



Additionality is in detail: Farmers' choices regarding payment for ecosystem services programs in the Atlantic forest, Brazil



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ARTICLE INFO

Article history:

Received 26 April 2016

Received in revised form

8 June 2017

Accepted 15 June 2017

Available online 8 July 2017

Keywords:

Additionality
Forest conservation
Forest restoration
Mata Atlântica

ABSTRACT

Payments for ecosystem services (PES) have spread rapidly across the globe in the last two decades, emerging as an important alternative to halt deforestation and biodiversity loss. The motivations of farmers to take part in PES programs, however, is still largely unknown. Most of the recent studies on the theme have investigated factors influencing participation but a few of them have looked at the factors explaining the minimum financial compensation that farmers would expect to receive to join PES. Particularly scarce are the studies aiming to understand the relationships between the minimum amount of money (MAM) that farmers would demand to get involved in PES programs for forest conservation and restoration and the impacts of such programs on PES additionality. We focused our study on the early stages of the PES program of the Chapecó Ecological Corridor, an important agricultural region that provides vital ecosystem services in Southern Brazil. One hundred farmers from 21 municipalities were interviewed. Data were tested using maximum likelihood and the model selection approach. Almost all farmers interviewed (94%) manifested interested in taking part in a PES program focused on forest conservation, but only 48% would like to get involved in a forest restoration program. PES program modality (100%), farmers' income (65%) and educational level (54%) were the most important variables influencing the minimum amount of money required by farmers to get involved. In average, the farmers would expect 35% more for forest restoration (US\$ 185.56/ha) than for conservation (US\$ 116.53/ha) programs. In any case, however, the net increase of forest cover resulting from the PES program would be insignificant. Nevertheless, PES could provide some additionality by halting forest degradation and by helping to curb small-scale and illegal deforestation. The low interest in restoration activities may jeopardize the PES program goals and cause negative impact on the implementation of the National Forest Act in the region. To overcome this constraint, the PES program managers should work with the farmers to raise awareness about the relevance of forest restoration in a region with seasonal water shortages, high level of erosion and of water pollution.

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1. Introduction

Payments for ecosystem services (PES) have successfully promoted land uses and natural resources management favorable to the provision of ecosystem services worldwide (Muradian et al.,

2010; Sommerville et al., 2009). In Brazil, PES programs spread widely across the country since the first initiative in 2005 (Coudel et al., 2015; Lavratti et al., 2014). However, only a minority of studies assessed the main factors influencing the willingness of stakeholders to join such programs and almost none investigated the minimum amount of money the farmers would require to do so. Many of the PES programs already implemented focused on forest conservation or restoration and agroecological transition, aiming at improving water quality and provision, carbon sequestration, carbon stock, and biodiversity conservation (Guedes and Seehusen, 2011; Lavratti et al., 2014; Pagiola et al., 2013a; Santos and Vivan,

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2012; Tejero and Stanton, 2014). For megadiverse countries like Brazil and for world biodiversity hotspots like the Atlantic Forest (Mittermeier et al., 1997; Myers et al., 2000), PES can play an important role as a conservation tool, especially in restoration initiatives, as it implies an increase in forest cover and in forest connectivity (Garcia et al., 2013; Melo et al., 2013).

The number of studies dedicated to investigate the main factors influencing farmers' willingness to participate in PES programs increased during the last two decades (Blackmore and Doole, 2013; Bremer et al., 2014; Fisher, 2012; Kauneckis and York, 2009; Kosoy et al., 2008; Muñoz-Piña et al., 2008; Page and Bellotti, 2015). In Brazil, one study evaluated three PES programs and concluded that awareness, environmental concern and low opportunity costs of land influenced farmers' willingness to participate. The risk of being fined for non-compliance to the National Forest Act apparently stimulated farmers to participate in PES programs (Zanella et al., 2014).

Some studies indicate economic incentives as one of the main factors affecting farmers willingness to participate in PES programs (Bremer et al., 2014; Corbera et al., 2007; Fisher, 2012; Kosoy et al., 2008). Other reasons include the positive perception of environmental issues, income, farm size, access to technical assistance and information, and social capital (Arriagada et al., 2009; Blackmore and Doole, 2013; Defrancesco et al., 2006; Page and Bellotti, 2015; Torres et al., 2013). Personal values also play an important role in decision-making regarding participation in PES programs (Dworak et al., 2009). Knowler and Bradshaw (2007) reviewed a number of studies and concluded that there are no universal variables that explain why farmers join programs aimed at implementing environmental conservation actions for agricultural lands. Socioeconomic, political, cultural and biophysical characteristics of rural properties make each region unique, which results in different motivations and forms of participation in such programs.

