

**THE IMPACT OF EQUITABLE PAYMENT FOR WATERSHED  
SERVICES SCHEME ON LIVELIHOODS IN TANZANIA:**

**The Case of Uluguru Mountains**



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**MSc. (Natural Resources Assessment and Management) Dissertation**

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**SCHEME ON LIVELIHOODS IN TANZANIA:**

**The Case of Uluguru Mountains**

**By**

**Kassim Ramadhani Mussa**

**A Dissertation Submitted in Partial Fulfilment of the**

**Requirements for the Degree of Master of Science in Natural Resources**

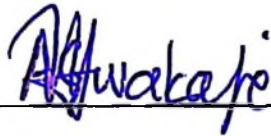
**Assessment and Management of the University of Dar es Salaam**

**University of Dar es Salaam**

**November 2012**

**CERTIFICATION**

The undersigned certifies that she has read and hereby recommends for acceptance by the University of Dar es Salaam a dissertation titled, "*The Impact of Equitable Payment for Watershed Services Scheme on Livelihoods in Tanzania: The Case of Uluguru Mountains*", in partial fulfilment of the Degree of MSc. NARAM of the University of Dar es Salaam.



**Professor Agnes G. Mwakaje**

**(Supervisor)**

Date: 2<sup>nd</sup> January 2013

## DECLARATION AND COPYRIGHT

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## **DEDICATION**

**This work is dedicated to our beloved daughter, Nasrya K.R. Mussa (Naah).**

## ABSTRACT

Care International and World Wide Fund for Nature (WWF) initiated a payment for ecosystem services (PES) project namely Equitable Payments for Watershed Services (EPWS). The scheme aimed at modifying unsustainable land use practices to conserve and improve watershed areas around Kibungo Juu sub-catchment, in the Uluguru Mountains. It also aimed at improving the quality of life of the communities involved through substantial benefits. The EPWS tried to demonstrate how PES can reverse environmental degradation by addressing the core drivers of land-use changes through market incentives. There has been a growing interest by researchers and conservationists in finding out whether the participation in PES schemes improves conservation and increases the stock of livelihood capital. This study was an attempt to provide answers to some of these predicaments. The main objective of the study was to find out the impact of EPWS on the communities in the Kibungo juu sub-catchment in the Uluguru Mountains. A total of 120 households were selected from 3 out of the 5 participating villages, divided into 60 participating and 60 non-participating households. There was also a consultation with focus groups, key informants as well as the researcher's physical observation. Structured and semi-structured questionnaires were used to collect information. The livelihood impact of the EPWS scheme was measured using a few selected livelihoods items from the five broad categories. The trend of responses and internal consistence were computed using Mean Likert Scale and the Cronbach Alpha coefficients while the Conjoint Model was used to determine the preferences of ecosystem service providers. The findings showed that the EPWS scheme had the potential to improve livelihood capital for the environmental service providers. Nevertheless, for the EPWS scheme to be successful the observed challenges must be addressed. First and foremost, the respondents felt that the reward for adopting the conservation practices did not reflect the opportunity cost. This could be explained by the considerable number of EPWS participants who had quit the project. The respondents also preferred payment to be in form of agricultural input voucher rather than direct cash and that it should be channelled through local governments and not project implementers.

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**LIST OF ABBREVIATIONS**

<b>CBC</b>	Choice Based Conjoint
<b>CE</b>	Choice Experiment
<b>CLM</b>	Conditional Logit Model
<b>EPWS</b>	Equitable Payment for Watershed Services
<b>ESPs</b>	Ecosystem Service Providers
<b>FGDs</b>	Focus Group Discussions
<b>ICDPs</b>	Integrated Conservation and Development Projects
<b>IIED</b>	International Institute for Environment and Development
<b>KII</b>	Key Informant Interviews
<b>NGOs</b>	Non Governmental Organizations
<b>NTFPs</b>	Non Timber Forest Products
<b>PES</b>	Payment for Ecosystem/Environmental Services
<b>RUT</b>	Random Utility Theory
<b>SPSS</b>	Statistical Package for Social Sciences
<b>UNCED</b>	United Nations Conference on Environment and Development
<b>WCED</b>	World Commission for Environment and Development

## CHAPTER ONE

### INTRODUCTION

#### 1.1 Background information

It is generally accepted that the Uluguru Mountains in Tanzania, which are part of the Eastern Arc Mountain ranges 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 this is because the area receives one of the highest rainfalls in Tanzania (Burgess *et al.*, 2002). It is the source of Ruvu River, which provides water to most parts of Dar es Salaam city and Coast region.

However, the economic value of such services is seldom recognized in land-use decisions due to market failures associated with externalities and the provision of public goods. When smallholder farmers inhabiting the mountains decide whether or not to clear natural forests for agricultural use, they usually factor in the internal benefits from increased crop production and the costs involved in clearing the land but they are unlikely to consider adverse impacts on environmental services to external users, unless they are being directly rewarded to do so (Pagiola *et al.*, 2002). As a result, they will clear more forests than would be considered desirable for

society when the benefits of increased agricultural production are compared with those associated with the full range of forest ecosystem services. 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 due to uncontrolled agro-chemical use by smallholder farmers. This situation has negatively affected water 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. However, judicious decision-making needs to achieve a balance the watershed needs of local communities, such as subsistence agriculture and fuel, with national water needs, such as the expansion of water supply infrastructure due to the increasing population.

In the recent past though, several conservation projects have been initiated, aiming at restoring the natural resource base of the Uluguru Mountains. Albeit, not all have been equally successful and thus the focus gradually shifted from a subsidy-based approach to conservation, to direct payment for environmental services, under which farmers receive an economic incentive for providing ecosystem services through their conservation efforts.

In response to that paradigm shift in conservation in the Uluguru Mountains, 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). 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 through addressing the core drivers of land-use change. Improved land management in the catchment areas was also expected to lead to improved water quality for both rural and urban consumers. However, it is not known to what extent the EPWS scheme has impacted communities' livelihoods.

### **1.2 Statement of the problem**

After the release of the Brundtland Report by the World Commission for Environment and Development (WCED, 1987, followed by the United Nations Conference on Environment and Development also known as the *Rio Summit*, *Rio Conference* or *Earth Summit* of 1992, tropical conservation slowly took a more people-centred direction. That paradigm shift echoed conventional wisdom that alleviating poverty was the only way to conserve and protect the environment. Researchers like Salafsky and Wollenberg (2000) and Pearce *et al.* (2003)

hypothesized that integrated conservation and development projects (ICDPs) and sustainable forest management were two major instruments that would simultaneously improve incomes and conserve the environment. On the contrary, Sayer (1995) maintained that, despite the scattered successes, neither approach had until then achieved major shifts in tropical land degradation. In addition to Sayer's argument, Adams *et al.* (2004) and Wunder (2001) expressed deep-seated concerns about the extent to which it makes sense to forcibly link conservation and poverty-alleviation agendas when the trade-offs outweigh the synergies.

In spite of the mixed reactions from various researchers and conservationists, it is envisaged that participation in a PES scheme would increase the stock of natural, social, human, physical and financial assets at the household and community level, while improving resilience to environmental and economic shocks. Therefore, in the context of rural, natural resource-dependent poor communities, PES schemes are supposed to constitute co-investment in livelihood assets, in which the payment itself becomes part of a broader strategy encompassing both environmental stewardship and sustainable livelihoods (van Noordwijk *et al.*, 2007).

Nevertheless, researchers like Grieg-Gran *et al.* (2005); Pagiola *et al.* (2005); Porras *et al.* (2008) and Wunder (2008) argue that PES schemes were not initially developed as instruments for improving livelihoods. It is not until recently that there has been increased interest in the impact on the livelihoods of participating and non-participating ecosystem service providers (ESPs), particularly in relation to livelihood improvement. Following that improvised link between PES and livelihood

improvement, researchers like Landell-Mills and Porras (2002); Grieg-Gran *et al.* (2005); Pagiola *et al.* (2005); Scherr *et al.* (2007); Pagiola *et al.* (2008) and Peskett *et al.* (2008) conducted studies to assess the degree to which low-income ESPs 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, the overall impact on livelihoods of PES schemes in Tanzania has not been studied and, on top of that, the connection between participation in a PES scheme and a change in the stock of natural, social, human, physical and financial capital at the household and community level has not been adequately studied either. Therefore, the potential of PES initiatives improving the livelihoods of ESPs in Tanzania is largely disputable and remains elusive and inconclusive.

In addition, while it is generally proclaimed that PES initiatives can only work on a long-term basis if they are to be judged in terms of reducing the poverty of local communities, limited empirical information and knowledge exist for establishing both the short and long-term impacts of PES schemes with regard to improving the livelihoods of ESPs. Furthermore, fuzzy information surrounds most of the PES schemes around the world with regard to which challenges and preferences could hinder or influence the commitment of ESPs to switch to improved land management practices, which would lead to improved environmental conservation, leading, in turn, to an improvement in rural livelihoods.

This study therefore sought to address these important knowledge gaps by providing both quantitative and qualitative estimates of the extent to which the EPWS scheme benefited low-income natural resource stewards and sellers of ecosystem services in the Uluguru Mountains. More importantly, the study sought to find out the preferences of ESPs, which would enable the designing of effective and acceptable PES schemes that would work in terms of improving the livelihoods of natural resource-dependent communities and conserving the environment. The findings of this study are expected to be a lesson for any subsequent PES schemes in Tanzania and elsewhere in the world, particularly the way in which PES schemes can foster the livelihood opportunities of ecosystem service providers.

Furthermore, the study will inform policymakers and the donor community on how best PES schemes could achieve both livelihood enhancement and the long-term security of ecosystem service provision. It is also expected to add to the body of knowledge through being published in referred journals.

### **1.3 Study objectives**

#### **1.3.1 General objective**

The main objective of this study was to assess the extent to which the equitable payment for watershed services scheme has contributed to the livelihood improvement of communities in the Uluguru Mountains.

### **1.3.2 Specific objectives**

- (a) 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.
- (b) To assess the impact of equitable payment for watershed services scheme on livelihoods of the ecosystem service providers in the Uluguru Mountains.
- (c) To explore the challenges which either, hold back or threaten the participation of ecosystem service providers in the Uluguru Mountains.
- (d) To elicit the preferences of ecosystem service providers for the different predetermined EPWS attributes and attribute levels.

### **1.4 Research questions**

This study was guided by the following research questions

- (a) What is the type and degree of adoption of environmental and watershed conservation activities introduced by the EPWS scheme in the Uluguru Mountains?
- (b) To what extent has the equitable payment for watershed services scheme impacted the livelihoods of the ecosystem service providers in the Uluguru Mountains?
- (c) What key challenges have been holding back and/or threatening the participation of ecosystem service providers to the equitable payment for watershed services scheme in the Uluguru Mountains?

(d) What is the preference of ecosystem service providers in the Uluguru Mountains on different EPWS/PES attribute and attribute levels?

### **1.5 Significance of the study**

This study contributes greatly to the body of knowledge, first, by contributing to the scanty, but increasing number of choice experiment studies conducted in developing countries like Tanzania, by applying the state-of-the-art stated preference valuation method. Secondly, the study highlights the benefits as well as the costs that ESPs have to endure in adopting environmental conservation practices and it sheds light on how any incentive-based conservation scheme in the Uluguru Mountains would need to compensate and/or pay the local communities if a certain proportion of the local land or forest is to be contracted for use by the payment for ecosystem services initiative. Thirdly, the results generated from this study could be used to support conflict resolution and negotiation between farmers and conservation practitioners. Finally, 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.

## CHAPTER TWO

### LITERATURE REVIEW

#### 2.1 Description of key concepts of Payment for Ecosystem Services (PES)

Despite the fact that the literature so far does not conventionally define PES, adding to ever mounting conceptual confusion, Wunder (2005) used five, relatively simple criteria to describe the Payment for Ecosystem Services principle, synonymously known as Payment for Environmental Services 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. However, the concern about this definition as supported by Vatn (2008) is that using criteria (i) and (ii) and basing PES on the buyer–seller interaction confines the concept to a few peculiar cases, because most of the real world situations do not conform to this definition.

Moreover, 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. PES as defined by FAO (2007) is therefore a subset of compensation and reward for ecosystem services, which is defined and analyzed elsewhere by Swallow *et al.* (2009). However, Wunder *et al.* (2005) added that PES is implemented through conditional agreements between land stewards and ecosystem service beneficiaries

such as private businesses, communities and society as a whole. Therefore, Wunder (2005) expanded the definition further by adding that, currently, four ecosystem service types on which PES operates stand out: (i) Carbon sequestration and storage (ii) Biodiversity protection (e.g. conservation donors paying local people for setting aside or naturally restoring areas to create a biological corridor); (iii) Watershed protection (e.g. downstream water users paying upstream farmers for adopting land uses that limit deforestation, soil erosion, flooding risks, etc.); (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) could potentially be traded, for example, wilderness areas providing pollination services to agriculture, but so far only the four mentioned services operate on a significant commercial scale in Tanzania and elsewhere in the world. It should also be noted that sometimes several services can be provided in a synergetic way and a bundled PES scheme can enable several service users to package their payments to service providers. But not all services are truly threatened and scarce, and not all users are willing to pay. Partial trade-offs between services are also likely.

However, it was beyond the scope of this study to fully consider the implications of these definitions in analyzing the livelihood impact of the EPWS scheme. However, it is worth noting that this study adopted the above definitions wholly or partially in order to have an agreed yardstick for the discussion, conclusion and recommendations. The following subsection therefore discusses livelihood,

livelihood improvement before tackling the implication of PES schemes on the livelihoods of the ecosystem service providers.

## **2.2 Livelihood and livelihood improvement**

According to Chambers and Conway (1992), livelihood comprises the capabilities, assets (both material and social) and activities required as a means of earning a living. A livelihood is said to be sustainable when it can cope with and recover from stresses and shocks, maintain or enhance its capabilities and assets, while not undermining the natural resource base (*ibid*). In tandem with Chambers and Conway (1992), Davies (1996) maintains that 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. Such resilience in the face of stresses and shocks is key to both livelihood adaptation and coping with them (*ibid*). 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) suggests that, the ability to pursue different livelihood strategies is dependent on the basic material and social, tangible and intangible assets that people have in their possession. Drawing on an economic figure of speech, such livelihood resources may be seen as the capital base on which different productive streams are derived, and from which livelihoods are constructed. Identifying what livelihood resources are required for different livelihood strategy combinations is thus a key step in the process of assessing livelihood impact of any development initiative.

