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The impact of equitable payment for watershed services scheme on livelihoods in Tanzania: The case of Uluguru Mountains

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Abstract

Care International and WWF initiated Equitable Payments for Watershed Services (EPWS) scheme. The Scheme aimed at modifying unsustainable land use practices to conserve watershed areas in the Uluguru Mountains and improving the livelihoods of the communities. This study investigates the outcome of the project and this study is a response to this. A total of 120 households were selected randomly from 3 villages under the Scheme. There was also a consultation with focus groups and key informants. Structured and semi-structured questionnaires were used to collect information and analysed using Chi-square and Choice Model techniques. Findings revealed a significant improvement in social capital and land productivity ($p=0.05$) while access to non-timber forest products and wildlife resources were reported to have deteriorated. Also livelihood capital of financial, human and physical did not improve among the EPWS participating respondents. The most preferred incentive package by the respondents was mentioned to be sustainable land use, access to forest goods and services, improved extension services, access to inputs and agricultural commodity markets. For sustainability of the EPWS programmes, incentives packages should reflect the opportunity cost of abandoning the ongoing land use practices by the communities. The package should also take into account people's choice and preferences.

Keywords: Conservation, Payment for environmental services, Livelihoods, Tanzania, Africa

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1. Introduction

It is generally accepted that the Uluguru Mountains in Tanzania provide a variety of valuable environmental services which include biodiversity, carbon sequestration, and watershed functions. According to Mittermeier et al. (2004), the area possesses great endemic biodiversity with several endangered floral and faunal species, thus classified as among the top biodiversity hotspots of the world. However, the most important benefit for Tanzanians is perhaps the regulation of water flow. The Uluguru Mountains form the main water catchment area of the Wami/Ruvu Basin and it is the source of Ruvu River, which provides water to most parts of Dar es Salaam city, Morogoro and Coast regions (Burgess et al., 2002). Nevertheless, the economic value of such services is seldom recognized in land-use decisions due to market failures associated with externalities and the public goods characteristics.

In Tanzania, pressure from unsustainable farming and logging activities have significantly reduced forest cover in the Uluguru Mountains and therefore most environmental services are under threat. Allegedly, over the last fifty years or thereabout, a significant proportion of tree cover has been lost, resulting in recurrent landslides, massive forest loss, bare mountain slopes, high sediment load in rivers and streams and rampant water pollution. This situation has negatively affected quantity and quality of the water in Ruvu River and its tributaries. To that effect, the resilience of the water sector in Tanzania largely depends on the ability of the government and other stakeholders to quickly improve the management of important ecosystems and watersheds like the Uluguru Mountains in Morogoro, Eastern Tanzania.

In 2009 Care International and the World Wide Fund for Nature (WWF), together with the International Institute for Environment and Development (IIED) initiated a payment for ecosystem services project known as Equitable Payment for Watershed Services (EPWS). In this concept it was hoped that the environment service buyers could be the Government of Tanzania through water utility companies, the private companies such as breweries and beverage companies. The project was aimed at modifying unsustainable land use practices in order to conserve and improve watersheds around Kibungo juu sub-catchment, in the Uluguru Mountains, for reliable supply, flow and quality of water. The programme was also aimed at improving the quality of life of communities through providing substantial benefits to the poor, hence contributing to poverty reduction strategies in Tanzania. The project therefore proposed to demonstrate how equitable PES could reverse forest loss and the related goods and services through addressing the core drivers of land-use change.

Generally the impact of PES on enhancing conservation and livelihoods is inconclusive. Grieg-Gran et al. (2005); Pagiola et al. (2005); Pagiola et al. (2008) and Peskett et al. (2008) conducted studies to assess the degree to which low-income Environmental Service Providers (ESP) are benefitting or could benefit from PES schemes. The results from all these studies indicated that PES does or could provide important livelihood benefits to poor people at the household or community level, whether in the form of cash payments or non-cash benefits. However, Sayer (1995) explained that despite the scattered successes, neither approach had until then achieved major shifts in tropical land degradation. This suggests a need to undertake more studies on the impact of PES on conservation and livelihoods case by case before a robust

policy implication could be developed. This is especially important for a country like Tanzania where PES is a new concept and in most cases still under experimentation.

The main objective of this study was to come up with an understanding of the impact of the equitable payment for watershed services scheme on livelihood improvement of the communities in the Uluguru Mountains. Specifically, the study intended to:

- Examine the types and extent of adoption of environmental and watershed conservation activities introduced by the EPWS scheme in the Kibungo juu sub-catchment area.
- Assess the impact of EPWS on livelihoods of the ecosystem service providers in the Uluguru Mountains.
- Investigate the choice and preferences of ecosystem service providers for the different predetermined EPWS attributes.

This study contributes to the body of knowledge on PES, conservation and livelihoods. Also the results generated from this study could be used as one of the tools for conflict resolution and negotiation between farmers and conservation practitioners. Furthermore, the study informs policy/decision-makers and the donor community on how best PES could be implemented for the optimal outcome of poverty alleviation and environmental conservation.

2. The theoretical framework of PES and livelihoods impacts

2.1. Defining PES

FAO (2007) define PES as an approach to environmental management that uses cash payments or other compensation to encourage ecosystem conservation and restoration. It includes direct payments from ecosystem service beneficiaries to land stewards, as well as indirect payments earned through eco-certified production. According to Wunder (2005) four ecosystem service types on which PES operates stand out: (i) Carbon sequestration and storage (ii) Biodiversity protection; (iii) Watershed protection, (iv) Landscape beauty (e.g. a tourism operator paying a local community not to hunt in a forest being used for tourists' wildlife viewing). However, environmental services other than those pointed out by Wunder (2005) also could potentially be traded, for example, wilderness areas providing pollination services to agriculture (Mussa, 2012), but so far only the four mentioned services operate on a significant commercial score in many parts of the world.

