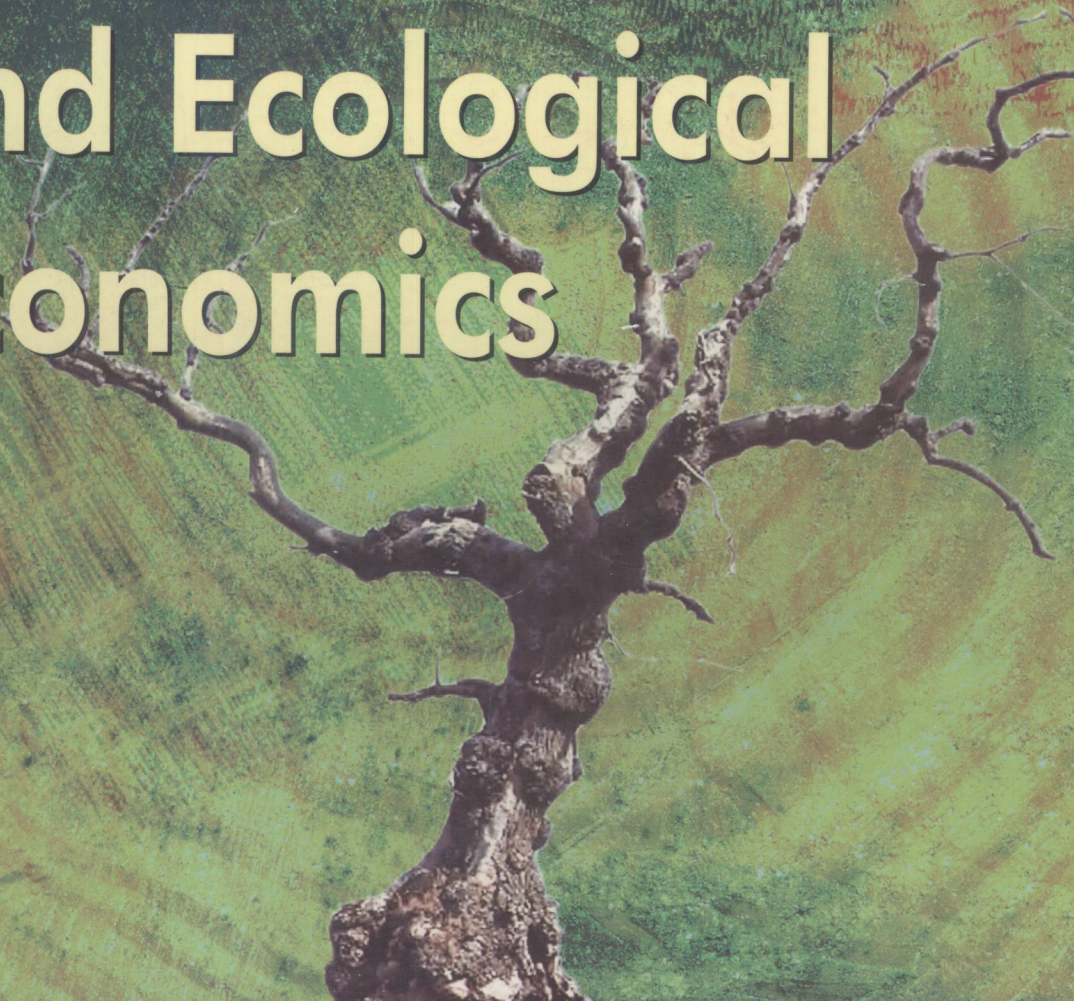




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DIMENSIONS OF **Environmental and Ecological Economics**



Editors

**Nirmal Chandra Sahu
Amita Kumari Choudhury**

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Preface

Our stimulus for bringing out this book came from our interaction with eminent experts of the world, whom we met in the fifth biennial meeting of the International Society for Ecological Economics on "Beyond growth, policies and institutions for sustainability" during November 15–19, 1998 at Santiago, Chile. There we discovered why textbooks on ecological economics become inadequate so quickly. Not only is environmental and ecological economics a fast growing field of study, but different academic niches are continually being identified and pursued.

