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Household participation in Payments for Ecosystem Services: A case study from Mozambique

Joao Daniel Mudaca [a,*], Toshiyuki Tsuchiya [a], Masaaki Yamada [b], Siaw Onwona-Agyeman [b]

[a] United Graduate School of Tokyo University of Agriculture and Technology, Tokyo, Japan
[b] Graduate School of Tokyo University of Agriculture and Technology, Tokyo, Japan

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ABSTRACT

The success of the PES programme in developing countries depends on the active participation and contribution of rural households. This paper investigates the factors influencing rural households' decision to participate in the PES programme in the N'hambita Community in Sofala Province, Mozambique, based on data collected through a survey of 115 households, using factor analysis and multiple regressions. Factor analysis has shown that the main factors influencing the household decision to participate in the programme are latent variables labelled as economic benefits, followed by social inclusion and forest conservation accounting, with 31%, 19% and 14% of the total variance respectively. Multinomial logistic regression demonstrates that the gender, marital status, household age, the educational level of the head, land area, distance from the project centre and source of income are important variables in explaining the level of participation of the three factors.

1. Introduction

Payments for Ecosystem Services (PES) is one of the alternative ways proposed to achieve better conservation success by financially linking the beneficiaries of ecosystem services to households managing resources that provide the services (Ferraro and Kiss, 2002; Wunder, 2008; Pagiola, 2008; Porras et al., 2008; Clements et al., 2010; Pattanayak et al., 2010; Lopa et al., 2012). The payments are provided to stimulate management of resources, adopting sustainable land-use practices while increasing their net income and improving the environmental quality (Lee and Mahanty, 2009).

Worldwide, numerous PES initiatives are being implemented at varying scales, ranging from local initiatives for conserving watersheds to regional and global arrangements for biodiversity and carbon sequestration services (Corbera et al., 2007; Landell-Mills and Porras, 2002; Wunder, 2008). There are also PES initiatives for landscape beauty and for bundles of several ecosystem services (Landell-Mills and Porras, 2002). It is believed that the majority of PES initiatives, mostly located in developing countries, may help improve the livelihood of local people by reducing poverty, especially in poor communities that engage in selling their ecosystems (Pagiola et al., 2005). Although the PES programme approach for poverty reduction presents some risks and obstacles, it also creates potential opportunities.

The most obvious way in which PES may assist rural households lies in the effect the PES programmes may have on household financial assets, while some obstacles related to tenure, landholding size, high transaction costs to participate in PES programmes (e.g. title papers, complex procedures), high investment cost to adopt PES related land-use practices, a lack of awareness, education and access to technical knowledge might dissuade households from participating in PES programmes (Lee and Mahanty, 2009).

A study conducted on reforestation projects for carbon sequestration in the Huetar Norte region in Costa Rica reported that households received direct payments estimated at US$516 per hectare per annum from the carbon sales generated for a period of five years, even though it was not their main motivation to participate in the project (Miranda et al., 2004). Apart from direct payments, PES programmes may increase income by providing rural households with employment opportunities; this can be seen in the case of a watershed development programme in Madhya Pradesh Province in India, which positively affected agricultural productivity in the villages and created more demand for labour (Sengupta et al., 2003).

Some studies indicate that farmers and forest owners' motivation to join PES programmes may be related to economic benefits, the production of multiple outputs such as timber, fuel wood, fruits and nuts, as well as expected soil improvement benefits (Lee and Mahanty, 2009). Members of the community interviewed in a project of carbon sequestration in Costa Rica and Ecuador, indicated that carbon payments were important for diversifying and stabilizing their income (Grieg-Gran et al., 2005).

The potential impacts of PES programmes will only be realized by those who participate in the programme (Pagiola et al., 2005; Kosoy et al., 2008). To contribute to the success of PES programmes in developing countries, this research has been carried out with the aim of identifying and characterizing factors that influence rural households'

* Corresponding author.
E-mail address: jmudaca@hotmail.com (J.D. Mudaca).

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decisions to participate in the forest carbon programmes and analysing their relationship with the socio-economic characteristics of households in N'hambita community village in Sofala province, Mozambique.

2. Background of the N'hambita Community Carbon project

Mozambique faced a long period of civil war from 1975 until 1992, during which time the Miombo woodland forest resources were heavily devastated due to wildfires and other unsustainable land-use practices. The N'hambita community, located in the buffer zone of the Gorongosa National Park in Sofala Province, Mozambique, also was seriously affected by the civil war and during this period, the residents were forced to immigrate to neighbouring regions (Walker and Desanker, 2004). After the civil war, activities of the National Park reopened and residents returned to their place of origin. With the establishment of carbon sequestration projects in the community to revitalize the ecosystem, new challenges were opened to the local people. Currently, the project is one of the reference PES schemes in the world, aiming to improve the livelihoods of the local people by implementing sustainable land-use systems in their farms (Grace, 2008; Jindal et al., 2012). The sustainable land-use includes the implementation of agroforestry practices for carbon mitigation to be sold in the potential international carbon market.

The project follows international standards approach, as part of a Plan Vivo system by using carbon payments to compensate rural households for applying sustainable land-use practices and enhance their well-being (Jindal et al., 2012). The N'hambita project started in 2003 as the first forest-based carbon mitigation project in Mozambique. The first phase of the project was funded by the European Union (EU) until 2008 and since then it has been operated based on revenue from carbon sales, mainly to international markets (Jindal et al., 2012).

