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Mick Common and Sigrid Stagl
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Ecological Economics

Taking as its starting point the interdependence of human and natural systems this book provides a comprehensive introduction to the emerging field of ecological economics. The authors, who have written extensively on the economics of sustainability, build on insights from both mainstream economics and ecological sciences. It assumes no prior knowledge of economics and is well suited for use on interdisciplinary environmental science and management courses.

MICHAEL COMMON is Emeritus Professor at the Graduate School of Environmental Studies, University of Strathclyde and a member of the editorial board of the journal *Ecological Economics*. He is highly respected both for his teaching and as author of numerous journal and book publications on the economics of the environment since 1973.

SIGRID STAGL is a Senior Research Fellow at SPRU, University of Sussex. She is a member of the editorial board of the journal *Environmental Values* and is currently Vice-President of the European Society of Ecological Economics. She was awarded the first Ph.D in Ecological Economics worldwide.

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Common and Stagl have written the definitive text to date for ecological/environmental economics. It presents the standard theories of neoclassical economics and points the way toward a richer understanding of the relationship between the human economy and the natural world. The field of economics is undergoing a revolution that will fundamentally change economic theory and policy. Central to this revolution is the recognition by economists that economic behavior cannot be understood outside its social and environmental context. This text brings environmental economics into the twenty-first century and will be the standard in the field for years to come.'

JOHN GOWDY, Professor of Economics, Rensselaer Polytechnic Institute, and former President of the U.S. Society for Ecological Economics

'*Environmental* economics has existed as a powerful discipline for nearly 50 years. *Ecological* economics borrows heavily from it, and overlaps it significantly. But there are differences. Ecological economics perhaps invests more heavily in understanding ecological science, takes more note of discontinuities and non-linearities in ecological and economic systems, and pays less attention to notions of economic efficiency and outcomes determined by short-term human wants. Anyone wanting an explanation and exploration of these differences in a lucid and informative manner will want to own Mick Common and Sigrid Stagl's textbook. It is a very fine introduction.'

DAVID PEARCE, Emeritus Professor of Environmental Economics, University College London

'Clear presentations of the reasoning and facts underlying environmental science and economics, a steady focus on the high hopes of economists and the earthly fears of ecologists, and inspiring descriptions of how ecological economists are trying to make sense of life on earth. This is the book we have been waiting for.'

RICHARD B. NORGAARD, Professor of Energy and Resources, University of California, Berkeley, and former President of the International Society for Ecological Economics

'This book provides a coherent account of the major environmental challenges to economic and human progress of the twenty first century. It is clear, direct and easily understandable and conveys a powerful message that we

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ignore the sustainability and ecological aspects of the economy at out peril. I recommended it highly to all students and scholars of the emerging field.'

NEIL ADGER, Reader in Environmental Economics,
University of East Anglia.

'This book satisfies the urgent need for an introductory text on Ecological Economics that is informative but not overly detailed on environmental sciences, strong on and where necessary critical of economics, and representative in its coverage of new theory and methods.'

JEROEN C. J. M. VAN DEN BERGH, Professor of Environmental
Economics, Free University, Amsterdam

'With this excellent text, Mick Common and Sigrid Stagl have provided an authoritative introduction to ecological economics. It offers a very clear and comprehensive review of the concepts, methods and issues on which ecological economics focuses, with a wealth of examples and worked simulations. Assuming nothing more than the most basic knowledge of mathematics, the book develops the economic principles relevant to environmental policy; it also introduces the necessary understanding of the relevant natural scientific concepts and principles. These economic and scientific methods are then synthesised to analyse current environmental problems and to indicate policy approaches to their solution. With extensive referencing to the current literature, the book is an excellent basis for the study of ecological economics and environmental policy.'