2.2. Livelihood and livelihood improvement

Chambers and Conway (1992) define livelihood to comprise the capabilities, assets (both material and social) and activities required as a means of earning a living. According to Davies (1996), the ability of a livelihood to cope with and recover from stresses and shocks is central to an assessment of the impact on livelihoods of any development initiative. The author emphasizes that such resilience in the face of stresses and shocks is key to both livelihood adaptation and coping with them. Those who are unable to cope (temporary

adjustments in the face of change) or adapt (longer- term shifts in livelihood strategies) are inevitably vulnerable and unlikely to achieve sustainable livelihoods.

Scoones (1998) classified livelihood assets into the following categories. (i) Natural livelihood assets which include soil, water, air, genetic resources and environmental services such as the hydrological cycle, pollution sinks etc, from which resource and services useful for livelihoods flow. (ii) Economic or financial capital, the capital base comprising cash, credit/debt, savings, and other economic assets, including basic infrastructure and production equipment and technologies, which are essential for the pursuit of any livelihood strategy. (iii) Human capital such as the skills, knowledge, ability to labour and good health and physical capability important for the successful pursuit of different livelihood strategies is another category of livelihood assets (iv) Social capital, the social resources (networks, social claims, social relations, affiliations, associations) upon which people draw when pursuing different livelihood strategies requiring coordinated actions. This categorisation of livelihood has been adopted in this study.

2.3. The impact of PES on livelihoods

Although various case studies show that PES programmes can have positive impacts on local livelihoods (Inforesources, 2004), generally the literature on the impact of PES on livelihoods is rather inconclusive. For example, PES advocates argue that PES can provide new (especially private-sector) funding; and that poor communities selling these services can improve their livelihoods. Molnar et al. (2004) argue that as markets and compensation schemes for ecosystem services are established, low-income land stewards stand to benefit from the increased value placed on the services these lands provide. According to the authors, empirically, poor people who participate in PES generally receive a net positive level of benefits from cash payments and/or other livelihood enhancements.

Wunder (2008) analysed six PES projects and found that the benefits accruing to the poor ESPs were significant in all cases, with payments comprising 10 to over 50% of household income. Milder et al. (2010) estimated that watershed protection PES could benefit 80–100 million low-income households by 2030, adding that, historically, the public sector has been the largest buyer of watershed protection services, a situation which apply to Tanzania although also private companies such as those involved in breweries and beverages are also potential key buyers. Wunder et al. (2005) concluded that when PES does not benefit participants, it is because participation is not truly voluntary.

On the other hand, Uchida et al. (2007) and Bennett (2008) found that household-level effects associated with China's Sloping Land Conversion Programme have been more variable. According to these studies although the programme reached millions of low-income households with an overall positive effect, payments were sometimes not fully delivered or were less than farmers' opportunity costs. More serious PES sceptics fear that it reintroduces fines and fences by decoupling conservation from development. This fosters an asymmetric distribution of power within society and it literally means that powerful conservation consortia may deprive communities of their legitimate land-development aspirations and that commercial conservation may erode culturally rooted, not for profit conservation values (Vogel, 2002). Furthermore, sceptics question the effectiveness of a market-based instrument like PES in terms of benefiting the poor.

Despite all that, PES impacts on conservation and livelihoods are still potential. According to the study by Bhatnagar (2008), PES schemes usually tend to internalize private and public benefits, targeting win-win options by maintaining the environmental services and improving livelihoods. Jindal and Kerr (2007) warn that PES schemes must take care to avoid situations where livelihood improvement and environmental protection objectives compete with each other.

2.4. The conceptual framework of the study

PES is usually guided by national and international laws (Figure 1). In this conceptual framework these are regarded as external forces which any PES idea has to take account of it in order to succeed. The implementing agency (Care international, WWF and IIED), being guided by the national and international laws, comes up with an incentive package, (e.g. monetary payments/compensation, agricultural inputs) which induces behavioural change amongst ESP so that they adopt environmental conservation activities with the assumption that the incentives will attract the participation of ESP, from which livelihood impact of a PES scheme can be measured. It is further hypothesized that the more that conservation activities under PES are adopted, the more likely that the implementing household/individual will receive Benefits including cash, which would lead to improved livelihoods.

On the other hand, the implementing agency, using existing national and international laws, has to elicit the preferences of the ESP as these can be used to devise an incentive package that attracts participation, hence the adoption of conservation activities. However, there are stated cases where non-participants communities also adopt conservation activities under PES. Does this apply to the EPWS scheme in the Uluguru Mountains? Generally, this study attempts to assess on whether EPWS in Uluguru Mountains catered for the preferences of the ESP (both participants and non-participants) and improved livelihoods of the participating communities.

3. Material and methods

3.1. The study area

The Uluguru Mountains lie in the Eastern Tanzania, between latitudes 7° and 8°S and longitudes 36° and 38°E, about 200 km from Dar es Salaam, the commercial city of Tanzania (URT, 2012). This study was carried out in Kibungo juu ward in Morogoro region. The population was 6297, with 3393 and 2904 being female and male residents, respectively. Rainfall is estimated to 1,200 be mm/year and above 2,000mm on the western slopes. The mean annual temperature is 24.3°C (URT, 2012).

