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Understanding the economic value of water ecosystem services from tropical forests: A systematic review for South and Central America



Elena Ojea^{a,b,*}, Julia Martin-Ortega^c

^a Basque Centre for Climate Change (BC3), Alameda Urquijo 4, 4-1, 48008 Bilbao, Spain

^b Bren School for Environmental Science and Management, UCSB, Santa Barbara, CA 93106, USA

^c Social, Economic and Geographical Sciences Group, The James Hutton Institute, Craigiebuckler, Aberdeen AB15 8QH, United Kingdom

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ABSTRACT

There is a well-established body of literature on monetary valuation of water ecosystem services to support the case for sustaining tropical forests. However, this literature is heterogeneous in its purposes and approaches and has not been carefully compared, providing a fragmented view of the values of forest water services. This paper addresses this knowledge gap through an orderly review and a regression meta-analysis of existing valuation studies at the regional level in South and Central America. This analysis allows identifying some factors that systematically influence forest values. However, it also reveals a lack of a systematized approach to valuation and a lack of sufficiently coherent evidence. This represents a barrier for the incorporation of the values of water ecosystem services into decision-making.

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* Corresponding author at: Basque Centre for Climate Change (BC3), Alameda Urquijo 4, 4-1, 48008 Bilbao, Spain. Tel.: +34 944 014 690; fax: +34 944 054 787.

E-mail addresses: elena.ojea@bc3research.org (E. Ojea), julia.martinortega@hutton.ac.uk (J. Martin-Ortega).

Introduction

The hydrological cycle is responsible for providing society with ecosystem services that are critical to human well-being (Acreman, 2001; Maltby and Ormerod, 2011). Changes in forest status can lead to significant changes in hydrological functions, altering run-off processes, flow regulation, flood control, groundwater recharge and water quality (Lele, 2009). Forest ecosystems are globally threatened by deforestation, climate and land use changes (FAO, 2012), compromising the services they provide (Turner et al., 2010a,b) and threatening the livelihoods of more than half a billion people globally (Agrawal et al., 2011; Sunderlin et al., 2005).

Although there is longstanding concern about human life being critically dependent on a finite natural resource base (Meadows et al., 2004; Pearce and Turner, 1990), a milestone in the global debate about the consequences of ecosystems change for human well-being is found in the Millennium Ecosystem Assessment (MA, 2005) and subsequent associated international initiatives over the last ten years (e.g. TEEB, 2010; UK National Ecosystem Assessment, 2011). These theoretical and practical initiatives have contributed greatly to a growing consensus over the need to incorporate the value of ecosystem services in conservation planning and environmental management in general (Plummer, 2009; Turner et al., 2010a,b; Martin-Ortega et al., 2015) and in decision-making related to forests in particular (Stenger et al., 2009; Chiabai et al., 2011; Ojea et al., 2010) to mitigate the negative consequences for humans.

The predominant, albeit contested (Gómez-Baggethun et al., 2010; Spangenberg and Settele, 2010; Nogaard, 2010) paradigm used to interpret the effects of environmental change in human-wellbeing has been that of neoclassical economics, based on the measurement of the welfare changes associated with changes in ecosystem status in monetary units (Pearce and Turner, 1990; Bateman et al., 2011). Efforts to estimate the monetary value of water-related ecosystem services have been taking place for over forty years (Loomis, 2000) and studies addressing this issue have increased progressively in the last decade (Fisher et al., 2009; Johnston et al., 2003).

In this context, an increasing number of Payments for Ecosystem Service (PES) schemes have also arisen (Camhi and Pagiola, 2008), accompanied by an expanding literature (Pascual et al., 2010; Pascual and Corbera, 2011; Martin-Ortega et al., 2013). PES schemes are advocated in situations in which an environmental externality (e.g. deteriorated water quality due to deforestation) can be re-dressed through the creation of ad-hoc markets (Engel et al., 2008; Fisher et al., 2010; Pagiola, 2008). For example, downstream users of water would pay for changes in forest practice and forest conservation that can sustain the required supply and quality of water. It has been suggested that PES schemes might overcome some of the limitations of traditional conservation instruments under certain conditions (Engel et al., 2008; Wunder et al., 2008).

There is then a well-established body of literature on monetary values for water services to support the case for sustaining tropical forest ecosystems. This might give the impression that there is a good understanding of the welfare benefits that forest conservation provides in relation to the water services and, as a corollary, the welfare loss associated with ecosystem status decline. However, this literature is very heterogeneous in purpose and approaches and has not been carefully compared, providing a very fragmented view of the value of forest water services (Lele, 2009; Ojea et al., 2012).

There is an urgent need for a much clearer and more comprehensive understanding of the monetary values of the full suite of water-related ecosystem services associated with forests. In this paper we explore whether it is possible to identify key determinants that, according to existing evidence, systematically influence the monetary value of tropical forests' water services at regional level. We focus in Central and South America which, together with South-East Asia, is where the majority of water valuation studies and PES schemes of tropical forests are concentrated (Lele, 2009; Ojea et al., 2012; Brouwer et al., 2011).

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