The project is extensive and the main target group is local people living in the N'hambita community. There is no restriction on participation as long as the households willing to participate live within the selected villages in N'hambita community. The project invites the households to promote the adoption of improved forest-based land use practices in the project area. In total, the project has seven types of agroforestry systems available. The agroforestry systems, namely boundary planting, homestead planting, cashew fruit orchards, mango fruit orchards and woodlots, typically involve tree planting around the boundaries of the farm. The agroforestry systems, which involve interplanting with *gliricidia* and dispersed interplanting with *faidherbia,* have advantages as they increase the N-fixation in the soil, remove the need to practice slush-and-burn agriculture and enable the farmers to use the same land for a longer period (Palmer and Silber, 2012).

Once enrolled, the households receive free seedlings and technical support on agroforestry system management. Each agroforestry system implemented by the household is selected as separate contract and the household can enter multiple contracts, either by adopting the same agroforestry system in the same farm or combining different agroforestry systems (Jindal et al., 2012). One of the contract regulations indicates that households cannot open new areas for agricultural purposes. Households that follow the contract regulations are financially compensated for the carbon generated on their farms. While carbon offsets are generated over 100 years, households receive their entire payment during the seven years of the contract.

3. Theoretical framework (modelling household participation in the PES programme)

Studies on conservation agriculture and agroforestry have identified a number of household and individual determinants influencing adoption decisions. Individual characteristics are shown to be important factors (Falconer, 2000; Zbinden and Lee, 2005; Defrancesco et al., 2008; Toma and Mathijs, 2007) as are motivation, preferences and attitudes of households. In order to deal with these behavioural categories such as motivation and attitudes of households, which contrast with other factors of adoption decision such as individual characteristics (age, gender or farm size, etc), the author proposes the use of latent variables, a method for translating a large set of variables into a few independent choice variables.

Three latent variables were identified as factors of adoption decisions in a similar fashion as employed by Toma and Mathijs (2007). The first latent variable labelled as *economic benefits* suggests that farmers are motivated by a diverse set of benefits that may influence behavioural patterns in relation to land use and the provision of ecosystem services. This includes the benefits generated from carbon sales and employment opportunities as influential factors, since it is likely that without cash compensation households will stop protecting ecosystems.

The second latent variable labelled as *social inclusion* is also recognized as an important resource for shaping individuals' participation in biodiversity conservation. The more a farmer is able to express his or her opinion, the more he or she is likely to participate in the activities required by PES programmes (Pretty and Smith, 2004).

The third latent variable labelled as *forest conservation* addresses not only general attitudes toward the environment, but also the opinion of the importance of the environment and forest degradation. Depending on the goal of the PES programme, some households might be interested in participating due the degree of deforestation, while others might be concerned about the emission of greenhouse gases into the atmosphere. The complete list of latent variables and their constituent indicators is reproduced in Table 1.

The decision of a land or a forest owner to participate in a forest promotion programme can be analysed with a binary or multiple-choice model, depending on the programme's provisions and requirements. In both cases, the model is based on the maximization of an underlying utility function, which is assumed to be consistent with individual household behaviour. Following the past studies on programme participation and adoption of agricultural technologies by Brotherton (1989), Chambers and Fosters (1983), and Lee and Boisvert (1985), the utility of participation is a function of two vectors, Z and X:

$$U_i^p = V(Z_i^p X_i) + (Z_i^p, X_i, e_i^p)$$

Participation: $P_i = 1$ if $U_i^0 < U_i^1$,

Non-participation: $P_i = 0$ if $U_i^0 \geq U_i^1$,

where p denotes dependent variables indicating farmers' decisions to participate (1 if yes; 0 if no) and V represents the vectors of explanatory variables affecting the utility. Vector V can be broken into

Table 1
Latent variables and constituent indicators to be included in factor analysis.

Name of the variables	Abbreviation	Scale likert
Latent variable 1: Economic benefits		
Benefits generated from carbon sales	CARBSALE	[1–4]
Employment opportunity in the project centre	EMPLOPPO	[1–4]
Project support in seedlings for AF systems	SEEDFOAF	[1–4]
Yield of agricultural lands with AF systems	YIELDAGR	[1–4]
Income of NTFP (ex. timber selling, etc)	INCONTFP	[1–4]
Latent variable 2: Social inclusion		
Join the training programmes in the project centre	TRAINPRO	[1–4]
Technical support from the project staff	TECHSUPP	[1–4]
Express concerning during the meetings	CONCMEET	[1–4]
Able to exchange opinion with others	EXCHOPIN	[1–4]
Social activities in the community (ex. Fire patrol)	SOCICOMM	[1–4]
Latent variable 3: Forest conservation		
AF techniques increase NTFP	AFTEINCR	[1–4]
AF techniques reduce the shifting cultivation	SLUSBURN	[1–4]
Diversification from forest related resources	DIVEFORE	[1–4]
Project goal to reduce the informal charcoal production	INFOCHAR	[1–4]
Avoid the GHG emission to the atmosphere	GHGEMMIS	[1–4]