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Progress made in managing and valuing ecosystem services: a horizon scan of gaps in research, management and governance

Ross T. Shackleton[a,*], Per Angelstam[b], Benjamin van der Waal[c], Marine Elbakidze[b]

[a] Centre for Invasion Biology, Department of Botany and Zoology, Stellenbosch University, Matieland 7602, South Africa
[b] Swedish University of Agricultural Sciences, School for Forest Management, Forest-Landscape-Society Research Network, PO Box 43, SE-73921 Skinnskatteberg, Sweden
[c] Geography Department, Rhodes University, Grahamstown 6140, South Africa

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ABSTRACT

Sustaining functional ecosystems that provide services for human well-being is a global challenge. This makes valuing ecosystem services and managing them important to ensure benefits to the environment and livelihoods. Strides have been made in research and knowledge development, policy formulation and the implementation of natural resource management (NRM) programs and investment into ecological (green) infrastructure globally. However, further funding is needed for such programs to be scaled up and adapted to local contexts. Horizon scanning is a useful approach to identify future trajectories, and to guide research, policy formulation and management implementation, as well as to identify gaps. Past achievements, gaps and future needs in relation to "optimising and unlocking investment in ecological infrastructure and valuing ecosystem services" were identified through a free listing questionnaire and a group workshopping exercise by 44 participants involved in an international workshop. The 10 key needs raised were all closely interlinked and fall under the overarching themes of research and assessment, policy formation and implementation, strategic planning as well as management and governance of the policy/adaptive management cycle. We discuss the need to overcome these gaps in the context of South Africa and in relation to other countries globally.

1. Introduction

Globally, ecosystem services have been recognised as a way to communicate the importance of maintaining natural capital as a base for human well-being (Norgaard, 2010; Lele et al., 2013). Hence, conservation programs, management initiatives and landscape restoration at multiple spatial scales is important to ensure improved supply and sustainable use of these services (Costanza et al., 1997; Higgins et al., 1997; UN, 2010; Sabogal et al., 2015). To ensure the sustainable supply of ecosystem services, functional ecological (SANBI, 2014) or green (European Commission, 2013a) infrastructure is needed. These terms refer to naturally functioning ecosystems and cultural landscapes that deliver valuable services to people (WWF and AfDB, 2012; Aronson and Alexander, 2013; Garrido et al., 2017). Ecosystems and cultural landscapes are being degraded and threatened, thus investments into functional ecological (green) infrastructure is needed to maintain biodiversity and to sustain the provision of ecosystem services, important for poverty alleviation and development (de Groot et al., 2013; SANBI, 2014). This is in line with global policies such as the Aichi targets (CBD, 2010) and the UN Sustainable Development Goals. Maintenance of functional ecological infrastructure needs to be integrated into the spatial planning and expenditure of a range of government departments along with other stakeholders, such as the private sector, and requires national and transnational planning to make it work (SANBI, 2014; Angelstam et al., this issue). For example, South Africa has made several investments to sustain ecological infrastructure also termed natural resource management (NRM) to aid poverty relief and improve the supply of ecosystem services. This includes programs such as Working for Water (WfW) (van Wilgen and Wannenburgh, 2016) and the introduction of systematic conservation planning (Pressey et al., 2003) run at a large national scale. Despite this, key gaps in knowledge and inadequate implementation act as barriers to effective NRM in South Africa (Shackleton et al., 2016; Angelstam et al. this issue). Similarly, the Weeds of National Significance (WoNS) program in Australia aims to systemically manage invasive species to reduce their negative impacts on biodiversity, ecosystem services, and human well-being and shows mixed success (Raphael et al., 2010). In accordance with international

* Corresponding author.
E-mail addresses: rtshackleton@gmail.com (R.T. Shackleton), per.angelstam@slu.se (P. Angelstam), bvdwaal@gmail.com (B. van der Waal), marine.elbakidze@slu.se (M. Elbakidze).

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and EU policies and directives a key target of the national environmental policy in Sweden is to maintain functionality of ecosystems in the long term (SOU, 2013). To guide environmental legislation and spatial planning Sweden has recently established 16 environmental quality objectives. The aim is to restore and maintain functional landscapes for conservation, use, and to secure the long-term delivery of ecosystem services, as facilitated by functional green infrastructure (Jaeger et al., 2011; SOU, 2013), however, this is a considerable task and may face many barriers. Furthermore, local scale community based natural resource management (CBNRM) programs exist globally and have shown many successes and failures (Dressler et al., 2010).

