

Recognising institutional context in simulating and generalising exchange values for monetary ecosystem accounts

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Abstract

The paper argues that monetary valuation of ecosystem services for ecosystem accounting needs to be sensitive to institutional context, when simulating markets to generate exchange values where none was available previously and when conducting value generalisation that extrapolates exchange values from specific sites to the whole accounting area. The same ecosystem type can contain different governance regimes or, conversely, a single governance regime may be present in many ecosystem types. Governance regimes are, in part, determined by ecosystem type and condition, but also by ecosystem access characteristics which vary over urban-rural gradients. An ecosystem service will not have a single price if costs of supply and transaction vary in space. This is generally true for all accounting compatible valuation methods if they are extrapolated across different market contexts, but require particular attention if markets are simulated for specific locations and then assumed to be generally valid for the accounting area. The paper exemplifies this for different institutional settings for exchange values of recreation services exploring the general recommendation in SEEA EA for making valuation methods sensitive to institutional context. Stated preference methods simulate markets for ecosystem services. The paper then reviews non-market stated preference valuation studies that have been sensitive to institutional design. Findings on institutional design are, therefore, specifically relevant for simulation of market exchange values for the purpose of compiling monetary ecosystem accounts. The paper finds that disregard for the institutional context in valuation for ecosystem accounting can lead to: (i) errors of generalisation/aggregation and (ii) downward 'bias' in simulated accounting prices (relative to the status quo of the institutional context).

Keywords

simulated exchange value (SEV), recreation services, System of Environmental and Economic Accounts Ecosystem Accounts (SEEA EA), value transfer, value generalisation, stated preference, non-market valuation, monetary accounts

Introduction

The variation in rules governing ecosystems on private, communal and public property across a national accounting areas is potentially large and is expected to determine the data available on ecosystem services use and the feasibility of monetary valuation methods in ecosystem accounting (Barton et al. 2019a, Barton et al. 2019b). The System of Environmental and Economic Accounts - Ecosystem accounts (SEEA EA) recognises that institutional regimes are specific to ecosystems and resource characteristics and may impact on the estimation of non-market values (United Nations 2021, NCAVES and MAIA 2022). However, guidance on how to address the institutional context of valuation methods for ecosystem accounting is limited. This paper aims to fill a gap in the ecosystem accounting literature by connecting to institutional economic literature where institutional characteristics are considered integral to value articulation of ecosystem services. The discussion is grounded in the general case of recreation services and the specific method example of simulated exchange value (SEV).

Caparros et al. (2017) demonstrated how simulated exchange value of recreation services depends on market institutional assumptions of whether the recreation area is in the equivalent of monopolistic, oligopolistic or perfect competition for visitors with other recreation areas. At the aggregate scale of valuation for ecosystem accounting, market structure in SEV depends on the degree to which recreation services at a given sites have substitutes, determined in the short run by the number and similarity of recreation sites and their relative proximity for visitors (ibid). The challenge of also representing institutional variation in local tenure rights in non-market valuation of ecosystem services applied to SEV in ecosystem accounting is starting to be recognised. For example, Pelletier et al. (2021) conducted recreation accounts for one type of land-use tenure across multiple ecosystems in NSW National Parks Estate, but recognised that “decisions around the provision of outdoor recreation services are made by land owners, private and public, and there is no institutional channel that would enable such decisions to span different land tenures” (p.13). The due consideration of variation in rights regimes in valuation methods is of particular importance for the recognition of local and indigenous communities' values in policy decisions, based on ecosystem accounting (IPBES 2022).

This paper argues that valuation methods for ecosystem services should recognise variation in local rights regimes in order to improve the representation of local use values and how they may vary depending on communities' management of their local