3.2. Data collection

Both secondary and primary data were collected. The study started with an extensive review of the earlier studies on PES, which helped to familiarise with the sector and helped to establish a gap for field data collection.

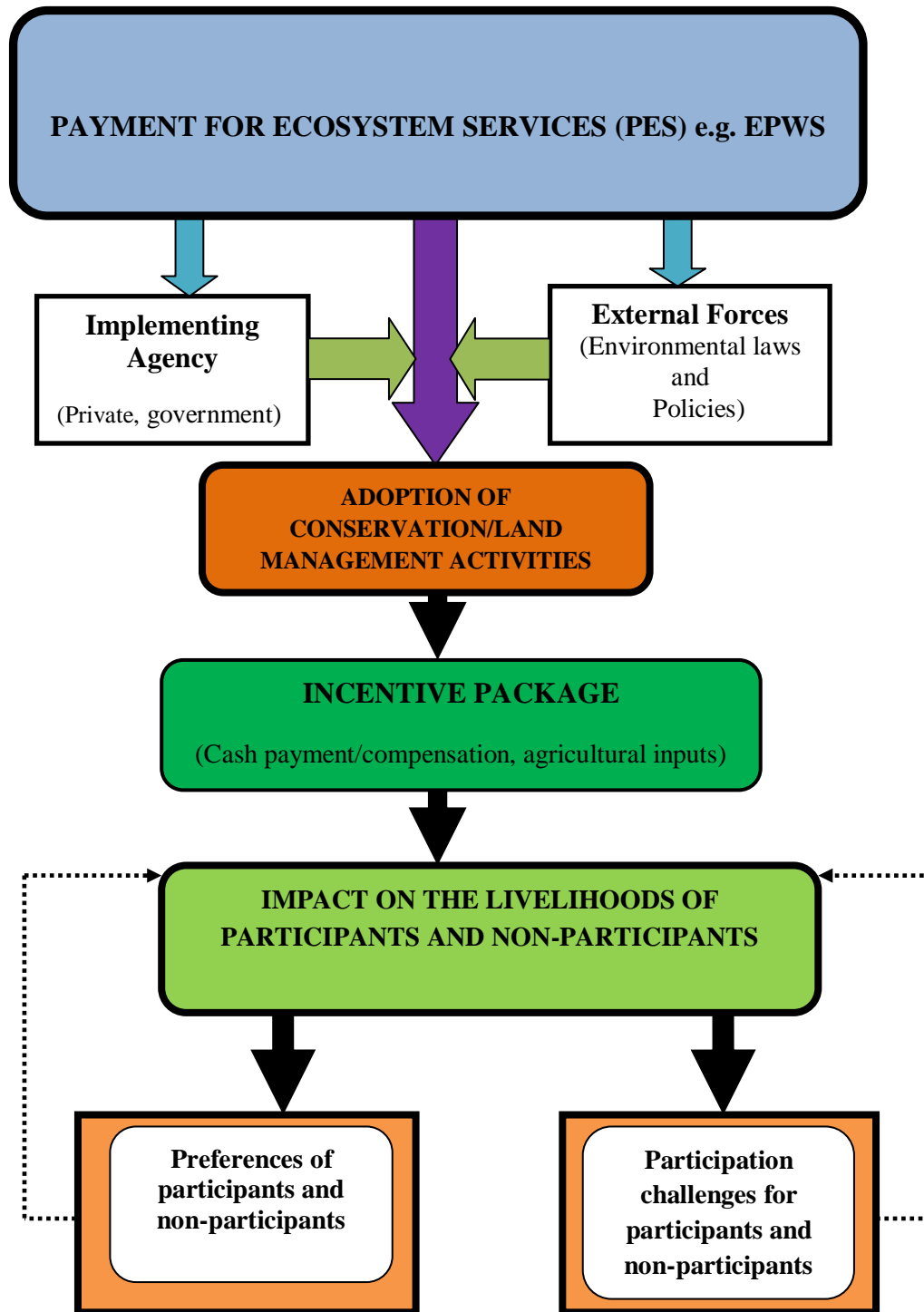


Figure 1. Conceptual framework

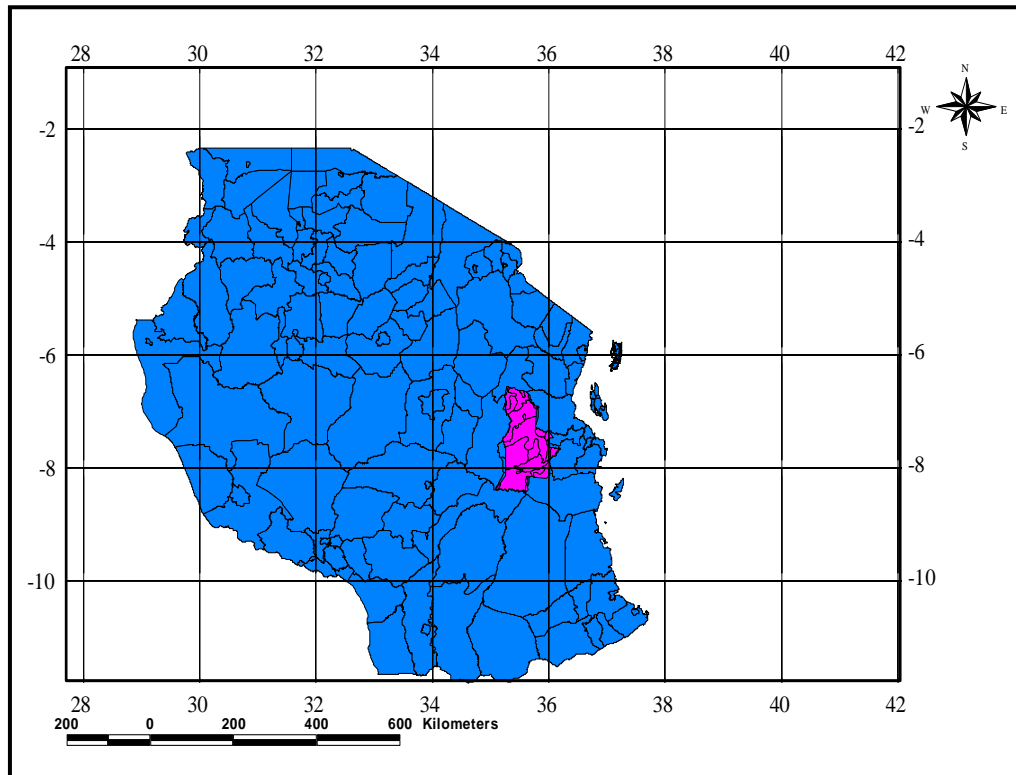


Figure 2. The location of Uluguru Mountains in Tanzania

The sampling frame was based on the list of the Scheme participating names and village government household roster. The total number of households (n) to be surveyed was determined using the following formula:

$$n = \frac{N}{1 + Ne^2}$$

$$1 + Ne^2$$

- where: n = sample size
- N = total number of households in the area; and
- e = desired margin of error

A total of 120 households were selected randomly in the three villages for interview from a total of 1102 which is 10.9% of the total households in the three study villages. The respondents were basically heads of households and where the head of the household was not available, a spouse, child or a member of the family who was knowledgeable with the family matters responded on behalf of the household.

3.3. Livelihood impact determination

DFID's Livelihood Framework identifies 6 types of capital. These include: natural, human, physical, social, financial, and political capital. In this study only the first 5 capital were considered as presented in Table 1. For each item, a scale of four-point were used as follows:

1=Worsened, 2 =No change, 3=Slight improvement , 4=Great improvement

A chi-square was used to determine whether there was any significant difference between the participating and non-participating respondents.

Table 1. Livelihood capital data

Livelihood capital	Livelihood item number	Selected livelihood items
Natural capital	1	Land productivity
	2	Access to and availability of Non-Timber Forest Products
	3	Wildlife resources
Human capital	1	Health and nutritional improvement
	2	Vocational knowledge and skills
	3	Capacity to work
	4	Capacity to adapt to environmental and economic shocks
Social capital	1	Networks and connections
	2	Trust and mutual support
	3	Common rules and sanctions
	4	Participation in various events
	5	Leaderships skills
	6	Governance
Financial capital	1	Savings
	2	Access to credit
	3	Wages and employment
	4	Access to markets
Physical capital	1	Shelters and houses
	2	Energy resources
	3	Communication systems
	4	Water supply systems

The data were collected using structured and checklists. This study was conducted between January and February 2011. The data were analysed using the Statistical Package for Social Sciences (SPSS) and Microsoft Office Excel.

3.4. The choice model