JOHN PROOPS, Professor of Ecological Economics, Keele University, and
former President of the International Society for Ecological Economics

'Here it is – the book that fills the gap! It offers students a very good introduction to environmental management as the interdisciplinary challenge it is. It integrates core elements from natural and social sciences into a coherent text – a rare feature. In doing so it is really enlightening, well structured and enjoyable to read. Moreover, it is well organized for teaching purposes – even with a web page attached to it.'

ARILD VATN, Professor of Environmental Sciences, and
Vice-President of the European Society for Ecological Economics,
Norwegian University of Life Sciences

'This book offers an innovative and sophisticated approach to teaching ecological economics at the introductory level. For economics students, Common and Stagl provide a basic understanding of the biophysical foundations and environmental impacts of economic activity. For environmental studies students, the authors provide a grounded and yet accessible introduction to the concepts and methods of economics – especially as they relate to the interplay between economic growth, natural resource depletion, and the achievement of sustainable development. "Ecological Economics: An Introduction" could and should

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be used in core courses in academic programs aimed at integrating ecology and economics at the levels of research and praxis.'

RICHARD B. HOWARTH, Professor of Environmental Studies, Dartmouth College

'This textbook is a brilliant guide to understanding the global environmental and distributional challenges we are facing. Common and Stagl master a truly transdisciplinary approach and take a fresh look at the structuring of the issues, resulting in a textbook that is both committed and balanced and which offers an alternative perspective to traditional environmental economics introductions. Furthermore, the educational presentation is very carefully prepared and clear, ideal for beginning students.'

INGE RØPKE, Associate Professor, Technical University of Denmark

'This is the most comprehensive and readable treatment of the complex transdisciplinary field of Ecological Economics to date. It will be a standard reference for students and practioners for years to come. When it has come to replace "Samuelson" as the standard textbook for introductory economics courses, we will know the world is on a path toward sustainability.'

ROBERT COSTANZA, Gund Professor of Ecological Economics and Director, Gund Institute of Ecological Economics, The University of Vermont, and former President of the International Society for Ecological Economics

'How refreshing to see an introductory economics textbook which begins by stating, "The pursuit of sustainable development . . . cannot be left to markets – there is an inescapable role for government"! This new text is the first I've seen which actually begins from the beginning, setting the economy in its environmental context and requiring no prior economics indoctrination (which then would need to be critiqued and expunged). It explains the rationale behind modelling and explores basic principles of ecology, thermodynamics and economics before discussing their many complex interrelationships with currency and style. The sections on policy and governance are sophisticated and comprehensive. This is an introduction to economics for the 21st century, economics as it must become if the profession – and the global economy itself – are to survive.'

PATRICIA E. PERKINS, Associate Professor, York University, Toronto

'This is the most coherent book introducing ecological economics to date. Other attempts have proven to be a mishmash to standard economics and alternative thinking which is often contradictory. Common and Stagl tackle what makes ecological economics distinct head on and provide the strongest textbook currently on the market. Their coverage of ethical issues upfront is particularly welcome. The text is clear and well written for the uninitiated.'

PROFESSOR CLIVE L. SPASH, Research Chair in Environmental & Rural Economics, University of Aberdeen, and President of the European Society for Ecological Economics

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Preface

We will explain what this text is about, who it is written for, and how it is organised in the Introduction, and in Chapter 1. In regard to subject matter, we can say here that ecological economics is the transdisciplinary study of the human economy as part of nature's economy. In modern terms, the idea that the human economy needs to be, and can be, studied in this way is a relatively new one. Institutionally, ecological economics can be said to date from the establishment of the International Society for Ecological Economics, ISEE, in 1989.

ISEE now has several thousand members throughout the world, and our first acknowledgement is of the intellectual stimulation and nourishment provided by fellow members of that organisation. Perusal of the contents of the journal *Ecological Economics*, or of the proceedings of one of the many conferences and workshops organised by ISEE and its affiliated regional societies, will make clear our debt here. It is impossible to fully acknowledge our debts to the many individuals, not all members of ISEE, who have contributed to the development of ecological economics. Some indications of some of these debts are given in the Further Reading sections at the end of each chapter.

