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Participation of Ecosystem Service Providers in a Watershed PES Project in Tanzania: Connection with the Coasean Perspectives

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Abstract

The equitable payment for environmental service projects seem to have good objectives, but not so many households participated in it. Limited empirical information surrounds the most Payment for Environmental Services (PES) schemes with regard to which factors could influence the commitment of environmental service providers to switch to improved land management practices. Are these factors stemming from the Coasean theorem? The answer to this question is imperative as it paves way to more robust approach of PES implementation in Tanzania and worldwide. This study therefore sought to explore the challenges which either, held back or threatened the participation of ecosystem service providers in the Uluguru Mountains to the equitable payment for watershed services scheme, linking them to the main treatise of the Coasean theorem. This study employed a partially mixed concurrent dominant status design in which quantitative and qualitative approaches were used simultaneously, but with the quantitative approach being dominant. The mixed-methods design brought together different strengths of quantitative and qualitative methods, while offsetting the weaknesses of using a single method and expanding the set of collected data.

Keywords: Payment for Environmental Services (PES); Participation challenges; Equitable Payment for Watershed Services (EPWS); Coasean theorem

Introduction

It is generally agreed that attempts to reduce environmental degradation in the tropics are considered to have been essentially ineffective [1]. This is due to poor performance of the command and control approaches for protecting ecosystems and the environment. The command and control approaches, also known as the fines and fences, mainly characterized by compliance or facing legal sanctions have been associated with a number of environmental problems, which include deforestation, deteriorating water quality, reduced water flows and unprecedented sediment loads in rivers, streams and reservoirs. In that regard therefore, it is not objectionable that environmental degradation, particularly watershed destruction has been on the rise, leading not only to economic costs to governments and water management authorities, but also social costs, particularly to poor people who are disproportionately dependent on natural resources for their livelihoods. It is due to the failure of command and control approaches that environmental and natural resources economists, environmental scientists, conservationists and practitioners came up with an incentive-based mechanism known as Payment for Environmental Services (PES), synonymously known as payment for ecosystem services, which has attracted interest as a mechanism that translates external, non-market values of the environment into real financial incentives for local actors to provide environmental services [2].

Almost all PES projects attempt to put into practice the Coasean theorem, which provides that, "the problems of external effects can, under certain conditions be overcome through private negotiation between affected parties" [3]. In a nutshell, the Coasean theorem means that environmental externalities can be solved through private bargaining between people who are willing to pay in order to reduce an environmental hazard and people willing to accept compensation in order to reduce the activity that generates the environmental burden. Hitherto, the Coasean approach is best described using the main points embedded in the theorem itself. Nevertheless, Wunder [4] defined a Payment for Environmental Services principle as (i) a voluntary transaction where; (ii) a well-defined environmental service (iii) is being bought by a minimum of one environmental service buyer (iv) from a minimum of one environmental service provider (v) if and only if the environmental service provider secures environmental service provision.

That paradigm shift in conservation was positively responded to in Tanzania by Care International and the World Wide Fund for Nature (WWF), together with the International Institute for Environment and Development (IIED) who, in 2009 initiated an Equitable Payment for Watershed Services (EPWS) in the Uluguru Mountains, Morogoro, Tanzania. The EPWS scheme 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 also aimed at improving the quality of lives of communities through providing substantial benefits to ecosystem service providers, hence contributing to poverty reduction strategies in Tanzania. The project therefore proposed to demonstrate how equitable PES could reverse forest loss through addressing the core drivers of land-use change. Improved land management practices in the catchment areas were also expected to lead to improved water quality for both rural and urban consumers.

Although having good objectives of the EPWS project in the Uluguru Mountains, not so many households had joined it. Furthermore, even the number of ecosystem service providers who had joined the program

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in year 2009 started to plummet, and by the end of the project there was a considerable number of farmers who had quit the project, thus casting doubt on the sustainability of the scheme, and casting doubt on when exactly are PES projects going to benefit the poor as it was put forward by Zilberman et al. [5]. Although, some authors hint on the potential of PES schemes to generate win-win outcomes, equity in the design of PES programs is a major concern [6]. In addition, limited empirical information surrounds most PES schemes around the world [7] with regard to which factors influence the commitment of environmental service providers to switch to improved land management practices, which would in the end lead to improved environmental conservation, thereby leading to improved livelihoods. According to the one of the provisions of Coasean theorems i.e., "willingness of the parties at stake to participate". Under such circumstances therefore, the success of any PES project hinges on the participation of both ecosystem service providers and the ecosystem service beneficiaries.