In assessing the willingness of the communities to abandon the activities that would seem to fuel degradation of the land and opt for alternative sustainable livelihoods Used choice model techniques choice model techniques. This model presented in the form of repeated choices. More specifically, the sampled respondents were asked to choose between alternative circumstances, defined in terms of their attributes.

Therefore, the study assumed utility to be a function of income from lands resources and the various forms of incentives that can be offered to minimise degradation of the lands. Following the Random Utility Model (McFadden, 1974):

$$U_i = V(\text{Resource}_{1_i}, \text{Incentive}_{1_i}, \text{Incentive}_{2_i}, \text{Incentive}_{3_i}; \beta) + \varepsilon_i, \quad (1)$$

where V , the observed part of respondent i 's utility, is a function of the measurable and observable attributes in the form of resources and any incentive that can be provided to mimic degradation. The compensation attributes enter the function both linearly and as interactions with each other as incentives. To analyse this trade off statistically an error term, ε was added.

The probability that respondent i will choose alternative j out of a total of J alternatives is:

$$P_{ij} = P(U_{ij} > U_{ij'}) \quad \forall j' \neq j = 1, 2, \dots, J. \quad (2)$$

If the error terms, ε , is *i.i.d.* and follow the type I extreme value distribution (Gumbel distribution), equation (3) translates into the multinomial logit model of the following form:

$$P_{ij} = \frac{\exp(V_{ij})}{\sum_{j'=1}^J \exp(V_{j'})} \quad (3)$$

The attribute parameters, β , can be estimated by the maximum likelihood method.

To be able to assess the value of the lands, circumstances were defined in the form of converting farmland into forest, reduced use of the forests and wildlife resources, subsidy on agricultural inputs, extension services and cash payment channels. Respondents were presented with six choice sets, each one consisting of a set of hypothetical alternatives, varied in terms of attribute levels and benefit alternatives. A base option (the status quo or "I don't want to participate") was included as a measure to avoid unrealistic choices for those who might not be interested.

3.5. Limitations of the study

The study is limited to the environmental service providers only (environmental service supply side). However, it would have been more informing if the study had covered both the supply and demand side. This was done due to the limited resource (both financial and time). The study also covered three villages only out of the five that were under the project with the same reason. These limitations were minimised through applying different techniques of data collection, a process that complemented each other leading to more reliable data. Also the study community is quite homogeneous with little variation. In addition, a detailed scoping exercise work with stakeholder for pilot choice experiment design before the actual design was carried out.