In that regard therefore, 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. Scoones (1998) adds that a key issue in the assessment of livelihood strategies is the scale at which an assessment takes place. Livelihood strategies, for example, can be described at an individual, household and village level, as well as at regional or even national levels. However, there are obvious differences between scale levels in terms of the net livelihood impacts of any initiative towards any of the groups. For an individual it is best to pursue a particular set of livelihood assets in combination, but these may have either positive or negative impacts on other household members or the broader community.

However, Chambers (1987) points out that whether such livelihood pathways and portfolio combinations result in positive or negative impacts in any community is a contentious issue, adding that not only is the total number of sustainable livelihoods

created important in analyzing livelihoods, but also the level of livelihood intensity. Livelihood resources may be combined creatively and innovatively, often in complex ways, to create more livelihoods in a particular area. In addition, Chambers (1997) points out that such a well-being approach to livelihood analysis may allow the people themselves to define which criteria are important. This may result in a range of criteria for measuring sustainable livelihood outcomes, including diverse factors such as self-esteem, security; happiness, stress, vulnerability, power and exclusion, as well as the more conventionally measured material concerns.

In order to create livelihoods therefore, people must combine the capital endowments they have access to and control over. These may be made up of personal capabilities, tangible assets (e.g. stores and material resources) and intangible assets (claims and access) (Chambers and Conway, 1992). On any scale, livelihoods are composed in complex ways, with multiple and dynamic portfolios of different activities that are often improvised as part of on-going performance, concludes Richards (1989).

### **2.3 The impact of PES on livelihoods**

Sustainable development can only take place if the sustainable use of natural resources is ensured while livelihood constraints are also tackled. Yet it would be precarious to conclude that PES constitutes a straightforward instrument for improving livelihoods. The first goal of PES is to ensure a continued flow of ecosystem services through sustainable resource management. Various case studies show that PES programmes can have quite positive impacts on local livelihoods (Inforesources, 2004), but does this also apply to poor, rural natural resource stewards in Tanzania? In most cases, it is precisely these people who either facilitate

or endanger the provision of ecosystem services in the upper reaches of catchment areas. Sustainable management and the employment of conservation measures are often costly and involve considerable effort. Poor land users cannot afford to take risks, and usually they do not possess the necessary capacity to make changes in their systems of resource use and land management. They also lack the competence and the institutional support to participate in markets for ecosystem services. It is however argued that, in the developing world, mountain communities generally tend to suffer disproportionately from lower levels of development than those in lowland areas. The prevalence of poor and vulnerable people increases with elevation (Hassan *et al.*, 2005; Huddleston and Ataman, 2003). A study in Nepal by ICIMOD (2010) showed that livelihood inequality between mountain communities and those living in other areas is currently increasing. Therefore, the livelihoods of mountain communities have to be understood in the light of several mountain-specific constraints which intensify the prevalence of poverty. These include the fragility of ecosystems, remoteness, poor accessibility and marginalization of mountain communities from the mainstream, lack of equity in terms of access to basic facilities such as health care, education, and physical infrastructure, as well as to markets, political power, and representation; lack of employment opportunities; and proneness to natural disasters (*ibid.*).

The rhetoric from PES advocates has it that innovation is urgently needed because current approaches provide too little value for declining funding; that PES can provide new (especially private-sector) funding; and that poor communities selling these services can improve their livelihoods. Molnar *et al.* (2004), for example, argue

that throughout the developing world, critical ecosystem services are generated on rural lands owned or managed by low-income people, including natural forests, agroforests, farmland and rangeland. 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. However, 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 the benefits these participants receive. Empirically, poor people who participate in PES generally receive a net positive level of benefits from cash payments and/or other livelihood enhancements, as noted by Molnar *et al.* (2007).

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. In addition, Uchida *et al.* (2007) and Bennett (2008) found that household-level effects associated with China's Sloping Land Conversion Programme have been more variable. Furthermore, Uchida *et al.* (2007) and Bennett (2008) added that, 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. 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, and actually this is what is happening in Tanzania and the trend is expected to continue. Wunder *et al.* (2005) concluded that when PES does not benefit participants, it is because participation is not truly voluntary. On top

of this, despite participation being voluntary, it has to reach as many people as possible.

On the other hand, 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. However, an important point often overlooked by the sceptics in the debate is conditionality. This principle makes PES unique among various incentive-based conservation approaches. PES schemes are based on the condition that people who benefit from ecosystem services may have to offer payment to the land users, who are in the position of providing the services. Intuitively, buyers would not want to pay for services they can obtain without paying, and they would not want to make payments to people who do not provide the service. Payments are thus conditional on the continued supply of and demand for the environmental service in question.

Despite all that, Willetts (2008) points out that payment for ecosystem services schemes in developing countries involve local-level environmental negotiations between the public and private sectors. These mechanisms primarily give physical value to specific resource improvements and they reorganize funding streams towards particular environmental objectives using positive incentives. Moreover, payments for ecosystems services schemes are initiated to address ecological

externalities, incentive incompatibility, information asymmetries and market failure for provisioning public goods (Muthoo, 2001). Meanwhile, Bhatnagar (2008) hints that 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. If efforts to help the poor in a PES programme come at the expense of delivery of the service, the programme may fail, in which case of course it cannot help the poor anymore (*ibid*). Therefore, for PES schemes to benefit the poor, they must be able to provide the desired service, and demand for it must persist, or else payments may no longer continue.

#### **2.4 Challenges of participating in Payment for Ecosystem Services schemes**

Jindal and Kerr (2007) pointed out that the first question a pro-poor PES programme needs to consider is whether the poor can participate. Participation is often the principal question addressed in studies on PES and the poor, as also commented on by Lee and Mahanty (2009). Furthermore, Lee and Mahanty (2009) proclaim that even if markets for ecosystem services exist, various challenges may exclude the poor from participating in the project. Some of the obstacles of participating in PES schemes are land tenure insecurity, size of landholding, high transaction and opportunity costs of participating in PES schemes, high investment costs of adopting PES-related land-use practices, lack of awareness, education, or access to the technical knowledge required for measuring and monitoring the impact of PES activities (Lee and Mahanty (2009); Jindal and Kerr (2007)).

## **2.5 Valuing Payment for Ecosystem Services using choice experiment method**

Choice experiments provide an approach to estimating stakeholder preferences for a predicted or planned future scenario that cannot be objectively assessed by using existing knowledge (e.g. climate change, price shifts, new technology, new environmental management approach, etc). It allows decision-makers to explore behavioural responses and priorities, which cannot be satisfactorily arrived at by analysing observed data. One peculiar feature of the methodology is that a good or service is characterised by a collection of attributes and attribute levels rather than assuming an aggregate '*whole good*' approach (Lancaster, 1966). As such, experimental design presents choice tasks in a trade-off or voting game format, which allows the marginal value respondents place on each attribute to be assessed. The methodological framework is well known and discussed extensively by Louviere *et al* (2000). A major limitation of the method is that choices are often shaped by the way they are framed (*ibid*). Therefore, to overcome this methodological impasse, scoping analysis and identifying attributes well before the choice experiment survey were done so as to create a valid and legitimate choice experiment design.

Despite all that, in various studies, the choice experiment (CE) method has been found to be a suitable approach for estimating farmers' preferences that inform policy design. Of particular note is the study by Hope *et al.* (2006), which proved how the CE method was able to combine earlier qualitative inquiry involving primary stakeholders (e.g. farmers/land managers) and secondary stakeholders (e.g. government and wetland users) to design experimental scenarios. The scenarios were pictorially presented to some illiterate stakeholders, who might otherwise be

excluded from decision making. Though incentives were considered central to changing farmers' land management behaviour, the *status quo* remained that suggested that the choice task proved too difficult for some respondents or there was limited trust in the effective implementation of the choice scenarios. In a nutshell, Hope *et al.* (2006) explored small-scale farmers' adoption of organic farm management as an approach to mitigating off-site water quality impacts in the Bhoj wetlands in India. A stated choice experiment was used to evaluate preferences of a watershed sample of farmers for trade-off scenarios, with crop price, labour, input and land certification being the attributes. A latent class specification revealed two farmer sub-groups and estimated different weighted preferences in an aggregate model influenced by socio-economic characteristics. The results indicated that incentives are crucial to the adoption of organic farm management, subject to farm location, farmer profile and current farming practices.

In another study, Birol *et al.* (2006) used the choice experiment method to account for preference heterogeneity in wetland attributes in Cheimaditida wetland in Greece. In this study, experimental design techniques and SPSS Conjoint software were used to obtain an orthogonal design, which consisted of only the main effects, and resulted in 32 pair wise comparisons of alternative wetland management scenarios. These were randomly blocked into 4 different versions, each with 8 choice sets. Each set contained two wetland management scenario and an option to select neither scenario. Such an "opt out" option was considered as a *status quo* alternative, whose inclusion in the choice sets was instrumental to achieving welfare measures that are consistent with demand theory (Louviere *et al.*, 2000).

It was explained to the respondents that if they chose neither scenario, they would not be expected to pay. However, there would not be any active wetland management, in which case the conditions in the wetland would deteriorate to such a level that biodiversity, open water surface area and research and education attributes would be affected and no locals would be retrained in environmentally friendly employment. The results from this study indicated that there were positive and significant economic benefits associated with the ecological, economic and social attributes of the Cheimaditida wetland. The impacts of the social, economic and attitudinal characteristics of respondents as regards their valuation of wetland management attributes were significant and conformed to economic theory. Furthermore, there was considerable preference heterogeneity within Greek society, which the author thought should be taken into consideration when designing the provision of public goods, such as wetlands.

## **2.6 Conclusion from literature review**

From the literature review, it was realized that the list of livelihood capital provided by Scoones (1998) is clearly not exhaustive and other forms of livelihood capital had to be identified. In this study therefore, a fifth category of livelihood capital was added, which is physical capital, as clearly described in the methodology. In that regard therefore, livelihood capital in the context of this dissertation, which was used to assess the impact of the EPWS scheme on livelihood improvement refers to financial, social, human, physical and natural capital.

Secondly, from the literature review it could be concluded that investigating (both positive and negative) multiplier effects of particular initiatives is an important issue when assessing the impact on livelihoods of any project. Analyzing the impact of one person's livelihood activities on others, both now and in the future, is thus important. The net effects of investing in one set of livelihood strategies therefore needs to be assessed, and future impacts analyzed appropriately. From the literature review, information on how PES schemes can improve livelihoods is inconclusive and this is the major missing link between conservation and poverty alleviation. The debate between PES advocates and PES sceptics is ongoing and thus more research is needed to document the impact on livelihoods of PES schemes. Given the linkages between rural livelihoods and forests, which are essential because they act as safety nets for poor households, as revealed by the various literatures reviewed, there is a need to investigate how EPWS and other PES schemes are interlinked in terms of the interests of forest resource custodians and rural communities. On top of that, there is inconclusive information on how PES schemes should be designed in order to be of benefit to natural resource-dependent communities, and not a burden. This is one of the information gaps this study sought to fill.

Another obvious gap revealed by the literature review is that, the adoption of different conservation activities under PES were not highlighted, but instead the challenges of participation, successes and failures were given prominence. Therefore, apart from examining various challenges concerning EPWS participation in the Uluguru Mountains, this study also highlighted the extent to which different conservation activities introduced by EPWS scheme had been adopted, and it drew

from the experiences of both participating and non-participating ESPs. Furthermore, it was also found that the challenges of participating in a PES scheme were highlighted in a holistic manner by various authors, irrespective of the difference in the perceptions of participants and non-participants. This study tried to overcome this oversight by analyzing the challenges facing EPWS participants and non-participants separately.

Last but not least, most of the choice experiment studies reviewed have been carried out outside Tanzania. This suggests that very few choice experiment studies have been undertaken in Tanzania. This study therefore utilized this method to model the preferences of ESPs in the Uluguru Mountains that pertain to watershed conservation and PES implementation. In addition, in this study the *status quo* scenario was not included and therefore welfare measures using the choice experiment method were not part and parcel of this study. Welfare measures were only carried out by analyzing access to livelihood capital as set forth in the second specific objective of this study.

## **2.7 The Conceptual framework of the study**

### **2.7.1 A general overview**

According to Reichel and Ramey (1987), a conceptual framework is a set of broad ideas and principles taken from relevant fields of enquiry and used to structure a subsequent presentation. When clearly articulated, a conceptual framework is a potentially useful tool for scaffolding research, hence assisting the researcher in making sense of the subsequent findings.

In this study therefore, such a framework was used as a starting point for reflecting on the research idea and its context. In addition, Guba and Lincoln (1989) pointed out that the framework is a research tool designed to assist a researcher in developing an awareness and understanding of the situation under scrutiny and in communicating it. Guba and Lincoln (1989) conclude that the framework forms part of the agenda that is to be scrutinised, tested and reviewed as a result of the investigation. The following subsection describes the conceptual framework that guided this study.