Colloquially, a number of authors [5-7] have tried to pinpoint various factors limiting effective participation in PES projects. However, the results are site-specific and thus cannot be used as a blueprint for improving the performance of PES projects everywhere in the world. Jindal and Kerr [8] pointed out that the first question a pro-poor PES project needs to consider is whether the poor can participate, concluding that participation should therefore be the principal question to be addressed in studies on PES and the poor. Some studies [8,9] asserted that even if markets for ecosystem services exist, various factors may exclude the poor from participating in the PES project, and articulated some of the participation challenges as being land tenure insecurity, size of landholding, high transaction, opportunity costs of participating in PES schemes, high investment costs of adopting PES-related land-use practices, inadequate awareness and education, inadequate access to the technical knowledge required for measuring and monitoring the impact of PES activities. So, the principal questions which guided this study were; what key challenges have been holding back and/or threatening the participation of environmental service providers to the equitable payment for watershed services scheme in the Uluguru Mountains? To what extent are the challenges linked with the Coasean theorem? This study therefore sought to analyse the main challenges encountered by EPWS participants and non-participants, and model the influence of the main tenets of the Coasean theorem to the participation of environmental service providers.

Methodology

This study was carried out in the Eastern slopes of Uluguru Mountains, Morogoro region, where the EPWS project was being implemented as shown in Figure 1. The Uluguru Mountains are found within Morogoro rural district (majority), Mvomero district and Morogoro municipality, all within the Morogoro Region. The main Uluguru Mountains are a ridge running approximately north-south and rising to 2630 metre altitude at the highest point. The greater Ulugurus area also includes a number of isolated massifs surrounding the main block, Kitulangh'alo, Dindili, Mkumgwe, Mindu and Nguru ya Ndege. On the main Uluguru range, 50 villages touch the forest boundary and over 151,000 people are found within the mountain area, often at increasing densities at higher altitudes up to the forest boundary.

This study employed both, quantitative and qualitative approaches. The quantitative approach was used for the overall design of the study whereas the qualitative method (focus group discussions, key informant interviews and participant observation) complemented the quantitative method. The mixing of qualitative and quantitative methods brought together different strengths of quantitative and qualitative methods, while offsetting the weaknesses of using a single method and expanding the set of collected data [10]. Generally, the household survey was informed by focus groups and key informant interviews in the first place, and then it was enriched by academic literature review.

This study targeted the Environmental Service Providers (ESPs)