4. Results

4.1. Socio-economic characteristics of the respondents

Approximately 74.2% of the respondents were men while 25.8% were female. The age of the respondents ranged from 20 years to over 70 years. However, the highest proportion of the respondents aged between 40 and 59 years for the scheme participants (35%) and non-participants (40%), respondents. This is normally the age group that is fully engaged in the farming business.

Farming was reported to be the major economic activity by a high proportion of the respondents in the two sample groups. The available land for agriculture ranged from 0.25 to 10 acres, with a high proportion of the respondents owning between 2 and 4 acres, which is equivalent of 51.7% and 46.7% of all land owned for the participants and non-participants respondents, respectively. Generally, land is limited in the study area and this could be one of the driving factors causing deforestation.

Majority of the respondents in both groups completed standard 7 (88.2%). There were considerable number of the respondents without any formal education (15%); with non participants respondents having 20% compared to 10% for the Scheme participants. This may suggest that joining PES programmes could also depend on the level of education of the individual candidate.

The results further indicate that smallholder farmers who joined the EPWS project as a household were 90% and those who joined as individuals were 5%. The rest 3.3% and 1.7% were Scheme employee and Consultants, respectively. These findings suggest that the participation in the PES is more of a family decision issue rather than individuals in the families. This is not surprising as land ownership in most developing countries is customary and therefore the whole family own the land.

4.2. Adoption of environmental conservation activities

Soil water and forest conservation, (conservation agriculture, afforestation and reforestation) were the key targeted outputs of the scheme, but with a view of improving the livelihoods of the communities. Other activities were related to terracing and tree planting (reforestation/afforestation) activities.

The findings indicate that before the introduction of the project, none of the interviewed ESP had started practicing any of the land management practices (Table 2). Neither bench nor *fanya juu*¹ terraces had ever been practiced by either participating or non-participating ESP. Three years after the introduction of the EPWS project (i.e. 2011), 60.3% and 31.9% of the scheme participating respondents reported to practice bench and *fanya juu* terracing respectively. Findings also show that afforestation/reforestation activities were reported to pick up from 8.7% before the project (i.e. before 2009) to 25% in 2011 (Table 2) for non-participating ecosystem service providers while 0.8% and 2.5% from this group practiced bench and *fanya juu* terracing, respectively. This was reported to be a result of distributing tree seedlings free of charge by the scheme to the communities. There was also environmental education programmes on conservation and natural resource management.

Nevertheless, findings show that afforestation and reforestation activities dropped from 13.3% before 2009 to 7.8% in 2011 (Table 2) by the scheme participating respondents. This happened due to the lack of satisfaction on the incentive package provided by the scheme for activities of *fanya juu* and afforestation/reforestation. According to the key informant and focus group discussions, one acre of bench terracing was worth T.shs. 149,000.00, the same size of land in which *fanya juu* terracing was practiced would fetch T.shs. 79,000.00 from EPWS project while a forested acre of land was worth T.shs. 750,000.00. As a result, a high proportion of the scheme participants rushed for bench terracing because the financial benefits were much higher than the other activities. It was reported further that financial benefits from terracing were immediate as compared to other practices.

Table 2. Adoption of land management practices

Land management practice	Percentage adoption (%)			
	Before the project		After the project	
	Participants	Non Participants	Participants	Non participants
Afforestation/Reforestation	13.3	8.7	7.8	25.0
Bench terracing	0	0	60.3	0.8
Fanya juu terracing	0	0	31.9	2.5
None	86.7	91.3	0	71.7
Total	100.0	100.0	100.0	100.0

Source: Survey data 2011

¹ *Fanya juu* terraces are made by digging a drainage channel and throwing the soil uphill to make a ridge (*Fanya juu* is a Swahili word meaning "throw soil uphill"). The channel is usually 50–60 cm deep and may have cross-ties at 10 m intervals.

4.3. The impact of EPWS on livelihood of the ESP

4.3.1. Impact on natural capital

Except for land productivity, findings show generally a low impact of the EPWS scheme on natural capital. Two out of the three natural capitals tested parameters were reported to be either not changed or worsened altogether among the scheme participating respondents. Findings revealed that land productivity improved significantly ($P=0.05$). This was a result of the adoption of terracing farming practices (Table 3). The adoption of bench and *fanya juu* compelled most of the scheme participating to use manure in their fields and planted trees an act that improved soil organic matter, nitrogen and prevented soil erosion. Access to and availability of Non-Timber Forest Products (NTFP) was reported to have significantly declined ($p=0.05$) by both the respondents i.e the scheme participants and non-participants. Similar findings were seen on access to wildlife resources (Table 3) where almost all of the respondents reported the situation to have significantly worsened ($p=0.1$) by both the participating and non participating respondents. The reason for this could be the enforcement of the by-laws which prohibited communities' access to natural forests and wildlife resources around the catchment areas. Instead, they were encouraged to plant trees and establish woodlots for obtaining various forest products.