We felt that a new look – paradigm or synthesis – was necessary. Therefore, we have compiled this book to achieve two main objectives. The first objective was to bring out a standard, systematically structured text covering a wide range of topics on different dimensions of the subject. The second objective was to try to inform students, researchers and policy-makers about the recent developments throughout the length and breadth of this vast field.

Some of the articles in this book assume a certain minimum exposure and orientation towards the subject. Thus, besides being a basic textbook, it could serve as a useful complement to an advanced textbook. The book is a bridge between the latest contributions of established and reputed scholars, and the basic requirements needed by students, researchers, policy-makers and field workers.

Part I of the book brings out the distinguishing features of the discipline. Economic approaches to environment have received a great deal of attention in the last two decades. Part II deals with these issues. Part III addresses the development–environment interface.

The scope of the work has been specifically designed to meet the needs of a wide group of readers. While designing the book, we have tried our best to coordinate the outlines and contents of various contributions so as to avoid the overlaps in the interstices.

Now, we list out our acknowledgements. We would like to profoundly thank all the contributors to this project. Their ungrudging cooperation encouraged us at every stage. We remain indebted to each of the authors, who gave the book strength and credibility. We thank the Island Press, the University of Wisconsin Press, Elsevier Science and Professor Martinez-Alier for permitting us to include published materials, for which they have the copyright. We have gratefully acknowledged their support in each of the specific papers. Dr Mrutyunjaya Mishra inspired us at every stage. We owe special thanks to him. Our sincere thanks are due to Mr Ashok Kumar Khanda, who did a marvelous job typesetting our manuscript.

Our deep sense of gratitude goes to the University Press for readily agreeing to take up the publication of this book with confidence in this ambitious project. They deserve our cordial thanks.

Notwithstanding our best care, all may not be well. There may be some missing links and mistakes. We own all of them and offer our apologies to the authors.

Nirmal Chandra Sahu

Amita Kumari Choudhury

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Introduction

NIRMAL CHANDRA SAHU AND AMITA KUMARI CHOUDHURY

Environmental and ecological economics is the study of the process of simultaneity involved in the functioning of the economy and the environmental/ecological system. It aims at the sustainable promotion of human well-being. It is a methodologically open applied branch, which gains strength from pluralism. The theoretical dimension of the subject has involved the analysis of issues which constantly demand new concepts, insights and principles. During the last three decades, several important human problems have been explained and analysed, and this has enlarged its frontiers. It has now emerged among the most sought after and best liked cross-disciplines in classrooms, research cells and in policy-making bodies. Though initially it was thought to be relevant only to the developed world, in due course it gained currency in developing countries as well. As the vast mass of literature on the subject is scattered in a variety of study material including journals and conference papers, teachers and students, in developing countries like India, find it difficult to distil and keep up with established ideas and ongoing researches. The present set of readings has been produced with a view to meet this challenge. Besides describing the paradigmatic basis of environmental and ecological resources, the book covers the economic dimensions and approaches to pollution, environmental management, biodiversity, global warming, energy evaluation, sustainable development and so on. The book is divided into three parts. The first part, containing twelve papers, is devoted to the foundation and theoretical structures.

In the first paper, the editors describe the evolution of environmental and ecological economics. The motivations that push the subject are enumerated, a definition of the subject is formulated, and its nature and scope discussed. The paradigmatic cleavage between neo-classical environmental economics and ecological economics is touched upon. The discussion is deliberately made brief as the chapters that follow present far more useful perspectives, presenting the reflections of the world's experts on the subject.