ecosystems. While the paper focuses on recreation to discuss the importance of institutional context of monetary valuation for ecosystem accounting, the topic is generally relevant for ecosystem service assessment for policy design. In broad terms, a 'policyscape' of different land-use governance regimes is often correlated with ecosystem condition and opportunity costs (Barton et al. 2013). A range of more or less exclusive voluntary and public protected area categories in rural areas is determined by the combination of public and private benefits from ecosystem services, correlated with gradients of ecosystem condition and opportunity costs of protection determined by physical accessibility (e.g. Wunscher et al. 2008, Pannell 2008, Robalino et al. 2015, Schroter et al. 2014). Institutional variation is not a special case, but observed across different ecosystems and resource types and at the core of research in institutional economics and common property resource management (Ostrom 1990, Ostrom 2005). The importance is not limited to rural or nature conservation. A wide variation in formal and informal use rights determined by availability, access and attraction of green spaces can be observed in urban areas landscape gradients (Biernacka and Kronenberg 2018). Institutional variation occurs at different levels of governance, for example, in groundwater management regimes that may vary greatly within a single state (Addicott and Fenichel 2019). For these reasons, spatial variation in institutional context should also be of general concern for valuation practitioners supporting national ecosystem accounting. In the next section, we ground this general concern for rights regimes in the valuation of recreation services. This forms the background for then discussing institutional design in stated preference and simulated exchange value methods, specifically.

Variation in the institutional context of recreation accounting prices

Fig. 1 provides a conceptual illustration of an urban-rural landscape gradient with differences in access and use rights across different imagined greenspaces. A range of open/exclusive access rights and travel costs from negligible to high require valuation methods for amenities and recreational cultural services to vary across these gradients (Barton et al. 2019b). Furthermore, differences between countries may mean that recreation service valuation methods that work for a given ecosystem in one country may be institutionally incompatible in another. Informal access and use rights may not be proxied by formal management designations (urban parks, national parks, nature reserves etc.) and will generally not be visible in the physical mapping of ecosystems and their land-uses. There may be differences in accessibility between green spaces due to hunting and harvesting rights which have an unobserved and incidental effect on recreation. Local social groups may enable recreation by providing site knowledge, as well as provide norms and informal rules for use. There may be constitutionally guaranteed public access rights to private unmanaged nature in one country, while being only *de facto* permitted, but not legally protected in another.

The variation in institutional contexts across a urban-rural gradient in Fig. 1, nuances the basic distinction between perfect and monopolistic competition discussed by Caparros et

al. (2017) and the exploration of Pelletier et al. (2021) of different accounting prices for the single regime of national parks. Many public and common property rights regimes do have net revenue optimisation as a management objective - the SNA is agnostic on this, accepting, as accounting compatible prices, those observed or simulated from any actual or feasible institution that identifies a voluntary transaction between two parties (United Nations 2021, NCAVES and MAIA 2022). In Fig. 2, we explore this agnostic institutional framing by combining variation in contexts into a single conceptual partial equilibrium model. Simplifying assumptions of site-specific linear demand and simple fixed and variable functions are used to aid presentation. In Fig. 1, we argued that governance regimes are conditional on landscape characteristics that vary in space. A central argument of the paper is caution in assuming any (market) institutional regime for a given ecosystem location, given a resource regime's conditional dependence on cultural practices and norms, which, in turn, have developed as adaptations to local physical resource characteristics and available technologies (Ostrom 2005). In this sense, Fig. 2 is artificial in that it combines different possible locations in a single figure. Notwithstanding its hypothetical 'compression' of situations across a landscape and institutional gradients, Fig. 2 provides a framework for discussing 'institutionally sensitive' design of non-market valuation methods to determine accounting prices for the purpose of ecosystem accounting. It also aims to place simulated market exchange values on a wider gradient of possible institutional regimes that may be faced by the ecosystem accounting practitioner.

If the green space really is open, access visits will increase until the marginal value of each visit is zero (point o in Fig. 2). In the absence of institutions governing use of the recreation area, the accounting price is zero (P_o). This would be the accounting price of a hypothetical location with no management costs (of litter, trail maintenance etc.), no carrying-capacity issues on the quality of the visit and, hence, no governance costs. At the other extreme, an ecologically sensitive recreation area might have an identified visitor-carrying capacity which - if auctioned to the highest bidders - would reveal a price at P_u . Carrying capacity and the corresponding price could only be determined with long-term monitoring of ecosystem response to visitors, information about access control, on-site management of visitors and design of an auction-pricing institution.