4.3.2. Impact on human capital

Human capacity development was reported to be the major impact of the EPWS scheme in the project area. A chi-square show that the scheme participating respondents to have significant difference ($p=0.1$) improvement in their human capital in terms of health and nutrition compared to the non-participating respondents. The findings also suggest that the scheme participating respondents also improved significantly on capacity to work ($p=0.05$), ability to adapt to various environmental and economic shocks ($p=0.05$) and vocational knowledge and skills ($p=0.001$) were continually improving (Table 3a). This positive livelihood improvement was a result of EPWS scheme through training workshops and exchange visits. These contrasting findings between the two groups were anticipated as the scheme non-participants were not part of the project and therefore could not benefit by the scheme through programmes of human capacity building. Nevertheless, the study also revealed a high level of dropouts from the project suggesting the non-satisfactory of the incentive package offered by the scheme.

4.3.3. Impact on social capital

Generally, the project performed well in terms of improving the social capital of the participating ESP. The results show a significant difference on networks and connections ($p=0.05$), common rules and sanctions ($p=0.05$), trust and mutual support ($p=0.05$) and participation in various events (0.001) (Table 3b). It was only the aspects of leadership skills and local governance which appeared to be not improved significantly between participating and non-participating respondents although the former indicated a certain level of improvement compared to the latter. The observed success came as a result of the project strategy of working with both, individual smallholder farmers and farmer groups which improved social coordination

and cohesion among the scheme participating service providers. It was generally found that the scheme could not do much for the non-participating farmers in terms of improving their social capital as it was beyond the project's focus.

Table 3a. Impact of EPWS on Livelihood on Capital assets

Livelihood capital	Selected livelihood items	Percentage response (%)								Chi-Square Level of significance	
		Worsened (1)		No change (2)		Slight improvement (3)		Great improvement (4)			
		PP	NP	PP	NP	PP	NP	PP	NP		
Natural capital	Land productivity	1.7	1.7	8.3	91.6	58.3	5.1	31.6	1.7	**	
	Access to and availability of NTFPs	81.6	85.0	13.3	11.6	3.4	1.7	1.7	1.7	**	
	Availability of wildlife resources	83.3	85.0	13.3	13.3	1.7	1.07	1.7	0	*	
Human Capital	Health and nutritional improvement	1.7	6.6	26.7	90.0	65.0	3.3	6.6	0	*	
	Vocational knowledge and skills	1.7	1.7	16.7	91.7	41.7	5	41.7	3.3	***	
	Capacity to work	3.3	1.7	56.6	95.0	38.3	1.7	1.7	1.7	*	
	Capacity to adapt to environmental and economic shocks	1.7	1.7	45	81.6	51.6	15.0	1.7	1.7	**	

*=significant at 10%, **=significant at 5% ***=significant at 1% NS=not significant

4.3.4. Impact on financial capital

There was no significant difference between participating and non-participating respondents in terms of financial gain. Findings show a generally nothing to low level improvement in terms of monetary compensation/payment among the EPWS scheme participants. Twenty eight percent of the respondents reported to have received nothing since the inception of the project and as high 86.7% received only between T.shs 10,000 to 50,000. It was reported that the monetary compensation received by the scheme participating ESP was far below the average household monthly income which was reported to be T.shs. 54 993.33 per month. Only 3.4% of the scheme participating respondents reported to have received payments from the project above their average monthly income. The results also show no any significant difference with regard to access to credit. There is a concern that without improving monetary compensation/payment the sustainability of the EPWS scheme is uncertain, and the prospects of up scaling PES projects in the country may not be realised.

It is however worth noting that there was a slight improvement in the household savings for the participating respondents ($p=0.1$). This was a result of improved agricultural productivity by the scheme participating ESP. This raised production and enabled them to earn more money by selling the surplus farm produce. On the other hand, access to credit, marketing systems, wages and employment did not improve for both scheme participating and non-participating respondents.

4.3.5. Impact on physical capital

Similar to the financial capital, physical capital also did not improve during the project implementation. There was no significant difference on access to energy resources and improvement in shelters and house by the participating and non-participating respondents (Table 3b). The findings also show that communication system did not improve about the scheme implementation. Furthermore, water supply system did not improve in terms of installing water piping. According to the respondents no direct or indirect contribution was made by the EPWS scheme with respect to their physical capital especially for issues like fuelwood which in their words deteriorated after the project implementation. Nevertheless, about 43.3% of the respondents indicated that water flow from the catchment areas had started improving.

4.3.6. Preferences of compensation for ecosystem service providers

Based on these experiment results a micro level model was estimated. The estimation of the results is based on fractional factorial design as presented by Louviere et al., (2000). This model considers only main effects and ignores potential interactions among attributes. Looking on the first column it is shown that choices of incentive packages were summarized on five broad categories; Sustainable land use and ownership, incentives related to accessing the natural resources (forest and wildlife) goods and services, incentives related to improved forest productivity such as afforestation and references and intensive farming through access to input vouchers.

