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Farmer participation in the equitable payments for watershed services in Morogoro, Tanzania

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Abstract

This article contributes to the limited empirical evidence on the determinants of farmers' participation decision in agricultural land (land use-modifying) payments for ecosystem services (PES) in developing countries. It examines how farmer and farm characteristics, programme factors, and the institutional context of its implementation determine farmers' decisions to participate in the Equitable Payments for Watershed Services (EPWS) programme in Morogoro, Tanzania, to shed light on participation in land use-modifying PES programmes more widely. The EPWS programme in the Kibungo Juu ward of Morogoro promotes the adoption of sustainable land management practices such as agro-forestry, reforestation and terracing to improve quality and quantity of water for downstream users. We used a multi-method approach to make use of both qualitative and quantitative data. We found that farm size, information, participation of farmers in the programme design and the needed degree of change in land management determined the adoption of sustainable land management practices. To foster the participation of small farmers, attention needs to be paid to the availability and access to information, participation of farmers in the design of programmes, local compatibility of practices, and support for initial costs of adoption.

Keywords

Payments for ecosystem services (PES), Watershed, Land use-modifying, Agriculture, Participation, Tanzania

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1. Introduction

Payment for ecosystem services (PES) is a popular approach for the provision of ecosystem services due to its principle of bridging the gap between private interests of farmers and the public benefits of conservation management (Engel et al., 2008; Ferraro and Kiss, 2002; MA, 2005; Pagiola and Platais, 2002; Wunder, 2005). Globally, there are numerous PES initiatives ranging from local initiatives for conserving watersheds to regional and global arrangements for conservation of biodiversity and carbon sequestration (Corbera et al., 2007; Landell-Mills and Porras, 2002; Wunder et al., 2008). There are also initiatives related to landscape amenities and bundles of ecosystem services (Landell-Mills and Porras, 2002). These programmes can be grouped to those implemented for services from agricultural lands and those for services from forest ecosystems (Wunder and Börner, 2011; Wunder et al., 2008; Zilberman et al., 2008, p. 2). Forest-based programmes are often use-restricting whereby land is diverted away from agricultural production to conservation. In contrast, programmes based on agricultural land are usually use-modifying, offering incentives for the adoption of technologies and practices that enhance the provision of ecosystem services (Wunder and Börner, 2011; Wunder et al., 2008; Zilberman et al., 2008, p. 2).

Most PES programmes in developed countries are for services from agricultural land whereas in developing countries (i.e. Latin America) they are often for services from forest ecosystems (Baylis et al., 2008; FAO, 2007b; Ribaudo et al., 2010; Schomers and Matzdorf, 2013; Wunder and Börner, 2011). Yet, agricultural ecosystems are vital ecosystems that supply many ecosystem services beyond food, fibre and fuel (Swinton et al., 2006). They supply provisioning services (e.g. food, fresh water, and bioenergy), cultural services (e.g. recreation and education) and regulating services (e.g., climate erosion, and pests) and at the same time demand supporting services (e.g. biogeochemical cycling, biodiversity/habitat) to function (FAO, 2007b; MA, 2005; Power, 2010; Swinton et al., 2006). As ecosystem services have been endangered by degradation of agro-ecosystems and budget constraints that limit their preservation, the establishment of PES programmes on agricultural land is essential in developing countries (Ferraro and Kiss, 2002; MA, 2005).

The development of PES programmes on agricultural lands is receiving increasingly serious attention in developing countries (Branca et al., 2011; FAO, 2007b; MA, 2005; Ribaudo et al., 2010; Wunder and Börner, 2011). However, whilst there has been some proliferation of

research on PES in developing countries, there remains a gap in empirical evaluations that assess the determinants of farmer decisions whether or not to participate in PES programmes implemented on agricultural land to address conservation and development objectives in developing countries. The development of PES interventions in developing countries faces significant challenges because of weak institutions, missing markets, high incidence of poverty, insecure land tenure, demand side limitations and supply side dynamics (Ferraro, 2009; Wunder, 2007). This suggests that farmers in agricultural land based PES programmes could face complex decisions on whether to adopt land uses promoted by them, taking into account the key hallmarks of PES such as voluntary transactions and conditional payments (Muller and Albers, 2004; Rios and Pagiola, 2010; Wunder, 2005, p. 3).