Between accounting prices P_o and P_u , a number of regimes and corresponding accounting prices could be simulated. In all cases, if a demand curve can be identified, different simulated exchange values can be estimated. Not all regimes would have efficiency optimisation or revenue maximisation as their objectives. The valuation method chosen to estimate the demand curve(s) needs to consider that institutional assumptions vary across the diversity of contexts represented in the figure. This is discussed in greater detail in the latter sections of the paper, but briefly here, stated preference studies must present a credible scenario for charging access fees for restricted access. Credible infrastructure and management for controlling entry should be specified. Owners must be legally permitted to charge for entry. Resource characteristics and technology must be available to physically restrict access. With the assumption of a credible stated preference valuation scenario, we

discuss alternatives from left to right in Fig. 2, in order of decreasing institutional constraints on visitation.

Visitation could be increased to i if a site's carrying capacity were increased using infrastructure (e.g. trail access), assuming only fixed maintenance costs. A (fixed) cost of production method of accounting would value the recreation service only as the grey area (Fig.2). Using a stated preference study, an accounting price P_i might be simulated, such that the predicted visitation does not exceed the infrastructure carrying capacity, increasing the accounting value to $P_i \times Q_i$. P_u and P_i do not optimise revenue, but represent an accounting price reflecting rationing of entry to respecting carrying capacity of ecosystem and built infrastructure. This may be compatible with management of the strictest categories of protection in some countries.

If the site has no substitutes, an owner wishing to take advantage of their monopoly situation can maximise revenues by charging an entry fee of P_m at visitation m where the marginal revenue is zero. If there are no variable costs, visitation m is equivalent to 50% of potential visitation relative to open access (o) (Caparros et al. 2017). Faced with lacking data, assumptions of no management cost (Hein et al. 2016) or constant variable costs are used for practical computational reasons (Pelletier et al. 2021).

With many similar sites within travel proximity, perfect competition may be assumed for a recreation area (Caparros et al. 2017). In this case, the simulated exchange value estimated at the intersection of the marginal willingness-to-pay and marginal recreation supply cost. This could be the situation of peri-urban natural forest recreation areas on private lands that could legally restrict access, with only constant variable maintenance costs, in which case the simulated exchange value p_f would determine visitation at f . A highly managed botanical garden or outdoor recreation/sports facility in an urban area may have competitors and perhaps stepwise increasing (variable) management costs. If it wished to maximise net revenue, it would charge an entrance fee of P_e , admitting a number of visitors at e .

In the case of both (e) and (f), if the owner were a public or private common property institution, this pricing may or may not be consistent with its mandate. Accounting price P_v could potentially be computed for a local urban open access recreation area where fixed cost infrastructure (e.g. public metro line access) and variable cost management (e.g. public trail and vegetation maintenance, litter collection) enable a visitor-carrying capacity to expand to v . However, even if P_v could be computed, an entry-fee may not be consistent with a governance regime where open access is constitutionally guaranteed. An example could be the Oslo peri-urban forest called Marka which is co-owned and managed between the municipal government, not-for-profit recreation organisations (DNT, Skiforreningen) and private forest owners. In such an open access, governance regime public agency budgets and voluntary member contributions may 'subsidise' the use of a wider public (the difference between the demand and variable cost curves between e and v). In the case where SEV is institutionally incompatible, recreation area contribution to the economy could be recorded using costs of production, given as the area under the fixed and variable costs curves up to the level of management v .

The more we assume a greenspace is managed, the higher the costs of management, but also the higher the information costs for the valuation practitioner in determining the shape of the supply curve. SEV, assuming fixed and/or constant variable costs, is less information demanding (Caparros et al. 2017, Pelletier et al. 2021). An assumption about management costs explicitly defines a level of management effort and implicitly defines visitation capacity. Simulating exchange values and visitation that maximise revenues assuming no, or only fixed, costs may or may not be compatible with physical or perceived carrying capacity of the recreation area, its managers or visitors.

Monetary accounts as value articulating institutions

In this section, we examine some considerations in designing 'institutionally sensitive' valuation methods used to estimate demand as outlined in Fig. 2. Environmental assessment methods, including monetary valuation, can be considered as "value articulating institutions" (VAI) (Vatn 2009). A valuation method thought of as a VAI observes or creates a choice situation with a set of rights and rules which determine how people state or reveal economic choices. This is also useful framing for practitioners of monetary valuation for ecosystem accounts. Standardised 'one-size-fits-all' assumptions about rights regimes and market structures across ecosystems and land-uses may facilitate valuation for the national accounting purposes of a statistical agency, but be deemed unreliable and/or unjust by local stakeholders for the purposes of ecosystem management (IPBES 2022). This is particularly relevant for stated preference methods used as input to simulated exchange value to determine the accounting price. Hein et al. (2016) called attention to the sensitivity of simulated exchange value to the stated preference survey design. It is, therefore, useful to have an understanding of the explicit assumptions about the simulated market(s) - the institutional context(s) – as they could apply across a national accounting area. Value transfer for national ecosystem accounting may be particularly exposed to what we could call 'errors of institutional generalisation' when a small set of study sites in one type of jurisdiction is used to infer accounting prices in a much larger accounting area including other jurisdictions.