### **2.7.2 A description of the conceptual framework of this study**

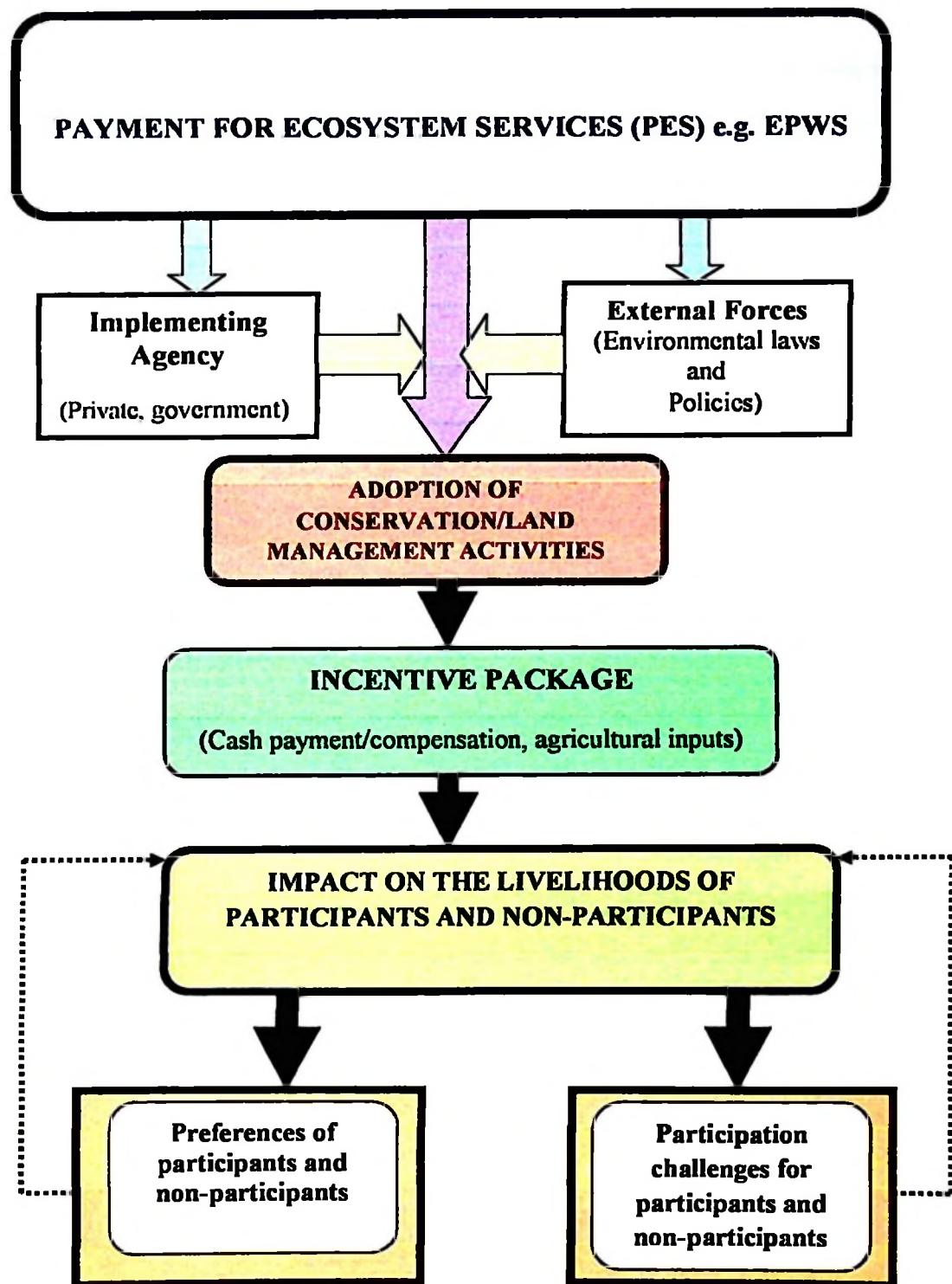
Payment for Ecosystem Services (PES), e.g. Equitable Payment for Watershed Services (EPWS) scheme, is a project-based concept that requires an implementing agency, which can either be a non-governmental organization or a department within a government ministry. However, being an environmental policy tool, PES is usually guided by National and International laws (Fig. 1). These are some of the external forces which any PES idea has to take account of in order to succeed. The implementing agency, being guided by National and International laws, comes up with an incentive package, (e.g. monetary payments/compensation, agricultural inputs) which induces behavioural change amongst ESPs so that they adopt environmental conservation activities. The incentive package has the potential to attract the participation of ESPs, from which livelihood impact of a PES scheme can be measured. Jindal and Kerr (2007) pointed out that for PES schemes to benefit the poor, they must be able to provide the desired service, and demand for it must be

persistent, or else the incentive may no longer be forthcoming. Cole (2010) concluded that PES participants in Costa Rica planted substantially more trees and more species than non-participant farmers. This shows that there is the possibility of non-participants in any PES scheme adopting conservation activities. However, it is hypothesized that the more that conservation activities under PES are adopted, the more likely that the implementing household/individual will receive payment, which would lead to improved livelihoods. Generally, that is more likely to be the case for participant ESPs than for non-participants. How the EPWS scheme benefited the non-participant ESPs in the Uluguru Mountains formed the question, which ought to be answered by this study. However, the impact on livelihoods of a PES scheme is usually measured using a composite of livelihood capitals, other than financial gain only, as suggested by Uchida et al (2007) and Bennett (2008). Therefore, it would be precarious to conclude that PES constitutes a straightforward instrument for improving livelihoods.

On the other hand, the implementing agency, using existing national and international laws, has to elicit the preferences of the ESPs as these can be used to devise an incentive package that attracts participation, hence the adoption of conservation activities. As stated earlier, the higher the rate of adoption of conservation activities the higher the payment. This therefore leads to greater improvements in the livelihoods of participating ESPs. However, there are stated cases where non-participants also adopt conservation activities under PES. Does this apply to the EPWS scheme in the Uluguru Mountains? In addition, the question as to whether EPWS catered for the preferences of the ESPs (both participants and non-

participants) in the Uluguru Mountains was one of the key concerns, which led to the formulation of the study problem. Together with the preferences, the participation challenges, when well monitored, can be a basis for moulding the ongoing PES scheme, thus attracting non-participants into the PES project and reducing the rate of dropouts of project participants. These two variables (preferences and participation) are intimately related in such a way that well catered for preferences will reduce the number of challenges that threaten the participation of ESPs.

The conceptual framework (Fig. 1) therefore helped in strengthening and keeping the study on track by shading light on types of data to be collected and the variables to be analyzed. This provided a glimpse of how the livelihood impact of EPWS scheme in the Uluguru Mountains differed between participants and non-participants. The conceptual framework also helped in the analysis of the rate of adoption of land management and conservation activities, comparing the two respondent groups (i.e. participants and non-participants). Eventually, the idea was to reveal how different were the preferences of participant and non-participant ecosystem service providers, with regard to EPWS implementation strategies and how significant was that difference? Lastly, the conceptual framework helped in collecting data to visualize the challenges that hold back non-participant ESPs and those which threaten the participation of participant ESPs, thus contributing to dropouts and less livelihood impact of EPWS scheme to the ESPs in the Uluguru Mountains.



**Figure 1: Conceptual framework of the study**

## **CHAPTER THREE**

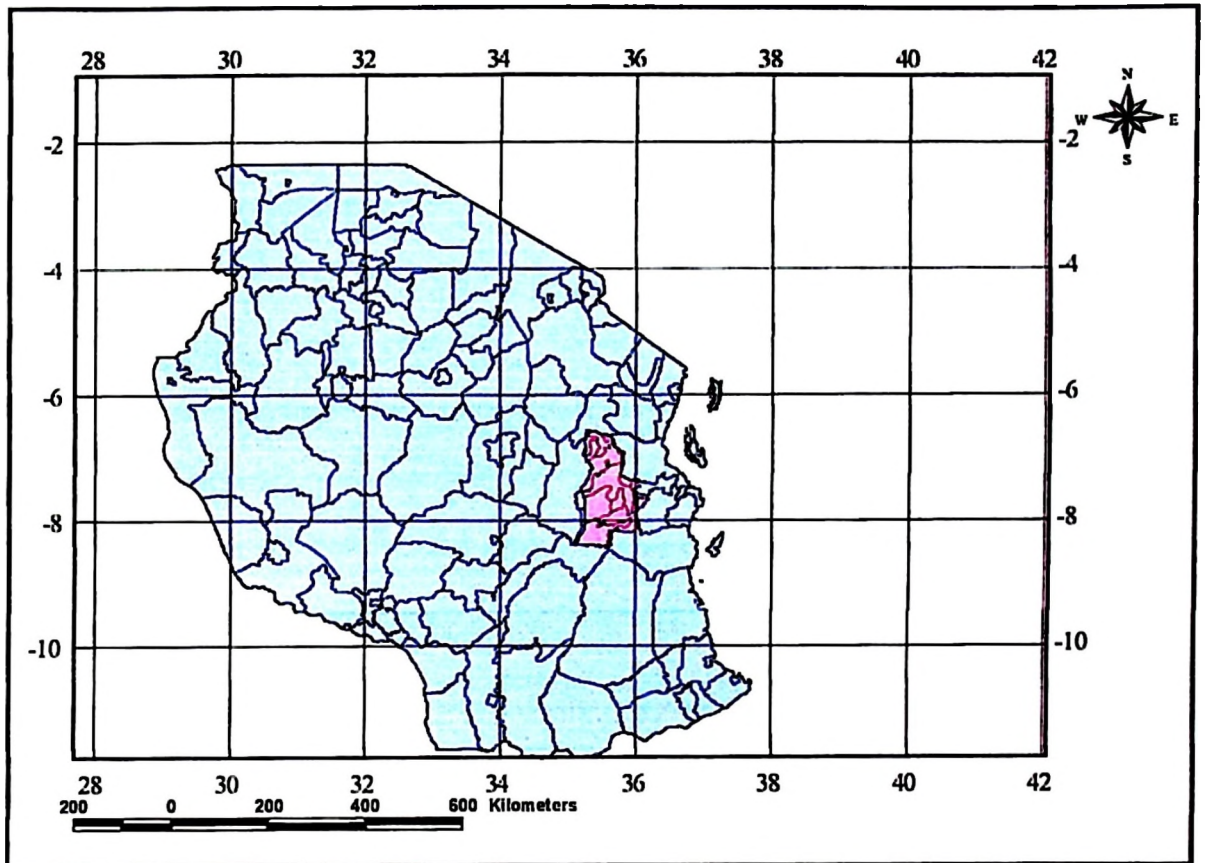
### **STUDY METHODOLOGY**

#### **3.1 Description of the study area**

##### **3.1.1 Geographical location and socio-economic status**

The Uluguru Mountains lie immediately South of Morogoro town (Fig. 2) in 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. Different socio-economic activities are carried out around the forest, but agriculture is the most predominant economic activity which is mostly carried out at subsistence level to produce both food and cash crops. However, livestock keeping and petty trading are other economic activities carried out by the people of the Uluguru Mountains. In all the villages where the EPWS scheme has been implemented, the providers of the ecosystem services were poor rural communities, whose area is characterized by high rates of land degradation, biodiversity loss and watershed destruction.

This study was carried out in Kibungo juu ward, which is one of the 25 wards of Morogoro Rural District, in Morogoro region. Specifically, the study targeted Nyingwa, Lanzi and Kibungo villages, the main reason being that these are 3 of the 4 villages selected for pilot implementation of the EPWS scheme in 2009. Fig. 2 shows the location of Uluguru Mountains in Tanzania where this study was carried out.



**Figure 2: The map of Tanzania showing the location of Uluguru Mountains and the study area**

### **3.1.2 Population of the study area**

According to a ward census carried out in 2010, the population of Kibungo juu ward was 6297, with 3393 and 2904 being female and male residents respectively. The ward was made up of 1736 households, with Nyingwa village having the largest number of households, followed by Lukenge, Lanzi, Kibungo and Dimilo (Table 1). The study villages had a total of 4066 inhabitants, with 1102 households. Nyingwa village is the most populous of all the study villages, having the largest number of households, followed by Lanzi, which has a lower number of inhabitants per household than Kibungo village, but Kibungo village has a higher number of inhabitants than Lanzi village (Table 1).

**Table 1: Population of Kibungo juu ward**

Village name	Number of households	Number of people		
		Male	Female	Total
Kibungo	335	593	697	1290
Dimilo	280	511	542	1053
Lanzi	349	613	671	1284
Lukenge	354	492	686	1178
Nyingwa	418	695	797	1492
<b>Total</b>	<b>1736</b>	<b>2904</b>	<b>3393</b>	<b>6297</b>

**Source: Kibungo juu ward 2010 household roster**

### 3.1.3 Climate of the study area

On the eastern slopes of the Uluguru Mountains, where this study was carried out, the estimated rainfall is 1,200 mm/year and is well above 2,000mm on the western slopes. The area has two rainfall seasons per year, the long rains, from March to May, and the short rains, from October to December. The mean annual temperature is 24.3°C, with a maximum of 26.5°C in December and a minimum of 21.1°C in July (Lyamuya *et al.*, 1994). However, Jens *et al.* (1993) argued that the mean annual temperature can go down to 19.5°C in certain years, with a maximum of 22°C in December and a minimum of 17° C in July.

## **3.2 Research design**

### **3.2.1 Livelihood survey design**

Given the complex nature of the linkages between payment for ecosystem services and livelihood improvement, the mixed-methods design was adopted for this study. The study employed a partially mixed concurrent dominant status design (Onwuegbuzie and Collins, 2007), in which quantitative and qualitative approaches were used simultaneously, but with the quantitative approach being dominant. The quantitative approach was used for the overall design of the study whereas the qualitative method (Focus Group Discussions and Key Informant Interviews) complemented the quantitative method. The mixed-methods design brought together the different strengths of quantitative and qualitative methods, while offsetting the weaknesses of using a single method and expanding the set of collected data.

This study targeted the ESPs from three villages in Kibungo juu ward, both participants and non-participants in the EPWS scheme. In order to be objective in carrying out a comparative assessment of the impact of the scheme on livelihoods, ESPs who joined the EPWS scheme in 2009 in the three study villages of Kibungo juu ward were chosen, and their livelihoods compared with the ESPs who, at that time, had not joined the project. It is therefore imperative to say that, in this study, the unit of observation was an ecosystem service provider while the unit of analysis was the household.

**Table 2: Number of participating and non-participating households in the study area**

<b>Village Name</b>	<b>Total number of households</b>	<b>Number of participating households since 2009</b>	<b>Number of non-participating households</b>
Kibungo	335	57	278
Lanzi	349	61	288
Nyingwa	418	51	367
<b>Total</b>	<b>N=1102</b>	<b>N<sub>pp</sub>=169</b>	<b>N<sub>np</sub> = 933</b>

**Source: Survey data 2011**

### **3.2.2 Sampling procedure**

Both probability and non probability sampling techniques were used in this study. The first level of selecting interviewees involved a purposive sampling technique, which was used to obtain the villages that joined the equitable payment for watershed services scheme since 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 group leaders of farmer groups while for non-participants, the sampling frames were obtained from Kibungo juu ward office and the respective village household rosters. Thereafter, stratified sampling technique 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 general population size (number of households) in a village and number of households participating in the EPWS scheme. This was specifically done

to improve the representativeness of the sample by reducing sampling errors. The following equation facilitated the division of sampling frames into homogeneous subgroups:

$$n = \frac{n}{N}n_1 + \frac{n}{N}n_2 + \frac{n}{N}n_3 \dots\dots\dots(1)$$

**Where;**

**n** = sample size

**$n_1$ ,  $n_2$  and  $n_3$**  are the number of households selected randomly from Kibungo, Lanzi and Nyingwa villages respectively while  **$N$**  denotes the sampling frame. Thereafter, random sampling technique was used to select the interviewees from each village.