This study seeks to narrow the above gap by empirically evaluating the determinants of farmers' decision to participate in PES programmes implemented on agricultural land to achieve conservation and development goals in developing countries. Most of the existing studies focus on China and Latin America, particularly on forest based PES programmes financed by governments and international organisations (Ferraro, 2009; Grosjean and Kontoleon, 2009; Pagiola, 2008; Pagiola et al., 2007, 2010; Uchida et al., 2007; Wunder and Albán, 2008).

Pagiola et al. (2005) categorise factors that can determine a farmers' decision to participate in a PES programme into factors that affect eligibility to participate; factors that affect a households' desire to participate; and factors that affect their ability to participate. In addition, technology adoption and programme participation studies indicate that factors influencing farmers' participation decisions can include farmer and farm characteristics, programme factors, and the institutional context of the programme (Brotherton, 1989; Knowler and Bradshaw, 2007; Kosoy et al., 2008; Pagiola et al., 2007; Wauters et al., 2010; Wilson, 1997; Yiridoe et al., 2010; Zbinden and Lee, 2005). Farm and farmer characteristics include age and education of a household head, which often determine the ability to obtain and process information and implement knowledge intensive conservation practices (Ayuk, 1997; Azizi Khalkheili and Zamani, 2009; Kosoy et al., 2008; Langpap, 2004; Mullan and Kontoleon, 2009; Zbinden and Lee, 2005). Other farm and farmer characteristics include land tenure, labour availability, access to information, opportunity cost of land and expected impacts on the household income (Mullan and Kontoleon, 2009; Wunder, 2006; Schuck et al., 2002; Zbinden and Lee, 2005).

Programme factors include programme targeting, conditionality, size of incentives, information flow, participatory nature of programme design and expected changes in farm management introduced by the programme (Brotherton, 1989; Kosoy et al., 2008; Mullan and Kontoleon, 2009; Pagiola et al., 2005; Wilson, 1997; Wünscher et al., 2008). Factors related to the wider institutional context include tenure systems in the area of project implementation, access and availability of credit to finance conservation practices, and social and cultural values such as the importance of non-timber products to households, which may influence the land owners willingness to participate in conservation programmes (Corbera et al., 2009; Kosoy et al., 2008; Miranda et al., 2003; Pagiola et al., 2005, 2007, 2008).

This article uses both quantitative and qualitative approaches to explore how farm and farmer characteristics, programme factors, and institutional contexts determine farmers' decisions to participate in agricultural land based PES programmes. This mixed method approach helps to counteract a naïve rational choice view that farmers consider only costs and benefits when deciding whether to participate in a programme (Kosoy et al., 2008). The research focuses on the Equitable Payments for Watershed Services (EPWS) programme piloted in the Kibungo Juu ward in Morogoro, Tanzania as a case study.

The paper is structured as follows: Section 2 describes our methodology. In Section 3 we report the findings on the extent to which farmer and farm characteristics, programme factors and the institutional context of a programme influence participation in the EPWS programme. In Section 4 we discuss the findings in the light of the literature, in Section 5 we draw conclusions and in Section 6 we make policy recommendations.

2. Methodology

2.1. The case study

The EPWS programme is an agricultural land based PES programme in the Kibungo juu ward in Morogoro, Tanzania (Fig. 1). It targets upstream farmers in the Uluguru Mountains in the upper catchment of the Ruvu River, which provides drinking water to Dar-es-Salaam (Branca et al., 2011, Lopa et al., 2012). The EPWS programme promotes sustainable land management practices such as agro-forestry, fanya juu (‘is a Swahili word which means ‘throw soil upwards’ i.e. fanya juu terraces are constructed by digging ditches and heaping

the soil, forming bunds in the upper sides of the ditches) and bench terracing to reduce nutrient mining and soil erosion, which cause high turbidity levels in the Ruvu River. Turbidity increases the costs of water treatment for the water company serving Dar es Salaam and alters seasonal flow patterns. Through village-level contracts, farmers participating in the EPWS programme receive agricultural inputs, technical assistance, and monetary rewards for adopted practices. More information on the EPWS programme can be found in Lopa et al. (2012) which discusses its development, operationalisation, payment mechanism and sustainability. Branca et al. (2011) in turn use the EPWS programme as a case study to explore key challenges for PES programmes in supporting the adoption of sustainable land management practices in developing countries. This article examines factors determining farmers' decisions to participate in the EPWS programme to draw conclusions about factors influencing participation in agricultural land based PES programmes in developing countries.

