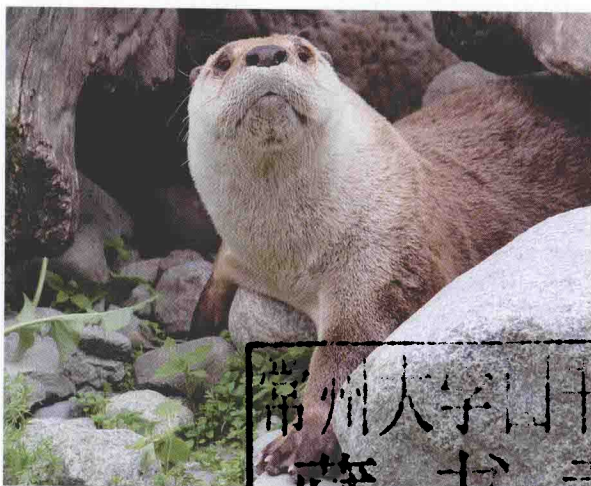
Fourth Edition

David A. Anderson

ROUTLEDGE


ENVIRONMENTAL ECONOMICS and Natural Resource Management

Fourth Edition



David A. Anderson
Centre College

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ENVIRONMENTAL ECONOMICS and Natural Resource Management

Necessary decisions about natural resources and the environment pit the present against the future, development against nature, and certain benefits against uncertain consequences. The resulting importance of careful economic analysis heightens the need for high-quality educational materials for the next generation of decision makers.

With *Environmental Economics and Natural Resource Management* we aim to provide the most user-friendly textbook on the market. The fourth edition pairs the story-based narrative and visual emphasis of previous editions with new policy initiatives and the latest developments in the field. The expanded set of visual aids includes scores of color photographs and illustrations unmatched in other texts.

In this book students will discover environmental policies from around the world, practical approaches to resource-use dilemmas, techniques for environmental dispute resolution, and ample coverage of hot topics including:

- tradable emissions permits
- solar and wind energy
- recycling policies
- global environmental initiatives.

This innovative textbook serves students of environmental economics, ecological economics, and natural resource management. Instructors receive access to an online *Instructor's Guide* with answers to the practice problems and downloadable slides of the figures and tables in the book.

David A. Anderson received his B.A. from the University of Michigan and his M.A. and Ph.D. from Duke University. His other books include *Favorite Ways to Explore Economics* and *Economics by Example*. He is the Paul G. Blazer Professor of Economics at Centre College.

For Donna, Austin, and Ally

Preface

Environmental economics is unique among course offerings. Like the arts, the environment serves as a basis for cultural identity and a fount for social welfare. As in the natural sciences, students of environmental economics seek a better understanding of the natural world. Yet the study of environmental economics holds special importance because it speaks directly to practices and policy decisions that determine our fate. Economic tools address the specifics of what products best serve society, what regulations are appropriate, what incentives are optimal, and what resources should be conserved.

Humans have the capacity to protect, alter, or destroy natural resources on a grand scale. Regulators confront trade-offs between lives and profits, and can be guided by greed or emotion, if not by informed approaches. Economic analysis reveals that the value of human life is not infinite and the optimal amount of pollution is not zero, but that ignorance of economic insights results in undervalued lives and excessive pollution. The purpose of this book is to make the tools of economic analysis readily available to college students interested in the environment or natural resources.

Most people are aware of debates surrounding environmental assets. Relatively few are familiar with the economic way of thinking. Even fewer know the means by which to weigh short-term costs against long-term benefits, or the costs and benefits of, say, biodiesel as an alternative fuel. When information is lacking, critical environmental policy is more easily swayed by questionable arguments. It may be inhuman to be dispassionate, but economic theory provides opportunities to displace emotions with concrete criteria. The challenge, then, is to apply the most valid methodology earnestly and honestly. This book explains relevant techniques and points out likely missteps.