### **3.2.3 Sample size determination**

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 (35.5%) were chosen for interview. Accordingly, 60 non-participating respondents, equivalent to 6.4% of the non-participating households were chosen for interview, making a 1:1 sampling ratio. Financial constraints and the large expanse of the study area hampered the collection of an equivalent sub-sample from non-participating ecosystem service providers (i.e. 35.5%), thus opting for a 1:1 ratio in order to enhance comparative analysis and discussion of the two sub-groups. Table 2 shows the total number of households that joined the EPWS scheme in 2009 in each study village and the number of non-participating households until December 2011.

Given that the required number of participating households for interview was 60, equation 1 was modified and used to divide the sampling frame into homogeneous subgroups as follows:

$$n_{pp} = \frac{n_{pp}}{N_{pp}} n_K + \frac{n_{pp}}{N_{pp}} n_L + \frac{n_{pp}}{N_{pp}} n_N \dots\dots\dots(2)$$

**Where;**

$n_{pp}$  = sub-sample size of participating ecosystem service providers

$n_K$ ,  $n_L$  and  $n_N$  are the number of participating households of Kibungo, Lanzi and Nyingwa villages respectively.

$N_{pp}$  = Sampling frame of participating households in the three study villages (i.e.169).

$\frac{n_{pp}}{N_{pp}}$  = The proportion of participating ecosystem service providers interviewed (i.e. 60/169)

In the case of non-participating households, the number of interviewees was derived from the total population of the three study villages, which comprised of 1102 households. Out of these, 169 households had been participating in the project since 2009, leaving only 933 households which were not participating in the equitable payment for watershed services scheme (Table 2). Likewise, equation 1 was modified to obtain the sub-sample size of the non-participating ecosystem service providers as follows;

$$n_{np} = \frac{n_{np}}{N_{np}} n_{nK} + \frac{n_{np}}{N_{np}} n_{nL} + \frac{n_{np}}{N_{np}} n_{nN} \dots\dots\dots(3)$$

Where;

$n_{np}$  = sub-sample size of non participating ecosystem service providers

$n_{nK}$ ,  $n_{nL}$  and  $n_{nN}$  are the number of non-participating households in Kibungo, Lanzi and Nyingwa villages, respectively.

$N_{np}$  = Sampling frame of non-participating households in the three study villages (i.e. 933).

$\frac{n_{np}}{N_{np}}$  = The proportion of non-participating ecosystem service providers interviewed,

which is 60/933.

The total sample size for this study therefore was  $n_{pp} + n_{np}$ , which is equal to 120 households, and hence 120 households of ESPs were selected for this study (Table 3). Kothari (2004) points out that the sample size should neither be excessively large nor too small, but should be optimal. This sample size (120) was considered optimal for carrying out any subsequent statistical analyses. For that reason, the choice experiment survey was instituted using the very same households in which the livelihood survey was carried out.

**Table 3: Number of households selected for interview from the selected villages in the Uluguru Mountains-Tanzania**

Village Name	Number of respondents		
	Non participants	Participants	Total
Nyingwa	23	18	41
Lanzi	19	22	41
Kibungo	18	20	38
<b>Total</b>	<b><math>n_{np} = 60</math></b>	<b><math>n_{pp} = 60</math></b>	<b>n =120</b>

Source: Survey data 2011

### **3.3 Data collection techniques and tools**

#### **3.3.1 Livelihood data**

Data for this study came from both primary and secondary sources. Secondary data were collected mainly through literature review. Secondary data were collected to find out what had already been done by other researchers, pertaining to this study and what had not. Primary data were collected using a 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 (Appendix I). 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 the challenges encountered by both participants and non-participants with regard to participation in the EPWS scheme, as well as general environmental and land management issues that community members were involved in. In addition, data on the status of ownership, availability and access to productive and other key livelihood capitals before and after the project were collected. The respondents were presented with items connected to five livelihood capitals to indicate the extent to which EPWS has contributed to each aspect. The livelihood impact was therefore measured using a few selected livelihood items from five broad categories of livelihood capitals as presented in Table 4.

**Table 4: Livelihood capital data**

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

For each item, a mean score based on a four-point Likert scale (1= Worsened, 2 = No change, 3=Slight improvement, 4=Great improvement) was computed which literally helped to show the trend of the responses. As per the design of this study, a mean score of 2.5 and above denoted that EPWS scheme had a significant impact to the livelihoods of ESPs whereas a mean score below 2.5 denoted insignificant livelihood impact.

### **3.3.2 Choice experiment design**

#### **3.3.2.1 Overview**

The preferences of ecosystem service providers were estimated using a recently developed non-market valuation technique, namely the choice experiment (CE) method, which assumes that individuals choose the alternative which maximizes their utility. It applies probabilistic models for choosing between the different alternatives available in each choice set as described below.

#### **3.3.2.2. Why Choice Experiment Method?**

The choice experiment method was opted for in this study because it provided an approach to estimating stakeholder preferences for predicted or planned future scenarios that would be objectively assessed using existing knowledge. It invariably allows researchers, decision-makers and practitioners to explore behavioural responses and priorities, which cannot be satisfactorily answered by analyzing observed data.

#### **3.3.2.3 Theoretical description of the choice experiment method**

Choice Experiment method is a non-market valuation technique that is used to circumvent the absence of markets for ecosystem services. It creates a hypothetical market in which individuals are called to participate. The good to be valued is defined in terms of its constituent attributes and their levels. If one of the attributes is monetary, then the marginal willingness to pay (WTP) for each attribute can be extracted. The choice experiment method has its theoretical grounding in Lancaster's model of consumer choice (Lancaster, 1966), and its econometric basis from the

Random Utility Theory (RUT) (McFadden, 1974). Lancaster proposed that consumers derive satisfaction not from the goods themselves but from the attributes they provide. Therefore, an ecosystem service provider (the respondent) was assumed to have a utility function of the form;

$$U_{ij} = V(Z_j, S_i) + e(Z_j, S_i) \dots\dots\dots(4)$$

Where;

$U_{ij}$  is the utility of a respondent emanating from the attributes of a scenario and the social, economic and attitudinal characteristics of a respondent,  $V$  is an observable systematic component of the utility of an individual,  $e$  is the factor unobservable to the researcher and therefore was treated as a random (error) component,  $(Z_j)$  is the attribute of the watershed management scenario.  $(S_i)$  is a social, economic and attitudinal characteristics of the respondent. This means that for any respondent  $i$ , a given level of utility was associated with any watershed management scenario alternative  $j$ . Utility derived from any of the watershed management scenario alternatives depended on the attributes of the watershed management scenario  $(Z_j)$ , and the social, economic and attitudinal characteristics of the respondent  $(S_i)$ . In connection with that, the RUT states that the utility of a choice is comprised of a deterministic component ( $V$ ) and an error component ( $e$ ), which is independent of the deterministic part and follows a predetermined distribution. The error component implies that predictions could not be made with certainty and it reflects the lack of information regarding the characteristics of the alternatives and/or the characteristics of the individual on the part of the researcher. Therefore, it follows that choices made between project implementation alternatives were a function of the probability that

the utility associated with a particular option  $j$  is higher than those for other alternatives. Therefore, the Random Utility Theory formed the theoretical basis for integrating behavior with economic valuation in the choice experiment method and in that regard, the analysis of preference responses in this study was based on random utility theory which modeled the probability that individual  $n$  chose option  $i$  over any other option  $j$  belonging to the complete choice set  $C$  as;

$$P_m = p[(V_i + e_i) > (V_j + e_j)], \forall_j \in C \dots\dots\dots(5)$$

**Where;**

$P_m$  is the probability that alternative  $i$  is chosen by individual  $n$ ;  $(V_i + e_i)$  is a subset of choices for alternative  $i$ ,  $(V_j + e_j)$  is a subset of choices for alternative  $j$ .  $C$  is an entire choice set made up of  $(V_i + e_i)$  and  $(V_j + e_j)$ ,  $\forall_j \in C$  means alternative subset of choices for option  $j$  is the subset of an entire choice set  $C$ .

#### **3.3.2.4 Eliciting preferences of ecosystem service providers using the choice experiment method**

The first step in the choice experiment design was to define the good to be valued in terms of its attributes and their levels. Specific EPWS implementation attributes and their respective levels in this case were identified using a key informant interview (KII). Knowledgeable and informative individuals were contacted for an in-depth interview. The interviews were unstructured and open-ended so as to allow an open sharing of information (Appendix II). In addition to key informant interviews, three focus group discussions (FGDs) (each group consisting of 10 to 15 participants) were conducted in each of the three study villages (Appendix III). The FGDs involved

women, men and the youth separately, to determine the final attributes and their respective levels which are important to the ecosystem service providers themselves, as well as to familiarize with the vocabularies and the language which were to be used in the survey. Apart from determining the attributes and their respective levels, key informant interviews and focus group discussions were carried out to obtain information on socio-economic activities, land tenure issues, participation hurdles, perceptions on the EPWS scheme, livelihood issues and the role of each group in the project. Moreover, focus group discussions and key informant interviews collected the information about the total number of households participating in the scheme and the ones which joined the project since 2009, number of dropouts from the scheme and the underlying reasons for dropping out. The number of participating female-headed households, problems faced in the operationalization of the scheme and the aspects in which the ecosystem service providers thought the scheme had fostered or constrained their livelihoods were also gathered.

Thereafter, profiles were constructed from the attributes as well as their respective levels, using the orthogonal design function in the conjoint analysis software. A full-profile (also known as full-concept) approach of the conjoint analysis method was used, whereby respondents were asked to rank a set of profiles according to their preferences. Three attributes, having two levels each, were administered to all 120 ecosystem service providers in such a way that the ESPs were apportioned into two groups. The first one involved participating ESPs ( $n_{pp}=60$ ), while the second group was made up of non-participating ESPs ( $n_{np}=60$ ). Each profile consisted of a different combination of factor levels for all attributes of interest.

### **3.4 Data Analysis**

#### **3.4.1 Livelihood data analysis**

Sometimes the impact of the PES scheme on livelihoods is evaluated across a range of qualitative responses according to respondents' knowledge and perceptions of the PES policy, as suggested by Hope *et al.* (2005). It includes knowledge and perceptions of the impact of PES scheme on livelihood capitals other than financial capital, namely human, social, natural and physical capital. This study applied all the five categories of livelihood capital as suggested by Hope *et al.* (2005) to analyze the impact of the EPWS scheme on livelihoods of the communities in the Uluguru Mountains.

Livelihood data were analysed using statistical tabulation, including cross-tabulation, which linked the dependent variable to one or more independent variables and the construction of livelihood profiles using the selected livelihood items. The Statistical Package for Social Sciences (SPSS) software version 16.0 and Microsoft Office Excel 2007 were applied in the major part of the analysis. Descriptive variables like frequencies, mean score, correlation coefficients, standard deviation and percentage were calculated. Multidimensional analysis of the impacts of the EPWS scheme on the livelihood of ESPs was carried out with a livelihood improvement perceived as a multidimensional phenomenon rather than just a lack of income or food, as discussed elsewhere by Scoones (2009). A four-point Likert scale was used for this and for each livelihood item in the Likert scale, percentage response, mean score and Cronbach Alpha coefficient were calculated to reveal the direction of the responses with regard to livelihood improvement and the suitability

and reliability of the items for measuring the respondents' perception of the impact of EPWS on improving livelihoods. The Cronbach Alpha coefficient usually ranges from 0 to 1. The closer the coefficient is to 1, the greater the internal consistency of the items (Cronbach, 1951). However, the widely accepted cut-off Cronbach Alpha coefficient is 0.70 as shown in Table 5.

**Table 5: Cronbach's alpha coefficients for measuring internal consistence**

<b>Cronbach's alpha coefficient</b>	<b>Internal consistency</b>
$\alpha < 0.5$	Unacceptable
$0.6 > \alpha \geq 0.5$	Poor
$0.7 > \alpha \geq 0.6$	Questionable
$0.8 > \alpha \geq 0.7$	Acceptable
$0.9 > \alpha \geq 0.8$	Good
$\alpha \geq 0.9$	Excellent

**Source: Cronbach (1951)**

For conceptual purposes, the formula for the standardized Cronbach's alpha is shown in equation 6;

$$\alpha = \frac{N\bar{c}}{\bar{v} + (N-1)\bar{c}} \dots\dots\dots(6)$$

Where  $N$  is equal to the number of items,  $c\text{-bar}$  is the average inter-item covariance among the items and  $v\text{-bar}$  equals the average variance. Qualitative data, especially data collected through key informant interviews and focus group discussions were subjected to content and discourse analysis. Afterwards, discrepancy analysis was carried out by comparing the qualitative data with the data collected through household survey.

In analysing the challenges faced by the ESPs with regard to participation in the EPWS scheme, the weighted ranking method was employed, 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 the list of challenges facing the ecosystem service providers, categorized in terms of project participants and non-participants.

#### **3.4.2 Choice experiment data analysis**

The choice experiment data were coded according to the levels of the attributes. Experimental design techniques (Louviere *et al.*, 2000) and conjoint software were used to obtain an orthogonal design, which consisted of only the main effects so as to produce a number of pair-wise comparisons of alternative EPWS implementation scenarios. The scenarios were randomly blocked into different versions, each with one choice set. Generally, there were eight different profiles, which ESPs were asked to rank from 8 to 1, with 8 corresponding to the most preferred profile and 1 the least preferred profile, as presented in appendix IV. The conjoint procedure was used to calculate utility scores, called part-worths, for each attribute level. These utility scores, which are analogous to regression coefficients, provided a quantitative measure of the preference for each attribute level, with larger values corresponding to greater preference. Part-worths were expressed in a common unit, allowing them to be added together to give the total utility, or overall preference, for any combination of attribute levels. In addition to estimating the impact of each level

using the part-worth utilities, the relative importance of each attribute was determined by calculating the range of part-worth utilities (the difference between the highest and lowest value). The resulting importance values were converted into percentages by multiplying by 100 as shown in equation 7.

$$O_p = \frac{(\max u_p - \min u_p)}{\sum_{p=1}^I (\max u_p - \min u_p)} \times 100 \dots\dots\dots(7)$$

Where  $O_p$  is the relative importance of the attribute;  $\max u_p$  is the utility of the attribute's most preferred level and  $\min u_p$  is the utility of the least preferred level of the attribute. The goodness of fit of choice experiment model was determined. The aim was to find out the correlation between the observed and expected preferences of ecosystem service providers. Pearson's correlation coefficients were used to facilitate this task and to determine the significance of the choice experiment and the reliability of the model results.