2.2. Methods

Both quantitative and qualitative approaches are used to gain a deep understanding of the determinants of farmer participation. The study was conducted in three stages. The first stage included a literature review, observation of farms, semi-structured key informant interviews with CARE Tanzania's officers administering the programme, and a focus group discussion with four participating and four non-participating farmers in October and November 2010. The first stage of material collection sought to generate grounded knowledge about technology adoption, programme participation and the context of the EPWS programme. Key informant interviews were performed with the present and past village leaders, teachers, the ward forest officer and the EPWS programme officers (Babbie, 2008; Bernard, 2006).

In the second stage, structured questionnaires were administered to 116 EPWS programme participants and 117 nonparticipants between March and May 2011 in four villages in the Kibungo Juu ward. As the interest of the study was to explore the determinants of participation and the differences in participation within the sample, we selected households from each village using stratified random sampling generated through the wealth ranking technique which categorised households into poor, middle and rich to ensure that they were representative (Chambers, 1994; White and Pettit, 2004).

A nominal logistic regression model was used to determine what factors are significant determinants of a farmer0s decision to participate in the EPWS programme. This was informed by past studies on programme participation and adoption of agricultural technologies (Ayuk, 1997; Lise, 2000; Mullan and Kontoleon, 2009; Thangata and Alavalapati, 2003; Yiridoe et al., 2010; Zbinden and Lee, 2005). The factors hypothesised to influence farmer participation decisions on the basis of the literature review are summarised in Table 1. Given the hypothesised determinants of participation, the general form of the participation model is

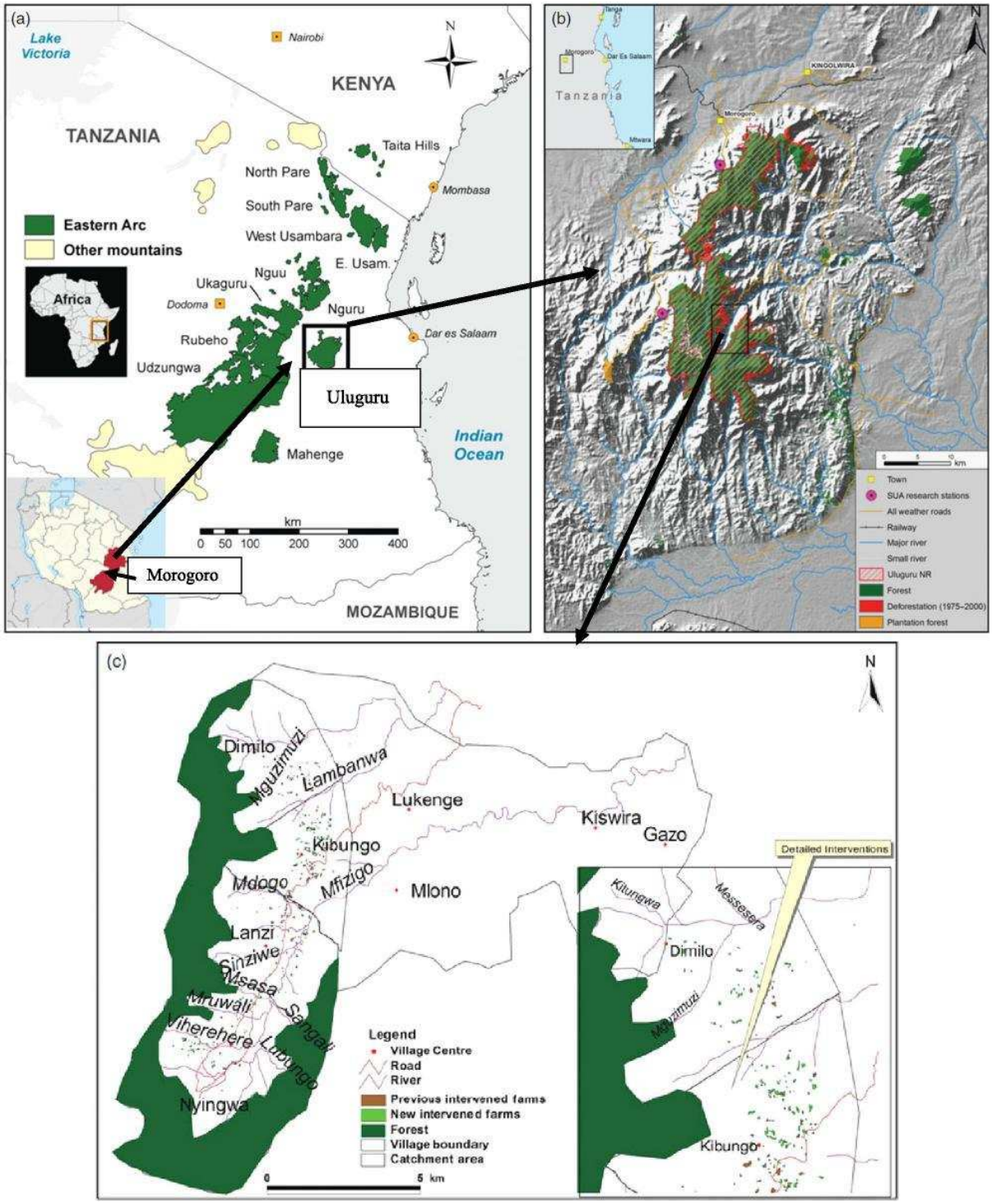
$$E(Y_i) = \alpha + \beta_1\, gender + \beta_2\, age + \beta_3\, educ + \beta_4\, hhsize + \beta_5\, fsize + \beta_6\, landown + \beta_7\, memberships + \beta_8\, importnNTP + \beta_9\, exluse + \beta_{10}\, participatory + \beta_{11}\, changeinm + \beta_{12}\, info + \varepsilon$$

