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The role of benefit transfer in ecosystem service valuation

Leslie Richardson [a,*], John Loomis [b], Timm Kroeger [c], Frank Casey [d]

[a] U.S. Geological Survey, Fort Collins Science Center, 2150 Centre Avenue, Bldg. C, Fort Collins, CO 80526, United States
[b] Colorado State University, Department of Agricultural and Resource Economics, Fort Collins, CO 80523, United States
[c] The Nature Conservancy, Central Science Department, 4245 North Fairfax Drive, Suite 100, Arlington, VA 22203, United States
[d] U.S. Geological Survey, Science and Decisions Center, Energy, Minerals and Environmental Health, 12201 Sunrise Valley Dr., Reston, VA 20192, United States

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ABSTRACT

The demand for timely monetary estimates of the economic value of nonmarket ecosystem goods and services has steadily increased over the last few decades. This article describes the use of benefit transfer to generate monetary value estimates of ecosystem services specifically. The article provides guidance for conducting such benefit transfers and summarizes advancements in benefit transfer methods, databases and analysis tools designed to facilitate its application.

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1. Introduction

The articles that make up this special section of Ecological Economics all have one common feature. Either explicitly or implicitly, they address the need for valuing the services provided by the natural environment in order to achieve more informed resource policy decisions. It is not always possible or efficient to conduct an original valuation study for each specific geographic area or service of concern. This article addresses the potential for using benefit transfer to estimate the value of nonmarket environmental goods and services generated by ecosystem processes. We first discuss the growing demand for monetized values of ecosystem services, and the role of benefit transfer in meeting this demand. We then review accepted guidelines for conducting benefit transfers and discuss advancements in transfer methods and modeling techniques. Next, we discuss the role of web-based resources in the valuation of ecosystem services along with recent references that provide in-depth reviews of these resources. Finally, we offer suggestions for improving benefit transfers in the spirit of improving ecosystem service valuation for future project or policy analysis.

2. The Demand for and Supply of Ecosystem Service Valuation Research

Growth in human population or per-capita resource consumption, shifting public preferences, increasing resource scarcity, declining environmental health and many other pressures mean that policymakers across the globe face increasingly complex decisions about natural resource management. Coupled with recent global assessments of the status of ecosystems and the benefits they provide to society (Millennium Ecosystem Assessment, 2005; The Economics of Ecosystems and Biodiversity, 2011; UK National Ecosystem Assessment, 2011), this has led to a rapidly growing demand for information on ecosystem service flows and their economic values. Ecosystem services can be thought of as the aspects of nature utilized (actively or passively) to produce human well-being (Fisher and Turner, 2008).

In the United States in particular, federal agencies have varied widely in their use of ecosystem service values in natural resource management decisions. However, recent guidance from a 2011 report by the President's Council of Advisors on Science and Technology has increased awareness of the importance of these values in federal decision making. The report recommends that federal agencies with responsibilities relating to ecosystems and their services be tasked with using best available techniques to value ecosystem services affected by their decision making and incorporate these results into analyses that inform major planning and management decisions (President's Council of Advisors on Science and Technology, 2011). Environmental damage caused by large oil spills has further highlighted the importance of assessing the lost value of goods and services provided by the natural environment. The Exxon Valdez oil spill of 1989 provided a major turning point for the consideration of non-use economic values in damage assessments. Over two decades later, the Deepwater Horizon oil spill has brought additional attention to valuing services lost from large-scale spills. Given the magnitude and depth of the event, a congressionally mandated report by the National Research Council notes that

* Corresponding author. Tel.: +1 970 226 9181.
E-mail address: lrichardson@usgs.gov (L. Richardson).

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"an 'ecosystem services approach' may expand the potential to to capture, value, and restore the full breadth of impacts to the ecosystem and the public" (National Research Council, 2012, p. 2). Many federal agencies have released formal guidelines and recommendations for addressing ecosystem services and estimating nonmarket values for use in management decisions (see Murray et al., 2013; Tazik et al., 2013; US EPA, 2009; USDA Forest Service, 2012; USDOI BLM, 2013, for example). Ecosystem service valuation is being incorporated into U.S. state decision making as well through initiatives such as the Genuine Progress Indicator endorsed by the states of Maryland and Vermont, and many private companies are exploring the inclusion of ecosystem service values in business decision making (see World Business Council for Sustainable Development, 2011).