Particular policies may also create particular institutional settings. Mitchell and Carson (1989) noted early on that respondents in contingent valuation surveys may weight their unbiased WTP response by their subjective belief in implementation of a policy, also known as 'probability of provision'. Carson et al. (1999) later wrote "from a practical point of view, most non-market valuation studies will continue to be commissioned with a particular policy in mind, and the focus will be on demonstrating internal validity to the decision-maker". Whittington (1998) argued that it is not possible to value a project independently of how it is paid for or the institutional regime that is assumed to be in place when the project is implemented.

Johnston et al. (2017) guidance on stated preference valuation is a relevant background for the role of institutional context as addressed by the benefit transfer literature. They write, "the choice of approach depends on the valuation context in question, including the type of good, the nature of the decision being evaluated and associated institutions

(property rights, tax system, etc.)” (p. 344). As discussed in this paper, a number of stated preference studies have observed impacts of institutional design of the policy scenario - notably the type of payment vehicle - on protest rates in stated preference. Johnston et al. (2017) note, “although the literature is clear that protest responses of various types may be a concern, there is no agreement on a single set of best practices to address these problems. Transparency in the identification and treatment of suspected protests is therefore essential, as is sensitivity analysis. [...] while a goal of SP design and analysis is to minimize the effects of anomalies, it is important to remember that there is likely no behavior, even in markets, that is universally consistent with the simple textbook neoclassical microeconomics paradigm” (p. 364). They also note that, “In addition (or alternatively), a respondent’s desired payment vehicle may not be realistic for the decision-making context” (p. 353). To address this, their Recommendation #11 for SP studies reads, “a payment vehicle should be selected to be realistic, credible, familiar, and binding for all respondents to as great an extent as possible and to ensure that payments are viewed as fixed and non-malleable. Payment vehicle selection should be informed by pretesting to minimize unintended effects on value estimates” (p. 352).

In ecosystem accounting, monetary valuation compatible with the system of national accounts requires using proxy market price data where ecosystem services currently have no market. When no close proxies are available, simulated exchange values, based on stated preference studies that assume a market institution, are recommended (ch. 9 United Nations 2021). Simulated exchange value is computed to optimise revenue for the hypothetical market institution (Caparros et al. 2017).

Simulated market context matters - findings from the stated preference literature

Meta-analysis of SP studies has found that payment vehicles can both change WTP and protest rates, biasing both the transferred marginal value and the generalisation to the population. In a meta-analysis of wetland valuation studies, Brouwer et al. (1999) found that income tax payment vehicles increase value estimates compared to alternative vehicles. In an international meta-analysis of stated preferences studies for environmental quality, Meyerhoff and Liebe (2010) found that protest rates to the same payment vehicle vary across countries. Protest rates are significantly lower in Scandinavian countries than in the US. Meyerhoff and colleagues speculate that “people living in these countries are less skeptical of the state and show higher levels of institutional trust (Scandinavian welfare model)” (p. 369). Specifically, protest rates were lower for a surcharge to an existing bill in Scandinavian countries. The authors speculate that, “the advantage of using a surcharge to an existing bill as a payment vehicle might be that increasing an existing amount is more easily accepted than introducing a new payment vehicle”. They found consistent evidence across countries that protest responses increased with entrance fee payment vehicles. The authors speculate that “entrance fees are probably often strongly opposed because they would clearly change existing property rights, that is, previously free access is restricted and priced” (p. 369).

The importance of shifts in institutional context for estimation of ES demand seems a general phenomenon for ecosystem services as can be observed in the examples below from water supply, wastewater, irrigation water and terrestrial and water-based recreation pricing.

