



Comprehending the multiple ‘values’ of green infrastructure – Valuing nature-based solutions for urban water management from multiple perspectives



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ABSTRACT

The valuation of urban water management practices and associated nature-based solutions (NBS) is highly contested, and is becoming increasingly important to cities seeking to increase their resilience to climate change whilst at the same time facing budgetary pressures. Different conceptions of ‘values’ exist, each being accompanied by a set of potential measures ranging from calculative practices (closely linked to established market valuation techniques) – through to holistic assessments that seek to address wider concerns of sustainability. Each has the potential to offer important insights that often go well beyond questions of balancing the costs and benefits of the schemes concerned. However, the need to address – and go beyond – economic considerations presents policy-makers, practitioners and researchers with difficult methodological, ethical and practical challenges, especially when considered without the benefit of a broader theoretical framework or in the absence of well-established tools (as might apply within more traditional infrastructural planning contexts, such as the analysis of transport interventions). Drawing on empirical studies undertaken in Sheffield over a period of 10 years, and delivered in partnership with several other European cities and regions, we compare and examine different attempts to evaluate the benefits of urban greening options and future development scenarios. Comparing these different approaches to the valuation of nature-based solutions alongside other, more conventional forms of infrastructure – and indeed integrating both ‘green and grey’ interventions within a broader framework of infrastructures – throws up some surprising results and conclusions, as well as providing important sign-posts for future research in this rapidly emerging field.

1. Introduction

Why place a value on natural environments? The economic valuation of nature based solutions, and more broadly – valuation of the natural environment – is a subject receiving increased attention, in part prompted by the Millennium Ecosystems Assessment (UNEP, 2015). Kallis et al. (2013) describe limitations to the desirability of undertaking monetary valuations of ecosystem services. Monbiot (2014) goes further, calling ‘naïve’ the strategy to value nature by putting a price on it, and referring to the ‘Natural Capital’ agenda as being ineffective because it closes down discussion and does not challenge the premises, values and framing of neo-liberal perspectives of deregulation.

Kallis et al. (2013) describe certain criteria that a monetary valuation should meet, if it is to be helpful: (1) *Will it improve the environmental conditions at stake? (additionality); (2) Will it reduce inequalities*

and redistribute power? (equality); (3) Is it likely to suppress other languages of valuation and value-articulating institutions? (complexity blinding); and (4) Will it serve processes of enclosure of the commons? (accumulation by dispossession/ neo-liberalism).

A separate but related reason for considering whether and how to value green infrastructure is to improve the incisiveness, and hence the quality, of analyses. We can avoid wasted or unfocused effort by clarifying the rationale for undertaking particular types of study. Such reasoning can help investigators to select the most appropriate methods to answer the most relevant questions for the decision concerned. Barton (2015) helpfully categorises different reasons for undertaking economic analyses into ‘decision contexts’ of: (1) *awareness-raising; (2) accounting; (3) priority-setting; (4) design; and (5) calculation of economic liability.*

In this paper, we further consider the decision contexts for economic

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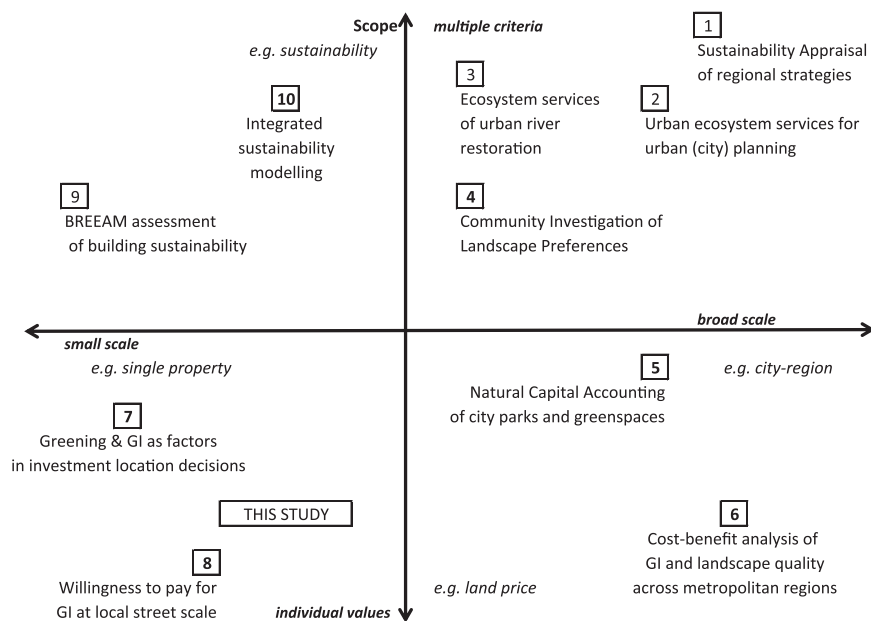


Fig. 1. Scope and scale of assessments of economic value, ecosystem services and sustainability.

