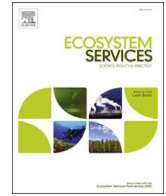




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Distilling the role of ecosystem services in the Sustainable Development Goals



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ABSTRACT

Achieving well-being for all, while protecting the environment, is one of the most pressing global challenges of our time, and a central idea in the UN Sustainable Development Goals (SDGs). We believe that integrating ecosystem services, the benefits nature provides to people, into strategies for meeting the SDGs can help achieve this. Many development goals are likely underpinned by the delivery of one or more ecosystem services. Understanding how these services could support multiple development targets will be essential for planning synergistic and cost-effective interventions. Here we present the results of an expert survey on the contributions of 16 ecosystem services to achieving SDG targets linked to environment and human well-being, and review the capacity of modelling tools to evaluate SDG-relevant ecosystem services interactions. Survey respondents judged that individual ecosystem services could make important contributions to achieving 41 targets across 12 SDGs. The provision of food and water, habitat & biodiversity maintenance, and carbon storage & sequestration were perceived to each make contributions to >14 SDG targets, suggesting cross-target interactions are likely, and may present opportunities for synergistic outcomes across multiple SDGs. Existing modelling tools are well-aligned to support SDG-relevant ecosystem service planning. Together, this work identifies entry points and tools to further analyze the role of ecosystem services to support the SDGs.

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1. Introduction

With the formal adoption of the UN Sustainable Development Goals (SDGs) and their launch in 2016, governments globally are tasked with developing pathways to achieve nationally prioritized targets that incorporate social, economic and environmental dimensions of sustainability, moving beyond sectoral approaches of the past. Building on progress made under the UN Millennium Development Goals (UN, 2015a), the SDGs are a globally agreed upon set of 17 goals, 169 nested targets, and over 200 associated

indicators that set the agenda for addressing sustainable development challenges by 2030. Yet, practical strategies for achieving these aims in unison, particularly how ecosystems can be both protected and managed to support human well-being objectives, are not specified and present important and urgent research questions.

The wide range of themes incorporated into the SDGs, from poverty and hunger alleviation to sustainable cities, economies, and ecosystems (see Table 1) point to their ambition to improve the lives of the world's poorest and most marginalized communities through a multi-sectoral approach. Embedded in the goals is an aim to rebuild and strengthen the integrity and function of ecosystems to secure the benefits they provide to both current and future generations (UN, 2015b; UN Secretary-General, 2014). In order for the SDGs to be achieved, national strategies must be built on sound science and engagement of local stakeholders (Griggs et al., 2014; LPFN, 2015; Mbow et al., 2014), and they must be sensitive to inherent interactions across goals and targets (ICSU ISSC, 2015; Nilsson et al., 2016).

Biodiversity, ecosystems and the services they provide underpin all dimensions of human, societal, cultural and economic well-being (Folke et al., 2016; MEA, 2005; Naeem et al., 2012). However, much of human economic and social development has come through the unsustainable exploitation of ecosystems (MEA, 2005; Raudsepp-Hearne et al., 2010a), with society approaching or already surpassing a number of planetary boundaries (Steffen et al., 2015). Despite intensive use of many ecosystems and substantial improvements in many aspects of development over the past century (UNDP, 2015), human well-being has yet to reach a minimum acceptable level for all people worldwide (Raworth, 2012). An estimated 795 million people remain undernourished (FAO, 2015), and access to education, health, employment and wealth is distributed highly unevenly across societies (UNDP, 2015; World Economic Forum, 2016). To realize the ambitions embodied in the SDGs, it will be essential to manage ecosystems to protect nature and the sustainable supply of, as well as equitable access to, the benefits and services they provide (DeClerck et al., 2016). Such efforts should increasingly be informed by regional, global and thematic assessment work that is currently being

undertaken by the Intergovernmental Panel on Biodiversity and Ecosystem Services (IPBES), amongst others.

Numerous articles have highlighted the importance of integrating environmental science into decision-making processes for the SDGs (ICSU ISSC, 2015; Norström et al., 2014; Rockström and Falkenmark, 2015; Stafford-Smith, 2014; Wood and DeClerck, 2015) and for understanding interactions between distinct sustainability targets (ICSU ISSC, 2015; Nilsson et al., 2016). According to a review of the targets and goals by the International Council for Science (ICSU ISSC, 2015), all SDG goals benefit to some degree from ecosystem protection, restoration and sustainable use. Sound ecological management is required not just to constrain the environmental costs of meeting development these goals, but also to enhance and sustain flows of ecosystem services to humanity. Achievement of higher order social and economic goals is dependent on a healthy biosphere (Folke et al., 2016).

For policy makers to embrace a development approach where the environment (i.e. natural capital) is managed to achieve multiple objectives, there must be a sound understanding of how the services provided by nature can contribute to individual or multiple SDG targets. It will be important for landscape managers implementing policy directives to know how these services are produced and affected by human activities across their landscapes to effectively manage for them. Over the past two decades, significant progress has been made to identify ways in which ecosystems benefit people and on the feedbacks between management actions and their impacts on single and bundles of ecosystem services (Díaz et al., 2015; Maes et al., 2012; Raudsepp-Hearne et al., 2010b; Renard et al., 2015). Synthesizing this knowledge in the context of the SDGs, at this early point in their uptake, will help define a path forward on how best make use of the current knowledge of ecosystem services to achieve targets under the UN directive for a holistic approach (UN, 2015b), as well as to identify opportunities for cross-sectoral collaborations for addressing interrelated SDGs.

Similarly, rapid progress has been made over the past decade on evaluating and integrating ecosystem services into landscape planning with the emergence of modelling tools and high-resolution spatial datasets. Ecosystem service models provide important tools

Table 1

Sustainable Development Goals and the selected targets evaluated in the expert survey (see details on targets in SM1).

SDG	Title	Goal	Evaluated Targets
SDG1	No Poverty	End poverty in all its forms everywhere	1.1, 1.2, 1.5
SDG2	Zero Hunger	End hunger, achieve food security and improved nutrition and promote sustainable agriculture	2.1, 2.2, 2.3, 2.4, 2.5
SDG3	Good Health & Well-Being	Ensure healthy lives and promote well-being for all at all ages	3.3, 3.4, 3.9
SDG4	Quality Education	Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all	
SDG5	Gender Equity	Achieve gender equality and empower all women and girls	
SDG6	Clean Water & Sanitation	Ensure availability and sustainable management of water and sanitation for all	6.1, 6.3, 6.4, 6.6
SDG7	Affordable & Clean Energy	Ensure access to affordable, reliable, sustainable and modern energy for all	7.1, 7.2
SDG8	Decent Work & Economic Growth	Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all	8.2, 8.4, 8.9
SDG9	Industry, Innovation & Infrastructure	Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation	9.1, 9.4
SDG10	Reduced Inequality	Reduce inequality within and among countries	
SDG11	Sustainable Cities & Communities	Make cities and human settlements inclusive, safe, resilient and sustainable	11.5, 11.6, 11.7, 11.a, 11.c
SDG12	Responsible Production & Consumption	Ensure sustainable consumption and production patterns	12.2, 12.3, 12.4, 12.5
SDG13	Climate Action	Take urgent action to combat climate change and its impacts	13.1
SDG14	Life Below Water	Conserve and sustainably use the oceans, seas and marine resources for sustainable development	14.1, 14.2, 14.3, 14.14, 14.5, 14.7
SDG15	Life on Land	Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss	15.1, 15.2, 15.3, 15.4, 15.5, 15.8
SDG16	Peace, Justice & Strong Institutions	Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels	
SDG17	Partnerships for the Goals	Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development	

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