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Analysis

Benefits From Water Related Ecosystem Services in Africa and Climate Change

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ABSTRACT

The present study collects original monetary estimates for water related ecosystem service benefits on the African continent from 36 valuation studies. A database of 178 monetary estimates is constructed to conduct a meta-analysis that, for the first time, digs into what factors drive water related ecosystem service values in Africa. We find that the service type, biome and other socioeconomic variables are significant in explaining benefits from water related services. In order to understand the importance that benefits from water related ecosystem services have for climate change, we explore the relationship between these benefits and the countries' vulnerability and readiness to adapt to climate change. We find that countries face synergies and trade-offs in terms of how valuable their water related ecosystem services are and their potential vulnerability and adaptation capacity. While more vulnerable countries are associated with lower benefits from ecosystem services, countries with a higher readiness to adapt are also associated with lower ecosystem service values. Results are discussed in light of natural capital accounting and ecosystem-based adaptation.

1. Introduction

The concept of ecosystem services (ESs), understood as the contribution of the benefits derived passively or actively from ecosystems towards current and future human well-being (Fisher et al., 2009), has gained increasing recognition in the last decade. Mainstreamed by the Millennium Ecosystem Assessment (MA) Program (2005), ESs were at the focus of the United Nations Environment Programme (UNEP) led study on The Economics of Ecosystems and Biodiversity (TEEB, see de Groot et al., 2012), and are still evolving under the currently developing Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) initiative (Díaz et al., 2015). The conservation and improvement of ecosystems has been identified as a central challenge to sustaining livelihoods for the XXIst century (Gleik et al., 2003; Guerry et al., 2015), and research programs as well as conservation initiatives have been launched at local, national and international levels (Díaz et al., 2015). In this context, research to synthetize available evidence on ES monetary values is of prime importance, and understanding what drives these values and how they relate to countries' climate vulnerability can provide policy guidance regarding the potential of ESs for climate change adaptation.

The present paper focuses on water related ESs in Africa and their links to climate change vulnerability and adaptation. Water-related ESs are understood as the services provided by biomes that are river flow impacting or river flow dependent (see the concept of natural infrastructure in Mul et al., 2017).[1] In other words, biomes that impact or are predominantly dependent on river flow, as opposed to being predominantly rain fed, deliver water related ESs. This landscape approach considers biomes as the entry point to identify the set of ESs produced. The water related ES category draws on the MA and TEEB

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[1] For more on this distinction, please see the WISE UP project http://www.waterandnature.org/initiatives/wise-climate.

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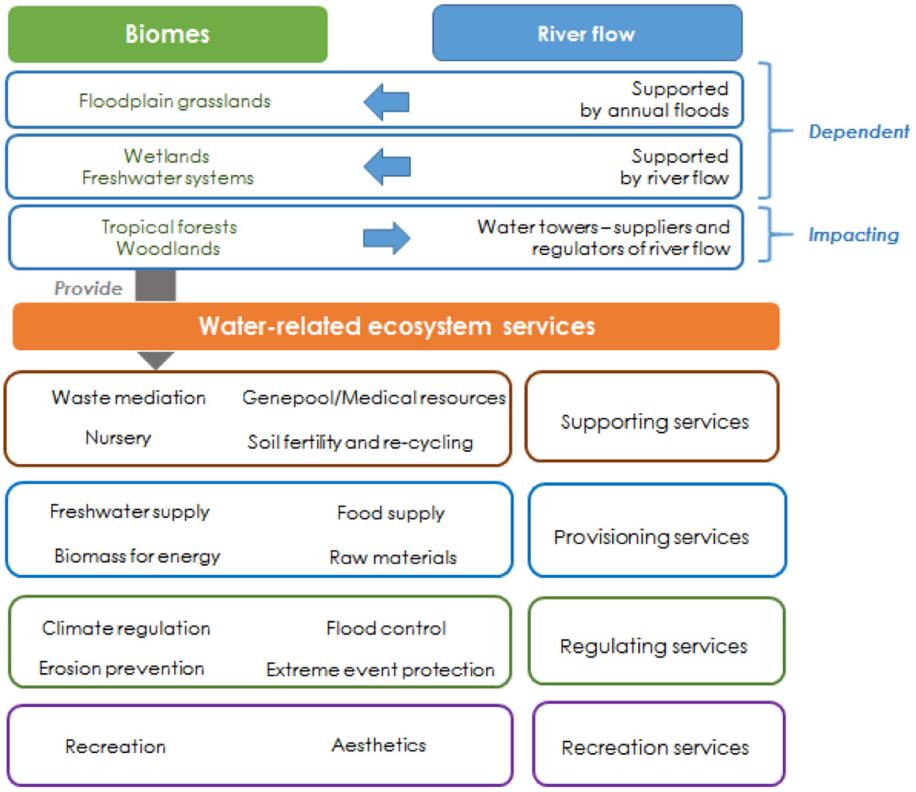