Morrison et al. (2000) investigated whether different payment vehicles result in different numbers of protest responses. They did not find any evidence of significant differences between protest rates for income tax versus water charges. However, they did find that willingness-to-pay under the water charges vehicle is significantly higher than under income tax and that home owners are less willing to pay an increase in water rates than non-home-owners (who do not pay water rates). Instead of deleting protest responses from the estimation of WTP, they propose to recode responses, based on follow-up questions to protesters i.a. of whether they would support the policy "if an acceptable way of collecting the money could be found" (p 419). Of note for our discussion here, protest rates were lower when respondents were asked to assume that the payment was institutionally feasible. Additionally, the geographical coverage of persons who do not currently pay water rates may not be homogeneous, which could lead to spatial transfer/generalisation errors.

In a CV study of willingness-to-pay for coastal wastewater treatment, Barton (2002) noted that the policy proposed in the CV scenario had its own transaction costs in the form of very localised externalities and an institutionalised distrust in part of the population. In a CE study of irrigation water pricing in Karnataka, India, Barton and Bergland (2010) found that different institutional arrangements in different parts of the irrigation area played a role in preference for the status quo (SQ) of the irrigation option. They noted that this could be a result of water management institutions being endogenous to the level of water supply. Notably, participation in water-sharing agreement reduced status quo opt out, while participating in a water-user association increased opt out, in relation to an irrigation fee payment vehicle. They proposed a CE with individual status quo information as useful in study settings where there is large heterogeneity in use or perception of (environmental) service levels across respondents and the policy is viewed as so contentious that a significant portion of respondents is expected to prefer their current situation to a proposed policy. Similarly, Veetil et al. (2011) found that, under conditions of improved water rights, there is a preference for volumetric pricing increases, whilst the presence of a Water Users Association reduces this preference.

Soderberg and Barton (2014) found that the likelihood of finding a 'protester', or someone indicating a 'true zero' WTP, increased the further away the respondent lived from lakes improved by a eutrophication mitigation policy in south-eastern Norway. They found that distance decay in WTP was explained by protest and zero responses. For this reason, they concluded that their contingent valuation results could be used to identify the 'economic jurisdiction' Bateman et al. (2006), but not to determine (with significant accuracy) whether benefits aggregated across households within that area outweigh costs of measures.

Campos et al. (2007) show that protest responses are higher for entrance fees than travel expenditure payment vehicles and different for two recreation areas in Spain (35% at PSG and 23% at ANP). Removing protest responses (as zeros) from the model, increases WTP

estimates by 71-94%. Campos et al. (2007) write “Establishing entrance-fees to protected forests is not a common practice in Spain and people do perceive free access as a right, although this is not always legally so (private owners have the right to exclude free access although they do not generally use this right)”. Protesters prefer a quota-based system to an entrance fee to regulate visitor numbers - respondents’ protest is because of perceived right of free access. A study in the UK used parking fees as an accepted payment vehicle to fund a marine-protected area (Paltriguera et al. 2018).

Whittington and Pagiola (2012) call for CV studies of PES to assess transaction costs for alternative means of providing the ecosystem service. In the context of outdoor recreation, transaction costs of a simulated market include costs of excluding non-paying visitors and payment collection. Both contingent valuation (Campos et al. 2007) and choice experiments (Oviedo et al. 2016) of recreation to open access recreation sites have shown that the shift in rights from open access to payment of an entrance fee both increases protest rates and leads to a welfare loss. Oviedo et al. (2016) found that the marginal utility of entrance fees and trip expenditures were significantly different, despite respondents being offered the option to consider aggregate trip + entrance fee costs. Respondents were willing to pay around 2.7 times (270%) as much in trip expenditures as in entrance fee for visiting the forest (Whittington and Pagiola 2012).

Oviedo et al. (2016) aggregate WTP values across both payment vehicles, an approach which does not make any assumption about a valid institutional context for SEV, letting the proportion of protests and differences in utility be reflected in estimates. Provided an SP study passes some ‘constitutional’ threshold, the pooling of responses to different assumptions about the market revealing exchange value is a pragmatic convention that ‘absorbs’ respondents reactions to different payment vehicles and rights allocations.

SP studies applied to SEV note the institutional context for which study site estimates were elicited. Note that their results are valid for managed open stone pine and cork oak woodlands of the southwest, west and northwest of the country, whereas forests in the northeast are found as wild private gardens of cottage houses limiting public access.