Challenging traditional views on ecological economics, Richard Norgaard focuses on new perspectives. His curiosity centres around the strength of the methodological visions of ecological economics, involving a new understanding of the relationship between expertise and governance. In the interrelation between the economic and the ecological system, the challenge is to turn our shared scepticism into a story that provides a positive

and constructive bond. The paper argues that the need in front of the ecological economist is a shared adherence to this new life story. The issues under focus include limits of physical and biological systems, irreversibility, hierarchical thinking, co-evolution of knowledge, value governance, economic and technological sub-systems of the social systems, methodological pluralism, sustainability, precautionary principles, the role of the invisible hand and human equity. It is observed that environmental problems arise due to deficiencies in the academicians' or people's abilities to collectively perceive, learn and act. The paper prescribes methodological pluralism as a starting point to escape from this situation. Norgaard points to a vision that acknowledges participatory interaction through discursive democracy.

Peter Soderbaum regards the institutional approach as a useful theoretical alternative to neo-classical economics in dealing with environmental problems. He rejects the idea of a paradigm shift and agrees with Norgaard that a degree of pluralism would represent a considerable step forward. A number of institutional changes that are promising from the point of view of social and ecological sustainability should be followed. The major issues are ecological economics and institutional thinking, the actor network approach to social change, a disaggregated and ideologically open idea of economics and efficiency, positional analysis as a possible disaggregated approach and social and institutional change for a sustainable society. To Soderbaum, new thinking and institutional arrangements along these lines would be congruent with the ideas of economists and leading business actors. A change in the rules of trade will be helpful in bringing us closer to a sustainable society.

Joan Martinez-Alier argues that ecological economics is not a branch of economics but another term for human ecology. The ideas and processes as analysed include the relationship between political ecology and ecological economics, discrepancies between economic time and bio-geochemical time, environmental justice, natural resource management, the economy immersed in the social and physical world, unequal ecological exchange, sustainability indicators such as human appropriation of net primary production (HNPP), material intensity in production and consumption, energy return on inputs (EROI), dematerialisation, ecospace, the ecological footprint and carrying capacity, and the orchestration of science.

T. N. Jenkins's study emphasises the role of cultural heritage in establishing environmental ethics for today. The issues he raises are the ethical dimensions of environmental protection, the anti-ecological nature of Western tradition, the pro-ecological nature of Chinese tradition, the contrasts between the Western and Chinese traditions, and the ethical escape from the developmental dilemma. Traditional Chinese culture suggests a relationship between people and nature resonant of contemporary environmental ideas. The European cultural heritage on the contrary is not resilient to Euro-centric materialism. The study concludes that the nurturing of a spirit of affirmation for the natural world, which can arouse an ethical obligation to safeguard the natural environment, is necessary.

Given the trend of liberalisation, internationalisation and environmental change, J.B. Opschoor has strongly argued for environmental management through market mechanisms. The fundamental problem is that market imperfections may have environmental repercussions, many of which can be corrected by policy intervention. In this context, the Market Based Instruments (MBIs) like charges, subsidies or other fiscal measures may not always be effective. Institutional adaptations such as changing conditions for bargaining or creating other mechanisms for exercising countervailing power may be more appropriate.

The creation of organisations and institutions capable of controlling the economic process directly is necessary under a set of policy measures.

Beat Burgenmeier pleads for the use of a transaction cost approach to environmental protection. The basic argument is that economic instruments cannot be exclusively linked to the market, but must be combined with other policy instruments. He analyses the market as one of the possible collective decision-making processes to operationalise sustainable development. The author concludes that to introduce the transaction cost approach in the ongoing policy debate, a considerable amount of empirical work should be done.

S.M.N. Islam presents the concepts, issues and methodology for dynamic intertemporal, optimal and sustainable growth modelling. Based on the intertemporal economy-environment interactions and constraints, the paper develops a theoretical model of optimal sustainable economic growth, a methodology for numerical implementation of the proposed model, and policies and measures for sustainable growth planning. A sustainability model should be specific so as to address issues of optimal growth programming, non-linear complex dynamics, limits to growth and the formulation of a relevant sustainability policy plan.

