Land Use Policy 45 (2015) 204–212

Contents lists available at ScienceDirect

Land Use Policy

journal homepage: www.elsevier.com/locate/landusepol

Valuing instream and riparian aspects of stream restoration – A willingness to tax approach

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ARTICLE INFO

Article history:
Received 15 July 2014
Received in revised form 5 December 2014
Accepted 27 January 2015

Keywords:
Stream restoration
Land use
Instream uses
Riparian areas
Non-market valuation
Choice modeling

ABSTRACT

Streams provide a variety of ecosystem and recreational services. Several studies have documented that the public often has a strong willingness to pay for stream restoration, however, many do not distinguish between the values for different types of uses of restored streams. Given that stream restoration can include a variety of actions both instream and along streambanks, which differ widely in terms of cost, it is important to distinguish between such benefits. Taking Israel as a case study, this paper uses an approach based on respondents' willingness to allocate tax monies in a choice modeling framework to evaluate the relative priorities that the public assigns to instream versus land-based uses of stream areas. In Israel, some rehabilitation of streambanks and riparian areas has occurred, but much less progress has been made on instream improvements, which would demand allocation of water, a scarce and pricey resource in the region. Respondents indicated a slight preference for land-based uses. Greater familiarity with streams was associated with higher utility from land uses. This indicates that less costly rehabilitation of land along stream banks is a reasonable first step for policymakers to take, before attempting more costly efforts requiring allocation of instream flows.

Introduction

Streams and rivers provide a variety of ecosystem and recreational services, as well as social and cultural values. Restoration of rivers and streams has become an important policy goal and a large scale industry in countries around the world. Bernhardt et al. (2005) document over 37,000 stream and river restoration projects implemented within the United States alone between 1990 and 2003. Numerous studies have documented the significant economic benefits of such services, with benefits of restoration outweighing the costs in many cases (e.g., Loomis, 1986, 1998; Hansen and Hallam, 1991; Emerton and Boss, 2004; Daubert and Young, 1981; Colby, 1989; NPS, 1995, 2001; Abromovitz, 1996; González-Cabán and Loomis, 1997; Johnston et al., 2006; Weber and Berrens, 2006). Achieving such benefits, however, can be an expensive endeavor. Bernhardt et al. (2005) and Sprague (2006) documented that river restoration had become over a billion dollar a year industry in the United States alone. Such large figures are not limited to developed economies. A single river restoration project in China was estimated to cost US$1 billion (Tullos, 2006).

With such high potential costs and benefits, it is not surprising that economic rationales are increasingly employed in decision-making regarding restoration of ecological services (Palmer and Filoso, 2009). In order to implement, finance, and evaluate a successful restoration plan, policymakers need to know which services people deem important and how much they are willing to sacrifice for them (Kondolf and Micheli, 1995). Several studies have looked at public preferences for environmental amenities associated with different types of land use (e.g., Kline and Wichelns, 1996; Hall et al., 2004), however, few if any, have compared relative preferences for instream and land-based uses of stream corridors.

Many of the benefits studies looking at benefits from stream restoration do not distinguish between the different types of amenities that such environmental improvements provide the public. Estimates of costs of different types of restoration activities show large discrepancies between differing objectives. For instance, riparian management is often much cheaper than flow related objectives. In their assessment of over 37,000 stream and river restoration projects in the United States, for example, Bernhardt et al. (2005) document that the median cost of riparian management projects was $15,000, while the median costs for flow modification and floodplain reconnection projects were $198,000

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http://dx.doi.org/10.1016/j.landusepol.2015.01.023
0264-8377/

and $207,000 respectively. With such disparities in costs, it is crucial to be able to distinguish the benefits for each type of restoration objective.

In this study we attempt to distinguish between the relative values the public places on instream versus riparian amenities in rehabilitated streams. We use as a case study streams in Israel. The overwhelming majority of Israel's population lives within 10 km of a stream, most of which are severely degraded and denuded of natural flow. Israel is also an arid country that fully exploits all of its renewable water resources and even augments this with significant quantities of desalinated water. As such, the marginal cost of water acquisition for instream flow purposes is exceptionally high. Thus, the case of Israel can serve as an excellent example of the need to estimate economic values of different intended uses within stream restoration and rehabilitation.

This study addresses this issue using a novel payment vehicle methodology. Contingent valuation (CVM) and choice modeling (CM) (also referred to as conjoint analysis) are two popular stated preference methods for estimating non-market values of environmental amenities, given their capacity to capture multiple benefits including both use and non-use values (Louviere et al., 2000; Freeman, 2003). CVM typically asks respondents directly regarding willingness to pay (WTP) (or willingness to accept (WTA)), whereas CM asks respondents to choose between alternative scenarios of varying environmental qualities and varying costs. According to Loomis (2006: 5), "CVM estimates a value for the entire restoration improvement program, while conjoint allows for the valuation of each individual ecosystem service provided by the restoration." For this study, we conducted a CM analysis in order to assess the value placed by the public on stream rehabilitation in Israel, and to discern the relative preferences and perceived welfare gains from different types of environmental services. Specifically we compare the values the public places on land-based recreational activities along stream banks with those of instream activities such as boating and swimming.