where Y_i is the dependent variable — participation, α is the constant, βs are the coefficients of each explanatory variable and ε represent errors due to unobservable.

In the third stage, the determinants of participation were explored further on the basis of 32 key informant interviews and 16 focus group discussions. In this stage, key informant interviews were conducted with the EPWS programme officers, village leaders, eight representatives of EPWS groups in each programme village, and eight EPWS participating and eight non-participating households. Focus group discussions were used to capture divergent viewpoints about the determinants of participation decisions (Hopkins, 2007). The selection of focus group participants was based on their experience and knowledge of the EPWS programme and the community (Creswell and Plano Clark, 2007; Hopkins, 2007). Representatives of local organisations and participating and non-participating households were selected for focus group discussions. Separate focus group discussions were conducted with EPWS participating and non-participating households in each programme village. The size of focus group discussions was between 8 and 10 people. The key informant interviews and focus group discussions were conducted in Swahili, audio recorded and then transcribed to English. The content analysis approach was used to analyse key informant interviews and focus group discussions data (Neuendorf, 2002).

Fig.1. (a) The Eastern Arc Mountain. (b) The Uluguru Mountains showing the location of the EPWS programme. (c) Kibungo sub-catchment in the Uluguru Mountains showing the

location of villages and small streams and the location of the focal villages and individual farmers' fields under project interventions (inset). Source: Adapted from Lopa et al. (2012).



Variable name	Description	Expected sign
gender	Gender of household head: 1 if male; 0 if female	-
age	Age of the household head	-
educ	Years of schooling of the household head	+
hhsize	Number of working people in the household aged between 16 and 64 years old	+
fsize	A farm size of the household	+
landown	Household land tenure: 1 if own private land; 0 otherwise (i.e. rented).	+
memberships	Number of affiliation that the household have	+
importnNTP	Importance of non-timber products (NTP)	+
exluse	Past land use: 1 if implemented conservation practice in the past; 0 otherwise	+
participatory	Programme inclusiveness in terms of participation in the design phase 1 and 0 otherwise	+
changeifm	Change in farm management required (1=difficult, 0=otherwise)	
info	Access to information and support i.e. EPWS extension services: 1 if yes; 0 if otherwise	+

Table 1:

The explanatory variables used in the logistic regression equation (1).

3. Results

3.1. The characteristics of EPWS programme participants and nonparticipants

Respondents included 65% males and 35% females and their average age was 48 years. Almost 70% of the respondents had 7 or more years of education while the remaining 30% had not completed primary school. The wealth ranking exercise identified 55.4% of respondents as middle income, 31.3% as poor and 13.3% as rich. Males made up 80% of the rich, 62.8% of the middle income, and 63% of the poor. The respondents' average harvest was 197 kg of maize, 111 kg beans, and 50 kg groundnuts, 74 boxes of bananas and 45 boxes of cassava. Irrigation was practiced by 41.6% of farmers. Of these, 74% used traditional furrow, 22.7% used buckets and 3.1% used a combination of the two. The main occupation of nearly all respondents (95.7%) was farming. The rest were self-employed (3%) and wage employees (1.3%). The most commonly grown crops included rice, maize, beans, groundnuts, cinnamon, sugarcane, banana, cassava, sweet potatoes, tomatoes, cabbages and pineapple. The average farm size was 3 acres: the largest farm among the respondents was 6.5 acres and the smallest less than an acre. Over half of the households, 54.1% owned private land, 42% cultivated lineage land and 3.9% rented or shared crop lands. Most farms (65.3%) were on moderately hilly or flat terrain, 20% on hilly terrain and 14.7% on flat terrain. Most farms had dark brown silt soils locally known as fifisi (85.2%) and the rest had either red soil (12.1%), clay soil — kikododo (1.3%) or grey soil — fibwefibwe (1.3%). Over three quarters (78.1%) of the farmers used the soil quality to determine land use, the rest (21.9%) did so on the basis of road access. The farmers' average walking time from their cultivation to the nearest service road was 60 min.