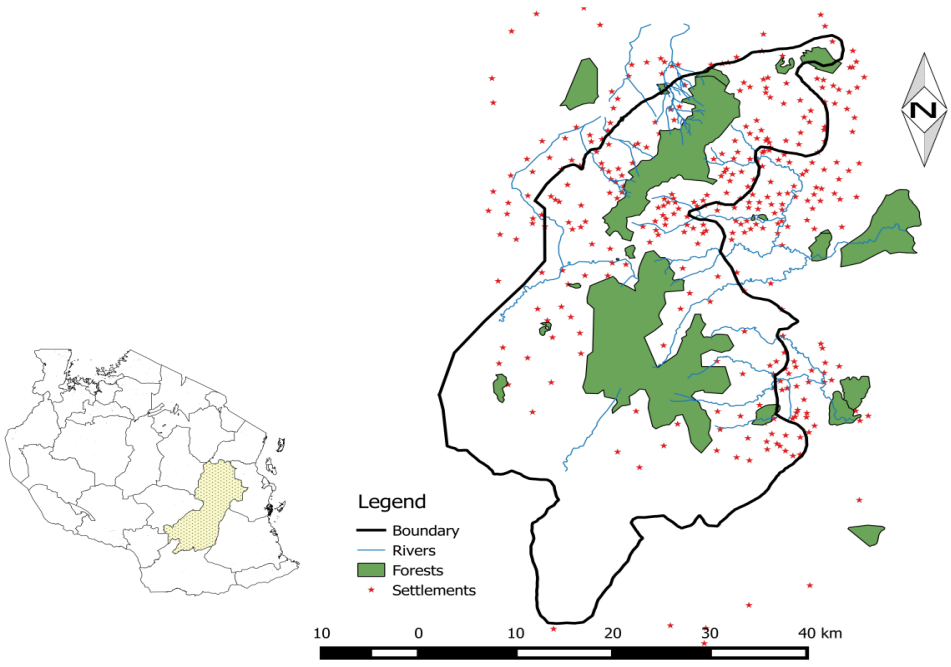

Figure 1: Map showing the location of Uluguru Mountains and the study area.

from three villages in Kibungo juu sub-catchment, both participants and non-participants in the EPWS project. In order to be objective in carrying out a comparative assessment of the participation challenges for both, participants and non-participants to EPWS, ESPs who joined the EPWS scheme in year 2009 in the three study villages were chosen, and the challenges they encountered compared with the ESPs who, until the end of the project had not joined. Table 1 shows the total number of households that joined the EPWS scheme in year 2009 in each study village and the number of non-participating households. The data collected showed that 169 (N_{pp}) out of 1102 (N) households in the study area participated in the equitable payment for watershed services project. Therefore, the number of non-participating households (N_{np}) was simply the difference between and the N (sampling frame) and N_{pp} (participating households).

Both probability and non-probability sampling techniques were used in this study. The first level of selecting study units involved a purposive (non-probabilistic) sampling technique, which was used to identify the villages around the Kibungo juu sub-catchment in which the equitable payment for watershed services project had been operating since year 2009. The second step in the sampling procedure was to obtain the sampling frame of participating and non-participating ESPs in the purposively selected villages. The sampling frames of participants were obtained from the farmer group leaders while for non-participants; the sampling frames were obtained from Kibungo juu ward office and the respective village household rosters. Thereafter, stratified sampling technique (probabilistic) was applied to obtain the proportion of respondents (both participating and non-participating ecosystem service providers) from each village whereby the sampling frame was divided into non-overlapping subsamples based on the overall population size (number of households) in a village and number of households participating in the EPWS scheme (Table 1). This was specifically done to improve the representativeness of the sample by reducing sampling errors. Thereafter, simple random sampling technique was used to select the interviewees from each village.

After obtaining the sampling frames for both, participating and non-participating households in the study area, the overall sample size was determined, whereby 60 participating ecosystem service providers were chosen for interview in a deterministic manner. Accordingly, 60 non-participating respondents of the non-participating households were deterministically chosen for interview, making a 1:1 sampling ratio (Table 2).

Data for this study came from both primary and secondary sources.

Village name	Total number of households (N)	Number of participating households since 2009 (N_{pp})	Number of non-participating households (N_{np})
Kibungo	335	57	278
Lanzi	349	61	288
Nyingwa	418	51	367
Total	1102	169	933

Table 1: The participating and non-participating households in Kibungo Juu ward.

Village name	Number of respondents		
	Participants (n_{np})	Non-participants (n_{pp})	Total
Nyingwa	18	23	41
Lanzi	22	19	41
Kibungo	20	18	38
Total	60	60	120

Table 2: Number of households selected for interview.

Secondary data were collected mainly through literature review, which aimed at finding out what had already been done by other researchers which pertained to this study and what had not. Primary data were collected using a structured household questionnaire, which was administered to participants and non-participants in the scheme, containing both structured and semi-structured questions. A one-to-one interview method was used to administer the questionnaire. The questionnaire was designed to collect information on household characteristics, household income, cultivation and land size; indicators of wealth, food security aspects, labour, wages and finally the challenges faced by both participants and non-participants with regard to participation in the EPWS scheme were collected. A binary logistic regression approach was used to model the participation against some participation constraints emanating from the main tenets of the Coasean theorem. These factors were land tenure (1=Secure, 2=Insecure), transaction cost (1=Low, 2=High), information flow (1=Good 2=Poor). Opportunity cost (1=Low, 2=High), compensation (1=Fair, 2=Not Fair). The goal of logistic regression was to estimate the unknown parameters β in below given equation. This was done using maximum likelihood estimation method, which entailed finding the set of parameters for which the probability of the observed data are greatest. The maximum likelihood equation was derived from the probability distribution of the dependent variable.

$$\ln(\frac{p}{1-p}) = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \beta_5 x_5$$

Where p is the probability of participation, β_0 is the model constant, β_n are the factor coefficients, {n=1, 2, 3, 4, 5 which are (1) compensation, (2) transaction cost, (3) information flow, (4) land tenure, and (5) opportunity cost}.