Table 3b. Impact of EPWS on Livelihood on Capital assets

Livelihood capital	Selected livelihood items	Percentage response (%)								Chi-square level of significance
		Worsened (1)		No change (2)		Slight improvement (3)		Great improvement (4)		
		PP	NP	PP	NP	PP	NP	PP	NP	
Social capital	Networks and connections	1.7	1.7	5.0	93.7	76.7	6.3	18.3	1.7	**
	Trust and mutual support	1.7	1.7	71.7	95	23.3	5	1.7	1.7	**
	Common rules and sanctions	1.7	1.7	6.7	85.0	70.0	11.7	23.3	1.7	**
	Participation in various events	1.7	1.7	3.3	100	71.7	1.7	25.0	1.7	***
	Leaderships skills	1.7	0	66.7	98.3	26.7	1.7	5.0	0	*
	Governance	1.7	1.7	70.0	91.7	25.0	8.3	5.0	2.2	NS
Financial capital	Savings	1.7	1.1	35.0	81.7	53.3	18.3	11.7	1.7	*
	Access to credit	1.7	1.7	86.7	90.0	8.3	10.0	5.0	1.7	NS
	Wages and employment	1.7	1.7	81.7	95.0	13.3	5.0	5.0	1.7	NS
	Access to markets	3.3	1.7	73.3	96.7	21.7	3.3	1.7	1.7	NS
Physical capital	Shelters and houses	1.7	1.7	68.3	83.3	26.7	11.7	5.0	5.0	NS
	Energy resources	28.3	25.0	66.7	75.0	5.0	1.7	1.7	1.7	NS
	Communication systems	3.3	1.7	76.7	91.7	15.0	8.3	5.0	1.7	NS
	Water supply systems	6.7	1.1	91.6	100	1.7	1.7	1.7	1.7	*

PP=participants PP=Non-Participants

Source: survey data 2011

Table 4. Choice experiment results of assessing incentive choice preferences and willingness to participate in the EPWS related activities

Conditional (fixed-effects) logistic regression						Number of obs	=	1278
Log likelihood = -302.05193						LR chi2(30)	=	159.19
						Prob > chi2	=	0.0000
						Pseudo R2	=	0.2086
didep1	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]			
_Ichoices1_2	5.350072	2.94649	1.82	0.069	-.4249425	11.12509		
_Ichoices1_3	7.264684	3.503154	2.07	0.038	.3986289	14.13074		
_Ichoices1_4	8.170632	2.603474	3.14	0.002	3.067918	13.27335		
_Ichoices1_5	6.586416	2.771805	2.38	0.017	1.153777	12.01905		
_Ichoices1_6	6.046658	2.667954	2.27	0.023	.817564	11.27575		
age	(omitted)							
_Ichoxage_2	-.0212626	.0280303	-0.76	0.448	-.0762011	.0336758		
_Ichoxage_3	-.0472655	.0373146	-1.27	0.205	-.1204008	.0258698		
_Ichoxage_4	-.0431342	.0228341	-1.89	0.059	-.0878882	.0016198		
_Ichoxage_5	-.0325321	.0252917	-1.29	0.198	-.0821029	.0170388		
_Ichoxage_6	-.0273317	.0236867	-1.15	0.249	-.0737567	.0190933		
occup	(omitted)							
_Ichoxoccu~2	-.1034639	.3634256	-0.28	0.776	-.8157651	.6088373		
_Ichoxoccu~3	-.0655569	.4925626	-0.13	0.894	-1.030962	.899848		
_Ichoxoccu~4	-.2549364	.2944625	-0.87	0.387	-.8320722	.3221995		
_Ichoxoccu~5	-.3543655	.3380449	-1.05	0.295	-1.016921	.3081903		
_Ichoxoccu~6	-.0262929	.2999506	-0.09	0.930	-.6141852	.5615995		
district	(omitted)							
_Ichoxdist~2	-1.834979	.629856	-2.91	0.004	-3.069474	-.6004837		
_Ichoxdist~3	-1.86523	.7361209	-2.53	0.011	-3.308	-.4224593		
_Ichoxdist~4	-1.670078	.5807051	-2.88	0.004	-2.808239	-.5319167		
_Ichoxdist~5	-1.623588	.6047332	-2.68	0.007	-2.808843	-.4383325		
_Ichoxdist~6	-1.600892	.5872568	-2.73	0.006	-2.751894	-.44989		
income	(omitted)							
_Ichoxinco~2	3.05e-08	6.29e-07	0.05	0.961	-1.20e-06	1.26e-06		
_Ichoxinco~3	-4.17e-07	9.89e-07	-0.42	0.673	-2.36e-06	1.52e-06		
_Ichoxinco~4	-1.62e-07	5.94e-07	-0.27	0.785	-1.33e-06	1.00e-06		
_Ichoxinco~5	-6.67e-07	6.99e-07	-0.95	0.340	-2.04e-06	7.04e-07		
_Ichoxinco~6	-3.38e-07	6.19e-07	-0.55	0.585	-1.55e-06	8.74e-07		
educ	(omitted)							
_Ichoxeduc_2	.2186974	.4524274	0.48	0.629	-.668044	1.105439		
_Ichoxeduc_3	-.4609571	.6011813	-0.77	0.443	-1.639251	.7173365		
_Ichoxeduc_4	.2201194	.3767814	0.58	0.559	-.5183586	.9585973		
_Ichoxeduc_5	.4107091	.4221676	0.97	0.331	-.4167242	1.238142		
_Ichoxeduc_6	.3287348	.3880582	0.85	0.397	-.4318452	1.089315		

The results in the table confirm that the model fitted estimates very well the incentives identified. In all cases the coefficients are highly significant and have the anticipated signs. The pseudo R squared marches well with previous studies in Tanzania while the chi-square is significantly within the acceptable range. The results interacts the responses with key individual characteristics such as occupation, age, education and income (Table 4).

In order to present the realistic assessment in terms of preferences of the incentives, the study used the information in the Table 4 to estimate the marginal rates of substitutions between the incentives. The results (Table 5) show that incentive packages related to sustainable land use and management, access to forest goods and services as well as farming intensification have the highest preference. The results are very stable even with interactions elaborated above. Hence, the results suggest that the preferred incentives by the respondents are in the form of improved farming system such as extension service support on access to input vouchers, marketing of agricultural products and others.