There is some evidence that protest response rates are lower in CE than CV studies, at least for open ended CV studies (Meyerhoff and Liebe 2010). A possible cause is that the status quo option does not explicitly ask respondents to consider disagreement with the policy scenario (Barton and Bergland 2010). CE may, therefore, be less appropriate for uncovering sensitivity to institutional market context as a basis for simulating exchange values.

Controlling for institutional context in value transfer

In targeted guidelines for BT, Johnston et al. (2021) argue that “with the exception of a few core dimensions such as income, studies are not consistent with regard to the dimensions of similarity that are considered to be important. In general, however, one should strive for similarity in demographic, institutional and cultural context in international benefit transfer

between policy and study sites, as these dimensions have been found hard to correct for in function transfers".

Applications in both developed and developing countries should take into account unique cultural and institutional considerations (Bennett and Birol 2010). This poses challenges for benefit transfer for ecosystem accounting. International benefit transfer is more likely in countries too small to have built a basis for meta-analytic transfers and countries with little prior valuation research.

It is generally recommended that the BT researcher should identify and use only similar studies from the same country or other closely located countries which share a similar institutional and cultural context (Hynes et al. 2013). They write that, under conditions of homogeneity in valuation methods, cultural and institutional conditions across countries and a meta-analysis with large explanatory power, the transfer errors could still be large. Lindhjem and Navrud (2008) show that international meta-analytic transfers for no-timber forest benefits in Nordic countries do not, on average, perform better than simple value transfers averaging over domestic studies.

Study design recommendations

Stated preference studies may be generalised to a national accounting area in natural capital accounting using WTP estimates, for example, for welfare satellite accounting. SP may also be generalised to accounting areas as input to simulated exchange values in SEEA EEA. Based on the above discussions, some specific design recommendations are made to practitioners looking to apply stated preference methods to simulated exchange values:

Payment vehicle split sample test. Stated preference studies that have conducted split sample tests of different payment vehicles should be preferred where available (e.g. Campos et al. 2007Oviedo et al. 2016). Studies can code for institutional contextual explanations of protests. Exchange values can then be simulated for alternative demand curves reflecting any differences in the proportion of protest rates (coded as omitted or zero responses) due to different rights assumptions, as well as any differences in marginal utility due, for example, to differences in perceived transaction costs of payment vehicles.

Threshold for protest responses. Since protest responses are by convention often deleted from the valuation models, some minimum standard of representation of the population in generalising values is needed. A maximum share of protest responses to the payment vehicle is needed. There are currently no guidelines in SP for welfare analysis. Protest rates in CV studies are often around 10% (pers. comm., S. Navrud). Follow-up questions to protests may help to identify and reduce the 'true' protest rate (Morrison et al. 2000). An option to recode protest responses as zero WTP or as the mean or median of the sample, obscures the question of transferability between institutional contexts.

Aggregation across institutional design contexts. An alternative to screening out a study with high protest rates is to use a combined model of different payment vehicles (e.g. entrance fee and increased travel expenses) as a basis for estimating a demand function (Oviedo et al. 2016). This is an 'agnostic' approach which does not assume any particular feasible market institution for the ecosystem service. It accounts for the downward correction of WTP due to lacking institutional feasibility. However, it does not offer an approach per se to high protest rates due to changes in the status quo rights allocation. A drawback is also that this requires split sample testing of different institutional assumptions, which makes stated preference studies more expensive. Pre-testing different formats of payment vehicle and access rights allocation assumptions may avoid the need for testing for institutional assumptions in the SP survey itself.

Conclusions

The System of National Accounts is agnostic about market institutions, accepting as accounting compatible prices observed or simulated from any actual or feasible institution that identifies a voluntary transaction between two parties. Standardised 'one-size-fits-all' assumptions about rights regimes and market structures across ecosystems and land-uses may facilitate valuation for the national accounting purposes of a statistical agency, but may be deemed unreliable and/or unjust by local stakeholders for the purposes of ecosystem management. The variation in market institutional contexts in an ecosystem accounting area is potentially diverse between the two extremes of perfect and monopolistic competition. Non-market governance regimes increase this diversity and with it, the potential for bias when generalising exchange value estimates. Many public and common property rights regimes do have net revenue optimisation as a management objective. The institutional conditions for market prices and exchange values should, therefore, be subject to assessment before generalising accounting compatible exchange value methods. Using recreation services as an example, the paper uses a partial-equilibrium diagram to explore some other possible institutions that could also give rise to voluntary transactions with a variety of accounting compatible prices. The framework is a basis for discussing in more depth the issues with institutional design of stated preference valuation studies when used to simulate exchange values for the purposes of monetary ecosystem accounts.

