

Stanislav E. Shmelev

Ecological Economics

Sustainability in Practice

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ISBN 978-94-007-1971-2 e-ISBN 978-94-007-1972-9
DOI 10.1007/978-94-007-1972-9
Springer Dordrecht Heidelberg London New York

Library of Congress Control Number: 2011939209

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Printed on acid-free paper

Springer is part of Springer Science+Business Media (www.springer.com)

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Introduction

This book is devoted to the M.Sc. and first year Ph.D. students reading for degrees in Environmental Change and Management, Sustainability, Ecological Economics, Environmental Management, Philosophy, Politics and Economics and taking part in similar programmes. It is aimed to provide an overview of a range of new methodological tools: environmentally extended input–output analysis, multicriteria decision aid, optimization, geographical information systems, life cycle assessment, material flows analysis and modern applications of these tools to the most pressing today’s problems: assessment of sustainability, climate change and renewable energy, loss of biodiversity, global resource use and sustainable waste management, corporate sustainability and other relevant themes.

There have been textbooks published on Environmental and Resource Economics i.e. Turner, Pearce and Bateman (1994), Hanley and Shorgen (2001), Perman et al. (2003). All of them as well as this present text have their peculiarities: Perman et al. devote considerable attention to the environmentally extended input–output analysis covered in this volume, however do not cover the important field of multicriteria decision aid. Turner, Pearce and Bateman was a groundbreaking text at the time but is a little bit out of date at the moment, it also involves a strong emphasis on monetisation and cost-benefit analysis, which is not shared by the author of the present volume. Hanley and Shorgen (2001) is more focused on market instruments and less on the systems perspective.

Several strong textbooks on Ecological Economics have been issued in the past, i.e. Daly and Farley (2004), which comprises chapters on macroeconomic theory (IS-LM model) and new ways of assessing sustainability (ISEW) but doesn’t cover such important applied areas as corporate sustainability, renewable energy or waste management and is more targeted at the US audience. Common and Stagl is probably the best available modern text in Ecological Economics however it is a bit too long for a semester course (592 pp) and although the text covers very relevant areas of environmental policies, the environmental effects of international trade, and involves two applied chapters on climate change and biodiversity loss, it does not discuss such methodological tools as multi-criteria decision aid or explore applications of principles of sustainability in the urban or corporate context, and is written

at a more elementary level, than e.g. Perman et al. (2003). Faber and Proops (1998) is a wonderful theoretical introduction to the field, the book has a distinct philosophical focus but does not have many practical applications and is a little bit out of date over 10 years after its publication.

The current text is designed to be a concise, crisp, and elegant guide packed with references for students with some background in economics, environmental science or mathematics aimed at developing their analytical skills required for redirecting our development path towards sustainability in government, international organisations, academia, non-profit sector and business. It builds on the idea that a significant adjustment of the current economic theories is required, which was recently supported by the emerged world economic crisis, the climatic and biodiversity crisis the world is currently facing and the enormously slow progress that has been made in the field of reorientation of the global economy towards sustainability. We have chosen a positive approach for problem solving and strategic development, which is aimed at educating the future decision makers and business leaders.

The content of the book is envisaged to be the following: the first part of the book is theoretical, it is designed to give the methodological background and the tools for subsequent analysis; the second part is devoted to the applications.

Chapter 1 presents the subject of ecological economics, the interaction between the economic system and the environment; Chap. 2 explores the ideas of material and energy flows from the point of view of industrial ecology; Chap. 3 explores the ethical and world systems basis for sustainability thinking; Chap. 4 looks at decision making and the methods that could be used to support such processes, especially Multicriteria Decision Aid; Chap. 5 studies the concept of externalities and macro-economic basis for environmental policy; Chap. 6 explores the potential of environmentally extended input–output modelling for sustainability analysis; Chap. 7 looks at another important aspect of ecological economic analysis: macro assessment of sustainability, the method invented by the author of this book and essentially the application of multicriteria decision aid to the dynamic comparison of periods in a performance of a country or a region.

Part two includes a chapter on the renewable energy, biodiversity assessment, sustainable cities, regional waste management, and Corporate Sustainability. The author felt that such a composition of subjects will give the students a holistic perspective on sustainability issues.