Since participation occurs with probability p, then the odds of participation occurring is equal to $\ln(\frac{p}{1-p})$.

A further analysis of challenges faced by the ESPs with regard to participation in the EPWS scheme was carried out through weighted ranking approach, whereby interviewees were asked to rank the challenges from 1 to 5, with the first challenge having a weight of 5 points, the second challenge having 4 points and the third, fourth and fifth challenges having 3, 2, and 1 points, respectively. The total score and percentage were determined at the end to come up with a list of challenges facing the ecosystem service providers, categorized in terms of project participants and non-participants. The Statistical Package for Social Sciences (SPSS) version 16.0 facilitated data organization, coding and analysis.

Results and Discussion

This study revealed a variation of participation challenges between the ecosystem service providers who participated in the equitable payment for watershed services project and those who did not participate. Figure 2 presents five challenges as pointed out by both participating and non-participating ecosystem service providers. The list presented to environmental service providers regardless of whether they were participating or not, included compensation problems, high transaction cost, land tenure problems, especially poorly defined property rights, perceived low profitability of EPWS activities, implying high opportunity cost, and poor information flow, including information asymmetry.

It was found that, a big group of participants expected unreasonably higher compensation than the project could realistically offer. This was

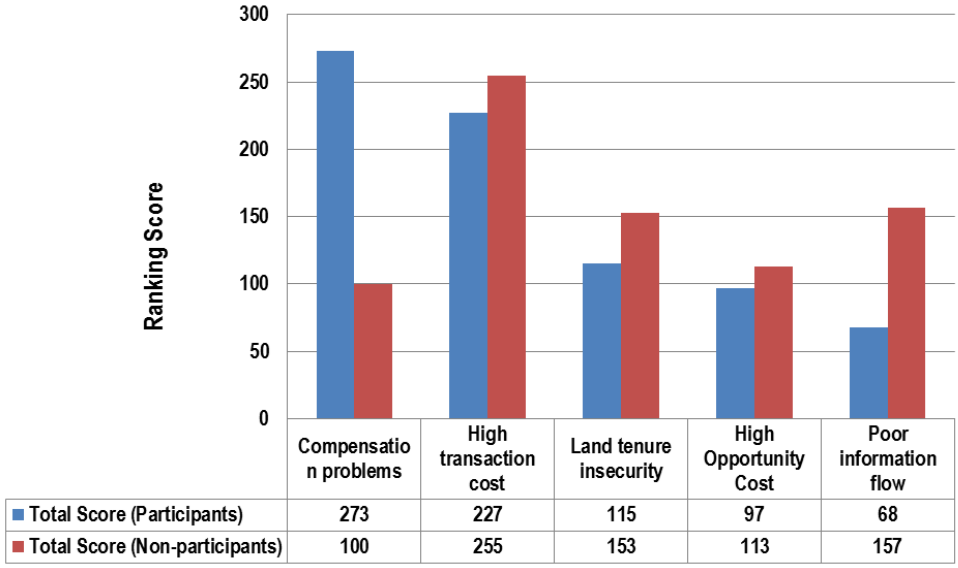

Figure 2: Participation challenges for project participants and non-participants.

