

Book review

The Economics of Ecosystems and Biodiversity: Ecological and Economic Foundations, edited by Pushpam Kumar, 2010, London and Washington: Earthscan, ISBN 978-1-84971-212-5 (HB) Price £49.99 [Earthscan have offered a 20% discount off the book for EDE readers. To receive the discount enter 'EDETEEB' into the voucher code box at the checkout on the Earthscan website at <http://www.earthscan.co.uk/?tabid=102480>]

Although *Environment and Development Economics* does not as a rule publish book reviews, this volume is particularly relevant to the areas of interest of the journal. The topic of the book, economics of ecosystems and biodiversity, is an issue which is on the frontier of interdisciplinary research involving scientific fields such as economics, ecology, and biology, and also ranks very high on the applied decision-making agenda.

Concerns about the implications of climate change and the ongoing anthropogenic influence on ecosystems has spurred the scientific and the decision-making communities to focus on the related losses in terms of biodiversity and ecosystem services as well as the need to value these losses so that awareness is increased and efficient policies can be designed.

The Economics of Ecosystems and Biodiversity: Ecological and Economic Foundations, which is part of the books of Phase II of The Economics of Ecosystems and Biodiversity (TEEB) project, represents a very serious attempt to address the economics of ecosystems and biodiversity, both at the conceptual level and also at the applied level.

The present work builds upon the foundations established by the earlier work produced by the Millennium Ecosystem Assessment (MA). The MA put together, in an organized framework, the concepts that have been previously developed regarding ecosystem services and their classification, the usefulness of these services, and their relation to human well-being.

Building upon this work, the present volume undertakes to relate biodiversity with ecosystems services and to provide both a theoretical and an empirical framework for valuing these services.

The volume is comprised of seven chapters which discuss conceptual and methodological approaches to the valuation of ecosystems services and biodiversity. In addition it contains three very useful appendices. The first one presents a case study wherein the TEEB methodological approach is applied to a very important problem of ecosystem valuation, that of the Amazon. The other two appendices include results from a large number of well-organized published case studies regarding valuation of ecosystems

services associated with specific ecosystems. The volume also contains a glossary of relevant terms.

The study leader of TEEB, Pavan Sukhdev, begins the volume with a general outline of the questions that TEEB is attempting to answer and its links to climate change studies, especially the *Stern Report*. Then, in the introduction to the volume, the editor Pushpam Kumar explains why it is important to provide an economic analysis of factors affecting ecosystems and biodiversity, given the new evidence about the degradation of ecosystems and biodiversity loss and the potential impact of these losses on human welfare. He also traces some of the relevant literature that has proven influential in the development of the economics of ecosystems and biodiversity.

Chapter 1, 'Integrating the Ecological and Economic Dimensions in Biodiversity and Ecosystem Service Valuation', stresses the importance of linking the biophysical characteristics of ecosystems to human well-being through the flow of services provided by ecosystems, and presents the conceptual framework employed by TEEB for the valuation of ecosystem services and the link of valuation to decision making. The concept of ecosystems services is a central one in laying the foundations for the economics of biodiversity, since it connects biodiversity losses with losses in ecosystem services and the consequent losses in benefits accruing to the society. The chapter highlights the importance of clarifying the differences and links among function, services and benefits; makes clear the need to take into account both the spatial and the temporal dimensions of the problem; provides a very useful typology of ecosystems services, benefits and values associated with these services; and links these concepts to decision making.

Chapter 2, 'Biodiversity, Ecosystems and Ecosystem Services', presents and critically reviews the relationships between biodiversity, the structure and the functioning of ecosystems, and the provision of ecosystem services. In exploring the role of biodiversity in ecosystem functioning, it stresses the relationship between biodiversity and productivity, biodiversity and response diversity, and idiosyncratic effects due to keystone species properties. In particular it offers a very useful analysis of the links between biodiversity and provisioning services (e.g. food, water, fuels, medicinal), regulating services (e.g. air quality, climate, extreme events), supporting services (e.g. primary production, soil fertility) and cultural services (e.g. aesthetics, recreation, art, spiritual). There is also a discussion regarding ecosystem management in terms of bundles of ecosystem services and management under uncertainty. The responses of ecosystems to change and the concept of resilience are explored and linked with policy objectives, followed by a discussion regarding a formal link between biodiversity, ecosystem services and human well-being, defined in terms of an intertemporal welfare objective.