The fourth edition of *Environmental Economics and Natural Resource Management* retains the story-based narratives and visual emphasis of the previous editions, updated with contemporary policy initiatives from around the world and discussions of the latest developments in the field. As visual aids, an expanded array of full-color photographs, diagrams, and graphs impart new perspectives on global environmental and resource issues. “Reality Checks” in each chapter delve more deeply into the application of economic principles in the

real world. Review problems and “websurfing challenges” reinforce understanding, and suggested Internet links and additional readings serve students whose interests have been stirred. Some of the more challenging models appear in appendices to grant instructors the flexibility to cover them or not. Above all, this textbook addresses the critical objectives of environmental and economic literacy with policy-oriented, application-based content that is easy to follow.

Although ethical dilemmas surround environmental economics, criteria for deciding right from wrong receive little coverage in many textbooks. The need for education on ethical considerations is punctuated by daily headlines about corruption and severe abuses of the environment. The allocation of scarce resources involves moral quandaries over the treatment of humans, wildlife, and future generations of the same. Chapter 16 of this textbook explains secular ethical theories and highlights the role of ethics in environmental policy.

While alarm about resource scarcity earned economics a reputation as the “dismal science,” there is hope for a marriage between growing consumer demands and progress on environmental fronts. The navigation of economic growth through sensitive environmental waters requires deliberate practices and a firm understanding of the relevant theory and evidence. May reading this book be a meaningful step along that journey.

General Overview

This textbook is divided into three parts. The chapters in the first part introduce environmental economics and provide a review of the more useful tools in the field. The second part lays out current areas of interest and concern, and explains alternative approaches to problem solving and the attainment of efficiency. Although the topic of environmental policy appears throughout the text, the third part emphasizes policy and public-sector oversight. Because decisions regarding natural resources cannot escape the realm of ethics, the final chapter provides a foundation in environmental ethics.

One cannot discuss or apply environmental economics appropriately without adequate knowledge of the underlying concepts and definitions. Without an understanding of the food chain, one cannot appreciate the economic value of plankton. Not knowing the meaning of hedonic pricing, one cannot speak intelligently about estimating the value of biodiversity. For this reason, the opening sections of most chapters contain definitions and perhaps a taste of chemistry, biology, or political science. The alternative would be to assume that readers have taken and remember all of those classes that complement environmental and natural resource economics—an expectation I would not want applied to myself!

Part I Building a Foundation

Chapter 1 The Big Picture

This chapter presents an overview of compelling environmental economics issues and gives readers a sketch of what is ahead in the text and why it is important. Nine key areas within the field are briefly highlighted: market failure, waste and recycling, environmental ethics, sustainable development, biological diversity, environmental degradation, alternative energy sources, population and economic growth, and natural resources management. The chapter provides less-than-subtle hints that the forthcoming tools of economics will address each of these issues.

Chapter 2 Efficiency and Choice

This chapter covers the primary tools of economic analysis, explaining marginal analysis, expected value calculations, supply and demand, and consumer choice. It is written as a comprehensive review for students who have seen most of this material in other courses, and to serve as a reference for students who encounter applications of this material later in the text and want to re-read the underlying concepts.

Appendix Efficiency in Greater Detail

This appendix provides a mathematically rigorous explanation of efficiency criteria.

Chapter 3 Market Failure

This chapter explains why the invisible hand might not always yield an efficient outcome. The sources of market failure—externalities, public goods, imperfect information, and imperfect competition—are explained in detail, including graphical analysis and real-world examples. In addition to foreshadowing the policy solutions of the second section, this chapter presents the Coase Theorem using numerical examples.

Chapter 4 The Role of Government

Chapter 4 analyzes the role of government in stemming market failure. Discussions address the need for government, the solutions government brings, and some of the pitfalls of both public and private approaches to externalities. The chapter also identifies opportunities to gain by substituting regulation for liability risks, and outlines key environmental agencies and legislation.

Chapter 5 Trade-offs and the Economy

Many of the most difficult questions in this field deal with long-run versus short-run benefits, and financial versus environmental gains. This chapter explains the tools of discounting and their applications. The chapter then covers methods for weighing economic growth against environmental degradation, and explores prospects for economic growth that are consistent with environmental goals.