Challenge	1st rank count (n × 5)		2nd rank count (n × 4)		3rd rank count (n × 3)		4th rank count (n × 2)		5th rank count (n × 1)		Total score		(%)		Overall rank	
	PP	NP	PP	NP	PP	NP	PP	NP	PP	NP	PP	NP	PP	NP	PP	NP
Compensation problems	215	15	44	48	6	21	8	8	0	8	273	100	35.0	12.8	1	5
High transaction cost	70	170	140	56	15	27	2	2	0	0	227	255	29.1	32.8	2	1
Land tenure insecurity	5	60	16	16	42	45	38	20	14	12	115	153	14.7	19.7	3	3
High opportunity cost	5	5	16	32	54	39	12	22	10	15	97	113	12.5	14.5	4	4
Poor information flow	0	20	0	64	18	27	28	36	22	10	68	157	8.7	20.2	5	2

PP: Participants; NP: Non-Participants.

Table 3: Challenges encountered by ecosystem service providers.

partly attributed to either information breakdown and/or information asymmetry. Therefore, enforcing the agreements between Care International (the EPWS project implementers) and the environmental service providers (local communities) in the Kibungo juu sub-catchment would have strengthened the position of ESPs and would have pressed the beneficiaries to live up to their promises.

Table 3 presents five topmost challenges ranked by participating and non-participating ecosystem service providers in the study area. Payment problem as a challenge came almost from every participating respondent (Figure 2), most of them having been paid only once, mainly in the first commitment year (i.e., 2009), and no payments were made afterwards. Furthermore, the transaction costs cited by local community members included costs for preparing terraces, costs for purchasing farmyard manure and costs for managing the tree seedlings to name a few.

While the participating ESPs cited compensation problems from the ecosystem service beneficiaries and/or the implementing agency as their topmost challenge, which threatened their participation in the EPWS scheme, it was high transaction costs which arose as the most distressing challenge for non-participating ESPs as shown in Figure 2 and Table 3. Basically, the observed difference in the ranks of participation challenges between participating and non-participating ESPs is not statistically significant. It was found that, the ranking trend showed a little negative correlation, with Spearman's rank-order correlation coefficient r_s=-0.3, and t=-0.5447. However, the trend sheds a bit of light on how one should try to keep the participants in the project and entice the non-participants to joint in. Much as issues like information asymmetry and high opportunity costs may be quite a stumbling block to both groups, they are affecting non-participants more than they do to the participating ESPs. Transaction costs and compensation problems affect the participants more than they affect the outsiders (Table 3). These findings echo what was found by Branca et al. [11] that, farmers face barriers to adoption of such practices, especially lack of technical capacity and high upfront costs associated with sustainable land management practices.

Modeling the influence of the main tenets of the Coasean theorem to the participation of environmental service providers

The logistic model estimation results show that, the odds of an ESP participating if compensation is well designed and reasonably fair is 1.4 times higher than the odds of not participating. In the same line of thinking, the odds of an ESP participating in a PES project if transaction costs are reasonably low are 1.5 times higher than the odds of not participating. The two Coasean participation variables (compensation and transaction cost) are statistically significant at 5% and 1% levels, respectively. As for information flow, land tenure security and opportunity cost, there is a reasonable influence on participation of ESPs, with a prospect of increasing participation if the variables are worked upon by the implementers. However, these three Coasean variables are statistically insignificant at 5% level of significance (Tables 4 and 5).

The -2Log likelihood ratio was found to be 181.207. This was applied in getting the Chi square value, which also tells us about the goodness of fit of the predictor model as compared to the constant-only (null) model. The model was found to be statistically significant at a 5% level of significance (Table 4). The Cox & Snell R Square and Nagelkerke R Square were 0.129 and 0.174, respectively. Normally, the Cox & Snell R-squared value cannot reach 1.0, and therefore Nagelkerke modified it to make 1.0 a possible value for R-squared [12].

The general findings from the Coasean theorem perspective

Generally, EPWS being a scheme that promotes equitable payment for implementing watershed conservation measures in the Uluguru Mountains, one of the observed equity constraints was insecure tenure. Land property rights are not in place as proposed by the Coasean theorem. This was found to be a hurdle to both, the participating and non-participating ecosystem service providers. This predicament was also raised during focus group discussions and the key informant interviews where it was clearly pointed out that land owners did not want terracing be practiced in their pieces of lands, because terracing causes loss of soil fertility after exposing the underneath red sub-soil, leading to reduced land productivity as compared to unterraced land. However, the extent at which land productivity plummets as a consequence of terracing has not been established by this study. Nevertheless, the use of organic fertilizers was said to reduce the aforementioned productivity problems, and therefore farmers who use organic fertilizers did not have problems with terracing in terms of reduced land productivity.