A number of colleagues, not all members of ISEE, were kind enough to read various draft chapters and offer comments and advice. In naming Steve Dovers, Felix Fitzroy, John Gowdy, Greig Mill, Roger Perman, Charles Perrings and John Proops we thank them and absolve them from any blame for deficiencies due to our not following their advice. We have both also benefited from feedback from students at the universities in Australia, Austria, UK and the US at which we have used some of the material here when teaching ecological economics.

We would like to thank staff at Cambridge University Press for their work in producing this textbook, especially Chris Harrison and Pat Maurice for, respectively, commissioning it and organising and supervising production. Finally, we thank our partners – Branwen Common and Peter Kaufmann – for putting up with the disruptions to family life that writing a book always entails, and for their encouragement to persevere with what at times was a daunting task.

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Introduction

WHO IS THIS BOOK FOR?

This textbook is written for students who are beginning a programme which is essentially concerned with the interdependence of the economy and the natural environment. We have called it *Ecological Economics: An Introduction* because that interdependence is what Ecological Economics is all about. However, programmes dealing with it also go under such labels as Environmental Management or Sustainable Development, and programmes in Environmental Science often include substantial components dealing with human systems and their effect on the environment.

Such interdisciplinary programmes are offered at both the undergraduate and postgraduate levels. This textbook is written primarily for beginning undergraduate students. However, where such programmes are at the postgraduate level, most beginning students are to some degree in the same position as beginning undergraduates – they have no previous background in one of the traditional disciplines involved. So, we think that this book should be useful to graduate as well as undergraduate students. For the former particularly, we have included Further Reading sections with each chapter which point to more advanced treatments.

While the book is mainly aimed at students beginning these kinds of programmes, we should say that in our view it would also serve very well as an introductory text in an economics programme. It is our view that all economists should appreciate that the material basis for economic activity is the natural environment, and have some idea about how that works in relation to human interests. Starting the study of economics here seems to us the proper way to ensure that they do.

Nowhere do we assume prior knowledge of ecology, economics or environmental science – it is an introductory text. Those who come to the book having previously studied in one of these areas can use the chapters selectively. Nor do we assume that readers have any background in mathematics beyond arithmetic and elementary algebra.

CONTENTS AND ORGANISATION

The book is organised into four parts. These are preceded by a chapter that introduces ecological economics, and the ideas of sustainability and sustainable development, which are themes that run through the book. This chapter also explains the relationship between ecological economics and 'ordinary' economics and how that is handled in the book.

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Part I is called 'Interdependent Systems'. Chapters 2 to 4 provide necessary ideas and information from ecology and environmental science, look at the history of our species, and then set out a framework for thinking about the interdependence of the modern economy and its environment.

Part II, 'Economic Activity', Chapters 5 to 9, is focused mainly on the economy and on economics. It starts with an introduction to economic accounting, and then looks at economic growth and human well-being, on the one hand, and economic growth and the environment, on the other. Chapter 8 introduces the case for markets as the means to organise economic activity, while Chapter 9 examines limits to what markets can do in regard to the natural environment and sustainability.

The pursuit of sustainable development, which requires sustainability, cannot be left to markets – there is an inescapable role for government. This is what Part III, 'Governance', Chapters 10–11, is about. In considering government policy it is helpful to distinguish between policy targets and policy instruments. Chapter 10 deals with the former, Chapter 11 with the latter.

Many of the problems that ecological economics is concerned with, and which threaten sustainability, transcend the boundaries of the nation states that are the principal means by which the world is organised politically. Part IV, Chapters 12 to 14, is called 'The International Dimension'. Chapter 12 is about international trade and related institutions, and the final two chapters deal with two major threats to sustainability that are essentially global in nature – climate change in Chapter 13 and biodiversity loss in Chapter 14.

