Ecosystem Services xxx (2018) xxx–xxx

Contents lists available at ScienceDirect

Ecosystem Services

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

Most finance to halt desertification also benefits multiple ecosystem services: A key to unlock investments in Land Degradation Neutrality?

Simone Quatrini [a,b,c,*], Neville D. Crossman [d]

[a] Department of Environmental Systems Science, Swiss Federal Institute of Technology (ETH), Universitätstrasse 2, 8092 Zurich, Switzerland
[b] URPP Global Change and Biodiversity, University of Zurich, Winterthurerstrasse 190, 8057 Zurich, Switzerland
[c] United Nations Convention to Combat Desertification (UNCCD), P.O. Box 260129, 53153 Bonn, Germany
[d] School of Biological Sciences, University of Adelaide, North Terrace, Adelaide, Australia

ARTICLE INFO

Article history:
Received 20 July 2017
Received in revised form 25 March 2018
Accepted 7 April 2018
Available online xxxx

Keywords:
Ecosystem services
Synergies
SDGs
Drylands
Land Degradation Neutrality
LDN fund

ABSTRACT

Quantifying the demand for multiple ecosystem services is difficult because it is subjective and heterogeneous. Using land degradation as a case study, this paper explores land restoration finance as a proxy for global ecosystem service demand. Land degradation has been high on the UN agenda since the 1992 Rio Summit, together with climate change and biodiversity. The supply of many ecosystem services is declining due to land degradation and desertification, particularly in drylands. The inclusion of a Land Degradation Neutrality (LDN) target in the United Nations (UN) 2030 Agenda for Sustainable Development reaffirmed the commitment by the international community to tackle this global environmental challenge. If this vision adequately reflects society's values, as expressed through demand for ecosystem services, we should see land restoration finance targeting areas where potential ecosystem service supply could be enhanced the most. To test this hypothesis, we used spatial analysis of key ecosystem services, as well as comparative analysis of synergistic values and other indicators of financial resources committed between 2008 and 2013 to address land degradation. These activities can generate multiple benefits for many ecosystem functions and services. Official activity-level environmental ratings – called Rio Markers – were used to identify those activities that were intended to produce multiple ecosystem services benefits in terms of land restoration, biodiversity protection and climate change mitigation. Our analysis concludes that many land restoration activities are synergistic and reveals other important aspects: (i) developing countries report, on average, higher synergistic values than developed countries and development finance organizations; (ii) donor countries report more conservatively than recipient countries; (iii) multi-purpose synergistic projects attract more funders than single-purpose ones. In some cases countries with high ecosystem service supply receive higher investment, but this finding is not strong, indicating that investment could be more strategically targeted. These findings suggest, in particular, that the synergistic features of multi-purpose land restoration activities could be harnessed to enhance investment effectiveness and impact. This, in turn, would make LDN finance more prominent in development aid portfolios and in public/private sustainable investment strategies.

1. Introduction

Quantifying the demand for multiple ecosystem services is difficult because of the many motivations that underlie individual human decisions and choices. This difficulty is amplified at global scales by the heterogeneity of socio-ecological systems (Liu et al., 2007). An alternative is to identify proxies for ecosystem service demand that reflect society's values and its demand for ecosystem services. For example, water footprints offer a relatively simple proxy for the demand of a single ecosystem service, and the footprint can be traced at global scale to estimate flow for meeting demand (Ayanu et al., 2012). But there are many other ecosystem services not considered in footprint analysis (Galli et al., 2012), which calls for other ways to measure global ecosystem services demand. In this paper we explore the spatial and temporal flow of investment in restoring degraded ecosystems as a potential indicator (or proxy) of the demand for a wide set of ecosystem services. For this purpose, we focus on land degradation as a case study.

* Corresponding author at: Department of Environmental Systems Science, Swiss Federal Institute of Technology (ETH), Universitätstrasse 16, 8092 Zurich, Switzerland.
E-mail address: qsimone@student.ethz.ch (S. Quatrini).

https://doi.org/10.1016/j.ecoser.2018.04.003
2212-0416/

Land degradation is an undesirable change or disturbance to land largely caused by human activities. Under severe climatic conditions, such as in drylands, it may lead to irreversible land productivity losses and desertification (Geist and Lambin, 2004). Desertification is defined as land degradation in arid, semi-arid and dry sub-humid areas resulting from various factors, including climatic variations and human activities (United Nations, 1994). Many ecosystem services are disappearing as a consequence of land degradation and desertification, especially in drylands (Agardy, 2005). It is estimated that two thirds of the world's drylands are moderately to severely degraded, with 12 million hectares of degraded land added each year (Hori et al., 2012) to a 'stock' of 2 billion hectares of land already degraded worldwide (Lal, 1990). The annual cost of land degradation is estimated between USD 300 billion (Nkonya et al., 2016) and USD 490 billion (UNCCD Secretariat, 2013).