Indrajit Ray makes a survey of the application of game theories to environmental problems. The study pursues two objectives. First, he surveys basic game theoretical models and solution concepts that analyse environmental problems. The fundamental models elaborated in the study help to cope with transfrontier pollution problems. The popular solution concepts of cooperative, non-cooperative and coalition games are recalled. The author has a second and more important objective of indicating new directions, which have surfaced through recent developments in game theory literature. The concept of coalition-proof correlated equilibrium and the theory of social situations, which have not been used in environmental economics so far, have rich potential to expand our understanding and to deal with environmental problems.

Anthony M. Friend's paper reflects the inadequacy of the neo-classical approach to environmental valuation. The elements of the problem are accounting for variance in ecological and economic transaction costs, and identifying the conditions of an equilibrium exchange rate between economic and ecological currency. The central theme is the feasibility of designing a system of conservation accounts i.e., an ecological price structure. The author suggests employing ecological prices as an efficient way to balance limited environmental supply with insatiable economic demand.

V.Kerry Smith makes an interpretative appraisal of the non-market valuation of environmental resources. His focus is on the performance of modelling strategies rather than on estimates of specific resource values. The paper seeks to gauge whether the methods are up to the tasks demanded of them and to identify new research priorities. A protocol is designed to coordinate non-market valuation studies.

Charles Perrings provides new insight into the causes and consequences of the use of ocean resources and options for dealing with institutional facilities. The paper rejects the principle of open access while arguing for collective action to protect the oceans. The elements of the problem analysed include growth in demand for ocean resources, depletion of stocks in imperfectly regulated fisheries, issues relating to poverty of resource users and uncertainty about the dynamics of marine and terrestrial activities and pollution. The paper argues that sustainable use of coastal and marine resources require new approaches at the national, regional, and the global level, involving human-ocean interaction.

The second part includes twelve articles on different economic approaches to deal with the environment. Prabha Panth makes a survey of the methods used to measure environmental damage costs. These range from physical to economic measures that monetise environmental destruction. The analyses of the measures involve identification of the activities that cause environmental damage, measurement of environmental destruction in physical terms, evaluation of the impact of environmental damage on the economy and the suggestion of policy measures to control damage. As environmental damage often remain undiscovered and are unconceivable and unimaginable, the measurement of their impact are taken as approximations.

In yet another contribution on environmental valuation, Karl-Goran Maler, Ing-Marie Gren and Carl Folke aim at arriving at a proper method for multifunctional ecosystems. Distinguishing between values revealed and not revealed by markets, they have developed alternative classification of values using the household production method. The values of a multifunctional ecosystem can be estimated, provided one has knowledge of two processes. First, the household's combination of different market goods and environmental resources in order to obtain certain ecological services. Second, the ecosystem's production of various ecological services used as inputs in the production of the household output.

V. Santhosh, V. P. Bharadwaj and N. C. Sahu prepare an overview of biodiversity valuation techniques. The first part of the paper contains a description of the meaning and importance of biodiversity and its components. The second part is a critical appreciation and analysis of economic evaluation methods. Biological diversity is a global asset of tremendous value to the present and future generations. Depletion of biodiversity at an alarming rate due to human activities poses a threat to its stability. Valuation of biological resources is therefore socially, economically and ethically important.

Amita Kumari Choudhury and Nirmal Chandra Sahu compare different types of environmental taxes under standard fiscal criteria. Pursuing the comparison mainly in the Indian context between product charge and emission charge, they feel the latter is likely to be effective for pollution control, but factors such as information requirement, transaction cost and administrative feasibility could pose problems. A critical analysis suggests that product charge can be useful in India in the short term. The country should, however, build up the machinery for imposing and collecting an emission charge.

Rita Pandey's analysis aims to devise a pollution tax for industrial water pollution control. First, she discusses the alternative strategies for reducing pollution followed by a brief survey of studies on water pollution control. Dr. Pandey uses firm level data collected through a sample survey of sugar industries. The effluent treatment plant (ETP) is considered a production activity with a production function relating the maximum output obtainable from a given set of inputs. The ETP output is considered as a product having two dimensions – the quantity and the quality of effluents. For the analysis of data, the study uses the Cobb–Douglas production function. Dr. Pandey suggests that pollution taxes should be equal to the highest marginal cost of abatement with periodic revision based on considerations of the firm's responses, inflation and the advent of new technology.