I would like to express my sincere gratitude to Prof. David Orr for giving me the International Society for Ecological Economics membership as my 21st birthday present, my Ph.D. advisors Dr. Gerald Shalabin and Dr. John Powell, my parents, as well as Prof. John Proops, Prof. Beat Bürgenmeier, Prof. Robert Ayres, Prof. Jeroen van den Bergh, Prof. Peter Söderbaum, Prof. Joan Martinez-Alier and Prof. Bernard Roy for our discussions with them, their support and encouragement. I am particularly grateful to Dr. Barbara Cowell for carefully reading the manuscript and suggesting ways to improve the style. Chapter on sustainable cities is written in collaboration with Prof. Irina Shmeleva, chapter on sustainable waste management with Dr. John Powell.

I sincerely hope that the methods and ideas presented in this book are going to be taken on by the students and developed further by the next generation of economists. The students using this textbook will undoubtedly benefit from reading the original scientific papers quoted in the literature reviews in respected chapters. I would highly encourage the interested readers to find and explore the original sources. Each chapter in this book is designed in such a way that it could be read independently. All chapters taken together will give the reader a “bigger picture”, an interdisciplinary and holistic perspective on ecological economics and sustainability analysis as seen by the author.

Oxford

Part I
Theory of Ecological Economics

Chapter 1

The Economic System and the Environment

Abstract The first chapter defines ecological economics as an interdisciplinary field of research focused on the interactions between the economy and the environment. Major milestones in the history of ecological economics are identified. Definitions from the founding fathers of ecological economics are given and key differences between the methods of environmental and ecological economics are explored. A conceptual graphical model of the economic system as seen by ecological economics is constructed. The model includes renewable and non-renewable resources, the recycling sector as well as major elements of the environmental system being affected by the economy. The chapter presents an overview of the applications of major ecological-economic methods to key ecological-economic problems according to the Scopus academic citation system. Major gaps in the literature are identified.

Keywords Ecological economics • Sustainability • Economic system • Problems • Methods

Definitions

When he (she) starts to study ecological economics, the student embarks on an exciting interdisciplinary journey, which will bring answers to important questions, help to understand the ecological-economic system in all its intricacy and lead to new insights. Ecological economics emerged as a response to the pressing environmental problems of the twentieth century and the inability of neoclassical economic theory to solve them or provide adequate explanations for the unprecedented decline in biodiversity, the changing climate, increased generation of waste, all caused by the pursuit of economic growth.

It is very natural to start such a journey with definitions by the pioneers:

Robert Costanza (Costanza 1989) defines the new interdisciplinary science in the following way:

- Ecological Economics addresses the relationships between ecosystems and economic systems in the broadest sense.

This very inclusive definition implies that the works on the Limits to Growth (Meadows and Club of Rome 1972), the first environmentally focused input–output studies (Leontief 1970), the first conceptual models where different material resources were considered as important inputs to industrial processes (Ayres et al. 1970) all belong to the interdisciplinary field of ecological economics.

John Proops (1989) suggested a more detailed and elaborate definition, differentiating (i) the scientific aims and problems and (ii) political and ethical issues:

Scientific Aims and Problems

- Establishing a historical perspective on social-natural interactions
- Finding a common language and a set of concepts for the analysis of economies and ecosystems
- The area of intersection between natural science and social science

Political and Ethical Issues

- As a forum and structuring for policy analysis
- A framework for the ethical analysis of intertemporal and interspecies choice
- The influencing of decision makers

According to this definition, such works as (Fischer-Kowalski 1998, Fischer-Kowalski and Hattler 1998) focusing on the historical dimension of the human appropriation of natural resources, the interdisciplinary works on the ability of systems to return back to undisturbed states, which is also called “resilience” (Holling 1973) and the works on means of taking nature into account when making decisions (Foster 1997) all form the first pillar of ecological economics according to Proops. Interestingly, Proops emphasises the second, transformative and interactive dimension of ecological economics, which is designed to be the policy forum for influencing decision makers.

Jeroen van den Bergh (2000) explicitly mentions all the constituent disciplines that interact to support ecological economics:

- EE integrates elements of economics, ecology, thermodynamics, ethics, and a range of other natural and social sciences to provide an integrated and biophysical perspective on environment-economy interactions, aimed at contributing to structural solutions to environmental problems.

