



Economic valuation of ecosystem services in Mexico: Current status and trends



Gustavo Perez-Verdin ^{a,*}, Enrique Sanjurjo-Rivera ^b, Leopoldo Galicia ^c,
Jose Ciro Hernandez-Diaz ^d, Victor Hernandez-Trejo ^e, Marco Antonio Marquez-Linares ^a

^a Instituto Politecnico Nacional, CIIDIR Dgo, Sigma 119, Fracc. 20 de Nov. II, 34220 Durango, Dgo, Mexico

^b World Wildlife Fund, Gulf of California Program, La Paz, BCS, Mexico

^c Universidad Nacional Autonoma de Mexico, Instituto de Geografia, Ciudad de Mexico, Mexico

^d Universidad Juarez del Estado de Durango, ISIMA, Durango, Dgo, Mexico

^e Universidad Autonoma Baja California Sur, CEEA, La Paz, BCS, Mexico

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ABSTRACT

Using various sources of information, we reviewed the literature about the economic valuation of ecosystem services in Mexico. The objectives were to analyze the diversity and consistency of value estimations, identify research gaps, and suggest directions for future research. We found 43 studies that used non-market valuation methods to estimate the economic benefits of 24 types of ecosystem services. The most evaluated service was recreation, followed by water and food resources. Contingent valuation was the most cited method, followed by travel cost and choice experiment methods. While the number of studies is encouraging, many important ecosystem services still remain unnoticed and are not accounting towards the total economic value (e.g. pollination, medicine, bioenergy, etc.). In addition, the majority of studies revealed a lack of validity tests, which challenges the reliability of results. Hypothetical bias and the embedding effect are serious problems that must be addressed in future stated preference studies. Considering the issues reviewed here, we believe that the scientific community in Mexico should keep doing more research on economic valuation. This information can help to transit from hypothetical to real markets and to highlight the critical role of ecosystem services in society.

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* Corresponding author.

E-mail addresses: guperezv@ipn.mx (G. Perez-Verdin), esanjurjo@wwfmex.org (E. Sanjurjo-Rivera), lgalicia@igg.unam.mx (L. Galicia), jciroh@ujed.mx (J.C. Hernandez-Diaz), victortrejo@gmail.com (V. Hernandez-Trejo), marco_dgo@yahoo.com (M.A. Marquez-Linares).

1. Introduction

Research on the role of ecosystem services on human wellbeing has increased exponentially in the last few decades (Balvanera et al., 2012; Pirard and Lapeyre, 2014). Much of the interest is because they provide a great variety of benefits to society and some are critical for human wealth, health, livelihoods, and survival (Costanza et al., 2014). However, while searching for these benefits, society exerts excessive pressure over natural resources, leading to significant losses of land that sustain and provide the ecosystem services. According to Costanza et al. (2014), from 1997 to 2011 the worldwide loss of ecosystem services had been estimated to be around \$4.3 trillion per year due to land use change. The continued overuse of ecosystems has come at the expense of the livelihood of the future generations and the poor (de Groot et al., 2012).

The loss of ecosystem services (ES) has spurred many prominent scholars and organizations around the world to propose new forms to reevaluate the relationship between society and ecosystem services. The work done by Millennium Ecosystem Assessment, the United Nations-based The Economics of Ecosystems and Biodiversity, the Ecosystem Services Partnership, among others, are only examples of the society's interest to participate in forums to better manage ecosystem services (Costanza et al., 2014). One of the mechanisms that can be used to reframe the relationship between society and ecosystem services is through the assignment of an economic value (de Groot et al., 2012). Expressing the value of ecosystem services in monetary units has multiple uses such as project evaluation of ecosystem restoration, setting entry fees to national parks, or evaluating scenarios for policy making (Sanjurjo-Rivera and Cortes-Islas, 2008). As noted by Adams (2014), a monetary valuation of nature should be accepted only if it improves environmental conditions and the socioeconomic conditions that support that improvement.