Part II Issues and Approaches

Chapter 6 Environmental Quality

This chapter explains measures and determinants of environmental quality, including air quality, water quality, light pollution, and noise pollution. Case studies of solutions include policy, education, technology, product substitution, and market-based incentives. Tradable pollution permits are introduced, and receive more thorough coverage in Chapter 12.

Chapter 7 Energy

This chapter addresses traditional and alternative sources of energy, with attention to the trade-offs between various options, political and economic barriers, and future prospects. A case study of twenty-first century automotive technology provides a backdrop for discussions of the politics, pawns, and big players in energy-policy debates.

Chapter 8 Sustainability

This nebulous but conceptually attractive approach provides a guiding question for every activity that affects the environment: For how long can this activity be sustained? This chapter considers the appropriate application of the sustainability criterion and examines promising opportunities for sustainable development.

Chapter 9 Population, Poverty, and Economic Growth

This chapter covers demographic trends and their relationships to the environment. Past theories, including the work of Malthus and Kuznets, are coupled with more recent perspectives on municipal waste generation and the determinants of resource use. The chapter concludes with a discussion of how current and proposed government policies affecting poverty and economic growth are likely in turn to affect the environment.

Chapter 10 Biodiversity and Valuation

This chapter addresses optimal levels of biodiversity, issues of species prioritization, and the valuation of natural resources. Methods for estimating the marginal value of specific species are explained, with references to the current literature. Topics include the interpretation of market prices, contingent valuation, hedonic pricing, and the travel cost method.

Chapter 11 International and Global Issues

This chapter describes the aspects of environmental economics that transcend national boundaries. It covers attempts at international cooperation and the associated organizations and agreements. Topics include the CITES and Kyoto treaties, global warming, acid rain, natural disasters, global scarcity, poaching, and the strengths and weaknesses of international law.

Part III Policy and Procedure

Chapter 12 Perspectives on Environmental Policy

Building on the review of marginal analysis in Chapter 2, this chapter explains the application of cost-benefit analysis to major environmental policy initiatives. With an even-handed approach, the chapter presents the concerns of business firms and environmental guardians, discusses the specific marginal gains and losses, and explores the efficient reconciliation of relevant needs and wants. Case studies include congestion pricing and a thorough discussion of tradable emissions permits.

Chapter 13 Natural Resource Management: Renewable Resources

Although many of the chapters in this text pertain to natural resource management, Chapters 13 and 14 have a narrower focus. Chapter 13 introduces a model of renewable resource use that serves as a basis for policy discussions in this and the following chapter.

Chapter 14 Natural Resource Management: Depletable and Replenishable Resources

Models of depletable, recyclable, and renewable resource use appear in a single chapter, in which differences among the treatments can be easily identified and explained. For simplicity and brevity, one representative resource from each group is selected for a case study. Topics include consensus research findings and the optimal size and timing of harvests.

Appendix Intertemporal Allocation and Hotelling's Rule

The Appendix offers a rigorous explanation of optimal allocation across periods and a derivation of Hotelling's rule to supplement the rule's introduction in the chapter.

Chapter 15 Environmental Dispute Resolution

The field of environmental economics harbors many opportunities for disagreement. Liberals and conservatives battle over policy. Businesses and communities battle over growth. Owners of natural resources battle over use restrictions, liability, and conflicting ownership claims. How these disputes are resolved often determines the allocation of natural resources and the state of environment preservation. This chapter emphasizes efficient mechanisms for dispute resolution, including "cake-cutting" techniques, mediation, arbitration, and offer-of-settlement devices.

Chapter 16 Morals and Motivation

At the core of many environmental economics debates are moral issues involving the appropriate treatment of flora, fauna, fellow humans, and future generations of all the above. This chapter considers the motives behind our behavior; in essence, the elements of our utility functions. General ethical theories are followed by narrower discussions of deep ecology, social ecology, and ecofeminism. The chapter concludes with several alternative "tests" for whether particular actions that affect the environment are acceptable.

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Sonoma State University

S. Aaron Hegde
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Anonymous reviewers from:
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