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Analysis

Cultural bequest values for ecosystem service flows among indigenous fishers: A discrete choice experiment validated with mixed methods

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A B S T R A C T

Perhaps the most understudied ecosystem services are related to socio-cultural values tied to non-material benefits arising from human–ecosystem relationships. Bequest values linked to natural ecosystems can be particularly significant for indigenous communities whose livelihoods and cultures are tied to ecosystems. Here we apply a discrete choice experiment (DCE) to determine indigenous fishers' preferences and willingness-to-pay for bequest gains from management actions in a locally managed marine area in Madagascar, and use our results to estimate an implicit discount rate. We validate our results using a unique rating and ranking game and other mixed methods. We find that bequest is highly valued and important; respondents were willing to pay a substantial portion of their income to protect ecosystems for future generations. Through all of our inquiries, bequest emerged as the highest priority, even when respondents were forced to make trade-offs among other livelihood-supporting ecosystem services. This study is among a relative few to quantify bequest values and apply a DCE to model trade-offs, value ecosystem service flows, and estimate discount rates in a developing country. Our results directly inform coastal management in Madagascar and elsewhere by providing information on the socio-cultural value of bequest in comparison to other ecosystem service benefits.

1. Introduction

Perhaps the most understudied ecosystem services are related to socio-cultural values tied to non-material benefits arising from human–ecosystem relationships (Chan et al., 2011). Cultural ecosystem services are defined by the Millennium Ecosystem Assessment (MEA, 2005, p. 894) as “the non-material benefits people obtain from ecosystems through spiritual enrichment, cognitive development, reflection, recreation and aesthetic experience, including, e.g., knowledge systems, social relations and aesthetic values.” Cultural ecosystem services provide benefits to society, yet can be intangible and subjective, and do not transmit clear demand signals, making quantification difficult (MEA, 2005). Innovative approaches, such as participatory and GIS modeling and mapping, contingent valuation, and the extrapolation of secondary market data, have facilitated assessments of some cultural ecosystem services (Hernández-Morcillo et al., 2013 and the references therein). Yet economic valuations have largely focused on recreational and aesthetic benefits (e.g. Bergstrom et al., 1990; Cisneros-Montemayor et al., 2013; Cisneros-Montemayor and Sumaila, 2010; Grêt-Regamey et al., 2008; van Beukering and Cesar, 2004), while other aspects, such as bequest, remain elusive (Hernández-Morcillo et al., 2013).

Bequest value is a non-use value representing the importance people place on preserving or maintaining ecosystems for future generations (Chan et al., 2012b; Krutilla, 1967). Non-use values accrue independently of a person's own use of a resource, and they are often associated with irreplaceable resources (O'Garra, 2009). The perception that valued ecosystems are irreplaceable is often deeply tied to local socio-cultural values, and may persist despite the availability of physical substitutes (Crowards, 1995; O'Garra, 2009). Communities often develop unique relationships with ecosystems through rich histories of human–environment interaction and the continuity of culture, and place a high value on their endowment to future generations (Garibaldi and Turner, 2004). Bequest values of ecosystem service

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benefits therefore comprise an important component of total economic value.

Bequest values linked to natural ecosystems can be particularly significant for indigenous communities (O'Garra, 2009), whose production methods and livelihoods are often reliant on ecological structures and functions (Casey et al., 2008; Pearce and Warford, 1993). Moreover, indigenous communities often have deep attachments with particular ecosystem services that play a unique role in shaping their cultural identity, embedding them in traditions and narratives, ceremonies, and discourse (Garibaldi and Turner, 2004). Many communities steward important ecosystems because these services are crucial for supporting the continued existence and ability for maintaining integrity of cultural practices.

In this study we apply a discrete choice experiment (DCE) to determine indigenous fishers' preferences and willingness-to-pay (WTP) for bequest gains from management actions in a locally managed marine area (LMMA) in Madagascar. We design our DCE in a way that allows for the estimation of an implicit discount rate, reflecting the time preference of the local community. We validate our results by employing a unique rating and ranking game and other mixed methods.

We expect this study to make an important contribution to the field of environmental valuation. Cultural ecosystem service valuations are scarce, and little information exists on bequest values, particularly in low income indigenous communities (but see O'Garra, 2009). This study is also among a small number to apply a DCE to model trade-offs and value ecosystem service flows in a developing country context (Bennet and Birol, 2010b).[1] Our results can also directly inform marine and coastal management in Madagascar and elsewhere by providing crucial information on the often-overlooked socio-cultural value of bequest, and by providing information on the time horizon of indigenous fishers.