The focus of this review is primarily on the indirect and passive use ES that were valued through non-market methods. These ES are characterized by a quasi-public, non-rivalry property, the presence of externalities, and different scales of production (Brauman et al., 2007; Plottu and Plottu, 2007; Caro-Borrero et al., 2015). The quasi-public, non-rivalry nature implies that it is difficult, if not impossible, to exclude an individual from using an ecosystem service (e.g. CO₂ sequestration), and several individuals can benefit at the same time without diminishing each other's use values (Caro-Borrero et al., 2015). The presence of externalities means that the economic benefits of users of these services will not be deviated to compensate providers. And regarding the scale of production, these services are characterized by economies of scale in production; the larger the ecosystem, the lower the marginal costs (Brauman et al., 2007).

In Mexico, recognition and endorsement of the role of ecosystem services has been mostly led by the government (Corbera et al., 2009). In 2003, the Mexican government launched the so-called Payment for Ecosystem Services (PES or PSA for its Spanish acronym) program that basically attempted to reduce deforestation through three key instruments: (1) direct regulations of activities that change land use or degrade natural areas, (2) subsidies to sustainable forestry activities, and (3) policy actions to stop illegal logging (Muñoz-Piña et al., 2008). The payment, offered as an economic compensation or subsidy, was calculated as the opportunity cost of alternative uses of the land such as agriculture or livestock. The goal was to maximize the amount of forest that could be protected subject to a fixed budget. According to annual reports, the PES program has paid more than \$US 200 million and protected about 1.5 million hectares of strategic forest areas (CONAFOR, 2015).

Since the inception of the Mexican PES program, various

studies have been conducted to emphasize the need of compensating landowners according to the real benefits people obtain from ecosystems (Corbera et al., 2009; Balderas-Torres et al., 2013b; García-Amado et al., 2013; Sims et al., 2014; Caro-Borrero et al., 2015). The uniqueness of the Mexican PES comes from its nationwide scale and its consequential benefits aimed to improve economic conditions of poor forest owners while simultaneously reducing deforestation (Muñoz-Piña et al., 2008; Caro-Borrero et al., 2015), which only a few countries have attempted to do. Whether the program has achieved both goals is not the focus of this work. The purpose is to reveal if studies provide enough, consistent information about the value of ecosystem services, given the diversity of methods and geographical areas.

We focused on Mexico because the country has undergone high deforestation and degradation rates (Rosete-Vergés et al., 2014) and makes a good example of the potential response of society to reduce these problems. There is a growing interest to protect entire watersheds to promote other indirect, passive use values. Also, being a developing country, it represents a good case study to discuss the application and validity of non-market valuation methods, initially designed for developed countries¹ (Whittington, 2002). Finally, given the great amount of research conducted in the country, it facilitates an analysis of national level management policies. Therefore, the objectives of this study are (i) to document the number of economic valuation studies for ecosystem services in Mexico, (ii) analyze the diversity and consistency of value estimations, and (iii) identify research gaps and suggest directions for future research.

2. Methods

In this section, we provide information about the forms of data collection in this work, and the list of studies eventually used in our review. We considered only those studies that explicitly recognized the public nature of nonmarket ecosystem services, which are characterized by a diversity of direct, indirect, and especially passive use values. The majority of these types of values, single or combined, can be estimated through users' stated or revealed preferences (Freeman III, 2003). The targeted study had to explicitly state the amount of money that was assigned to an ES, including a description of the main factors motivating the user's preference. The reason to have a monetary value was essential to make standard comparisons among studies.

Several sources of information, where a reliable valuation method was used, were examined in this paper. The first source included a literature search from all available databases (e.g. Web of Science, Scopus, and Google Scholar), the web for nonmarket valuation studies, and several university collections of books, theses, and working papers either in Spanish or in English.² The last two sources were verified to check if availability was relatively easy and open to the public. A detailed review of keywords, abstracts, and introductions served to select studies directly related to ecosystem services and the valuation approach. Our selection criteria included: (a) they must have been conducted in Mexico; (b) be an original case study; (c) provide information about the valuation method used; (d) provide a monetary value of a given ecosystem service; and (e) provide the location of the case study

¹ For example, the number of contingent valuation studies since 1990 includes over 4000 publications, of which 146 have been conducted in developing countries (Durand-Morat et al., 2016).

² We excluded "gray" literature if access to the document was unclear. We did consider studies, such as those reported by government institutions or non-indexed university journals, as long as they used non-market valuation methods and offered comprehensive results.

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