Amita Kumari Choudhury has reviewed carbon tax (CT) literature. She describes the CT as an instrument to counter global warming, which is a major threat to the global economy. The different forms and effects of the proposal have been elucidated. The proposal is expected to yield a double dividend but there is no unanimity of opinion on this matter. Notwithstanding the controversy, a section of the world has already introduced CT. In

India, CO₂ emission is currently not high compared to some developed countries. However, it is increasing very fast, so some studies have proposed CT. Others have worked out the implications of the proposal for the Indian federation under different rates and scenarios.

M.K. Mishra describes energy flow through the ecosystem, a vital input for the study of ecological economics. The process of energy flow is discussed through primary and secondary production, foodchains and food webs, trophic levels and ecological efficiency. He briefly reviews energy flow models. How production, consumption, export, import and storage of energy are estimated for the energy budget are explained. The energy flows of a coastal village ecosystem in India are analysed in a case study.

Dhulasi Birundha Vardarajan examines the energy consumption pattern in India. The country is endowed with rich coal reserves and renewable energy potential. The focus is on increased energy consumption and the threat of carbon emissions. The study suggests the adoption of energy-efficient technologies to cope with the energy conservation paradox.

Rahul A. Shastri and Prabha Panth provide a theoretical and empirical analysis of the effects and economic determinants of greenhouse gas (GHG) emissions. They establish a link between economic growth and the accumulation of GHGs in the atmosphere. Using the log-linear (Cobb–Douglas) regression form, it is shown that the top 15 countries accounted for 75%, the top 23 for 84% and the top 46 for 95% of global GHG emissions. Further, there is a positive correlation between GNP, population and industrial share. The paper calls for making the growth path of poor countries less polluting with GHG emission control. The authors have suggested alternative solutions like the free transfer of emission control technology to less developed countries and a global trade in GHG emission rights.

Snigdha Chakrabarti draws our attention to the severity of the problem of urban waste management (UWM). The problem is related to the total quantum of waste generation, inadequate infrastructure for its management and its adverse impact on human health. She recommends pursuing a policy of waste minimisation and the elimination of landfills. Policies should be socially, physically and economically acceptable. Economic instruments like taxation and subsidies, as well as regulatory measures have been suggested.

Geoffrey N. Kerr and K. F. D. Hughey examine the domestic water demand management of Christ Church City, New Zealand. The study pursues two objectives — first, the identification of social, demographic, cultural, micro-geographic and other influences on household water consumption; and second, the identification of factors influencing the acceptability of specific water management instruments. The authors use the multi-nomial logit models and ranked choice model. The principal finding is the existence of systematic influences on both domestic water consumption and preferences for the management of domestic water use in Christ Church. The work emphasises the need for an interdisciplinary approach to the resolution of resource management issues.

The focus of M. Ravichandran's paper is on some of the crucial aspects of the drinking water problem at the village level in Tamil Nadu. The paper makes an empirical analysis of the problems of adequacy and the quality of drinking water available in rural India. Some of the conclusions have strong operational significance. It is disappointing that hardly four percent of the respondents manage to get the prescribed quality of drinking water. The contingent valuation exercise shows that there is a positive correlation between the willingness to pay (WTP) of the respondents for water supply and the family size, monthly income and per capita consumption.

The development–environment interface occupies our attention in the third part of the book. Nirmal Chandra Sahu has written a critique of the recently observed Environmental Kuznets Curve (EKC). The hypothesis has served to bring the growth controversy once again to our attention. It has been found that EKC is valid only for a few local pollutants but not for the issues like biodiversity, global warming and resource depletion. The hypothesis has also been criticised for data deficiency and unrealistic assumptions.

Herman E. Daly describes the growth process as a gradual movement from an empty world to a world full of human beings and their artefacts. The study attempts to point out appropriate strategies for sustainable development. He advocates shifting the focus of investment very forcibly from man-made to natural capital. Since natural capital has replaced man-made capital as the limiting factor, policies should be adopted to maximise the present productivity of natural capital while ensuring its future supply. This would increase the benefits of life-support services for non-human species. In the face of uncertainties about ecosystem costs, prudent management and investment on natural resources is necessary.