Two thirds (66.2%) of farmers were aware of the availability of extension services in their villages and 55.1% had received assistance from them. Over half (56.1%) of the farmers considered that the availability of extension officers had improved a little or greatly with the EPWS while for 38.8% it had remained the same. Also, conservation practices became common after the EPWS began. Over half (52.2%) of the farmers had planted trees on their farms before EPWS, while after its implementation 75.4% had planted trees. Agro-forestry practices spread from 46.7% of farmers before EPWS to 53.3% after it. In addition, after EPWS, 37.3% constructed bench terraces, 33.5% piled soil up (fanya juu) and 42.5% reforested.

There were clear differences between the EPWS programme participating and non-participating households (see Table 2). The heads of EPWS participating households were younger (age) than those of non-participating households. They also had received more education (educ) than the non-participating heads of households. The EPWS participating households were also larger (hhsize 15-64), with more members to contribute to farm work. Finally, the EPWS participating households had larger farms (fsize). Table 3 shows the breakdown of programme participants into wealth groups and their similarities and differences. The middle wealth group has younger household heads, with many years of schooling, and larger farm sizes than the low and high wealth group. Fig. 2 shows the distribution of the adopted SLM practices by wealth groups.

3.2. The determinants of EPWS programme participation

The potential determinants of participation in the EPWS programme are reported in Table 4. Farm size, access to information (extension services), the participatory nature of the programme in the design phase, and the magnitude of required changes in farm management are all positive and significant determinants of farmer participation in the EPWS programme. Other positive variables although not significant were the education of the household head, household head's social affiliations, amount of household labour, past conservation experience, and type of land ownership. Gender of the household head, the importance of non-timber forest products and the age of household head were negative and not significant determinants of the EPWS programme. In Table 1, the hypothesised determinants to participate in the EPWS programme are presented.

Farm size (fsize) is a positive and significant determinant of farmer participation in the EPWS programme. Regarding the influence of land size, key informants and the participants of focus groups argued that farmers who have large land holdings are more likely to adopt sustainable land management practices than small land holders. Larger land holders are more flexible, wealthier and able to handle the risk of crop failure by dividing up the farm for use for different purposes unlike smaller land holding farmers. Farmers with small farms were reluctant to construct terraces or use “fanya juu” measures: their farms were considered too small to produce enough food during the first 3–5 years of soil fertility regeneration following the construction of terraces. In the construction of terraces the fertile top soil is buried beneath unfertile rocky soil leaving the top soil unproductive. A farmer from Lanzi village explained that “if I construct terraces my children will die of food shortage; as without manure you will not be able to harvest anything”.

The farmers' access to information (info) is another positive and significant determinant of EPWS programme participation. Focus group discussions illustrated that public meetings conducted by the EPWS officers in programme villages provided information that was used to make participation decisions. The CARE staff stationed in the programme villages also disseminated information about the EPWS programme. In addition, information was exchanged among farmers: information on experienced harvest improvements was often obtained from neighbours and it was considered an important reason for adopting EPWS programmes' sustainable land management practices. For example, a farmer from Lanzi Village said that “I did not join the EPWS program from the beginning because of my limited faith in what the EPWS experts were telling us. However, when I witnessed what my brother was harvesting from his small terraced farm, I was convinced to construct terraces. I immediately hired terrace construction experts and asked the CARE experts to provide advice to construct terraces in my three acre farm”.

Farmers also obtained information in local training workshops arranged to create awareness and develop practical skills for adopting and implementing project measures. Nearly 700 farmers were trained between July 2009 and June 2010 in sustainable land management practices, which included the construction and use of “fanya juu” and bench terraces, tree nursery establishment and management, tree planting methods and field management, grass strip farming techniques, practices to improve soil moisture and production, and animal husbandry for income generation and manure production.