The study examines the public's choices regarding allocation of tax monies between different rehabilitation options for streams in Israel. A willingness to allocate taxes (WAT) approach was chosen over more standard WTP approaches in an effort to avoid biases that traditional approaches face in terms of protest bids and free-ridership, as will be explained below. This more novel approach means that study results are not directly comparable to those using WTP, but they better reflect the relative priorities of the public for different stream rehabilitation attributes.

In sum, while prior research has looked at WTP for stream rehabilitation, few attempts have yet been made to evaluate the preferences for specific elements of rehabilitation plans. This work is an attempt to fill this empirical gap, while also contributing to the nascent burgeoning literature on alternative payment vehicles. This paper proceeds as follows: Section "Stream rehabilitation in Israel and the region" provides a brief review of stream rehabilitation in Israel, including the existing economic literature on the stream rehabilitation there. Section "Payment instruments in stated preference valuation" presents review of the research on stated preference models using willingness to allocate taxes rather than more traditional willingness to pay. Section "Methodology" provides a description of the study methodology and Section "Study results" presents the study results. Section "Discussion and conclusions" offers a discussion of the results and their policy implications, and suggestions for future work.

Stream rehabilitation in Israel and the region

Decades of development, in which water left instream was considered a waste of a scarce resource and streams themselves were considered primarily as conduits for evacuating sewage, left nearly all of the nation's streams severely denuded of flow. The flow that remains is often of poor water quality (Katz and Tal, 2013). A national administration for rehabilitation of the nation's streams was established in 1992, and shortly thereafter a national stream rehabilitation plan was developed (Kaplan, 2004). However, a report by the nation's Comptroller admonished the work of the administration stating that after nearly twenty years, no streams have actually been rehabilitated and that most of the work has focused on upgrading the areas along the stream banks rather than the streams themselves (State Comptroller, 2011). The rehabilitation of such riparian areas, even in situations with minimal water flows and water of very poor quality, has led to some urban renewal and development of local tourism, via amenities such as biking, jogging trails, picnic areas, etc.

While some improvement in water quality in streams has been achieved following improvements in sewage treatment, a major obstacle to further rehabilitation is the high marginal cost of supplying water for environmental (instream) flows in a country in which over half of all municipal water supply comes from desalination (Zask, 2012; Tal and Katz, 2012). The Israel Ministry of Environmental Protection (2010) presented calculations based on hedonic techniques that showed that rehabilitation of streams could potentially provide billions of dollars of benefits just in terms of increased housing values, let alone recreation, non-use, and other values. Given these differences in costs of delivering different types of stream amenities, it is important to understand the relative importance that the public places on different stream uses.

As stated, chronic water scarcity and years of development that did not prioritize (in fact, even prohibited) instream flows has left Israel's streams dewatered and degraded (Katz and Tal, 2013). Most of the nation's streams have less than 20% of their natural flow and are highly polluted (SPNI, 2008). Despite the sorry state of the streams, amenities such as jogging and biking trails and picnic areas developed along the stream banks now attract thousands of visitors each day. Such restoration activities along the Yarkon River in Tel Aviv, the country's largest metropolitan area, are considered a successful example of urban economic renewal. A large scale rehabilitation project costing roughly $50 million is now underway for the lower portion of the Kishon stream, which flows through the city of Haifa's industrial area, in an attempt to promote similar results.

The above rehabilitation projects notwithstanding, relatively little research has been done to investigate the economic benefits from stream rehabilitation in Israel. Becker and Katz (2006) used both travel cost and CVM methods to estimate WTP for stabilization of the Dead Sea levels for Israelis, Jordanians, and Palestinians, and found a strong WTP for all, while Tal et al. (2008) used a straightforward open-ended payment vehicle in a CVM study of a coastal stream in the West Bank and central Israel. Abramson et al. (2010) used an identical technique for two streams in order to compare Israeli and Palestinian WTP. Becker and Friedler (2013) found positive potential net benefits for cleanup of a pollution transboundary stream. A study by Friends of the Earth – Middle East using CVM, CM, and travel costs methods found that Israelis, Jordanians, and Palestinians all had substantial WTP for rehabilitation of the lower Jordan River, but that results were highly dependent on valuation method used, with the CVM method producing the highest net benefits (Bamya et al., 2012). The study compared different flow levels and different levels of quality (and thus different potential instream uses), and found that for given flow levels, the populations' WTP justified provision of high water quality to allow for unlimited instream uses (Bamya et al., 2012; Becker et al., 2014). All of the abovementioned studies looked at individual rivers or streams and none specifically compared instream versus off-stream uses or amenities.