Table 5. The results of choice experiments to assess willingness and preferences on incentives of EPWS respondents

Choices of Incentive Packages	Coefficient	Marginal Rate of Submission	Std. Err.	z
Alternative land use (property light)	5.350072	1	2.94649	1.82
Restricted Access	7.264684	1.357866586	3.503154	2.07
Sustainable land use	8.170632	1.527200382	2.603474	3.14
Access to natural resources	6.586416	1.231089226	2.771805	2.38
Intensive farming through input voucher access	6.046658	1.130201238	2.667954	2.27
Alternative land use with interaction with age	-0.0212626	1	0.0280303	-0.76
Restricted Access	-0.0472655	2.22294075	0.0373146	-1.27
Sustainable land use	-0.0431342	2.028641841	0.0228341	-1.89
Tree cutting	-0.0325321	1.530015144	0.0252917	-1.29
Intensive farming	-0.0273317	1.285435459	0.0236867	-1.15
Alternative land use with interaction with occupation	-0.1034639	1	0.3634256	-0.28
Restricted Access	-0.0655569	0.633621002	0.4925626	-0.13
Sustainable land use	-0.2549364	2.464013052	0.2944625	-0.87
Tree cutting	-0.3543655	3.425015875	0.3380449	-1.05
Intensive farming	-0.0262929	0.254126318	0.2999506	-0.09
Alternative land use with interaction with district	-1.834979	1	0.629856	-2.91
Restricted Access	-1.86523	1.016485747	0.7361209	-2.53
Sustainable land use	-1.670078	0.910134666	0.5807051	-2.88
Tree cutting	-1.623588	0.884799227	0.6047332	-2.68
Intensive farming	-1.600892	0.872430693	0.5872568	-2.73
Alternative land use with interaction with income	3.05E-08	1.00E+00	6.29E-07	0.05
Restricted Access	-4.17E-07	-1.37E+01	9.89E-07	-0.42
Sustainable land use	-1.62E-07	-5.31E+00	5.94E-07	-0.27
Tree cutting	-6.67E-07	-2.19E+01	6.99E-07	-0.95
Intensive farming	-3.38E-07	-1.11E+01	6.19E-07	-0.55
Alternative land use with interaction with education	0.2186974	1	0.4524274	0.48
Restricted Access	-0.4609571	-2.107739278	0.6011813	-0.77
Sustainable land use	0.2201194	1.006502135	0.3767814	0.58
Tree cutting	0.4107091	1.877978888	0.4221676	0.97

5. Discussion

Generally, the study revealed a low to moderate impacts of EPWS scheme on communities' livelihoods in the study area. The only remarkable impact was seen on human capital and satisfactory impact in some parameters of the social capital (e.g networks and connections, trust and mutual support, enforcement of common rules and sanctions and participation in various events). However, social capital related to leaderships skills and governance did not improve convincingly. Regarding the impacts on natural capital, results showed only improvement in land productivity while other parameters such as access to NTFP and wildlife resources reported to have deteriorated. Generally there was no significant impact on financial and physical capital between the participating and non-participating respondents. Also physical capital such as access to markets, shelters and houses, communication systems, water supply systems did not improve.

These findings suggests that farmers who join EPWS were facing high agricultural opportunity costs (Sommerville et al., 2010) and this could lead to un-sustainable PES programmes. Locatelli et al. (2008) report similar findings in that the incomes of the poorest landowners decreased as a consequence of reforestation. Mahanty et al. (2011) and Mahanty et al. (2013) also report similar findings in their study in Hyderabad, India where they revealed that payments for PES participants were often well below the opportunity costs which diminished local livelihoods and ultimately undermine the sustainability of such schemes.

Molnar et al. (2007) reports that the aggregate benefit of PES for the poor depends not only on the total number of poor people who participate, but also on the magnitude of benefits that these participants derive. In this study, although the scheme participating respondents received some benefits, but these benefits were generally low. Unlike Wunder (2008) who reported that the financial benefits accruing to the poor, ecosystem service providers were significant, comprising 10 to over 50% of household income, financial gain from this study was insignificant. This study also contradicts that of Uchida et al. (2007) and Bennett (2008) who found an overall positive effect of PES schemes to households in terms of household assets. In this study, there is generally evidence that EPWS in Uluguru mountains were paying more cost than the benefit they reaped. These findings should form a base for developing more innovative PES programmes that could attract more communities to join and be sustainable.

There is empirical evidence that Choice Method can shed useful light on the design of conservation policy, allowing policy-makers to take account of people's preferences (Hanley et al., 2006). In this study it has seen that incentive package and preference by EPWS participating respondents include packages related to sustainable land use and management and more access to forest goods and services have the highest preference. Respondents also have shown a preference on improved farming system through improved extension service, access to input vouchers, improved marketing of agricultural products and others.

6. Conclusion and recommendations

Generally the impact of EPWS on livelihoods of the participating communities has been not satisfactory. Nevertheless, the scheme has the potential to improve the livelihoods of rural communities if the observed

challenges are addressed. Generally the *pay off* from the PES project must reflect the opportunity cost of abandoning the current land use practices. The study also revealed the incentive package most preferred by the EPWS participating respondents to include sustainable land use and management, more access to forest goods and services, improved farming system through improved extension service, access to input vouchers, improved marketing of agricultural products and others. It is recommended that the incentive packages by PES schemes should reflect the opportunity cost of abandoning the ongoing land use practices by the responsible communities and take in consideration communities' preference while developing incentive packages in the PES programmes.

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