The participation of farmers in the design phase (participatory) was also a positive and significant determinant of participation. According to key informant interviews and focus group discussions, the EPWS programme design phase involved consultative (functional) participation in the form of research and through a village meeting. In these meetings, EPWS programmes' sustainable land management practices were marketed to farmers. However, the consultation did not determine programme content. A farmer from Kibungo village explained that “if the programme was collaborative and our opinions were asked and considered in the design of the programme, we would have preferred to start the programme by keeping livestock for manure followed by construction of bench terraces and “fanya juu”. The programme did not choose to do so. According to the EPWS programme officer, “....farmers was required to engage in sustainable land management activities that have additionality impact for the improvement of water for them to be eligible for payment”.

Another positive and significant determinant of farmer participation in the EPWS programme is the magnitude of required change in farm management (changeifm). Key informant interviews and focus group discussions highlighted that the adoption of agroforestry measures and reforestation were easier than the construction of bench terraces and “fanya juu”. The main constraint for the adoption of “fanya juu” terraces and bench terraces was the high costs of labour needed to construct terraces and the lack of manure. Without manure, terraces can take up to 4 years to regain fertility. This temporary crop yield decline could endanger food security. It was reported by a farmer in Kibungo village that “currently, we don’t have enough food because of little harvests caused by the lack of manure”. Another constraint was land tenure whereby in tribal lands, the customary land tenure system would not allow the construction of permanent structures such as terraces or “fanya juu”.

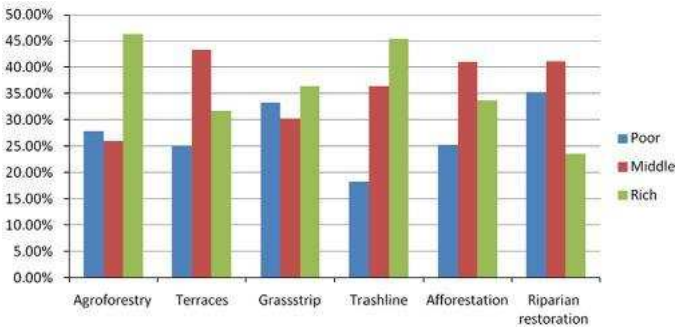
Name of the variable	Participating (n=116)		Not-participating (n=117)	
	Mean	Std. deviation	Mean	Std. deviation
gender	0.72	0.45	0.58	0.50
age	43.72	13.26	51.71	15.88
educ	6.74	2.03	5.68	2.20
hhsize	3.00	1.28	3.00	1.29
fsize	3.55	1.44	2.46	1.27
landown	0.60	0.51	1.59	0.62
memberships	5.21	1.49	1.08	1.22
importnNTP	0.84	1.12	3.09	0.84
exluse	0.54	0.50	0.38	0.49
participatory	0.88	0.31	0.25	0.44
changeifm	0.58	1.29	1.34	0.82
info	0.84	0.37	0.25	0.43

Table 2:

Descriptive statistics for explanatory variables.

Fig. 2. EPWS programme participant's implementation of SLM practices by wealth groups.

Note: The poor are 16, middle are 79 and the rich are 21.



	Name of the variable	Poor	Middle	Rich	All
	Distribution of participating households (%)	37.00	49.00	14.00	100.00
gender	Gender of the household head (%)				
	Male	40.50	44.00	15.50	72.40
	Female	31.30	46.90	21.90	27.60
age	Age of the household head (average)	41.91	42.88	49.9	43.72
educ	Years of schooling of the household head/respondent (average)	6.66	6.90	6.50	6.74
hhsize	Household members aged 15–64 (average)	2.00	3.00	3.00	3.00
fsize	Acres of land owned by household	2.28	4.40	3.84	3.55
landown	Private land ownership (% of yes)	35.70	51.40	12.90	60.30
memberships	Total number of household memberships (average)	3.50	5.77	6.30	5.21
importnNTP	Importance of non-timber products (NTP) (% of yes)	36.70	44.90	18.40	84.50
exluse	Conservation experience before EPWS scheme (% of yes)	49.20	34.90	15.90	54.00
participatory	Inclusiveness of the programme in terms of participatory nature of the programme in the design phase (% of yes)	37.90	45.60	16.50	88.80
changeifm	Change in farm management required (% of yes)	34.30	43.30	22.40	57.80
info	Access to information and support (% of yes)	40.20	43.30	16.50	83.60