T. N. Jenkins considers the re-valorisation of tradition and its strategic economic implications for traditional cultures in the light of the requirement for sustainable development. A culturally homogeneous world is an unattractive prospect in sustainable development terms. A framework is suggested for assessing the value of cultural diversity. Using insights provided by the actor-network theory, he shows how the valorisation of the local traditions provides strategic capacity to the local actors for endogenous development and for harnessing extra-local forces. The issues are illustrated with reference to rural policy in the marginal regions of Europe. The author suggests integrating local economies with the mainstream economy, with a stress on determination of the development path in accordance with local values.

M. D. Young identifies a set of necessary conditions to the successful governance of natural resource use. In a number of circumstances the best governance structure will be locational and personality specific. Young recommends the use of an adaptive structure to recognise the role of government in signalling the power of motivational instruments and to adopt processes that encourage local innovation. Excessive government interference to maintain natural capital and preserve intergenerational equity may lead to laxity and irresponsibility on the part of the environmental manager.

N. Manonmoney expresses concern over the seriousness of environmental problems. The paper seeks to minimise the problem with the proper management of natural resources particularly 'Common Property Resources' (CPRs). Natural resource management should foster production, optimise distribution and ensure sustainable uses. Sustainable management of CPRs depends on information relating to the total stock and flow of resources, the demand for resources and the rate of depletion and assignment of property rights and property regimes.

Gopal Kadekodi and A. Nayampalli attempt to model the dynamics of ecological changes linking selected major socio-economic and ecological conditions in the Chilka Lake region in Orissa. Ecological degradation of the lake is due to population growth, urbanisation and industrialisation, changing aquacultural practices and deforestation in the catchment areas. The problems identified include salinity decline, increasing silt, water area shrinkage, shifting of lake mouth, weed growth, diminution of species and a decline in migratory birds. The paper concludes that a combination of investment and community-oriented institutional policies, and holistic political will are necessary to save the lake and to reverse its biodiversity depletion.

P. A. Koli critically evaluates environmental laws and policy in India. The issues discussed are legislations, legal efforts, programmes and constitutional provisions for environmental protection in India. The paper concludes that public awareness against environmental pollution is more important than statutory provisions.

N. Rajalakshmi critically analyses the environmental hazards of the sugar industry. She has consolidated the literature on the environmental impact of this industry. She analyses by-product (molasses) utilisation of the sugar industry in Tamil Nadu. At the micro-level, the Trichy Distilleries has been studied to estimate the pollution abatement cost relating to treating waste water to bring the biological oxygen demand (BOD) and chemical oxygen demand (COD) to specified limits. She has offered suggestions for introducing action planning for environmental protection.

D. P. Pal appreciates the changing role of non-commercial and commercial energy in developing and developed countries. Identification of determinants of the use of commercial energy, changes in the sectoral patterns of energy supply, the output and energy intensity effects are some of the issues examined in the paper. Increasing energy consumption has raised the levels of green house gas emissions and enhanced environmental degradation. A well-conceived policy framework is suggested.

A. Ranga Reddy characterises large dams as white elephants from the environmental point of view. As these dams are an obstacle to nutrient transportation, they lead to the loss of terrestrial habitats, and are a source of chronic diseases, besides having an adverse effect on aquatic flora and fauna. He has offered alternatives to dams for better irrigation and soil conservation.

The book contains theoretical tools, methodological inputs, case studies, applications and strategies of environmental and ecological economics. Economic valuation and sustainable management of the environment is discussed in most of the papers. Some of the new issues and approaches that surface relate to conservation accounts, problems of the oceans, investment in natural capital, and the socio-cultural and ethical dimensions of environmental protection. The book looks at ecological economics as human ecology, and a field of pluralism of great relevance at present.

PART I

The Foundation and Theoretical Structure