Chapter 3, 'Measuring Biophysical Quantities and the Use of Indicators', deals with information which is relevant for assessing the economic impacts of changes in biodiversity and ecosystem services. It provides a detailed classification of existing biophysical measures associated with the measurement of biodiversity and ecosystems, and points out that

because most of the indicators associated with biodiversity and ecosystems have been developed without links to economic considerations, they are not able to provide the information necessary to assess the links between biodiversity, ecosystem services and benefits to humans in the context of the methodology developed by TEEB. Thus the chapter emphasizes the need for a new set of indicators capable of providing information regarding the consequences of biodiversity loss and capturing non-linear and multi-scale relationships. In this context the chapter explores indicators for timber production (provisioning service), carbon sequestration (regulating service), and social appreciation of agricultural landscape (cultural service).

Chapter 4, 'The Socio-cultural Context of Ecosystem and Biodiversity Valuation', looks at biodiversity valuation from a broader angle and points out the multi-dimensional and socio-cultural embeddedness of value that could make the question of choosing a value articulating institution more important than that of finding the correct value. Valuation is seen as a form of regulatory adaptation and as a feedback mechanism that helps us to better understand the impacts of economic activity on environment. The chapter considers the main challenges in valuation methodology and the need to address the complexity of the resource systems.

Chapter 5, 'The Economics of Valuing Ecosystem Services and Biodiversity', provides a comprehensive presentation of valuation methods in the context of the total economic value (TEV) framework. It reviews the current valuation methods used to value ecosystem services – direct methods, revealed preferences, and stated preference approaches – and discusses the impact of uncertainty in valuation. It also presents insurance, resilience and (quasi) option values, along with benefit transfer approaches, which represent a practical and cheap way to value ecosystem services, especially in the context of diverse ecosystems. The chapter further notes that under deep structural uncertainty and ecological thresholds, minimum safety standards and precautionary approaches might be desirable policy options.

Chapter 6, 'Discounting, Ethics and Options for Maintaining Biodiversity and Ecosystem Integrity', discusses the issue of the choice of the discount rate, which is central to any valuation exercise with a temporal dimension. The chapter presents the classic Ramsey discounting formula, along with issues related to hyperbolic discounting and the possibility that standard economic analysis might seriously underestimate the long-term benefits of biodiversity protection. In addition it provides a thorough exploration of the way in which conservation can be promoted by a low discount rate, as well as the impact of discounting on minimum safety standards.

Chapter 7, 'Key Messages and Linkages with National Policies', is a synthesis chapter that summarizes the key lessons derived from the assessment in chapters 1–6. This final chapter stresses the need to study the economics of ecosystem services using an interdisciplinary approach wherein the joint effort is undertaken by economics and ecology. It also points out the need to uncover the links between biodiversity, ecosystems and ecosystem services in order to understand the spatiotemporal

patterns of service flows. It goes on to describe linkages between ecosystems, ecosystem services and biodiversity, and discuss the choice of indicators and value articulating institutions in economic valuation of ecosystem services. There follows an analysis of the tools available for economic valuation, and the impact of non-linearities on valuation. The chapter concludes with a comprehensive summary of the emerging questions which are relevant for the economic analysis of ecosystems and biodiversity.

Appendix 1, 'How the TEEB Framework Can be Applied: The Amazon Case', illustrates how the application of the TEEB framework for the valuation of ecosystem services can be applied to the Greater Amazon. This a very interesting exercise that classifies the ecosystem services from the Greater Amazon at different spatial scales: global (carbon storage and capture, life cycles and gene pool protection); continental (climate regulation); regional (forest growth, erosion prevention, water purification, nursery service for fish population); and local (food and natural resources, biological control, aesthetic beauty, cultural heritage). It then characterizes the benefits associated with each service and estimates an economic value for most of them. Despite the simplifications that are involved, this study is useful both in terms of demonstrating the applicability of the TEEB approach but also in terms of helping decision makers to design new policies and support governance.

Appendix 2, 'Matrix Tables for Wetland and Forest Ecosystems', provides a very useful classification of the various services – provisioning, regulating, habitat/support and cultural – associated with wetland and forest ecosystems and provides extensive references to studies which use stated preferences, revealed preferences, production based, cost based, and benefit transfer methods to value these services.

Appendix 3, 'Estimates of Monetary Values of Ecosystem Services', contains a presentation of estimates of monetary values for ecosystem services. The valuations refer to marine ecosystems, coral reefs, coastal ecosystems, coastal wetlands, inland wetlands, fresh water systems, tropical forest, temperate forests, woodlands and grasslands and provide values for 22 ecosystem services. At the spatial scale the valuation studies cover world ecosystems and ecosystems located in Africa, Northern America, Asia, Europe, Latin America and the Caribbean, and Oceania.

In summary the present volume deals with the very important issue of the economic valuation of ecosystem services and provides a solid methodological framework for valuation purposes that brings out the interdisciplinary aspects of the field. The accompanying case study and the survey of existing valuation studies provide good applied examples. The volume will be very helpful not only to researchers working in the area of economics of ecosystems and biodiversity, but also to policy makers who will benefit from the concrete applied examples of valuations which could support policy design.