This definition corresponds to the spirit of interdisciplinary works on the biosphere (Vernadsky 1929), shallow and deep ecology (Naess 1973), new ethical economics (Schumacher 1973), and sustainable cities (Shmelev and Shmeleva 2009).

Ecological and Environmental Economics

Ecological economics has been critical of the mainstream for failing to educate future decision makers in the spirit of socially inclusive, environmentally sound and economically sustainable development. Graduates of neoclassical economic departments continue to reproduce the logical errors of the theory in the real world, suggesting that unlimited economic growth will cure all the problems of modern civilization, that one can simply export waste to less developed countries and that one only needs to take into account the economic costs and benefits of climate change and biodiversity to make a decision on what to do and where to invest to tackle the problem. And although there were significant figures in the neoclassical era, who brought the pure economic analysis to new heights, such as Alan Marshall, the twentieth century brought with it new challenges and required new methods to address them.

If one opens an introductory neoclassical textbook of economics one is most likely to see a diagram similar to the one depicted in Fig. 1.1. It usually includes such agents as households, firms, government and foreign agents. In very advanced textbooks this diagram will have a box called “Nature” or ecosystems, with the flows of materials and energy emerging from it. The problem with this formulation is that the role of the environmental system as a support system for all processes carried out in the national economy (agricultural production, mining, deposition of waste) is not represented accurately and the environment is considered as a subsystem of the economy. Hence the attempts to apply economic valuation to environmental phenomena, which constitute a logical error.

The vision of the world, which we can see in diagrams similar to Fig. 1.1 can be explained by the historical inheritance. In the nineteenth and even the beginning of the twentieth century, the world economy was operating in what Herman Daly (2000) called the “empty world”, depicted in Fig. 1.2.