We see the book as the basis for a two-semester course, and for that purpose the chapters follow a logical progression. However, we realise that in many programmes it may not be possible to devote two semesters to ecological economics. Often, some of the material that is in this book will be covered in parallel, or subsequent, modules/units in the programme. The book is an introduction, and all of the topics that it covers could beneficially be revisited in more depth and rigour in a degree programme dealing with the interdependence of human and natural systems. The range of topics will vary depending on the specific degree programme.

The wide variety of such programmes, and of the backgrounds of students beginning them, makes it difficult to be prescriptive about how the book could be used for a one-semester course – it depends a lot on what other courses the programme includes. However, we do offer the following list of chapters as a suggestion which could be useful in a variety of contexts:

(1) An introduction to ecological economics
(2) The environment
(3) Humans in the environment – some history
(4) The economy in the environment – a conceptual framework
(6) Economic growth and human well-being
(7) Economic growth and the environment
(11) Policy instruments
(13) Climate change
(14) Biodiversity loss.

Chapter 4 is the key chapter, setting out a way of thinking about economy–environment interdependence. Chapter 2 covers some topics in environmental science necessary for a proper appreciation of the significance of that interdependence – those who have done, are doing, or will do basic environmental science

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in other units could skip this. Chapter 3 provides some historical perspective. Chapter 6 deals with human poverty and economic growth as the means to its alleviation, and Chapter 7 with the question of whether growth can be sustained given economy–environment interdependence. The climate change problem, Chapter 13, is perhaps the biggest global environmental problem, and exemplifies all of the dimensions of the global sustainable development problem. Biodiversity loss, Chapter 14, is similar in many respects, but this chapter is short and probably worth reading with Chapter 13. Chapter 11, on policy instruments, provides some background to the discussion of policy in these two chapters.

PEDAGOGICAL FEATURES

Each chapter begins with a clear statement of what it will cover, and ends with a summary and a list, with page references, of key words and their meanings. At the end of each chapter there is a Further Reading section, and a list of website addresses where relevant material can be found. The Further Reading references are mainly intended for those who wish to take things further, whether in terms of the depth of treatment or the technical level of treatment. References at a similar introductory level to this text are marked with an *.

If you flick through the pages of this book you may well form the impression that there are lots of numbers and lots of mathematics. We assure you that, while this is true, there is no reason for anybody who considers themselves not proficient mathematically to be concerned. There is use of arithmetic and simple algebra where that is the simplest and most efficient way of getting across the basic ideas at an introductory level – as it often is. But, be assured, there is nothing beyond arithmetic and simple algebra, and every time either is used it is explained very carefully. Most of the time, it is just arithmetic. In a few places, the algebra is simple but tedious and it has been put in an appendix. In some chapters we use simulations done using a spreadsheet on a pc. In such cases the repetitive arithmetic that the spreadsheet does is carefully explained. Simulations are a very useful tool in the study of all kinds of systems.

SPECIAL FEATURES

Each chapter contains many features designed to enhance student learning.

- Chapters open with a list of four to eight key areas covered in the chapter to focus student learning.
- Focus boxes enliven the material with real-world illustrations drawn from various sources.
- Keywords are highlighted in bold throughout the text. End-of-chapter lists of keywords facilitate review of important terms.
- End-of-chapter discussion questions stimulate discussion and debate inside and outside the classroom.
- End-of-chapter exercises encourage students to work with and apply the material, gaining increasing mastery of concepts, models and techniques of analysis.
- The book has a companion website.

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COMPANION WEBSITE

Ecological economics is a developing field of transdisciplinary study, and sustainability and sustainable development issues are increasingly prominent in political debate and policy making. New publications, new data, new institutions and new policies are continuously appearing. Given this, there is a companion website to this book, which will be periodically updated to keep abreast of the latest developments. The companion website will also provide links to other related websites, which links will also be periodically updated. The address for this website is www.cambridge.org.common.

Part of this website will have restricted access for instructors. This contains transparencies for all graphs in the book, answers to end-of-chapter exercises and notes on discussion questions.

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