The remainder of our paper is structured as follows: we begin with a discussion of the DCE approach for cultural ecosystem service valuation, with a particular focus on applying it in developing countries and indigenous communities. We then proceed with a description of our study site. Next we present our study design and methods, followed by our results. We then conclude with a discussion of our results and their implications for environmental decision-making and valuation more broadly.

2. DCEs for Cultural Ecosystem Service Valuation

DCEs, originally developed by Louviere and Hensher (1982) and Louviere and Woodworth (1983), are increasingly being used by economists to elicit preferences and values for non-market ecosystem services (e.g. Adamowicz et al., 1994; Boxall et al., 1996; Hanley et al., 1998; Hoyos, 2010; Walsh et al., 1984). Based on a well-tested theory of choice behavior (Thurstone, 1927), DCEs can be used to model complex hypothetical scenarios involving trade-offs between several attributes that model real-world decision making. The flexibility of the approach allows for the attributes to be comprised of diverse ecosystem services, which may interact in complex ways. Given that a payment vehicle is also included as an attribute, preferences for estimated part-worth utilities, or the WTP for incremental changes in ecosystem services, can be estimated and compared based on respondents' choices.

Due to their flexibility, DCEs are perhaps the most appropriate available method for eliciting values in complex situations involving trade-offs between multiple ecosystem services, particularly those linked to socio-cultural values (Adamowicz et al., 2008; Noonan, 2003; Rolfe et al., 2000). Land and seascapes simultaneously provide provisioning, regulating, cultural, and supporting ecosystem services that are interrelated in complex ways, and decisions to maximize one or few may have to be made at the expense of others (Bennett et al., 2009; Rodríguez et al., 2006). In indigenous communities where local livelihoods and culture are inextricably tied to the natural environment, strengthening the rules governing natural resource use can help to ensure not only long-term ecological sustainability, but also socio-cultural sustainability. Yet the success of such management scenarios depends on the willingness of local resource users to give up short-term economic gains from resource extraction to achieve long-term ecological and economic results. The DCE approach is useful for modeling these trade-offs, and can uncover the importance of the less tangible, intrinsic cultural values for achieving successful, sustainable management (Hicks et al., 2009).

2.1. DCE Empirical Model

The choice modeling technique is based on the idea that any good or environmental scenario can be described in terms of its characteristics, called attributes, and the levels (representing changes in quality or quantity) of these attributes. In a DCE, respondents are asked to choose between different bundles of goods (in this case ecosystem services) described in terms of their attributes and attribute levels, at least one of which is typically some form of payment (Hanley et al., 1998). The analysis of choices is based on the characteristics theory of value (Lancaster, 1966) and random utility theory (McFadden, 1974; Thurstone, 1927), which describe discrete choices in a utility maximizing framework. If an individual's utility function is assumed to be dependent on a vector V of environmental attributes Z and socioeconomic characteristics S, and assuming the utility function can be partitioned into two components, one deterministic, observable component (V_{in}) and one random and unobservable component (ε_{in}), it can be formulated as (Hanley et al., 1998):

$$U_{in} = V(Z_n, S_i) + \varepsilon(Z_n, S_i) \tag{1}$$

where:

U_{in} total utility (U) individual i derived from alternative n
V_{in} observable utility (V) individual i derived from alternative n
ε_{in} unobservable utility (ε) for individual i from alternative n
Z_n particular attributes of ecosystem service Z in choice n
S_i attributes of the individual i.

The incorporation of the random component allows us to make probabilistic statements about individual behavior, where the probability of individual i choosing alternative n rather than m in a given choice set C is the probability that the random utility of alternative n is greater than the random utility of alternative m. The probability of choosing alternative n is then (Boxall et al., 1996; Hanley et al., 1998):

$$P(n|C_i) = \text{Prob}(V_{in} + \varepsilon_{in} > V_{im} + \varepsilon_{im}) \forall n \neq m \in C. \tag{2}$$

Employing a multinomial logit model for estimating choice probabilities, we assume that the random error ε_{in} is identically and independently distributed following a type I extreme (Gumbel) distribution with scale parameter μ, in which the true parameters are confounded (Hanley et al., 1998; McFadden, 1974). The probability of choosing alternative n is then:

$$P_{in} = \frac{\exp(\mu V_{in})}{\sum_n \exp(\mu V_{im})}. \tag{3}$$

As the scale parameter, μ, is confounded with the coefficients we would like to estimate (i.e., V_n, V_m), and μ is not directly identifiable from the data, we are unable to generate absolute estimates of the coefficients independent of our multinomial model. However, because the scale parameter is constant within an estimated model, it is valid to compare the relative sizes of coefficients within the same model

[1] Other comparison methods, however, such as the damage schedule approach, have also been used to value environmental changes (Chuenpagdee et al., 2001).