### **3.4.3 Limitations of the study**

#### **3.4.3.1 General limitations**

The first limitation of this study emanated from the scope of the study. Although all the findings were based on the implementation, successes and drawbacks of the equitable payment for watershed services scheme, this study covered only three out of the five villages where the scheme was being implemented. The reasons for that limited coverage stem from both limited resources and methodological criteria. On one hand, limited resources hindered covering Dimilo village despite the fact that it was covered by the EPWS scheme since its inception. On the other hand,

methodological factors could not allow the inclusion of Lukenge village in this study since this particular village only joined the project in 2010, thus falling short of the inclusion criteria as stipulated in the methodology part of this study. To that effect, none of the socio-economic and environmental conservation inferences drawn with regard to the EPWS scheme apply to the two aforementioned villages as they were not part of the sampling frame used by this study.

#### **3.4.3.2 Limitations of the choice experiment method**

The most serious limitation of the choice experiment method is its reliance on a small sample of respondents. No matter how representative a sample may be, the results cannot be extrapolated to represent a wider population. It is also important to note that for all conjoint analysis results reported in this study, the indicated importance of each attribute is only relevant to the attributes and levels tested in this study. Should the number and range of levels of any attribute tested change; the relative importance of that attribute and their respective part-worth values are also likely to change.

#### **3.4.4 Efforts to minimize the limitations**

In order to avoid the generalization of the findings of this study to the whole ward, the inferences were confined to the villages where the study was conducted. Also different techniques were used to collect data, a process that complemented each other leading to more reliable data. In addition, to minimize the limitations of the choice experiment method, a detailed scoping exercise work with actors and

stakeholder groups in the study villages was conducted to inform a pilot choice experiment design before the actual design was carried out.

## **CHAPTER FOUR**

### **RESULTS AND DISCUSSION**

#### **4.1 Overview**

This chapter presents and discusses the results of this study. In the first place, the chapter presents the socio-economic characteristics of the respondents. Furthermore, the results showing how the EPWS scheme has fostered and/or constrained environmental conservation in the watershed are presented and discussed. The chapter also presents the results of the preferences of the mountain-dwelling ESPs as regards the EPWS scheme that would form the basis for any subsequent PES programmes that might be applied in Tanzania and elsewhere. In addition, the chapter discusses a number of challenges that either threaten participation or discourage non-participants from joining this voluntary, incentive-based natural resource and environmental management approach. Last but not least, the chapter presents an analysis of the impact on the livelihoods of participating respondents of the EPWS scheme. To find out whether the livelihood impact was significant, the results are compared with that of non-participant respondents.

#### **4.2 Socio-economic characteristics of respondents**

##### **4.2.1 Age distribution of respondents**

Table 6 shows age distribution of the respondents. The study covered respondents with age ranging from 20 years to over 70 years, whereby only 5% of the non-participant respondents were in the age group of 70 years and above, none of the participant respondents were in this age group. However, the biggest proportion of respondents was between 40 and 59 years for both participants (35%) and non-

participants (40%). This is the age group that was fully engaged in the farming business, and were all heads of households, owning pieces of lands.

**Table 6: Age groups of respondents (%) from the selected villages in the Uluguru Mountains**

<b>Age group</b>	<b>Participants (n=60)</b>	<b>Non-participants (n=60)</b>
20-29	10	6.7
30-39	30	16.6
40-49	35	40.0
50-59	6.7	15.0
60-69	8.3	16.7
70 and above	0	5.0

**Source: Survey data 2011**

In terms of gender distribution, approximately 74% of the respondents were men for participating respondents, heads of households while 27% were female (Table 7). On the other hand, 75% of the non-participant respondents were men; heads of households and the rest were female respondents.

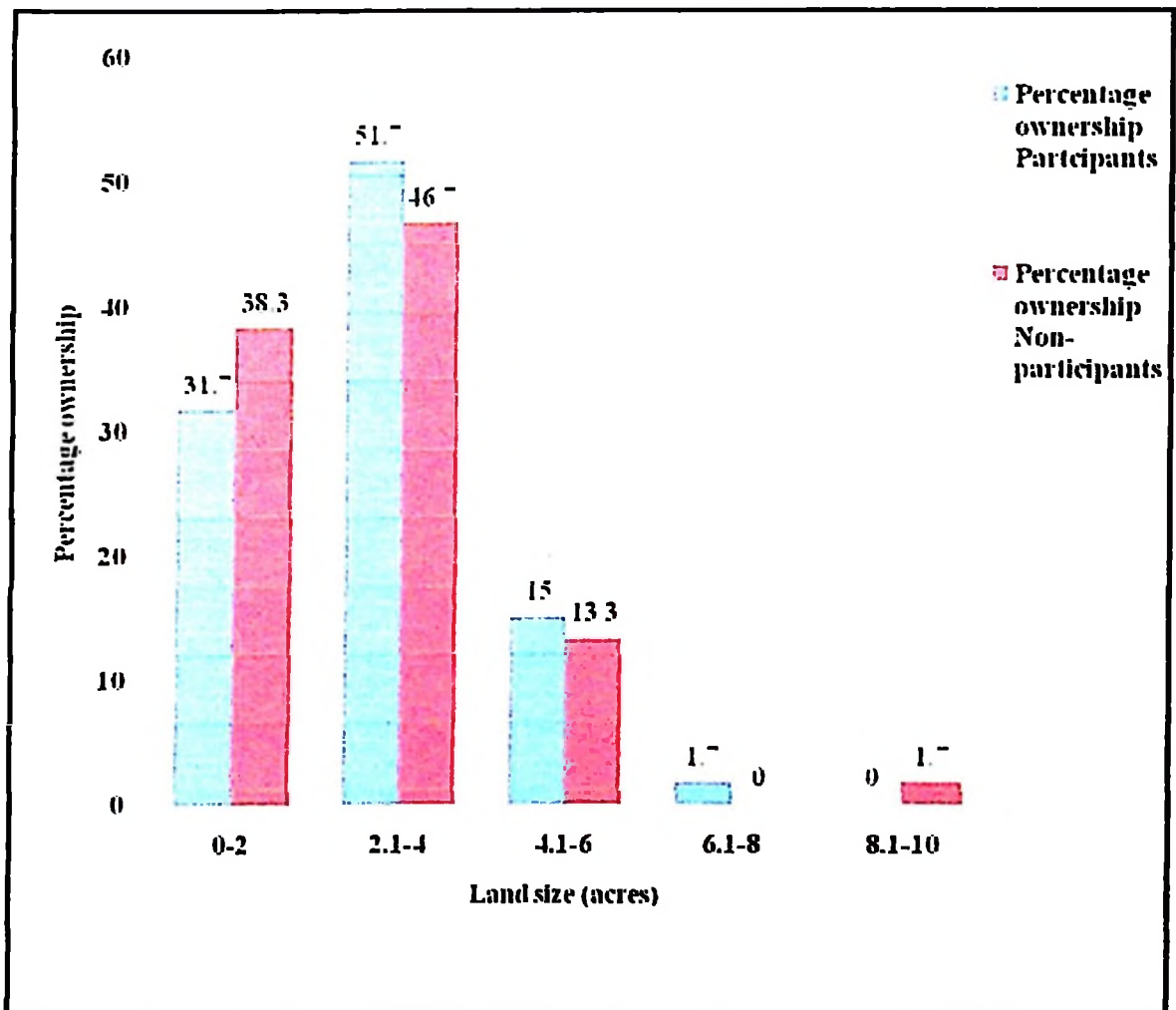
**Table 7: Sex of respondents (%) from selected villages in the Uluguru Mountains, Tanzania**

<b>Sex</b>	<b>Participants (n=(60)</b>	<b>Non-participants (n=60)</b>
Male	73.3	75.0
Female	26.7	25.0
<b>Total</b>	<b>100.0</b>	<b>100.0</b>

**Source: Survey data 2011**

#### 4.2.2 Land ownership

Farming was reported to be the major economic activity by a high proportion of respondents in the study area as shown in Table 8. The amount of acreage in which agriculture was practised ranged from 0.25 to 10 acres, with a high proportion of respondents owning between 2 and 4 acres, which is equivalent of 51.7% for participant respondents and 46.7% of non-participant respondents (Fig. 3).



**Figure 3: Size of land owned by the ecosystem service providers from the selected villages in the Uluguru Mountains**

**Source: Survey data 2011**

Table 8 presents the results of land ownership and place of origin of respondents. It was also found that the land tenure system was strongly linked to the place of origin of the respondents. This was one of the reported hindrances to participating in the EPWS scheme, as discussed in the subsequent sections. The results show that 95% of the EPWS scheme participants and 98.3% of non-participant respondents originated from the study villages. Only a small proportion of 3.3% and 1.7% of participating respondents were born outside the village but within the district and outside the region, respectively, while only 1.7% of non-participant respondents originated outside the study villages (Table 8).

**Table 8: Land ownership and place of origin of selected respondents in the study area**

Place of origin	Land ownership status (%)						Total (%)	
	Owned land		Rented land		Rented and owned land		PP	NP
	PP	NP	PP	NP	PP	NP		
Born in the village	91.6	91.7	1.7	3.3	1.7	3.3	95.0	98.3
Born outside the village but within the district	3.3	0	0	1.7	0	0	3.3	1.7
Born outside the district but within the region	0	0	0	0	0	0	0	0
Born outside the region	1.7	0	0	0	0	0	1.7	0
<b>Total</b>	<b>96.6</b>	<b>91.7</b>	<b>1.7</b>	<b>5.0</b>	<b>1.7</b>	<b>3.3</b>	<b>100.0</b>	<b>100.0</b>

*PP=Participating ESPs; NP=Non-participating ESPs*

Source: Survey data 2011

Despite the fact that some respondents who originated from the study area had the lands they work on rented from landlords within the study area, it was noted during focus group discussions and key informant interviews that most villagers who came from outside the ward, district or the region could hardly own land as normally the land is passed from one generation to another in the form of inheritance. It is therefore worth noting that upon analysing land ownership status, it was revealed that the ecosystem service providers (ESPs) who did not originate from the study area were not participating in the project as they lacked one of the essential criteria for participation in EPWS project.

#### **4.2.3 Occupation, education level and household income**

The results of this study revealed a positive but weak correlation between the size of land owned and the income of the surveyed households ( $R=0.184$ ). However, it was found that the correlation between household income and size of land owned was larger for the participating households ( $R=0.318$ ) than non-participating ESPs ( $R=0.092$ ). Another important aspect was the level of education of the respondents against their occupation. It was found that the participating ESPs fell into three categories of education levels, while EPWS scheme non-participant respondents were in two education categories. The EPWS scheme non-participants with no formal education but doing agriculture only comprised of 16.6% while those with primary education in the same category constituted 70% (Table 9). This suggests that the livelihood of most people in the study area hinges on farming. The households which supplement agriculture with petty trade for income generation constituted (13.3%) and the participating ESPs ranked this activity as second in order of

importance, while those practicing agriculture and livestock keeping were ranked third with 8.4% (Table 9). For non-participant respondents, livestock keeping and petty trade were indifferent as they both scored 6.7% as shown in Table 9.

**Table 9: Occupation and education level of the respondents from selected villages in the Uluguru Mountains**

Occupation	Education level (%)						Total (%)	
	No formal education		Primary school education		Secondary school education		PP	NP
	PP	NP	PP	NP	PP	NP		
Farming only	8.3	16.6	68.3	70.0	1.7	0	78.3	86.6
Farming and Livestock keeping	1.7	1.7	6.7	5.0	0	0	8.4	6.7
Farming and petty trade	0	1.7	13.3	5.0	0	0	13.3	6.7
<b>Total</b>	<b>10.0</b>	<b>20.0</b>	<b>88.3</b>	<b>80.0</b>	<b>1.7</b>	<b>0</b>	<b>100.0</b>	<b>100.0</b>

*PP=Participating ESPs; NP=Non-participating ESPs*

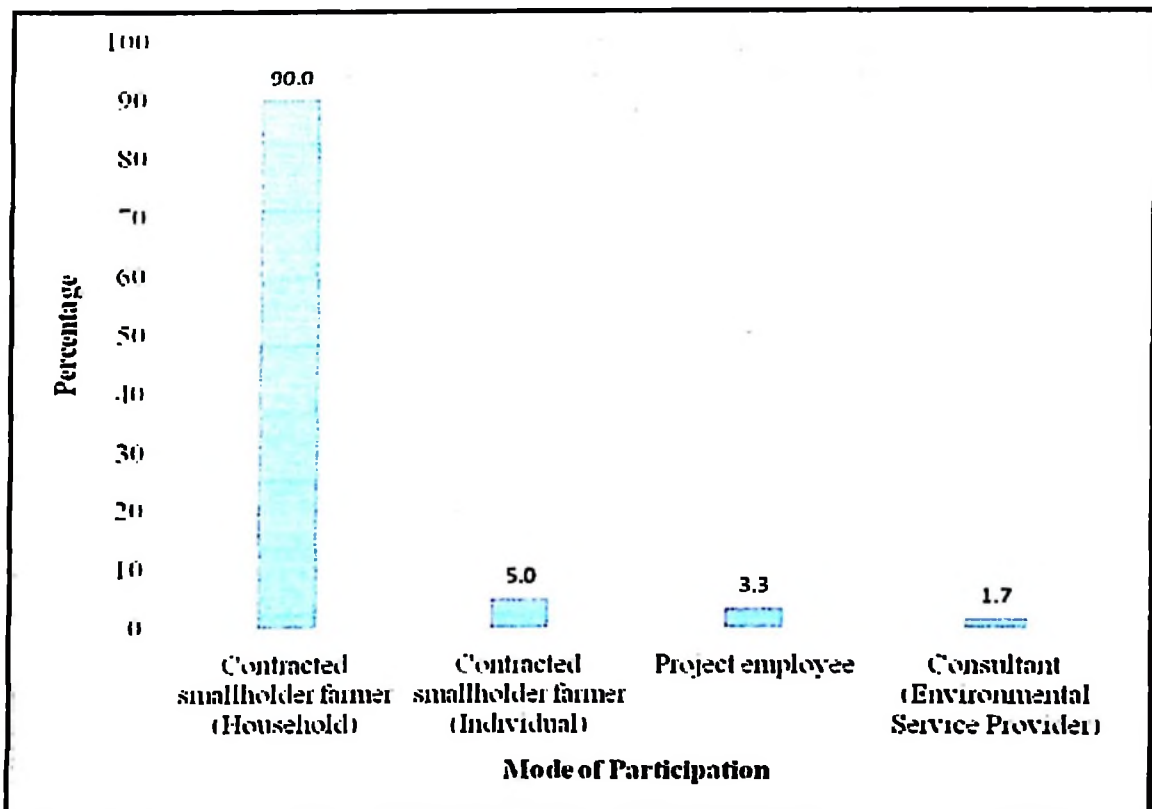
**Source: Survey data 2011**

Nevertheless, every respondent reported to practice farming as shown in Table 9. These findings are not different with those of Cole (2010), who reported that the main sources of household income in an agroforestry PES programme in Costa Rica differed between programme participants and non-participants. Cole (2010) added that nearly half of the landowners who received payments ranked subsistence farming as their main economic activity (44%) compared with only 6% of non-participant farmers. By contrast, half of the programme non-participants ranked

commercial agriculture as their main source of income, compared with 22% of participating farmers.