Fig. 1. Water related services from biomes linked to river flows.
Source: adapted from Mul et al. (2017) and the MA (2005).

classifications (MA, 2005; de Groot et al., 2012) and encompasses more ESs than hydrological services (Grizzetti et al., 2016). Fig. 1 presents the biomes included in the present study which interact with surface river flow and provide water related ESs.

Previous research has paid a lot of attention to water related ESs in other regions mainly due to the development of Payment for Ecosystem Services (Lele, 2009), but no previous studies have analyzed the values of water related ESs in relation to climate vulnerability and adaptation. In this paper, the focus is on the African continent, for three main reasons: 1) River flows are pivotal to the delivery of ESs crucial to millions of livelihoods (WWAP, 2016); 2) the African continent presents in general a high climate change vulnerability exacerbating the need for immediate policy solutions (World Bank, 2007), and; 3) water related ESs in Africa continue to be inadequately investigated with very poor coverage (Lele, 2009).

Water related ESs are affected by a very high variability of all climate and water resources characteristics — in turn exacerbated by climate change (Faramarzi et al., 2013; IPCC, 2014). Understanding the benefits of water related services delivery through economic valuation and the factors that affect these economic benefits can provide guidance for water resource management and climate change adaptation.

Africa is not the continent with the largest ES valuation literature (for details on ES valuation methods see de Groot et al., 2012; Pascual et al., 2010). Only 19% of the valuation studies referenced in TEEB are located in Africa. Most studies are located in the Americas (33%) and Asia (26%) (based on Mc Vittie and Hussain, 2013). Moreover, the valuation literature in Africa is geographically disparate: Southern and Eastern Africa gather the highest number of studies while North, West and central sub-Saharan Africa go under-represented. Valuation studies on water related ESs in Africa represent 28% of all water related ES valuation studies globally. The most frequently valued water related ESs are raw materials and food provision, mainly due to two different reasons: 1) these services are relatively easy to value using the direct market pricing method (Van der Ploeg et al., 2010) and; 2) dependence on provisioning services is high and proportionally larger in African developing countries than in developed countries, hence an early focus on estimating values for this type of service (Egoh et al., 2012; Mc Vittie and Hussain, 2013). Indeed, ESs' consumptive outputs (e.g. crops and fish) contribute to subsistence livelihoods and constitute a very important share of households' income in African developing countries, thus participating in poverty alleviation and reducing vulnerability to negative shocks (Egoh et al., 2012; Suich et al., 2015).

The role of ESs in reducing vulnerability and in contributing to adaptation is particularly important in the face of climate change (Jones et al., 2012; Munang et al., 2013a). Adaptation to climate change can be rooted in ES sustainability — known as 'ecosystem based adaptation' (Ojea, 2015). It is defined as an approach that "harness the capacity of nature to buffer human communities against the adverse impacts of climate change through the sustainable delivery of ES" and is expected to provide cost-effective adaptation resulting in resilient socio-ecological systems (Jones et al., 2012). Such adaptation option is hailed as particularly beneficial as carbon sequestering ecosystems[2] such as forests, wetlands and peatlands can contribute to achieving mitigation targets set under the 2015 Paris agreement as well as the sustainable development goals of the United Nations while delivering on adaptation to climate change (Munang et al., 2013b). Early evidence on ecosystem based adaptation supports this is the case (Doswald et al., 2014). However, little is known yet on the linkages between adaptation and the value of ESs at a regional scale (Ojea et al., 2015). Indeed, ecosystem-based adaptation approaches have not been mainstreamed yet, with only little evidence in the literature (Jones et al., 2012).

[2] A recent review highlights that much of the claimed climate regulation benefits of EbA, beyond carbon sequestering ecosystems, relate to local temperature regulation rather than mitigation (McVittie et al., 2017).