Restoration and conservation of forests have been commonly addressed together in analyses of voluntary participation and willingness to receive economic incentives to join PES (Arriagada et al., 2009; Blackmore and Doole, 2013; Kosoy et al., 2007, 2008). In Brazil, these are the two most common modalities of PES, although some programs promote other measures, such as agroforestry and silvopastoral systems (Santos and Vivan, 2012). There is a broad discussion about the prioritization of these two types of PES modalities (forest restoration and conservation), much of which focusing on additionality, because many forest restoration and conservation actions occur over areas that are already under protection according to the National Forest Act (Brasil, 2012) and the Atlantic Forest Law (Brasil, 2006a) (Pagiola et al., 2013a; Richards et al., 2015; Richards et al., 2015; Santos and Vivan, 2012).

Additionality in PES means that without financial compensation there would be no actions towards the provision of ecosystem services (Pattanayak et al., 2010). Some authors have argued that because resources for PES area scarce, the lack of additionality may compromise the financial efficiency of the program (Engel et al., 2008; Wunder et al., 2008). However, not rewarding farmers who have been intrinsically motivated to engage in conservation actions may lead to social injustice (Alpizar et al., 2013; Matzdorf et al., 2014). In developing countries, environmental law enforcement is generally weak and the use of PES to stimulate compliance with regulations has been an alternative to compensate the farmers for the forgone revenue imposed by restrictions on the use of forest resources and to reduce its social costs (Ministério do Meio Ambiente, 2013; Pagiola et al., 2013a; Richards et al., 2015).

In this study we analyzed both forest conservation and forest restoration PES programs, which can have different implication for conservation of the Atlantic Forest. While the standing forest patches are extremely relevant sources of biodiversity,

reconnecting these patches is crucial for the long-term maintenance of biodiversity and for ecosystem resilience (Banks-Leite et al., 2014; Cunha and Guedes, 2013; Pardini et al., 2010; Ribeiro et al., 2009). We aimed to understand the factors that influence the participation of private landowners in PES programs in the Atlantic Forest region, their willingness to participate in a conservation PSE program compared to a restoration program, and the amount of money they would demand to get involved. We believe that a better understanding of these issues can guide program actions towards the maximization of the results, especially those related to additionality.

2. Methods

2.1. Study site

The Chapecó Ecological Corridor (CEC) is a relevant case study for anticipating the effectiveness of PES programs because it is located within the Atlantic Forest biome, one of the top five hotspots of biodiversity in the world (Myers et al., 2000). The CEC is 5 thousand of square kilometers and comprises the largest continuous remaining fragments of mixed rain forest and deciduous forest in Santa Catarina (Ribeiro et al., 2009) (Fig. 1). It also contains areas of natural grasslands, ecosystems there are extremely threatened by the expansion of pine tree plantations led by the paper and timber industries (Overbeck et al., 2007, 2009).

The Ecological Corridor encompasses two National and one State Park, representing almost 20 thousand hectares of Protected Areas, sheltering several threatened species of mammals and birds (Bornschein, 2009; Mazzoli, 2008). A recent study in the area registered the expansion of distribution of four species of birds (Bornschein, 2009).

In addition to its considerable biological diversity, the region exhibits a high degree of social diversity. It includes two indigenous reserves that protect the Guarani and Xokleng ethnicities, the largest agrarian reform settlements in Santa Catarina (approximately 3 thousand families established in the region after 1985), as well as farmers outside of these settlements with properties ranging from 1 to more than 5 thousand hectares (Fukahori and Alarcon, 2013; Fundação do Meio Ambiente, 2009). The Chapecó water basin also provides clean water to more than 800 thousand inhabitants and to important agro-industries. Natural forests cover 50% of the area, while other land uses include silviculture, cattle raising and soybean cropping (Alarcon et al., 2011).

Created in 2009, the implementation of the CEC was planned to rely mainly on a Conservation Credit System (CCS), a biodiversity offset policy based on market mechanisms and linked to the mitigation hierarchy handled by the State Environmental Foundation (FATMA). The biodiversity offset policy aims at allocating private funds arising from environmental impacts within the Uruguay water basin to the conservation of native forest areas located in private properties at the Chapecó Ecological Corridor. Similar offset mechanisms have been implemented for approximately two decades in countries like the U.S.A and Australia. In Brazil, it is working specifically for Protected Areas and recently forest-set-asides according to the Brazilian Forest Code (Villarroya et al., 2014; McKenney and Kiesecker, 2010). Currently, the CCS is being implemented with resources coming from the State Government and the World Bank, through the Santa Catarina Rural Competitiveness Project (Phase III). A seed capital from the World Bank is promoting the start-up of the system.

2.2. Design and survey application

We evaluated the willingness of farmers to participate in a PES

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