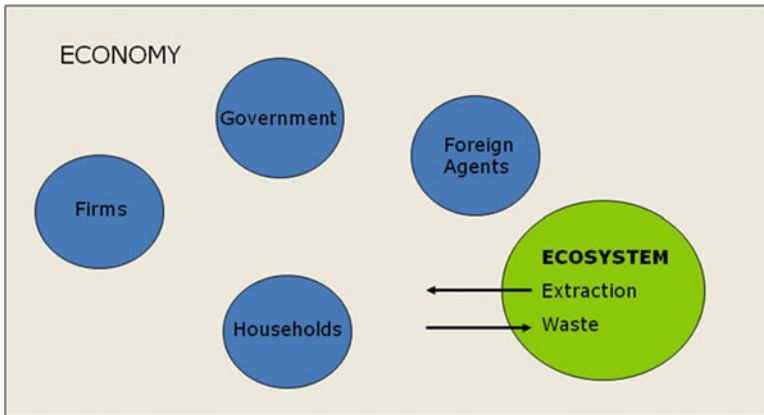


Fig. 1.1 Neoclassical view of the world

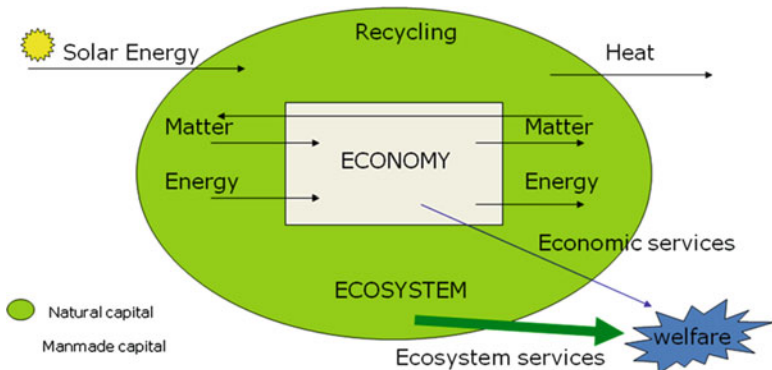


Fig. 1.2 “Empty” world, nineteenth and beginning of twentieth century

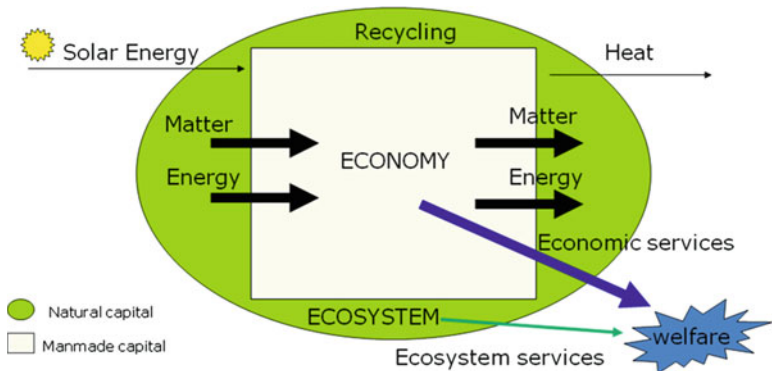


Fig. 1.3 “Full” world, 1960s onwards

We can see that the economy is small relative to the environment; the flows of resources and energy coming from the environmental system and deposited there as waste are relatively low. At the same time the flow of welfare that humans receive from the ecosystems in terms of fresh air, forest walks, clean water and beautiful scenery is considerably more significant than the flow of welfare derived from the economic system in terms of products and services.

Since the 1960s the world has changed (Fig. 1.3). Fuelled by the idea of economic growth and increased consumption, the economy grew tremendously to the point where the assimilative capacity of the biosphere has been reached and humans use very significant amounts of energy and materials, hindering the tendency for the environmental system to regenerate itself. Very often it simply has no time to regenerate, so rapid is the extraction of timber and other resources. At the same time, the flows of materials and energy from the environment to the economy and back to the environment become much more pronounced and the humans receive more welfare from the stream of goods and services (TV sets, mobile phones, cars, etc.) than from the environment. The overexploitation of the natural world has led to

Table 1.1 Differences between ecological and environmental economics (Source: van den Bergh 2000)

Ecological economics	Environmental and resource economics
1. Optimal scale	1. Optimal allocation and externalities
2. Priority to sustainability	2. Priority to efficiency
3. Needs fulfilled and equitable distribution	3. Optimal welfare to Pareto efficiency
4. Sustainable development, globally and North/South	4. Sustainable growth in abstract models
5. Growth pessimism and difficult choices	5. Growth optimism and “win-win” options
6. Unpredictable co-evolution	6. Deterministic optimisation of intertemporal welfare
7. Long-term focus	7. Short to medium term focus
8. Complete, integrative and descriptive	8. Partial, monodisciplinary and analytical
9. Concrete and specific	9. Abstract and general
10. Physical and biological indicators	10. Monetary indicators
11. Systems analysis	11. External costs and economic valuation
12. Multidimensional evaluation	12. Cost-benefit analysis
13. Integrated models with cause-effect relationships	13. Applied general equilibrium models with external costs
14. Bounded individual rationality and uncertainty	14. Maximisation of utility and profit
15. Local communities	15. Global market and isolated individuals
16. Environmental ethics	16. Utilitarianism and functionalism

increased CO₂ emissions and climatic changes, destruction of ecosystems and biodiversity, which stabilise the climatic system as well as the excessive pollution of the environment with waste, which is ever more apparent in the developing world.

The logic of ecological economics is that the world has changed tremendously and we need new conceptual tools to understand and manage the economic-environmental system. Ecological economists work across disciplines, building teams of experts and integrating knowledge to derive policy mechanisms, which help to prevent degradation and facilitate improvement.

By offering new methodological grounds, combining the advanced methods of environmentally extended input–output analysis, multicriteria decision aid, insights from ecology, biology, psychology and sociology, ecological economics aims to improve our understanding of sustainability and help to steer our economies in that direction.

Often there is confusion about the differences between ecological economics and the popular 1970s and 1980s school of environmental economics. Although the main focus of the two disciplines is similar, and one understands the value of the concept of externality and much of the analysis of environmental policy tools such as environmental taxes and their applications, which was prominent within environmental economics community, ecological economics is closer to the heart of the author for a number of reasons. Table 1.1 highlights the main differences between ecological and environmental economics as presented by Jeroen van den Bergh (2000).

Even if we focus here only on the most important ones, the differences will still be considerable. First of all, there is an explicitly long-term focus in ecological