This increased demand for information on ecosystem service flows and values has redoubled the longstanding effort of economists in nonmarket valuation. Economic theory has long recognized that the value humans receive from these services can be comprehensively captured in a Total Economic Value (TEV) framework that distinguishes among two broad value categories: use values, derived by producers and consumers from the direct or indirect use of a resource; and non-use, or passive use, values, derived from simply knowing that a resource exists in a particular condition or is maintained for future generations (Krutilla, 1967). Due to the characteristics of many ecosystem services, their value often is only partially or not at all reflected in market prices. For the last forty years, environmental and resource economists have developed, utilized, and tested methodologies to monetize the benefits provided by goods and services that are not traded in markets. There now exists a large body of research demonstrating the successful application of these methods to value ecosystem services such as recreation, air and water quality, water supply, flood prevention, scenic amenities, and the protection of threatened, endangered or rare species. These advances have led to an understanding that, while many challenges remain, economic valuation methods are capable of providing information that can routinely be used to improve public-sector decision making (National Research Council, 2004; President's Council of Advisors on Science and Technology, 2011). Further, a significant body of literature has emerged describing how economic analysis can be integrated into ecosystem service assessments and ecosystem-based management in particular (Bateman et al., 2011a; Fisher and Turner, 2008; Hanley and Barbier, 2009; Holland et al., 2010). Increased collaboration between ecologists and other natural scientists and economists is contributing to a more comprehensive understanding of the ecosystem service impacts of particular decisions and identifying ecological metrics more amenable to economic valuation, resulting in improved information for policymakers.

However, while great strides have been made in advancing the economic methods and tools used to monetize the contribution ecosystem services make to human welfare, the primary research providing these values has not kept pace with the increase in demand for this information (Bateman et al., 2011a). Some of this shortfall could be reduced by conducting additional original valuation studies in cases where the value of the information generated by such studies outweighs the cost of conducting them. Nevertheless, the reality of constrained planning budgets and timeframes means the long-term and interdisciplinary research often required for original ecosystem service valuation is simply not feasible for most planning and management decisions that affect the natural environment. This has led to the widespread use of secondary data for ecosystem service valuation. Applied carefully, such benefit transfer, which is the focus of the remainder of this article, constitutes a viable option for providing ecosystem service valuation information to policymakers. While benefit transfer has many limitations, it is often the best or only option available to inform the policy process and thus will continue to play a role in the field of ecosystem service valuation.

3. Benefit Transfer as a Method to Estimate Ecosystem Service Values

Benefit transfer is broadly defined as "…the use of existing data or information in settings other than for what it was originally collected" (Rosenberger and Loomis, 2003, p. 445). In the context discussed here, this involves the transfer of original ecosystem service value estimates from an existing 'study site' or multiple study sites to an unstudied 'policy site' with similar characteristics that is being evaluated. Benefit transfer is increasingly being used to meet the demand for increased information on nonmarket ecosystem service values in a manner relevant to the timeframe and budget within which decisions often have to be made. If original valuation is not feasible, the choice is not between a new study and benefit transfer but rather between benefit transfer and qualitative judgment (Smith et al., 2002). Federal agencies such as the U.S. Environmental Protection Agency rarely conduct an original valuation study to assess the ecological benefits of a proposed rule, relying instead on benefit transfer, a trend that is expected to continue due to the various constraints that make primary data collection impractical, especially for rules with short judicial or legislative deadlines (Iovanna and Griffiths, 2006). Indeed, carefully conducted benefit transfers have the potential to provide a reasonable approximation of the value of unstudied resources, especially recognizing that the issue with ecosystem service valuation is not necessarily perfection but usefulness (President's Council of Advisors on Science and Technology, 2011). In cases where greater precision in the welfare estimates would not likely change the main conclusions of the analysis (see Timmons, 2013, for example), such approximate values are adequate to inform policy decisions.

That said, benefit transfers will never take the place of a carefully conducted primary study (Bateman et al., 2011a; National Research Council, 2004). The lower level of validity and reliability of transferred value estimates has led researchers to question the appropriate balance between 'purism' and 'practicality' in empirical ecosystem service research (Bauer and Johnston, 2013), and even led to the development of methods for determining the economic returns to using original valuation research over benefit transfer for policy decisions (e.g., Allen and Loomis, 2008). Further, while a growing body of research is explicitly addressing the tradeoffs stemming from the use of benefit transfers, transfers remain the subject of controversy, due in part to the divergence between transfer practices recommended in the scholarly literature and those applied in policy (Johnston and Rosenberger, 2010) and even academic analysis (Nelson and Kennedy, 2009). This gap needs to be bridged if benefit transfer is to play an increasing role in policy decisions that impact our natural capital. Otherwise, if violation of the basic principles and methodological requirements for valuing ecosystem services through benefit transfer remains widespread, this may ultimately undermine the integration of ecosystem service values into policy making. In other words, the flip side of "some number is better than no number" is that "bad numbers may drive out all numbers." Wildly biased welfare estimates could result in all estimates of ecosystem service values, valid or not, being rejected out of hand. This would cause a serious set-back for an important effort that has brought together ecologists and environmental and natural resource economists, and both disciplines with policymakers. Biased estimates can also lead to badly misguided policy. Of course, this error of commission has to be balanced with the policy consequences of omission of the value of nature's nonmarketed outputs.

The mainstreaming of ecosystem service values into policy decisions thus would benefit from a certain amount of quality control. One approach for instituting such control would be to subject important benefit transfers to an external peer review process much like the U.S. Army Corps of Engineers currently does with its benefit–cost analyses of major (over one hundred million dollar) projects. In addition, the formulation of agency guidelines for benefit transfer

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