Ecological Economics 118 (2015) 168–176

Contents lists available at ScienceDirect

Ecological Economics

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

Revealing ecological processes or imposing social rationalities? The politics of bounding and measuring ecosystem services

Marc Tadaki [a,b,*], Will Allen [c], Jim Sinner [b]

[a] Department of Geography, University of British Columbia, 1984 West Mall, Vancouver V6T1Z2, British Columbia, Canada
[b] Cawthron Institute, Private Bag 2, Nelson, New Zealand
[c] Learning for Sustainability, P.O. Box 30108, Christchurch, New Zealand

ARTICLE INFO

Article history:
Received 29 November 2014
Received in revised form 29 May 2015
Accepted 15 July 2015
Available online 1 August 2015

Keywords:
Ecosystem services
Valuation
Deliberation
Participation
Social power
New Zealand

ABSTRACT

Ecosystem service (ES) frameworks have been developed to characterize and model the relationships between ecological processes and human benefits. Some argue that these relationships should be specified through expert-derived analytical (i.e., top-down) frameworks, in order to organize accumulated knowledge and create ready-made framings for communities on the ground. In contrast, arguments for the participatory construction of ES assessments emphasize the need for place-sensitive and deliberative (i.e., bottom-up) approaches. In this paper, we draw on a novel water planning exercise in New Zealand to examine the tensions that arise when expert-produced categories intersect with diverse stakeholder worldviews and aspirations. Expert-derived ES categories and analyses intervene in local valuation contexts in a range of ways, narrowing the scope of *which* ecological processes might be considered as relevant or legitimate (bounding), as well as affecting *how* these processes are described and compared (measuring). The practices of bounding and measuring ES in scientific and planning assessments should thus be conceptualized as involving political work and not just scientific judgment. This reframes the role of ecological science and scientists in ES debates, and this presents cautions as well as opportunities for future ES work relating to policy.

1. Introduction

The project of defining, measuring and modeling ecosystem services as “the provision of direct and indirect benefits to people from ecosystems” (Chan et al., 2012b) has attracted increasing governmental and scientific investment over the past two decades (Diaz et al., 2015; Millennium Ecosystem Assessment, 2005a; Sukhdev et al., 2014). Ecosystem services is both a concept and a framework through which to organize, derive knowledge about, and govern social–ecological processes (Braat and de Groot, 2012; Kareiva, 2011). What began as a metaphor to highlight social dependence on ecosystems has now become a major site of interdisciplinary knowledge production and a contested vehicle for policy application, in contexts ranging from community restoration projects to international conservation strategy (Ernstson and Sörlin, 2013; Norgaard, 2010; Ruckelshaus et al., 2015).

As the ecosystem services (henceforth ES) concept has gained purchase in academic and policy realms, some ES practitioners have begun to argue for the development of universal theoretical frameworks through which to make sense of (and meaningfully compare) insights from diverse applications (Crossman et al., 2013; Daily et al., 2009; Seppelt et al., 2012). Having logically coherent and consistent forms of ES accounting and classification is seen as a crucial part of accumulating and organizing knowledge about the biophysical and social production of ES (Boyd and Banzhaf, 2007; Wallace, 2007). ES in this context should be classified in ‘top-down’ fashion for their theoretical significance and analytical utility.

However, others argue that classifying ES and their interrelationships should be a place-based undertaking, and the categories of ‘services’ to be scientifically assessed should be developed with stakeholders in order to be useful in concrete and place-bound decision contexts, such as catchment and regional-scale planning (Fisher et al., 2009; Honey-Rosés and Pendleton, 2013; Potschin and Haines-Young, 2013). In this sense, ES should be classified ‘bottom-up’ in order to fit with local environments, social identities, and aspirations.

In this paper we explore how analytical ES categories came to intervene in and structure a local conversation about community values for freshwater. We illustrate how these categories can serve to differentially legitimate, stabilize, and marginalize particular views and values, and we highlight how mainstream practices of scientific measurement can effectively reproduce top-down power relationships, unless this is carefully guarded against. We contend that the scientific assessment of ES should not be conceptualized as an objective scientific practice concerned with simply ‘revealing ecological processes’, but rather we

* Corresponding author at: Department of Geography, University of British Columbia, 1984 West Mall, Vancouver V6T1Z2, British Columbia, Canada.
E-mail address: m.tadaki@gmail.com (M. Tadaki).
URL: http://learningforsustainability.net (W. Allen).

http://dx.doi.org/10.1016/j.ecolecon.2015.07.015
0921-8009/

might instead understand the work of ES assessments as imposing 'social rationalities' (defined in Section 3) through enacting particular values, categories and measurement strategies into positions of legitimacy and dominance.

In Section 2 we describe the analytical (top-down) and local (bottom-up) rationales for ES classification and how they relate to the perceived objectivity of ES analysts. In Section 3, we distil insights from critical nature–society scholarship to explore how categories of value and practices of measurement are infused with distributive and democratic implications. In Section 4 we outline our New Zealand case study, which provided a unique opportunity for dialog with local stakeholders about the relevance and utility of expert ES categories in planning frameworks. We discuss how 'bounding' and 'measuring' ES came to emerge as sites of political contestation through this process (Section 5). We reflect in particular on the role of scientific categorization, measurement and analysis in supporting certain arguments within conflict-ridden contexts of environmental management. Section 6 concludes by arguing that the bounding and measurement of ES are political exercises and not merely about 'revealing ecological processes'. Instead, thinking about ES assessments as *imposing social rationalities* provides cause to reflect on what kinds of decision making logics and cultural worldviews are being reproduced through ES analyses. This opens space to consider how ES analysis might contribute constructively toward enabling diverse forms of participation and representation in environmental decision making.