#### 4.2.4 Mode of participation of ecosystem service providers in the EPWS scheme

The findings of this study show that 95% of the participating respondents were smallholder farmers. The results further indicate that there were smallholder farmers who joined the EPWS project as a household (90%) and those who joined as individuals (5%) as shown in Fig. 4. However, quite a handful of the respondents (less than 10%) were employed by the project, thus earning part of their income from the project in the form of wages.



**Figure 4: Mode of participation in the EPWS scheme of respondents from selected villages in the Uluguru Mountains**

**Source: Survey data 2011**

### **4.3 Adoption of environmental conservation activities**

Being a payment for ecosystem services initiative, EPWS scheme had a primary objective of improving environmental conservation in the Uluguru Mountains, particularly watershed protection, besides fostering the socio-economic development of the ecosystem service providers. 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. Although at a differing degree, two key environmental and watershed conservation activities were ubiquitously found to be implemented by the ecosystem service providers. These were terracing and tree planting (reforestation/afforestation) activities. The rate of adopting the land management practices, and the types of land management activities practiced in the study area were examined, to both, participating and non-participating ESPs and the results are summarized in Table 10. There is a clear evidence to link the adoption of land management and conservation agriculture practices in the study area to the equitable payment for watershed services scheme.

The findings indicate that before the introduction of the project in Kibungo juu ward, none of the interviewed ecosystem service providers had started practicing any of the land management practices. Neither bench nor Fanya juu<sup>1</sup> terraces had ever been practiced by either participating or non-participating ESPs despite the fact that the practicing benefits were quite obvious to most of the community members. Two

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<sup>1</sup> Fanya juu terraces are made by digging a drainage channel and throwing the soil uphill to make a ridge (Fanya juu means “throw soil uphill” in Swahili). The channel is usually 50–60 cm deep and may have cross-ties at 10 m intervals.

years after the introduction of the EPWS project (i.e. 2011), 0.8% and 2.5% of the non-participating ESPs reported practicing bench terracing and Fanya juu terracing (Conservation agriculture techniques) respectively, despite the fact that there was no any incentive attached to their adoption. In addition, 60.3% and 31.9% of participant respondents reported practicing bench terracing and Fanya juu terracing respectively.

Afforestation/reforestation activities were reported to pick up from 8.7% before the project (i.e. before 2009) to 25% in 2011 (Table 10) for non-participant ecosystem service providers. This was reported to be a result of distributing tree seedlings free of charge by the EPWS project to almost every community member who wished to plant trees in their pieces of land. On top of that, environmental education program carried out by the EPWS project had persuaded the ESPs to get a glimpse of the benefits of tree planting for their own benefits as well as for the benefits of future generations. This is in line with Intergenerational and Intragenerational equity principles of sustainable development as stipulated in article 5 (3f) of the Tanzanian Environmental Management Act No. 20 of 2004. As for participant respondents, afforestation and reforestation activities dropped from 13.3% before 2009 to 7.8% in 2011 (Table 10). This was due to the fact that most of the participating respondents rushed for terracing because the financial benefits from terracing were immediate as compared to afforestation and reforestation.

In addition, the unit cost of the three conservation activities was significantly different from one another. From the key informant interviews and focus group discussions, it was realized that one acre of bench terracing was worth TSh. 149 000, the same size

of land in which Fanya juu terracing was practiced would fetch TSh. 79 000 from EPWS project while a forested acre of land was worth TSh.75 000. Therefore, this justifies why bench terracing was preferred over the other environmental conservation activities.

**Table 10: Adoption of land management practices by respondents in the study area**

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
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>

Source: Survey data 2011

#### 4.4 Livelihood impact of equitable payment for watershed services scheme

The impact of EPWS scheme to the livelihoods of those natural resource stewards was actually divided into two subgroups. The first one was that of the participating and the second one consisted of the non-participating ESPs. The reason for the inclusion of this second group stems from the general understanding that, for every development activity, there is always a spill-over effect, which trickles the benefits over to non-targeted beneficiaries. That spill-over effect can either be positive or negative. Thus it was thought pertinent to look at how this payment for ecosystem

services scheme had touched the lives of those who, in one way or the other, were not part of that project, but were in the area of influence, and thus they stood a chance of either benefitting from the project activities or giving away some of the good things they enjoyed before the project came into operation.

#### 4.4.1 The impact of EPWS on livelihood capitals of ecosystem service providers

##### 4.4.1.1 Impact on natural livelihood capital

Changes in access to natural capital were reported by both, participating and non-participating ESPs with respect to the EPWS scheme. While most of the natural capitals were either reported not improving or worsening altogether, land productivity was reported by participating ESPs to have improved with a 3.25 mean Likert score following the adoption of terracing in their pieces of land (Table 11).

**Table 11: Percentage response and mean score for natural livelihood capital by respondents from selected villages in the Uluguru Mountains**

Selected livelihood items	Percentage response on Likert scale items								Mean Likert score	
	Worsened		No change		Slight improvement		Great improvement			
	PP	NP	PP	NP	PP	NP	PP	NP	PP	NP
Land productivity	0	0	8.4	65	58.3	35	33.3	0	3.25	2.38
Access to and availability of NTFPs	38.3	40.0	58.3	60	1.7	0	1.7	0	1.67	1.60
Availability of wildlife resources	1.7	3.3	61.6	78.3	26.7	18.4	10.0	0	2.45	1.60

*PP=Participating ESPs; NP=Non-participating ESPs*

**Source: Survey data 2011**

The adoption of bench and Fanya juu compelled most of the participating ESPs to use manure in their fields. This led to improved soil fertility as a result of improving soil organic matter and soil nitrogen. For those who could not afford to purchase manure, land productivity was decreasing as reported earlier on.

On the other hand, access to and availability of Non Timber Forest Products (NTFPs) was reported to have declined by both participants (1.67 mean Likert score) and 1.60 mean Likert score for non-participants as shown in Table 11. Moreover, access to wildlife resources was also reported to have declined by both, participants and non-participants as indicated by their respective percentage response and mean Likert scores. The reason behind this scenario was purported to be the introduction and meticulous enforcement of by-laws prohibiting access to natural forests around catchment areas, which was literally aimed at curbing deforestation which had previously been the major source of land degradation. Instead, ESPs were continually being encouraged to plant trees and establish woodlots for obtaining various forest products.

It can therefore be said that the ability of the people in the study area to cope with and recover from various stresses and shocks using natural resource capital is a little bit constrained by the observed limited access, contrary to the schools of thought put forward by Chambers and Conway (1992), and Davies (1996).

#### **4.4.1.2 Impact on human livelihood capital**

Human capacity development was reported to be the major impact of the EPWS scheme in the project area. Participating ESPs reported positively that their ability to

work (3.35 mean Likert score), ability to adapt to various environmental and economic shocks (3.38 mean Likert score), and vocational knowledge and skills (3.25) were continually improving. This positive livelihood improvement was attributed to the EPWS scheme altogether through training workshops and exchange visits. However, the impact of the project on ESPs' health and nutrition in the study area was relatively immaterial (2.80) as compared to other human livelihood capitals, although well above the 2.50 threshold point as shown in Table 12.

**Table 12: Percentage response and mean score for natural livelihood capital from selected respondents in the Uluguru Mountains**

Selected livelihood items	Percentage response on Likert scale items								Mean Likert score	
	Worsened		No change		Slight improvement		Great improvement			
	PP	NP	PP	NP	PP	NP	PP	NP	PP	NP
Health and nutritional improvement	0	0	26.7	91.7	66.7	8.3	6.6	0	2.80	2.10
Vocational knowledge and skills	0	0	16.7	91.7	41.7	5	41.7	3.3	3.25	2.12
Capacity to work	3.3	1.7	5.0	95.0	45.0	1.7	46.7	1.7	3.35	2.07
Capacity to adapt to environmental and economic shocks	0	0	5.0	93.3	51.7	6.7	43.3	0	3.38	2.08

*PP=Participating ESPs; NP=Non-participating ESPs*

**Source: Survey data 2011**

Nevertheless, the experience was quite different for the non-participating ESPs as they reported a near-to-the-ground impact on human capital. The majority of respondents reported that they had not experienced any changes in human capital as a result of the EPWS scheme. This remarkable contrast with regard to the impact of EPWS scheme on human capital can easily be attributed to the fact that the non-participant respondents were not part of the project, with the result that whatever the benefits brought by the project, such as training and study visits and excursions, were not benefiting them. While the Likert scale mean score values for participating ESPs ranged from 2.80 to 3.38 (Table 12), all values being above the threshold value (i.e. 2.50), the mean score values for non-participating ESPs ranged from 2.07 to 2.12 (Table 12), all values falling below the threshold value, showing a declining impact on livelihoods.

Nevertheless, the general impression is that, the sustainability of the imparted vocational knowledge and skills and the capacity to adapt to various economic and environmental shocks is questionable. This is because the continuity of the project activities which led to the reported impact to the participating ESPs is uncertain due to observed dropouts from the project.

#### **4.4.1.3 Impact on social livelihood capital**

Table 13 shows the mean Likert scores ranging from 2.35 to 3.22 for participating ecosystem service providers. Leadership skills and local governance scored 2.35 each while for the other four items, the scheme performed much better (Table 13).

Since the project worked with both, individual smallholder farmers and farmer groups, it successfully managed to improve social coordination capacities and social cohesion among participating ESPs. Networking, participation in various social events, leadership skills, trust and mutual support and common rules and sanctions were all impacted positively by the project as evidenced by their respective mean scores in the Likert scale.

**Table 13: Percentage response and mean score for social livelihood capital from selected respondents in the Uluguru Mountains**

Selected livelihood items	Percentage response on Likert scale items								Mean Likert score	
	Worsened		No change		Slight improvement		Great improvement			
	PP	NP	PP	NP	PP	NP	PP	NP	PP	NP
Networks and connections	0	0	5.0	93.7	76.7	6.3	18.3	0	3.13	2.10
Trust and mutual support	0	0	71.7	95	23.3	5	0	0	3.18	2.07
Common rules and sanctions	0	1.7	6.7	85.0	70.0	11.7	23.3	1.7	3.17	2.15
Participation in various events	0	0	3.3	100	71.7	0	25.0	0	3.22	2.02
Leaderships skills	1.7	0	66.7	98.3	26.7	1.7	5.0	0	2.35	2.03
Governance	0	0	70.0	91.7	25.0	8.3	5.0	2.2	2.35	2.10

*PP=Participating ESPs; NP=Non-participating ESPs*

Source: Survey data 2011

Generally, the project performed well in terms of improving the social capital of the participating ESPs. However, the mean score values for non-participating ESPs ranged from 2.02 (participation in various events) to 2.15 (common rules and

sanctions) as shown in Table 13. It was generally found that the project could not do much for the non-participants in terms of improving their livelihoods through social capital as all the items fell below the 2.5 mean score value in the Likert scale (Table 13), indicating an insignificant impact from EPWS scheme.

#### 4.4.1.4 Impact on financial livelihood capital

The findings of this study showed that the monetary compensation/payment from the EPWS scheme ranged from TSh. 0 (28%) to TSh. 100 000 per year (Table 14). This implies that as at December 2011, a number of participating ESPs had not received any payment in spite of implementing land management practices in their farms as stipulated in the contracts.

**Table 14: Payment categories from EPWS scheme to the participating ESPs in the Uluguru Mountains**

<b>Payment/Compensation from EPWS (TSh)</b>	<b>Percentage (%)</b>
0	28.3
5 000 – 10 000	48.5
10 001- 20 000	38.3
20 001- 50 000	15.0
50 001- 100 000	3.4

**Source: Survey data 2011**

It can be observed from Table 14 therefore that the monetary compensation given to most of the participating ESPs was far below the average household income, which was found to be TSh. 54 993.33 per month. Only 3.4% of the participant respondents had received payment from the project, which was well above their average monthly

income. This implies that EPWS scheme payments to participating ESPs were an insignificant component of household income. Without improved monetary compensation/payment being given to the participating ESPs, the sustainability of the EPWS scheme is uncertain, and the prospects of introducing any other PES project in the Uluguru Mountains are doomed.

**Table 15: Percentage response and mean score for financial livelihood capital from selected respondents in the Uluguru Mountains**

Selected livelihood items	Percentage response on Likert scale items								Mean Likert score	
	Worsened		No change		Slight improvement		Great improvement		PP	NP
	PP	NP	PP	NP	PP	NP	PP	NP		
Savings	0	1.1	35.0	81.7	53.3	18.3	11.7	0	2.77	2.20
Access to credit	0	0	86.7	90.0	8.3	10.0	5.0	0	2.18	2.13
Wages and employment	0	0	81.7	95.0	13.3	5.0	5.0	0	2.23	2.07
Access to markets	3.3	0	73.3	96.7	21.7	3.3	1.7	0	2.22	2.05

*PP=Participating ESPs; NP=Non-participating ESPs*

**Source: Survey data 2011**

It is however worth noting that the project improved the household savings of participating respondents, as indicated by a mean Likert score value of 2.77 (Table 15). This is a result of improved agricultural productivity, especially by the participating ESPs, who could afford to apply manure in their farms. This raised production, leading to a large surplus, which enabled them to earn more money than

they had been receiving as payment/compensation from the EPWS scheme. It was reported that other participating ESPs could not apply manure in their fields due to financial constraints. On the other hand, access to credit, marketing systems, wages and employment had not improved significantly for both participants and non-participants (Table 15).