Table 3

Characteristics of the participating households by wealth category

Variable	Estimated coefficients	S.E.	t-Ratio	Marginal effects	Odds ratio
gender	−0.15	0.52	−0.29	0.78	0.86
age	−0.02	0.02	−1.00	0.30	0.98
educ	0.01	0.12	0.08	0.96	1.01
hhsize	0.15	0.2	0.75	0.45	1.16
fsize	0.38	0.17	2.24**	0.03	1.46
landown	0.33	0.48	0.69	0.49	1.39
memberships	0.05	0.16	0.31	0.75	1.05
importnNTP	2.77	0.45	6.16***	0.00	15.94
exluse	0.48	0.42	1.14	0.26	1.61
participatory	−0.12	0.48	−0.25	0.80	0.89
changeifm	0.76	0.46	1.65*	0.10	2.14
info	1.45	0.48	3.02***	0.00	4.28
Constant	−3.82	1.43	−2.67**	0.01	0.02
Nagelkerke R^2					0.67
Likelihood ratio test X^2					13.955 (8df)
Hosmer and Lemeshow test					0.83
Proportion of observation correctly predicted as participants (%)					86.2
Proportion of observations correctly predicted as non participants (%)					80.3
Overall percentage correctly classified (%)					83.3
Total number of observations					233

* Significant at=0.1%. ** Significant at=0.05%. *** Significant at=0.001%.

Table 4

The logistic regression results for a farmers' participation in EPWS programme.

4. Discussion

The findings of this study extend the limited empirical evidence relating to the reasons for farmers deciding to participate in agricultural based PES in developing countries. The findings of the study demonstrate that farm size, access to information, landholder participation in the programme design and the magnitude of change in farm management required by the programme determine whether farmers participate in the EPWS programme. Many of the findings are consistent with other studies that have investigated participation or adoption of agricultural conservation technologies.

Firstly, farm size is often reported to influence the adoption of soil and water conservation measures such as bench terraces, “fanya juu” and stone terraces (Santos et al., 2006). The common explanation for this finding is that larger farms can offer farmers more flexibility in decision making, greater access to discretionary resources, and more ability to deal with risks and more opportunity to try new practices than is possible for farmers with small farms (Amsalu and De Graaff, 2007). Farmers with large farms often invest more in conservation measures to increase farm income and wealth than those with small farms (Woldeamlak, 2007). Farmers with small farms lag behind in the adoption of terraces. In Ethiopia, Amsalu and De Graaff (2007) reported that the loss of land fertility due to terracing and temporal decline of yields discouraged small farmers from adopting stone terraces. Tenge et al. (2005) reported a similar finding from the West Usambara Mountains – the adoption of major soil and water conservation measures was lower among farmers with small farms than among farmers with a large amount of land.

Secondly, access to information significantly influenced participation decisions in the EPWS programme. This is not surprising because previous studies have long recognised the importance of information availability and access in the adoption and diffusion of innovation (Knowler and Bradshaw, 2007). It has been shown that information about conservation programmes helps the farmer to confirm or dismiss their positive or negative views or prior expectations about a programme (Frondel et al., 2012). Indeed, information is crucial for land owners before they can make decisions about opting in or opting out of agricultural conservation programme. This shows that channels or sources of information such as other farmers, media, meetings and extension officers need to be considered and improved to ensure the success of conservation practices (Knowler and Bradshaw, 2007). The choice of information channel is crucial because some channels can be significantly limited by the ability of potential adopters to access the available information and understand the message communicated to them (Napier, 1991). Some channels are more effective than others. In this

study, farmer to farmer communication was important in influencing adoption of sustainable land management practices such as bench terraces, “fanya juu”, agro-forestry and high value crops. This suggests that positive farmer-to-farmer communication has the potential to increase adoption of programme practices even after the programme ends.

Thirdly, the study findings show that farmers are more willing to participate when the programme is participatory. In the case of the EPWS programme, participation levels could have been higher if the views of the farmers on the importance of the availability of manure had been heeded in the design of the programme. As several other studies have reported, using a participatory approach in the implementation of conservation projects is invaluable. For example, in a case study on the Peruvian Andes, Posthumus (2005) shows that a participatory conservation programme has a significant positive influence on the adoption decision compared to a top-down conservation programme. Pretty and Shah (1997) similarly report that the use of a participatory approach encourages an amalgamation of farmers' knowledge with scientific knowledge while strengthening local capacities to experiment and innovate. In general, a participatory approach is a necessary precondition for effective implementation of sustainable land management practices.