Land degradation has substantial impacts on many ecosystem services, particularly food production, water, soil and air quality regulation processes, soil formation, climate regulation, habitat as well as important spiritual and amenity cultural services (ELD, 2015). For these reasons, halting and reversing land degradation has been high on the UN agenda since the 1992 Rio Summit, which laid the foundations for the three Rio Conventions of the United Nations: Convention on Biological Diversity (CBD), Convention to Combat Desertification (UNCCD), and the United Nations Framework Convention on Climate Change (UNFCCC). Many regional, national and local programs are now in place to avoid land degradation and restore degraded land and soil. Standard ISO 14055-1:2017 (International Standard Organization, 2017) has been developed to provide definitions and guidelines for the identification of activities relevant for combatting land degradation and desertification. Since the 1970s, there has been considerable increase in global investment into land degradation prevention and rehabilitation, to the point where an estimated amount of USD 70 billion is invested annually to halt desertification and improve the resilience of affected ecosystems (UNCCD, 2015). While much of the investment has come from the public sector, a growing proportion is coming from the private sector. Despite the large efforts deployed over the past 25 years, the environmental challenges addressed by the three Rio Conventions continue (Tollefson and Gilbert, 2012; Chasek et al., 2015).

In September 2015 the UN General Assembly adopted the Sustainable Development Goals (SDGs) that set ambitious targets on how to manage, transform and protect landscapes globally to the year 2030 (UN General Assembly, 2015b). Coherent national and international action on the SDGs should see increased landscape resilience within the prevailing climate change scenarios and limitations imposed by planetary boundaries (Brandi, 2015; Häyhä et al., 2016).

A main challenge will be to secure access to food, water and other commodities to an ever increasing global population (FAO, 2016). This is likely to generate a growing pressure on finite natural resources, and intensify competition on available water and land (Smith, 2013; FAO, 2016).

Within SDG 15 entitled *Life on land*, the international community specifically committed to 'combat desertification, restore degraded land and soil, including land affected by desertification, drought and floods, and strive to achieve a land degradation-neutral world' (SDG target 15.3) (United Nations, 2015). Recognizing that means for implementation of this target must originate from both the public and private sector, in October 2015 the UNCCD Global Mechanism was given the mandate to explore new funding options, including the creation of an independent Land Degradation Neutrality Fund to support LDN initiatives with blended public and private capital (UNCCD, 2016a).

The flow of finance for tackling land degradation and working towards LDN should reflect the aspirations of the international community by focussing on areas where there is a higher concentration of multiple ecosystem services supply as an efficient way to meet multiple ecosystem service demand. To test this hypothesis, we analysed trends and patterns in resources committed between 2008 and 2013 by 197 countries and intergovernmental organizations to address land degradation. These activities can generate multiple benefits for many ecosystem functions and services. But they can also cause trade-offs if poorly designed. For example, agricultural extension services to facilitate access by farmers to fertilizers and other inputs could generate benefits in terms of land productivity, but could also produce negative effects on local biodiversity. Activity-level environmental ratings officially assigned by project originators and beneficiaries – called Rio Markers – were used to determine whether activities were intended to produce land restoration, biodiversity and climate change co-benefits, as a proxy of multiple ecosystem services demand. For the purpose of this paper, we use the terms land restoration finance and desertification-related finance as synonyms referring to all types of funding for activities relevant for combatting land degradation and desertification. We addressed the following specific questions:

- Does land restoration finance target areas of high ecosystem services supply?
- How synergistic are activities funded by land restoration finance?
- Are donors and recipients of land restoration finance perceiving these synergies in the same way?
- Are synergistic or multi-purpose activities attractive to multiple funders?

2. Methods

2.1. Overview of Rio Markers

Since the Rio Conventions entered into force (CBD: 29th December 1993, UNFCCC: 21st March 1994, UNCCD: 26th December 1996), several reporting exercises have used Rio Markers (project level indicators) to monitor the number and volume of financial commitments to implementing the Conventions (Xiang and Meehan, 2005). Reporting entities assign a Rio Marker score to each project or activity that reflects its relative contribution to the objectives of each Rio Convention (OECD, 2016). Rio Markers can be used to identify co-benefits or synergies in the implementation of the three Conventions. Capturing project level synergies is important because they indicate whether investments have positive outcomes for multiple stakeholders and/or contribute to multiple environment and development goals (Grubb, 1993; Grainger et al., 2000; Swiderska, 2002; UNCCD Secretariat, 2015). Alternatively, projects that target the objectives of one Rio Convention may have negative trade-offs across the other Rio Conventions (Cowie et al., 2007). Detecting all potential positive and negative outcomes is critical during design and implementation of integrated landscape approaches that aim to minimise trade-offs and maximise synergies (Stringer et al., 2009; Cóndor et al., 2011; Bryan and Crossman, 2013; Sayer et al., 2013), and crucial for the mobilization of SDG finance (Schmidt-Traub and Shah, 2015).

Rio Markers provide insight into donor priorities (OECD, 2015) and reflect the importance assigned to a variety of ecosystem services associated with the objectives of the three Rio Conventions (Hammond and World Resources Institute, 1995; Bosch, 2011; OECD, 2016). Thirty-seven donor countries and 30 multilateral organizations regularly submit Rio Marker data to the OECD to monitor external development finance that targets environmental

Please cite this article in press as: Quatrini, S., Crossman, N.D. Most finance to halt desertification also benefits multiple ecosystem services: A key to unlock investments in Land Degradation Neutrality? Ecosystem Services (2018), https://doi.org/10.1016/j.ecoser.2018.04.003