Stated preference research has shown sensitivity of willingness-to-pay to the effects of different payment vehicle scenarios on demand for ecosystem services. Effects are significant where the simulated market changes the status quo allocation of access/use rights. Standard SP modelling excludes protest responses from welfare estimation. High protest responses may reflect lacking testing of the stated preference scenario. More specifically, high protest responses may relate to differences between the proposed and current local institutional context. If perceived property rights are different from a stated preference scenario and/or vary across the accounting area, it may be an indicator that willingness-to-pay data may not be generalisable to all parts of the ecosystem within the accounting area. Stated preference studies that assume a restriction of access or use

rights - such as a new entrance fee - relative to the status quo distribution of rights, have also shown significant lower WTP amongst users still willing to participate under the new regime. Protest rates for new entrance fees that suppose a change from open to exclusive access have shown high protest rates. Divergence in WTP for different payment vehicles have also been high. Disregard for the institutional context of valuation for accounting can, therefore, lead to:

1. errors of generalisation/aggregation and
2. downward 'bias' in simulated accounting prices (relative to the status quo institutional context).

The paper closes with some conventions that could screen for institutional feasibility and sensitivity of stated preference values before applying them to simulated exchange values for ecosystem accounting. Conventions include conducted split sample testing of alternative descriptions of the simulated market and payment vehicles, especially when there are large shifts in rights compared to the status quo. Further, some standard threshold for acceptable protest rates should be required for stated preference data used to simulate exchange values for accounting. Finally, practitioners should include the variation in the demand function due to institutional design in the simulation of exchange value, providing a range of SEV across alternative payments vehicles and institutional contexts.

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Conflicts of interest

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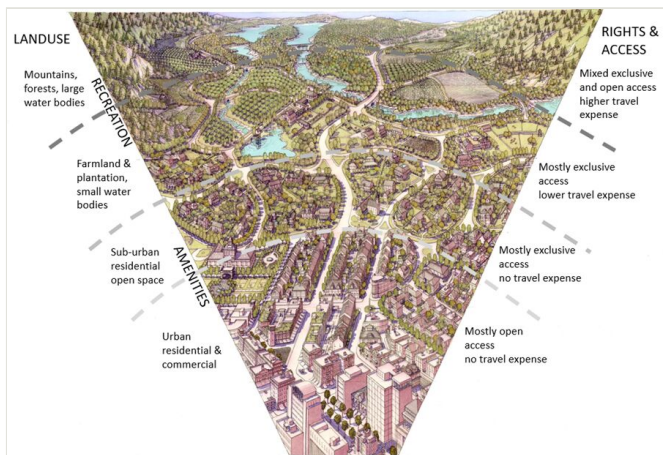


Figure 1.

Conceptual illustration of use rights and accessibility costs correlated across an urban-rural landuse gradient. Source: adapted from Duany Plater-Zyberk & Company <https://transect.org/>.

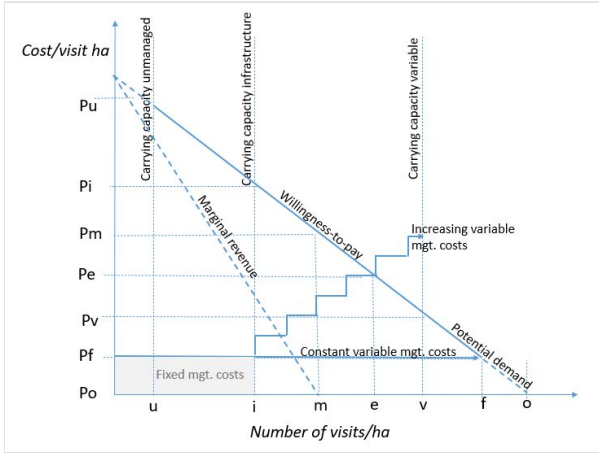


Figure 2.

Theoretical alternatives for a recreation service accounting price under different institutional assumptions. Source: adapted from Barton et al. (2019b).