Fourthly, we find that the magnitude of change in farm management required by the programme significantly influenced farmer participation in the EPWS programme. It has previously been reported that conservation technologies, which are easy to adopt for a particular farming system are more likely to be adopted than the difficult ones (Napier, 1991). It has also been reported that farmers are less likely to participate when a programme requires substantial changes in farm management (Wilson and Hart, 2001). For example, Wilson et al. (1999) report that some farmers in environmentally sensitive areas did not participate in a programme because of the immense changes required by it. Similar findings have been reported by Shiferaw and Holden (2000) in Ethiopia, Lapar and Pandey (1999) in the Philippines and Kerr and Sanghi (1992) in India. Lack of resources and high labour demand often constrain conservation practices such as construction of terraces and agro-forestry (Napier, 1991).

Fifthly, the findings suggest that the acceptance of terraces in the EPWS programme with PES incentives is novel. Construction of terraces introduced without incentives by the Uluguru Land Usage Scheme was violently resisted in the case study area in the 1950s (Carswell, 2006; Young and Fosbrooke, 1960). A PES approach has potential to encourage the adoption of agricultural pro-environmental behaviours such as construction of terraces and other conservation measures. However, customary land tenure poses a considerable

challenge to agricultural land based PES programmes in Morogoro and elsewhere in Tanzania because it restricts the right to create permanent structures and improvements on clan land. That is, the adoption of sustainable land management practices on the basis of PES incentives may not be compatible with the customary land tenure rules.

Finally, although one of the main intentions of EPWS programmes is to achieve equity, the findings show that farmers who have more land are more likely to participate than those with less land. This is not surprising because the payments made under PES programmes are payments to farmers for undertaking land use changes required by the programme (Wunder, 2008a, 2008b). Land ownership and distribution are critical to whether the programme can achieve its poverty reduction and equity objectives (Wunder, 2008b). The size of land holdings will influence farmers0 decision to participate in agricultural land based PES programmes. This will be a critical factor for targeting of PES contracts: targeting them to fewer farmers with big farms makes more economic sense than targeting many small farms. This could make a PES programme efficient while reducing administrative costs. The implication of this is that equity goals may conflict with the efficiency and environmental goals of a PES programme. As such, this will in turn force policymakers to choose an optimal balance among multiple goals.

5. Conclusion

The findings demonstrate that farm size, access to information, participation of farmers in the design phase and the change in farm management required by the programme significantly influence the decisions to participate in the EPWS programme. Given the widespread problem of watershed degradation in developing countries, these findings point to the urgent need for the establishment of PES programmes on agricultural lands to maintain and improve the quality and quantity of water resources in developing countries.

Our findings suggest that the effective design and implementation of PES programmes for implementation in agricultural systems requires a thorough understanding of resource manager characteristics, features of the PES programme and the institutional context of a PES programme. The participation of less wealthy farmers will not be achieved without supportive measures. Unavailability of agricultural inputs such as manure may prevent the construction of terraces on agricultural lands required for food production. This is a critical issue which requires rigorous assessment of landholders0 preferences from the local perspective during the design of PES programmes. Also, participation of farmers in

programme design and implementation can ensure inclusion of crucial factors for the participation of more disadvantaged farmers.

The findings also suggest that the willingness to participate in the EPWS programme increased over time. While access to information through the EPWS extension officers and public events was important, farmers also wanted to see if the early adopters benefited from the programme. When the substantial benefits from participation became clear, more cautious farmers became willing to participate. This suggests that programmes like EPWS should make a serious effort to generate demonstration cases and ensure sufficient time for recruitment of farmers.

6. Policy recommendations

To encourage wider adoption of sustainable land management practices, non-financial measures may be needed to deal with adoption barriers such as limited availability of irrigation water and manure, land tenure, fears over eviction or displacement by government and historical associations with terracing. Since the exchange of knowledge and information from farmer to farmer communication plays an important role in transferring the programme benefits and problems, supporting positive farmer to farmer learning is also a valuable and cost-effective means to encourage wider participation and enhance programme impacts.

The findings also suggest that extension contacts are essential for promoting the adoption of sustainable land management practices. At the policy level, this implies that improving the quality of extension services is of paramount importance for conservation practices and PES in particular. In providing effective services, extension agents should conduct frequent visits and meetings with farmers within their areas. Also, the enhancement of paraprofessionals such as local farmers who can read and write could improve the quality of extension services. In addition, extension activities of an agriculturally based PES programme must be based on the socioeconomic status of the farmers and needs. Furthermore, local farmers should be involved in the design of programmes and in modifying the implementation of the practices which may provide valuable feedback to programme improvements.

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