

Ecosystem services research in contrasting socio-ecological contexts of Argentina: Critical assessment and future directions



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ABSTRACT

In Argentina, agricultural expansion and intensification has stimulated the utilization of the ecosystem services (ES) approach to understand the consequences of land-use and land-cover changes. However, Argentina's increasing trends of environmental degradation and social conflict due to agriculture continue unabated. We qualitatively analyzed 24 published ES studies done in either the temperate Pampean (context of consolidated agriculture) or subtropical extra-Pampean regions (context of expanding agriculture), in order to identify country-level and context-specific research needs and gaps, and propose ways to address them. We observed that ES studies in both contexts: (i) tended to focus much more on the biophysical, supply-side of the ES cascade than on the assessment of cultural ES and benefits, (ii) invested more effort in describing coarse ecological patterns/processes than in producing locally-adapted knowledge through stakeholder participation, and (iii) were poorly articulated with decision-making processes regarding sustainable ecosystem management. Despite this, some ES studies performed in the context of expanding agriculture showed incipient efforts to recognize, disaggregate and involve stakeholders, and to understand ES values. To increase the applicability of ES knowledge in decision-making, "strong" transdisciplinary approaches should be implemented so that changes in ES delivery and values feedback on management decisions for reverting environmental degradation.

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1. Introduction

Unabated environmental degradation and poverty across the globe has led to the development of novel approaches to better understand how ecosystem change is affecting human well-being. The most prominent has been the ecosystem services (ES) approach, which originated in 1970s (Holdren and Ehrlich, 1974; Westman, 1977) and during the 1990s gained popularity in environmental research and policy forums (Costanza et al., 1997; Daily et al., 2009). During the last decade, the growing body of literature on ES was characterized by greater efforts towards delivering policy tools to mitigate and adapt to environmental problems (Abson et al., 2014). Despite an increasingly solution-oriented approach, several factors impede mainstreaming ES into public and private environmental agendas (Logsdon and Chaubey, 2013). Barriers to an effective uptake of ES in decision-making processes include a lack of consensus on how to define and assess ES (Nahlik et al., 2012), a weak integration of the biophysical and socio-cultural dimensions of the ES approach (Iniesta-Arandia et al., 2014), and a poor consideration of contextual factors driving ES supply and demand at the local scale (Potschin and Haines-Young, 2012).

The Millennium Ecosystem Assessment (MEA, 2005) defined ES as the benefits people obtain from ecosystems. This definition equates ES and the benefits derived from them, without a clear distinction between the ecosystem processes underpinning ES provision and the ES *per se*, thereby limiting the applicability of the ES approach to inform management and policy decisions (Wallace, 2007). The boom of the ES concept following the MEA came along with revisions of the ES conceptual framework, in an attempt to disentangle the links from ecosystems and biodiversity to human well-being, by distinguishing among the structure and function of ecological systems relevant to a service (the supply), the service actually used or enjoyed by people (the service *per se*), and the change in people's well-being that results (the benefit) (Tallis et al., 2012). In Latin America, research on ES supply and social values of ES is quite well developed, but research on the actual delivery of ES to societies has received much less attention (Balvanera et al., 2012). Measuring supply is necessary but not sufficient to determine the level of ES provision or the resultant benefits to society, which also requires information concerning the demand for and use of ES, taking into account the spatial distribution of people, infrastructure, ecosystems and the control of institutions over access and human behavior (Tallis et al., 2012).

Given that areas of high ES capacity and flow are often spatially mismatched and that ES demand is influenced by many factors extraneous to service production, quantifying ES components separately is an important step toward enhancing the ability of ES assessments to inform environmental decision-making (Villamagna et al., 2013). Haines-Young and Potschin (2010) proposed a framework that links the biophysical and socio-cultural dimensions of the ES approach along a cascade of components and linkages. In the ES cascade, biodiversity and ecosystem processes support multiple ecosystem functions, which underpin the provision of ES and the benefits derived from them (Fig. 1). We adopt the ES cascade framework for our analysis and define ES as the ecosystem processes and attributes that contribute directly or indirectly to produce a benefit to people.

The implementation of the ES approach has been mainly advocated for developing countries (Norgaard, 2010), owing to its claimed merits in this context. First, the ES concept is proposed to act as a boundary object for sustainability science, stimulating the integration of disciplines that were traditionally segregated (Abson et al., 2014). Second, the ES approach is portrayed as being flexible enough so as to be effectively applied in diverse socio-ecological contexts, thereby allowing the production of knowledge relevant for local stakeholders (Opdam et al., 2013). Third, given its focus on the linkages between ecological, economic and social change, the ES approach can help tackling the twin challenges of poverty and environmental degradation (Daw et al., 2011). These characteristics render the ES approach suitable to produce policy-relevant knowledge in countries with economies dependent on its natural capital and diverse and unequal societies. Argentina is a clear example of this situation as it has a large and heterogeneous territory that produces food for ten times the size of its population (400 million people, FAO, 2014), although the benefits derived are unequally distributed (World Bank, 2013).

In this country, the expansion and intensification of agriculture has led to rapid and extensive environmental degradation which led, for example, to the loss of 70% of its native forest area in the 20th century (SAyDS, 2007). In the last 20 years, international demand and national policies enabled the expansion of the agricultural frontier, initially within the temperate Pampean region and then into extra-Pampean subtropical regions such as the Chaco, Yungas, Campos and Atlantic forests (Fig. 2). The area cultivated with genetically-modified soybeans rose from 5 Mha in 1994 to 20 Mha in 2013, covering 65% of the country's arable lands (FAO, 2014). In the Chaco region, soybean cultivation expanded mostly through the conversion of native forests, to the extent that this region had the highest rate of forest loss in the 21st century (Hansen et al., 2013). This scenario has stimulated the utilization of

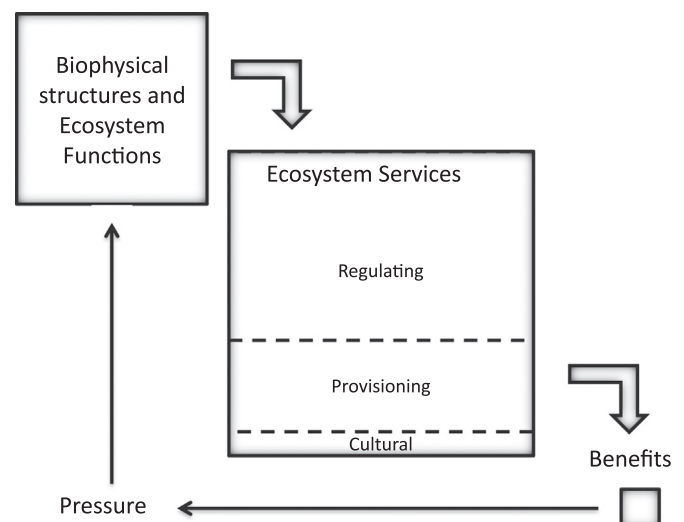


Fig. 1. Cascade conceptual framework (adapted from Haines-Young and Potschin, 2010). The box size is proportional to the number of studies that focused on that component of the cascade. The dotted lines within the ES box divide it into three sub-boxes. The size of these sub-boxes is proportional to the number of studies that evaluated each type of ES.

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