Accordingly, land tenure problems in payment for ecosystem services schemes have been reported by other researchers like Richards and Jenkins [13], who argued that common equity constraints in payments for ecosystem services from tropical forests are insecure tenure, weak local institutions and inequitable public enforcement capacity. The implication of land property rights in the success of PES projects is clearly manifested in the study. A person who does not own a piece of land cannot participate in the equitable payment for watershed services scheme (or any other watershed PES scheme for that matter), simply because they would not be able to implement the recommended conservation activities such as terracing, eventually they would not benefit from PES no matter how interested that person is, and no matter how the good intention a PES scheme has in terms of livelihood improvement. This underscores the fact that, if a PES project is to be judged in terms of livelihood improvement, participation should be a key factor.

	Chi-square	df	Significance
Step	20.696	5	0.001
Block	20.696	5	0.001
Model	20.696	5	0.001

df: Degree of freedom

Table 4: Omnibus tests of model coefficients and model summary.

Moreover, lower profitability of PES was cited as a challenge, mainly emerging as a result of combination of payment problems from the project implementers and high investment cost, with a few respondents citing poor information as a limiting factor to effective participation in the EPWS scheme. In most cases, this was pointed out by the non-participating ESPs, who ranked this problem as number 3 while for the participating ESPs, poor information was ranked 5th as shown in Table 3 and Figure 2. This rhetoric is supported by the argument of Wunder [14], who pointed out that, PES may not always result in livelihood improvement as targeted poor households may be reluctant to participate if PES payments do not cover the opportunity costs of required land use adjustments. This was quite obvious in the study area as one of the cited challenges for participation was unsatisfactory payment from the EPWS scheme, which caused resentment, reportedly leading to a huge number of participating ESPs dropping out from the project. In addition, the challenges found in this study are in line with those reported by Cole [15], who found that the payments from a PES program may serve to overcome several major obstacles facing participating farmers, which included high initial costs, perceived risk in investing in activities with long-term returns (e.g., afforestation and reforestation) and a lack of technical knowledge. All these obstacles were reported by both participating and non-participating ESPs in the study area, whether directly or indirectly.

Notwithstanding, Coase advocates for assigning property rights, arguing that once property rights are established, no government intervention is necessary and the distribution of income in the final outcome will vary based on who is assigned the rights [3]. However, the Coasean theorem does not simply mean that assigning property rights to an environmental conservation defaulter will cause environmental degradation to continue. It emphasizes that after assigning property rights, a deal could be struck among both parties to bring about a more desirable solution to the environmental problem at hand. Generally the Coasean theorem strives to make sure that property rights are well defined; people to act rationally and transaction costs as minimal as possible, if not zero. However, the challenges exposed by both participating and non-participating environmental service providers in the study area were more or less an indication of the deviation from the Coasean treatise.

In addition to that, Coase argued that negotiation will not work when a large number of people are involved, or when the victims are not well defined. Nevertheless, since the area is inhabited by smallholder farmers, having a large number of people was inevitable. It should also be noted that in a diverse community, like the Kibungo juu sub-catchment, different groups have different bargaining powers. This might have affected the distribution of the final outcome of the EPWS scheme. Furthermore, the transaction costs can be quite substantial, sometimes high enough to thwart what would otherwise be a beneficial transaction. Coase suggested that people or groups have to make agreements and the government's job is just to enforce them.

Participation challenge	β	SE	Wald test	df	Significance	exp(β)	95% CI for exp(β)	
							Lower	Upper
Compensation	0.350	0.125	7.900	1	0.005	1.419	1.112	1.811
Transaction cost	0.436	0.119	13.475	1	0.000	1.546	1.225	1.952
Information flow	0.106	0.078	1.825	1	0.177	1.111	0.953	1.296
Land tenure security	0.067	0.079	0.706	1	0.401	1.069	0.915	1.248
Opportunity cost	0.068	0.084	0.659	1	0.417	1.071	0.908	1.263
Constant	-3.859	1.324	8.498	1	0.004	0.021		

df: Degree of freedom; SE: Standard error; CI: Confidence intervals.