Table 1
Evaluations of economic value, ecosystem services and sustainability at different scales.

No.	Assessment type and reference	Description, scale and scope
1	Sustainability Appraisal (ODPM, 2005)	Wide consideration of social, economic and environmental impact of regional plans (England).
2	Urban ecosystem services (Gómez-Baggethun and Barton, 2013)	Classification and valuation of ecosystem services at city scale to support urban planning.
3	Ecosystem services of urban river restoration (Everard and Moggridge (2012)	Evaluation of the ecosystem services at the neighbourhood level derived from the restoration of an urban stream in London, England.
4	Community investigation – landscape preference (Ruelle et al., 2013)	Comparative case study (mixed methods) surveying at the site-community levels in Walloon, Belgium as part of Sheffield-led Creating a Setting for Investment project.
5	Natural capital accounting – valuation of parks (Vivid Economics, 2016)	Value of Sheffield's Parks: application of natural capital accounting towards high-level evaluation of the economic contribution of green spaces at city-scale.
6	Cost-Benefit Analysis of landscape quality enhancements (Mielke, 2008)	Economic analysis of long-term impacts of green infrastructure investments on regeneration across city-regions in the Ruhr, North Rhine Westphalia, Germany.
7	Analysis of factors affecting investor decision-making (Roberts et al., 2012)	Impact of landscape quality and greening on property investment decisions at the site-setting scale (brownfield business parks) in South Yorkshire, England.
8	Contingent valuation & willingness to pay for greening (Mell et al., 2013, 2016)	Economic valuation undertaken in Manchester and Sheffield of urban green infrastructure investments at street-neighbourhood scales within the VALUE project.
9	BRE Environmental Assessment Method (BREEAM, undated)	Certification method for evaluating the environmental sustainability of buildings and projects (originally at the individual building level, from 1990 onwards)
10	Integrated Sustainability Appraisal Modelling (Kumar et al., 2012)	Sustainability assessment of social, economic and environmental impacts using Bayesian modelling of expert opinions and empirical data, at neighbourhood scale.

analyses of urban water management scenarios including the use of blue-green infrastructure options. We examine different reasons for undertaking valuations, drawing on empirical studies undertaken in Sheffield over a period of 10 years and delivered through a series of EU co-operation projects.

Valuation can be viewed as one of several different types of assessment tool within a framework. Here, we consider valuation techniques along a spectrum, covering both (a) the geographical scale of analyses (e.g. from the level of the individual property to the city-region scale); and (b) the scope of analyses – from individual metrics ('reductionist' measures) to broad assessments using multiple criteria. The latter may bring together a range of reductionist measures, or may attempt to undertake more 'holistic' assessments of, for example, sustainability. Such evaluations may address either the substance of decisions or the governance of decision-making processes.

In Fig. 1 and Table 1 the projects led by Sheffield and undertaken at different scales have been 'mapped' on to such a framework. These range from attempts to assess the broad sustainability of integrated interventions in urban river networks (covering social, economic and environmental impacts) through to narrower economic analyses. Fig. 1 places the studies alongside other references and a selection of well-

known methods for assessment for the purposes of comparison. Examples of research undertaken as a part of Sheffield-led projects – including work carried out elsewhere or undertaken overseas by partners, are shown in bold (numbers 4, 6, 7, 8 and 10).

It is usual for economic evaluations of natural environments to consider the total economic value of the subject, that is, to assess all relevant benefits and costs, including social and private benefits and costs. Often, this involves a combination of specific estimation and grossing up to produce a measure of some particular benefit or cost. A typical example is that of Mell et al. (2016) who estimate local residents' 'willingness to pay' (through higher rents, mortgages or taxes) for different types of green infrastructure investment. This is then applied to all nearby dwellings to produce a figure for the gross impact of the investment on neighbourhood property values.¹ Similarly - and also in Sheffield – Vivid Economics (2016) estimated the impact of the city's parks on residential property values in the city by applying (through the benefits transfer method) estimates of a 'green premium' (of 4% of

¹ Of between £100,000 and £250,000, depending on the quality and quantity of the green infrastructure (Mell et al., 2016, p. 266).

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