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Economic valuation of biodiversity: A comparative study

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ABSTRACT

In recent years, an intensive debate on the economic valuation of biodiversity has entered the environmental-economics literature. The present paper seeks to offer first a critical review of key concepts that are essential for a proper understanding of such evaluation issues. Particular attention is given here to various monetary valuation approaches and to comparative (i.e., meta-analytical) methods from the perspective of conservation and sustainable use of biodiversity. Several illustrative examples are presented in order to highlight the usefulness of the various approaches discussed. Next, an attempt is made to infer general findings and lessons from past applied research by means of meta-analysis. In this context, a multi-dimensional technique originating from the field of artificial intelligence is deployed. It allows us to identify the most important variables responsible for changes in economic estimates of biodiversity.

1. Introduction

Biodiversity requires our attention for two reasons. First, it provides a wide range of indirect benefits to humans. Second, human activities have been contributing to unprecedented rates of biodiversity loss, which threaten the stability of ecosystems in terms of their provision of goods and services to humans. Consequently, in recent years many studies of biodiversity and its loss have appeared. This article critically evaluates the application of economic valuation methods for the assessment of monetary values for biodiversity benefits. Particular attention is given to comparative (i.e. meta-analytical) methods as an alternative valuation approach to the well known, and often costly, non-market methods. Finally, an attempt is made to infer general findings and lessons from available valuation studies by means of meta-analysis, as far as they address similar issues. In this context, a multi-dimensional technique originating from the field of artificial intelligence is deployed. Estimation results allow us to identify the most important variables responsible for changes in economic estimates of biodiversity.

The organization of the article is as follows. Section 2 discusses the challenge that comparative research is able to put forward in the field of economic valuation of environmental quality, in general, and biodiversity in particular. Section 3 offers a classification of biodiversity value, characterizing the approach adopted in the evaluation here offered, i.e. economic approach. Section 4 critically evaluates the use of the economic approach to the valuation of biodiversity and its wide range of revealed and stated preference methods. Section 5 shows an empirical attempt to infer general findings and lessons from past applied

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research by means of meta-analysis, discusses the range of empirical findings and evaluates their basis against the earlier presented framework. Section 6 concludes.

2. Biodiversity as a comparative research challenge

In recent years, the awareness has grown that biological diversity is of critical importance for the stability of the earth's ecosystem, as it forms the base for sustainable functions of natural systems. In addition, it also offers a great potential for human use (such as recreation or scientific research) (ten Kate and Laird, 2004). Biodiversity may reflect a great variety of appearances depending on specific geophysical and climatological conditions. For example, European ecosystems encompass more than 2500 habitat types and 215,000 species (Stanners and Bourdeau, 1995). Biodiversity has both quantitative and qualitative characteristics. It is generally accepted that biodiversity cannot exclusively be expressed in numbers, as it also depends on the ecological structure of a whole area. It is nowadays broadly recognized that human activities are adversely affecting the earth's biological diversity, as a result of prevailing production and consumption patterns and of land use changes (cf. van Kooten et al., 2000). Consequently, biodiversity tends to become a scarce economic good, for which however a proper pricing system does not exist. In the past years, research on the economic valuation of living natural resources and also of biodiversity has shown a significant progress, but there is certainly not yet an established framework for valuing biological variety. Apart from the lack of a solid economic valuation mechanism for biological diversity, there is also a serious lack of reliable and up-to-date information and monitoring systems with a sufficient geographical detail on biodiversity. Clearly, studies on biodiversity require a pluridisciplinary approach (see also Cattizone, 1999). Any economic approach to biodiversity is therefore, by definition, limited and partial in nature (see e.g. Pearce and Moran, 1994; Barbier et al., 1995). Although various approaches deploy contingent valuation methods, it ought to be recognized that this class of methods may certainly be helpful in assessing the use value of biodiversity, but has serious shortcomings in case of non-use values such as bequest and existence values (see also Desaigues and Ami, 2001).

The economic valuation of natural resources, in general, and biodiversity, in particular, is among the most pressing and challenging issues confronting today's environmental economists. Economists value biodiversity because valuation allows for a direct comparison with economic values of alternative options, a corner stone for any cost-benefit analysis exercise. In addition, the monetary valuation of biodiversity allows economists to perform environmental accounting, natural resource damage assessment, and to carry out benefit assessment. Valuation is also essential in the research of individual consumer behaviour. It indicates the opinion of individual consumers about certain biodiversity management objectives and identifies individual consumer motivations with respect to biodiversity conservation.

Despite some flaws in economic valuation approaches to biodiversity, there is a clear need to continue with developing rigorous valuation tools in order to cope with complicated trade-offs in environmental policy analysis in the context of sustainable development initiatives and emerging policies which take explicitly account of the variety in the earth's ecosystem. The current biodiversity conservation programmes in various countries require for their implementation considerable financial expenditures, which have to be traded-off against alternative uses. Although world-wide much progress has been made in identifying and prioritising such programmes, innovative valuation strategies are still needed to generate additional information in order to support the actions advocated in Agenda 21 of the 1992's Earth Summit United Nations Conference in Rio, Brazil. Biodiversity conservation programme funds have, in general, a rather poor underpinning and are not based on solid and explicit economic choice mechanisms. The reasons for this are manifold, but in general they are due to insufficient information on a given biodiversity issue as well as on undefined property rights, high transaction costs, divergence between private and social costs, inappropriate economic instruments and bureaucratic inertia of relevant political institutions. Public authority choices concerning biodiversity preservation programmes should ideally be based on sound economic principles and information, such as fair market prices, benefits of specific biodiversity policies and cost-opportunities of alternative decisions.

There is a growing awareness that biodiversity conservation programmes may generate many social benefits but sometimes at high costs, in particular in terms of management and information gathering. Against this background, many efficiency problems and fair public funds allocation issues have arisen. Although general information about biodiversity programmes is available through traditional policy channels, it is challenging to allocate and manage biodiversity funds adequately from the perspective of the non-market value of environmental resources. In order to obtain a balanced trade-off between programme costs and benefits, it is necessary to optimise an efficient use of the information available (van den Bergh et al., 1999). Fortunately, the number of studies concerning monetary biodiversity evaluation is quickly growing. Consequently, there is the need to deploy and develop adjusted methodologies and analysis instruments that can improve our understanding of economic biodiversity values and, concurrently, that would allow for a more accurate forecast of biodiversity values. Comparative analysis of many case studies is a key for enhancing an understanding.

The ecological economics of biodiversity centres around the crossroads of natural and human values of ecosystems. In addition to an analysis of methodological complexities, there is also a need to draw policy lessons and general findings from past applied research. The large number of applied economic valuation studies currently available has induced the search for commonalities and contrasts in different empirical investigations and has also induced the current popularity of meta-analysis and value transfer. In particular, in recent years we have seen a rising number of publications on the economic aspects of biodiversity, both theoretical and empirical. This prompts the intriguing question of whether more general valuation conclusions might be inferred from a set of specific empirical investigations on closely related research themes or issues in the area of biodiversity. Meta-analysis has originally