Vast strides have been made towards recognising the importance of conserving ecosystem services and implementing NRM, however, globally many attempts to do so are fraught with issues (e.g., Angelstam et al., 2011a, Halme et al., 2013). Therefore, this study aims to (1) identify and review past achievements, and (2) to identify, gaps and future needs in research, management and governance to improve the efficiency in sustaining the supply of ecosystem services. We apply the horizon scanning method to review the achievements in NRM and valuing ecosystem services during the past two decades, and present results on stakeholders' perceived future needs (Sutherland et al. 2010). We discuss these achievements and needs, drawing in particular from the South African context, but also using global case studies to show similarities and differences internationally. South Africa represents many African countries with extremely rich biodiversity that are at risk, boasting at least three global biodiversity hotspots (Myers et al., 2000). These are as are under threat from many global direct and indirect drivers (Richardson et al., 1999; Wynberg, 2002). Additionally, South Africa is a developing nation, and many communities are still heavily reliant on ecosystem services for their livelihoods which is also common elsewhere in the world (Le Maitre et al., 2000; Shackleton et al., 2007). Ecosystem services also play an important role in sustaining regional and national economies, both in South Africa and globally (Blignaut et al., 2008; Reyers et al., 2015). As in other countries, maintenance and investment into ecological infrastructure and ecosystem services is crucial in South Africa (Meredith, 2005); and there is a need to introduce and improve sustainability science research (Kates, 2011) and management as well as their connection with policy and governance (e.g., King and Thomas, 2007; Sutherland et al., 2010; Shackleton et al., 2011; Bengston, 2013). Looking forward is of particular importance in the rapidly changing world that we live in, and in the context of the high pressures the environment is facing today from many different direct and indirect drivers (Sutherland et al., 2010; Rockström et al., 2009; Bengston, 2013).

2. Horizon scanning as a research process

Horizon scanning for the future is the formal process of gathering, processing and disseminating information to support decision making in the future (Sutherland et al., 2010; Charest, 2012). Various methods exist to conduct horizon scans. All comprise of either questionnaires and workshops or a combination conducted in various forms and some have also used trees, literature searches, trend analysis and scenario planning (Sutherland and Woodroof, 2009; Sutherland et al., 2010; Bengston, 2013). The horizon scanning process used included two phases, a questionnaire and an open forum workshop with international experts, to identity future issues/needs. Futher, literature was consulted to supplement findings and to draw comparisons between South Africa and other countries (Sutherland and Woodroof, 2009; Bengston, 2013).

2.1. Questionnaire

An Ecosystem Services Partnership Atelier workshop that was held at Shelly Point - St Helena Bay, South Africa from the 15th to the 19th of November 2015 was used to build the case for further investment and optimization of NRM and valuing ecosystem services. The theme focused on "optimising and unlocking investment in ecological infrastructure and valuing ecosystem services in South Africa". This workshop involved 44 international participants from a range of countries and backgrounds, and represented government policy makers and managers (21), researchers from a variety of natural and social science disciplines (20) and representatives from the media (4), private sector (4) and various NGO's (6) with some participants straddling more than one discipline. At the meeting a questionnaire was distributed, which focused on (1) past achievements and (2) future needs. It was answered by 34 (out of 44) participants.

2.2. Open forum workshop

The participatory workshop was used for definition and revision of key sub-themes which arose from the questionnaire responses (Farley et al., 2009). Key themes emerging from the questionnaire data were grouped and then workshopped by all participants on the last day of the meeting. A lot of focus was placed on South Africa in particular, however, all of the issues raised were globally relevant and were widely discussed by international and South African participants drawing from examples and knowledge internationally. We summarised the past achievements into five main themes, and we present and discuss the five past successes and the 10 most commonly raised issues/needs relating to investing in and implanting NRM as well as valuing ecosystem services. Both the past achievements and future needs were supplemented by a review of literature. Additionally, informant interviews were made with the workshop organisers and facilitators to acquire information and input.

3. Results

3.1. Past achievements

Strides have been made in the last two decades on understanding global environmental issues (e.g., Ostrom, 2009; Rockström et al., 2009, Kumar, 2010), including understanding the value and role of ecosystem services and how to manage and restore them (Costanza et al., 1997; Millennium Ecosystem Assessment, 2005). In addition there has been a substantial rise in the number of national NRM projects being implemented (e.g. WoNS in Australia (Thorp and Lynch, 2000)) and many projects globally (Dressler et al., 2010), and South Africa boasts the internationally acclaimed Working for Water project (van Wilgen and Wannenburgh, 2016). Here we present five past successes that were highlighted in relation to "optimising and unlocking investment in ecological infrastructure and valuing ecosystem services" drawing on South African and global perspectives.

3.1.1. Increase in the research base and understanding

Globally, more than 2000 papers are published annually relating to ecosystem services. The participants discussed that the increased volume of research over the past two decades has drastically improved our understanding of ecosystem services globally. It has also led to improvements in scientific techniques and tools relating to ecosystem service research, valuation and management. Some important strides that have been made internationally include identifying the value of ecosystem services and their importance for human well-being (Costanza et al., 1997; Millennium Ecosystem Assessment, 2005). In particular large steps have been made in the theory of how to value ecosystem services using different techniques such as GIS based methods, system dynamic modelling, and survey based economic valuation approaches such as willingness to pay and direct use valuation (Boyer and Polansky, 2004; Hein et al., 2006; Tietenberg and Lewis, 2010; Vo et al., 2012). Many respondents mentioned that on a global level we are also learning about the role ecosystem services