#### **4.4.1.5 Impact on physical livelihood capital**

Generally, for participant respondents, the mean Likert scale values ranged from 1.77 (Energy resources) to 2.37 (Shelters and house), all falling below the mean threshold value of 2.50. On the other hand, the mean score values for non-participants ranged from 1.75 (energy resources) to 2.25 (Shelters and houses) as shown in Table 16, implying that EPWS scheme had insignificant impact on physical capital, to both, participant and non-participant respondents.

With regard to physical livelihood capital therefore, the respondents noticed that no direct or indirect contribution had been made by the EPWS scheme to their livelihoods. The best explanation for this is that the ESPs probably had not invested much in physical livelihood capital, such as household energy resources, unanimously reported to be firewood, which had seriously deteriorated. While energy resources scored 1.77 as a mean value in the Likert scale as regards the participant respondents, a score of 1.75 came from the non-participant respondents.

**Table 16: Impact of EPWS scheme on physical livelihood capital of selected respondents in the Uluguru Mountains**

Selected livelihood items	Percentage response on Likert scale items								Mean Likert score	
	Worsened		No change		Slight improvement		Great improvement			
	PP	NP	PP	NP	PP	NP	PP	NP	PP	NP
Shelters and houses	0	0	68.3	83.3	26.7	11.7	5.0	5.0	2.37	2.25
Energy resources	28.3	25.0	66.7	75.0	5.0	0	0	0	1.77	1.75
Communication systems	3.3	0	76.7	91.7	15.0	8.3	5.0	0	2.22	2.10
Water supply systems	6.7	1.1	91.6	100	1.7	0	0	0	1.95	2.00

*PP=Participating ESPs; NP=Non-participating ESPs: Source: Survey data 2011*

However, various authors have various comments with regard to PES schemes and livelihood improvement. Molnar *et al.* (2007) for example argued 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. Nevertheless, poor people who participate in PES generally receive a net positive level of benefits from cash payments and/or other livelihood enhancements than non-participants, concludes Molnar *et al.* (2007).

The findings of this study tally well with the findings of Molnar *et al.* (2007) who also reported that participating ecosystem service providers were better positioned to reap benefits from the EPWS scheme. Moreover, Wunder (2008), after analyzing an array of PES studies found that the financial benefits accruing to the poor, ecosystem service providers were significant, comprising 10 to over 50% of household income. However, this contradicts the findings of this study, which noted insignificant

payment from the EPWS scheme, with only 3.4% of the interviewed participating ESPs receiving payments which were above their monthly average household income. Much as the findings of this study contradict the suggestions of Wunder (2008) with regard to payments made to ESPs, they are consistent with the findings of Uchida *et al.* (2007) and Bennett (2008) who found an overall positive effect of PES schemes to households in terms of improving other household assets, but cash payments were either not fully delivered or were less than farmers' opportunity costs. The payments from EPWS scheme to the ecosystem service providers were less than other PES projects reviewed because the size of land in which land management practices were being implemented was relatively small as revealed in the previous sections, and even those with large chunks of land, shortage of human and financial resources were the key limiting factors. In spite of all this, payments were being made in a piece-meal style because ecosystem service beneficiaries who committed to compensate the ecosystem service providers in the study area were reluctant in remitting the payments.

However, some authors warn that the impact of PES programmes on livelihood improvement may not always be positive (Wunder 2005). Landell-Mills and Porras (2002) for example put forward two basic schools of thought for varied impacts of PES schemes on livelihood improvement. The first school of thought is that, land and labour market conditions can affect both participants and non-participants of PES programs, expounding that, with insecure tenure, poor households in target areas may be evicted by powerful groups willing to capture the increased value of previously marginal land. This has not been the case in the study area though.

A second school of thought from Landell-Mills and Porras (2002) suggests that, PES schemes may have a positive impact on those who participate but a negative impact on poor households that are unable to participate for whatever reasons. This second school of thought holds much truth for this study as the findings indicated a slight positive impact to the participants and an insignificant impact to the EPWS scheme non-participating ecosystem service providers.

#### **4.4.2 Measuring the reliability and suitability of Likert scale items**

The suitability and reliability of the items in the Likert scale in measuring the respondents' perceptions on the impact of EPWS on livelihood improvement of the ecosystem service providers were measured using the Cronbach model, which generated the Cronbach alpha coefficients as shown in Table 17. As stated in subsection 3.4.1 and Table 5, the Cronbach Alpha coefficient usually ranges from 0 to 1. The closer the coefficient is to 1, the greater the internal consistency of the items. However, the widely accepted cut-off Cronbach Alpha coefficient is 0.70. In this regard therefore, the internal consistency of the data, reliability and suitability of most of the items were in agreement with the Cronbach's model for measuring reliability. However, the suitability of financial capital was a little bit questionable as it registered a Cronbach's alpha coefficient of 0.69 (Table 17), and according to Cronbach (1951), 0.7 should be the cut-off point, below which the suitability of the item becomes questionable. This probably happened as it is quite difficult to measure monetary income in the subsistence economy since a number of commodities consumed do not pass through markets. Scoones (2009) for example pointed out that livelihood improvement should be perceived as a multidimensional phenomenon

rather than just a lack of income. This suggests that financial gain should not be taken as the only measure of livelihood improvement. However, for PES projects it is a very good incentive which invariably entices participation of ecosystem service providers.

**Table 17: Indicators of reliability of the selected livelihood items in measuring the livelihood impact of EPWS scheme to the ESPs in the Uluguru Mountains**

<b>Livelihood capital</b>	<b>Cronbach alpha coefficient</b>
Financial capital	0.69
Natural capital	0.75
Social capital	0.91
Physical capital	0.71
Human capital	0.91

**Source: Source: Survey data 2011**

#### **4.5 Participation challenges to the EPWS scheme in the Uluguru Mountains**

The study found a diversity of challenges between the ecosystem service providers who participated in the EPWS scheme and those who did not participate. While the participating ESPs cited payment problems from either the ecosystem service beneficiaries or the implementing agency as their top-most challenge, threatening their participation in the EPWS scheme, it was the high investment cost for non-participating ESPs which arose as the most distressing challenge. The investment costs cited included costs for preparing terraces, costs for purchasing farmyard manure and costs for managing the tree seedlings to name a few. Tables 18 and 19 present five, topmost challenges ranked by participating and non-participating

ecosystem service providers in the study area respectively. Payment problem as a challenge came almost from every participating respondent, most of them having been paid only once, mainly in the first commitment year (i.e. 2009), and no payments were made thereafter.

**Table 18: Challenges facing participating ecosystem service providers in the Uluguru Mountains-Tanzania**

<b>Challenge</b>	<b>1<sup>st</sup> rank count (n*5)</b>	<b>2<sup>nd</sup> rank count (n*4)</b>	<b>3<sup>rd</sup> rank count (n*3)</b>	<b>4<sup>th</sup> rank count (n*2)</b>	<b>5<sup>th</sup> rank count (n*1)</b>	<b>Total Score</b>	<b>(%)</b>	<b>Rank</b>
Payment problems	215	44	6	8	0	273	35.0	1
High investment cost	70	140	15	2	0	227	29.1	2
Land tenure problems	5	16	42	38	14	115	14.7	3
Low profitability of PES	5	16	54	12	10	97	12.5	4
Poor information flow	0	0	18	28	22	68	8.7	5

**Source: Survey data 2011**

In addition to that, problems related to land tenure systems were pointed out to be a threat to both the participating ecosystem service providers and the non-participating ones. In fact, this was raised during the focus group discussions and the key informant interviews. It was clearly pointed out that land owners did not want terracing be practiced in their pieces of lands. A high proportion of the respondents reported that terracing causes loss of soil fertility after exposing the underneath red soil which literally leads to reduced land productivity as compared to untterraced land. However, those who managed to either use agrochemicals or make organic fertilizers did not have problems with terracing. This implies that, a person who did

not own land would not be able to 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 needed conservation activities such as terracing.

In addition, lower profitability of PES was cited as a challenge, and according to the respondents, this was a result of combination of payment problems from the project implementers and high investment cost. Furthermore, a few respondents cited poor information as a limiting factor to the 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 5<sup>th</sup> (Tables 17 and 18).

**Table 19: Challenges holding back non-participating ecosystem service providers in the Uluguru Mountains-Tanzania**

Challenge	1 <sup>st</sup> rank count (n*5)	2 <sup>nd</sup> rank count (n*4)	3 <sup>rd</sup> rank count (n*3)	4 <sup>th</sup> rank count (n*2)	5 <sup>th</sup> rank count (n*1)	Total Score	(%)	Rank
High investment cost	170	56	27	2	0	255	32.8	1
Poor information flow	20	64	27	36	10	157	20.2	2
Land tenure problems	60	16	45	20	12	153	19.7	3
Low profitability	5	32	39	22	15	113	14.5	4
Payment problems	15	48	21	8	8	100	12.8	5

**Source: Survey data 2011**

These findings are supported by the argument of Wunder (2008) 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 requested 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 of Cole (2010) who reported that the payments from a PES programme 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 cited by both participating and non-participating ESPs in the study area.

#### **4.6 Preferences of ecosystem service providers**

This subsection provides the results and discussion of the choice preferences of ecosystem service providers with respect to the EPWS scheme implementation strategy.

The relative importance values for both, participating and non-participating ESPs show that, on average, the mode of payment of ESPs was 47.6% and 58.3% respectively. A high proportion of both, participating and non-participating respondents would prefer payments/compensation in terms of agricultural input voucher system rather than cash. This was the most important attribute in determining the preference for joining EPWS scheme or any other PES scheme in the Uluguru Mountains (Table 20). The second most important attribute was about the

channel of payments or compensation. A high proportion of the respondents indicated a preference for their payments to be channelled through local government rather than the project implementers. This attribute scored 42% for participants and 25% for non participant respondents (Table 20). Mode of implementing the watershed conservation activities was the least preferred attribute to both groups, with 10.2% and 16.3% for participating and non-participating ESPs respectively. This means that, the decision on whether to join EPWS scheme or not would definitely depend on which mode is used for paying or compensating the ecosystem service providers (i.e. cash or agricultural input voucher system). These results are consistent with the findings reported under subsection 4.5 where the greatest challenge reported by the participating ESPs was payment/compensation. This means therefore, if one wants to influence the participation of ecosystem service providers to a PES scheme, addressing the mode of payment is the most important thing to do.

**Table 20: Relative importance of EPWS implementation attributes**

Attribute	Relative importance of attributes (%)	
	Participants (%) (n=60)	Nonparticipants (%) (n=60)
Mode of payment/compensation	47.6	58.3
Channel of payments	42.2	25.4
Implementation mechanism	10.2	16.3

Source: Survey data 2011

The utility of each attribute level was determined by calculating part-worth scores for each separate group of respondents. The part-worth scores usually indicate the most

and the least preferred levels of the attribute. Attribute levels with positive part-worth scores are usually preferred over attribute levels with negative part-worth scores. In addition, higher part-worth score indicates greater preference than lower part-worth score of the attribute levels. The part-worth scores are usually unit-less, and the sum of all the part-worth scores of the attribute levels in a single attribute must equal zero. Table 21 shows the attribute level part-worth scores. For the mode of payment attribute, agricultural input voucher system (with 0.29 part-worth utility score) was preferred over direct cash payment (part-worth utility score = -0.29) by participating ESPs. The same preference was shown by non-participating ESPs with agricultural input voucher system scoring a part-worth of 0.25 over direct cash payment (-0.25).

These findings are not surprising as indicated in Table 9, where it is shown that the highest proportion of respondents depends on agriculture, though at different scales. This indicates therefore that, agriculture, being the main economic activity in the study area, access to agricultural inputs is more crucial than having cash. Further to that, there is a fear that money could be spent on other things other than re-investing it back into agriculture, thus lowering productivity. Furthermore, the reason for preferring agricultural inputs to cash payment was because, implementing some of the watershed conservation activities, particularly terracing, involved exposing red soil and burying top, black cotton soil which is presumably more fertile than red soil. Therefore, if one wants to maintain the same level of land productivity or even increase it after adopting terracing in their fields, the use of fertilizer becomes inevitable. However, due to limited livestock in the study area, farmers rely on purchasing manure from the lower lands in Morogoro town and its outskirts.

Experience shows that although farmers were taught on making composite manure, the rate of adoption remained low to the extent that people were found practicing terracing without using manure or any other type of fertilizer, thus leading to low agricultural productivity.

**Table 21: Attribute level part-worth utility scores**

Attribute	Attribute level	Part-worth utility scores	
		Participant respondent group (n=60)	Non-participant respondent group (n=60)
<b>Mode of payment</b>	Direct cash payment	-0.29	-0.25
	Agricultural input voucher system	0.29	0.25
<b>Channelling of payments</b>	Payment through project implementers	-0.07	-0.08
	Payment through local government	0.07	0.08
<b>Implementation mechanism</b>	Household-based implementation	-0.02	0.07
	Group-based implementation	0.02	-0.07
<b>Standard error</b>		<b>0.189</b>	<b>0.110</b>

**Source: Survey data 2011**

On the other hand, communities in the Uluguru Mountains preferred local government offices for payments as opposed to project implementers. This attribute level was favoured by a part-worth score of 0.07 for participating ESPs and 0.08 for

non-participants (Table 21). These results were supported by findings from focus group discussions, which showed that most of the ESPs in the Uluguru Mountains were losing faith in the implementers of EPWS scheme. This is because they had failed to implement the project, but their expectations were not being realized in terms of payments. Until December 2011, participating ESPs were paid only once despite being in a third year of carrying out watershed conservation activities in their fields. However, reluctance of some of the downstream beneficiaries of the ecosystem service, who initially committed to compensate the ecosystem service providers in the Uluguru Mountains under the EPWS scheme, caused resentment among the participating ESPs. In addition, non-participating ESPs were unsatisfied with poor and unreliable payments made to their participating fellows, thus showing less faith to the implementers and lost interest to the EPWS scheme.