2. Analytical and Contextual Motivations for Specifying ES

A fundamental task for any ES application is the selection of specific ecosystem 'services' for analysis. Which ecological processes are relevant for an ES assessment, and which human subjects are these assessments meaningful to? Which ecosystem characteristics should be measured, compared, and modeled, and how? There are many motivations guiding the selection of particular ES for scientific analysis. Here we distinguish between 'top-down' motivations that argue for ES specification based on analytical utility, and 'bottom-up' motivations that emphasize local biophysical and social contexts of ES, as well as the need for local voices to contribute to local decision making.

2.1. Top-Down, Analytical Motivations

Given a specific set of ecological variables and processes (inputs), a major task of ES analysis has been to translate these inputs into measurable *services* (outputs) of human value (Daily et al., 2009; Kareiva, 2011). According to this logic, ES are produced by the functions of ecological processes, which means that the correct scientific specification of these functions is crucial (Barbier et al., 2008; Kremen and Ostfeld, 2005; Tilman et al., 2012). By then measuring and/or modeling ecological variables and processes across space, an ES production function can quantify the ES provided by a landscape or ecosystem (Nelson et al., 2009), which can then be used to support environmental management.

An important point is that no ES analysis can proceed without a specification of what constitutes a 'service' of human value. Once a service is specified, it can be measured and modeled by analysts. But where do our categories of 'services' come from?

A significant literature in ES theory has debated what should constitute the properties of a 'service'. The Millennium Ecosystem Assessment (2005b) proposed a typology that distinguishes provisioning services (which generate products used directly by humans), regulating services (indirect benefits of ecological processes, such as the purification of water by wetlands), cultural services (nonmaterial benefits such esthetics, sense of place) and supporting services (functionality necessary for all other ES, such as nutrient cycling). While this was merely a tentative typology, the framework has inspired and influenced further ES work, for better or worse (Wallace, 2007). One of the most significant implications of the Millennium Ecosystem Assessment (MA) framework has been an ongoing concern with overlapping service categories. Boyd and Banzhaf (2007) have argued that the MA typology sets the stage for 'double counting', where supporting services may be 'counted' both individually as well as being embodied through provisioning or cultural services, when they should only be counted once. In this line of argument, a coherent and universal framework for the specification of services should be used in order to produce set of service categories that are logically related to each other and which do not overlap (see also Wallace, 2007).

Top-down arguments are also associated with the idea that scientific knowledge needs to underpin ES assessment, even if the results of such assessments are at odds with local public perceptions of ES. For example, Costanza et al. (2014) argue that:

> … estimating the storm protection value of coastal wetlands requires information on historical damage, storm tracks and probability, wetland area and location, built infrastructure location, population distribution, etc. …. It would be unrealistic to think that the general public understands this complex connection, so one must bring in much additional information not connected with perceptions to arrive at an estimate of the value. Of course, there is ultimately the link to built infrastructure, which people perceive as a benefit and value, but the link is complex and not dependent on the general public's understanding of or perception of the link (p153).

In this way, scientific analyses have an important contribution to make in connecting otherwise invisible biophysical processes to valued human outcomes.

In addition to these analytical *motivations* for ES classification, there are also a range of actual *classifications* being developed and circulated. de Groot et al. (2002), for example, advanced an alternative typology to the MA, suggesting distinctions between regulatory functions, habitat functions and information functions. Wallace (2007) argues for an ES classification based on a hierarchy of human needs (e.g., hunger, shelter, love) rather than being related to the biophysical aspects of the services themselves. Others have sought to develop the MA classification, both widening its scope to include more services (Vallés-Planells et al., 2014) as well as refining categories to reflect specific types of landscapes, such as urban environments (Gómez-Baggethun and Barton, 2013).

These trajectories in the ES literature provide a top-down mode of determining what constitutes a 'service' in ES assessments. We refer to these types of ES assessment as top-down because they are sourced from beyond the site (and perhaps outside the logics and practicalities) of their geographical and social contexts (see also Norton and Hannon, 1997: 242). The selection and specification of ES for analysis are often conducted based on what has been used in the literature or other a priori rationales; these choices are made by external experts.

2.2. Bottom-up, Contextual Motivations

In contrast to top-down analytical forms of ES specification, others have argued for ES assessments to embrace local and participatory elements in their design and application. This is for at least three reasons. First, biophysical environments and socio-ecological relations are heterogeneous across space. Attempts to quantify ES in a top-down fashion can mis-specify (and perhaps embed with some permanence) presumed relationships between local communities and the ecosystems in question (Daw et al., 2011; Menzel and Teng, 2010; Tadaki and Sinner, 2014). The idea that scientific assessments can determine which ecological processes are the most relevant in a given place a priori cannot be assumed (Potschin and Haines-Young, 2013).

Second, in order to be useful in grounded decision contexts, ES specification needs to be relevant to local problems and prospective governance mechanisms (Chan et al., 2012a). This requires more than