Table 5: Logistic model parameter estimation results.

Whether the government strived to enforce the agreements between Care International and the environmental service providers is quite doubtful. Quite a substantial number of people remained unpaid until the end of the project; while some were paid less than what they were initially promised.

Although poorly defined property rights have been found to be one of the critical predicaments towards a successful PES project in the Uluguru mountains, needless to say that the definition of property rights might have affected the number of participants in the EPWS project, both positively and negatively since more people would allocate themselves land close to riverbanks and catchment areas if they learned that they would be compensated. Since under normal circumstances, willingness to pay and willingness to accept are different due to differential income, people may not be willing to pay as much to avoid watershed degradation as they would require in compensation to accept it. This is most probably where the payment problems arose. Moreover, Branca et al. [11] reiterated that the adoption of sustainable land management practices can foster more efficient water use and increase agricultural productivity, while reducing environmental risks from water pollution and regulating flows serving downstream communities, the authors are ignoring to link all the plea to fostering effective participation, which is actually the basis for a successful PES project, as has been revealed by this study.

Elsewhere, the determinants of farmers' decision to participate on PES were examined by Kwayu et al. [16], citing farmer and farm characteristics, programme factors, and further, they concluded that, the institutional context of its implementation determine farmers' decisions to participate. In addition, farm size, information, participation of farmers in the programme design and the needed degree of change in land management determine the adoption of sustainable land management practices [17,18]. The findings and rhetoric echo the findings of this study, fortifying the argument that, participation of local community members is a precursor and an important ingredient of successful PES projects.

Conclusion

Generally there was a digression from the Coasean theorem, which occurred partly due to allocation of property rights/land tenure, which signal entry and exit in response to those rights. It is therefore very doubtful that private negotiations to improve environmental and natural resource management can be effective in most developing countries where implementation instruments are seriously weak. If such cases arise, then the government should stay out of the deal. However, plenty of cases where transaction cost is very high, compensation are problematic, there is massive information asymmetry, and many other issues lead to need for intervention by authorities. Therefore, it can fairly be concluded that, no matter how good incentive-based conservation mechanisms are in regulating environmental externalities, they are without challenges. However, the problems on payment seemed to discourage the non-participating ecosystem service providers from joining the EPWS scheme. It was also observed that, property rights were not as strictly defined as the Coasean theorem requires. Therefore, it suffices to say that the potential for success and hence livelihood and conservation improvement of the equitable payment for watershed services scheme in the Uluguru Mountains largely hinged on how it could foster the participation of ecosystem service providers in the study area, both participants and non-participants. Prognosticating the challenges beforehand would have been, and is indeed a major tool for the success of any PES scheme in Tanzania and elsewhere in the world. The EPWS scheme needs to address the challenges observed in this study if it wishes to secure the trust and ownership of the ecosystem service providers and the community at large. A need to clearly establish who causes the harm might have facilitated the right contractual establishments, and clearly stipulate whom the deal could be struck.

One important observation from this study is that, even if a payment for ecosystem services project has identified markets for the ecosystem service in question, some stealthy challenges to the ecosystem service providers (both participants and non-participants) may prohibit the success of a particular PES scheme. The envisaged failure may be in terms of both improved flow of ecosystem service(s) and livelihood, as these two are mutually reinforcing goals of environmental conservation. Therefore, supporting mechanisms may need to be created to ensure that the poor are not marginalised and/or excluded from participating in a PES project, a result of which is missing the non-monetary and the monetary benefits accruing from the sale of environmental goods and services.

People withdrew from the project when rumours spurred around that the payments do not compensate the transaction and the opportunity costs. So there was no any incentive to stay in the project. However, a simple question is, why did some of the ESPs stay in the project until it came to an end? This is a question that needs further investigation so as to draw some empirical lessons for other PES projects in Tanzania and elsewhere in the world. Information flow cropped up as a serious problem to both participants and non-participants. To non-participants, this was a reason for not joining, but to the participants, a communication breakdown called for resentment which in the end led to them quitting from the EPWS project.

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