However, through key informant interviews it was revealed that the project management could hardly be blamed for the payment problems, as this was caused by the downstream water consumers, (in most cases companies) who had promised to compensate the ESPs in the Uluguru Mountains but failed to do so on time. The delayed response and inaction of some of those companies therefore caused an uproar and distrust, mostly to the implementers of the EPWS project. This emanated from the fact that the implementers were only the link between the consumers and the providers of the ecosystem services, and any complaint made to the former by the latter would reach the implementers first.

In terms of how the activities could be implemented, there were mixed reactions as regards the preferences of the two attribute levels. The participating ESPs preferred

group-based implementation with a part-worth value of 0.02 against -0.02. The non-participating ESPs on the other hand preferred a household-based implementation mechanism as indicated by a part-worth value of 0.07 against -0.07 of group-based implementation strategy.

This contrasting preference between participating and non-participating ESPs with regard to the implementation of watershed protection and land management activities can best be explained by the fact that only 3.3% of the interviewed non-participating ESPs practiced terracing in their lands, but instead, most of them (25%) were planting trees only. This is because, apart from being tedious, tree planting (afforestation/reforestation) offers dual benefits to ESPs. Tree planting attracts payments from PES projects, including EPWS scheme, and it also has the potential to provide timber, firewood and non timber forest products to the current and future generations. The rest of non-participant respondents (71.7%) were not involved in any of the land management practices brought by the EPWS scheme in the Uluguru Mountains.

On the contrary, the participating ESPs would go for group-based implementation of the conservation activities since almost all the respondents practice terracing. This therefore explains why the participating ESPs chose group-based implementation while non-participating ESPs preferred the household-based mechanism for implementing conservation activities.

Nevertheless, although non-participating ESPs preferred the household/individual mode of implementation of the conservation activities over group-based approach, it

is obvious that the group-based approach is the most suitable one because it reduces transaction costs and the impact on conservation is more apparent under group work than for individual implementation. This is because greater area would be covered under group-based implementation than it would be for individual activity. In this regard therefore, the impact on livelihood resulting from increased production will be higher under group-based implementation than it will be for individual work.

Apart from that, standard errors in conjoint models were determined, which literally reflected the uncertainty in the preferences due to sampling and uncertainty regarding the estimated part worth values. They do not completely characterize the accuracy of the conjoint model. The standard error of estimation was therefore 0.189 for participating ESPs and 0.110 for non-participating ESPs (Table 21), being slightly larger for participating ESPs than for the non-participant respondents. One of the reasons for this difference could probably be misspecification of preferences in the choice cards.

The general rating of the EPWS profiles was concluded by summing up the individual utility scores (part-worth values) for each positive value in each attribute and a corresponding constant term of the conjoint model (Table 22). The additive part-worth function model was used to establish the overall preference of EPWS implementation options. This was taken to be the sum of the mode of payment/compensation, channel of payments and the implementation mechanism. Preference rating for participating ESPs was given by the sum of part-worth utility score for agricultural input voucher system (0.29), payment through local government offices (0.07) and group-based implementation (0.02), complemented

by a model constant term, which was 4.50. This resulted in a total preference score of 4.88 (Table 22). The preference rating for non-participating ESPs was 4.90, emanating from the sum of the part-worth utility scores and the constant term of the conjoint model as indicated in Table 22.

**Table 22: Preference rating of EPWS implementation profiles to the ESPs in the Uluguru Mountains-Tanzania**

<b>Attribute</b>	<b>Attribute level</b>	<b>Participant respondent group</b>	<b>Non-participant respondent group</b>
<b>Mode of payment</b>	Direct cash payment		
	Agricultural input voucher system	0.29	0.25
<b>Channelling of payments</b>	Payment through project implementers		
	Payment through local government offices	0.07	0.08
<b>Implementation mechanism</b>	Household-based implementation		0.07
	Group-based implementation	0.02	
<b>Total part-worth utility score</b>		<b>0.38</b>	<b>0.40</b>
<b>Constant part-worth value</b>		<b>4.50</b>	<b>4.50</b>
<b>Total preference rating</b>		<b>4.88</b>	<b>4.90</b>

Source: Survey data 2011

The preference modelling results revealed a slight discrepancy in terms of what the preferences of ecosystem service providers in the Uluguru Mountains were. This is based on how EPWS scheme attributes and attribute levels should fare in any

watershed-based PES project. While ESPs preferred agricultural input voucher system as a means of compensation (incentive package), the project went for direct cash payment. This monetary compensation lacked a monitoring system that would ensure the money was reinvested in conservation and agricultural activities. Another conflicting idea was observed in terms of how the money should be channelled. Ecosystem service providers favoured the local government authorities, the project opted payment through project implementers, in collaboration with local government councils. The choice of local government authorities as their trustees for the compensation/payment stems from social intimacy, trust and probably a belief that the ESPs can easily enforce accountability to their local government leaders than it is to the project implementing officers. However, project implementers and/or ecosystem service beneficiaries cannot surrender this important project activity to local government authorities alone. Co-managing the funds (or any other incentive package) between the two groups of stakeholders in any PES scheme, and probably involving group leaders in the mode of operation may be a working solution.

In order to determine if the slight difference in preferences observed between the participating and non-participating respondents was statistically significant, pair-wise t-tests were performed using the respective part-worth utility scores. The t-test results indicated that the difference in preference as indicated by the part-worth scores of attribute levels was statistically insignificant at 95% confidence level ( $t = 0.29$ ) as compared to a t-critical value of 2.13. Generally, the choice experiment results for this study are supported by the findings of Leimona *et al.* (2009) who analyzed preferred forms of rewards identified by communities by classifying them under the

five types of Sustainable Livelihood Approach capital. One group of respondents clearly requested monetary compensation. This is contrary to the findings of this study, since none of the two groups showed preference to monetary compensation.

However, Leimona *et al.* (2009) added that, most communities in all case study sites preferred various forms of indirect cash assistance (such as access to productive credit), productive physical inputs or assets (such as seedlings, farming tools, roads, access to market etc). The findings from this study are consistent with Leimona *et al.* (2009) since this study found that all the two respondent groups (i.e. participants and non-participants) preferred indirect cash payments by opting for an agricultural voucher system for accessing agricultural inputs rather than direct monetary payment from the EPWS scheme.

#### **4.7 Correlation between actual and predicted preferences of ecosystem service providers**

In trying to assess the correlation between the actual and predicted preferences, the Pearson's correlation coefficients were calculated for each respondent group. The results are presented in Table 23, which show a relatively high and positive correlation. This indicates also a relatively high level of reliability of these choice experiment results. The coefficients ( $R=0.771$  for non-participant respondents and  $R=0.616$  for participant respondents) indicate a strong positive linear relationship between the predicted and actual preferences of ecosystem service providers in the study area with regard to watershed conservation and payment for ecosystem services schemes. That is a sign that the conjoint models were generally accurate in predicting respondents' preferences for various watershed conservation scenarios.

Nevertheless, the difference between the predicted and actual preferences was insignificant for participating ESPs at 95% confidence level ( $p=0.052$ ) and significant for non-participant respondents at 95% confidence level ( $p=0.0102$ ). This implies that, out of the two groups, it is more accurate to predict the preferences of participating ESPs than it is for non-participating ESPs.

**Table 23: Correlation coefficients between observed and expected preferences of ESPs in the Uluguru Mountains-Tanzania**

<b>Respondent group</b>	<b>Pearson's correlation coefficient</b>	<b><i>p-value</i></b>
Participating ecosystem service providers	0.616	0.052**
Non-participating ecosystem service providers	0.771	0.012*

\*\* *Insignificant at  $\alpha = 5\%$ ; \*Significant at  $\alpha = 5\%$*

**Source: Survey data 2011**

## CHAPTER FIVE

### CONCLUSION AND RECOMMENDATIONS

This chapter presents the conclusion and recommendations of this study. The conclusions are based on the findings and the objectives of this study. Some of the recommendations provided by this study are policy-related, while others suggest further studies/researches.

#### 5.1 Conclusion

First and foremost, it can be concluded that the EPWS scheme has been successfully introduced and led to a satisfactory degree of adoption of land management and conservation activities that had never been practiced in the Kibungo juu sub-catchment. Bench and Fanya juu terraces (conservation agriculture techniques) were widely accepted, though a big challenge was that, they were tedious and labour intensive. Their massive width and length were believed to be the cause of that tediousness.

Secondly, the preferences of all ecosystem service providers were elicited. Generally the participants and non-participants had similar preferences for some attribute levels. Both groups ranked high mode of payment while channel of payment/compensation and mode of implementation were ranked second and third respectively. The difference between participants and non-participants was observed on whether implementation of conservation measures should be group-based or household-based. In this case, participants made a preference on group-based approach while non-participants opted for an individual approach. This may form a

base for any subsequent PES schemes not only in the Uluguru Mountains, but also elsewhere in Tanzania and beyond. Being one of the contemporary non-market valuation techniques often applied in natural resources and environmental assessment, it proved not only valuable as a policy decision-making tool but also as a conservation research technique. The average part-worth scores for the three attributes (Mode of payment, channelling of payments and mode of implementation) can be used to understand how a change in the performance of an attribute can influence the preference attached to each attribute and attribute level by ecosystem service providers.

Furthermore, this study also established the challenges for participation in EPWS scheme. The main ones were land tenure systems, high investment cost and payment problems. These issues came out clearly at all levels, i.e. focus group discussions, key informant interviews and household survey. Land tenure problems and high investment costs were reported by both, participants and non-participants while payment problems were the biggest concern to the participating ESPs. However, the problem on payment seemed to discourage the non-participating ESPs from joining the EPWS scheme.

Last but not least, it suffices to conclude that the livelihood improvement potential of EPWS scheme largely hinged on how it could impact on the livelihood capital available to the ecosystem service providers in the study area, both participants and non-participants. Although the impact of EPWS to the livelihoods of ESPs in the study area was very trivial, a slight positive livelihood impact was observed to the participating ESPs as compared with the non-participants. The non-participants were

not observed to benefit from EPWS scheme as the setting of any PES project invariably favours the participating ESPs. It could be concluded that the EPWS scheme had the potential to improve the livelihoods of ecosystem service providers if the challenges observed in this study could be addressed.

## **5.2 Recommendations**

This study came up with the following recommendations. The findings of this study on EPWS interventions in the Kibungo juu sub-catchment revealed that the participation of ESPs was critical to the success of the project. It is strongly recommended therefore that incentive packages put in place in all PES schemes should be greater than the opportunity cost of participating ESPs. This will definitely attract participation. However, socio-economic studies to establish this fact should be carried out first prior to determining the level of compensation/payment per unit area conserved.

Following eliciting the preferences of ecosystem service providers and comparing with what the EPWS scheme in the Uluguru Mountains was doing, it is therefore recommended that the preferences of the ecosystem service providers should be captured before any PES project is implemented. This implies that choice-based conjoint (CBC) studies should be the basis for decision-making in all incentive-based conservation projects like EPWS and other PES schemes.

Furthermore, it is recommended that PES schemes should establish a forum where ESPs can have their grievances/opinions/comments directly reaching the consumers of the ecosystem services who are pledging to compensate them. This will reduce the

friction between the implementing agencies and the ecosystem service providers. However, this will only be possible if the groups of participating ESPs are empowered from the very beginning to negotiate their incentive and/or compensation packages and be subsumed in all procedural undertakings that pertain to compensation of providers of a targeted ecosystem service.

Although it was very clear from the beginning that compensatory payments made to participating ESPs would correspond to the size of land in which conservation activities were to be implemented, it is high time that the role of monetary payments as positive incentives be thought about in the design of subsequent PES projects in the Uluguru Mountains and elsewhere in the world. This is due to the fact that, the unsatisfactory payments made to participating ESPs were becoming negative incentives to most community members in the study area. This tended to discourage the individuals to participate in the EPWS scheme.

In connection with above statement, there is every reason for concerns that, over time, monetary payments are perceived not as incentives for implementing environmental conservation activities, but as entitlements, and thus, lose their motivational strength. It is thus recommended that non-monetary compensations/incentive packages, where applicable and where necessary be opted for in place of monetary incentives. This may include enhancing the agricultural input voucher systems where farmers can access environmentally friendly agricultural inputs for increased production at the same time protecting the environment.

Lastly, to address the problem of lack of, and delayed payments to ecosystem service providers, it is recommended that water supplying companies e.g. Dar es Salaam Water and Sewage Company (DAWASCO), should be compensating ecosystem service providers directly from the monthly water bills of downstream water consumers. This can be undertaken by deducting the amount of money established by a prior study to determine the willingness to pay/ compensate the upstream providers of water as an ecosystem service and the willingness to accept the compensation by the providers of ecosystem services. However, this needs policy review, organizational, national and international policies, backed up by appropriate law(s).

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**12. Place of origin**

- 12.1 Born in the village
- 12.2 Born outside the village but within the district
- 12.3 Born outside the district but within the region
- 12.4 Born outside the region
- 12.5 Born outside the country

**13. If you moved into this village, when did you settle in? \_\_\_\_\_**

**14. What was your main reason for settling in this village?**

- 14.1 In search of agricultural land
- 14.2 In search of business opportunities
- 14.3 Following relatives
- 14.4 Marriage
- 14.5 Employment
- 14.6 Unfavorable climate conditions in previous place
- 14.7 Others (specify) 14.7.1 \_\_\_\_\_ 14.7.2 \_\_\_\_\_

**15. Characterization of household dwellings by construction materials**

House roof		House walls		House floor
	Grass, leaves, bamboo		Poles, branches, grass	Earth
	Mud & grass Concrete, cement		Mud & poles / stones	Cement
	Galvanized metal sheets		Mud only	Tiles
	Asbestos sheets		Mud bricks	Wooden
	Tiles		Burnt bricks	Stones
	Other		Concrete, cement, stone	Other:
			Other	

**PART B: PARTICIPATION STATUS AND CHALLENGES FOR  
PARTICIPATING IN THE EQUITABLE PAYMENT FOR WATERSHED  
SERVICES SCHEME**

---

16. Are you participating in the equitable payment for watershed services scheme?      16. 1: YES      16. 2: NO

17. If YES in 16, please state the date you joined the project: Month \_\_\_\_ Year \_\_

18. If YES in 16 above, please state the mode of participation in the project. If NO, please continue to question 19.

Casual labourer	18.1	Contracted smallholder farmer (As a household)	18.2	Contracted smallholder farmer (As an individual)	18.3	Contracted large scale farmer	18.4
Project employec	18.5	By the virtue of village leadership position	18.6	A consultant/ Service provider	18.7	Other, please specify	19.9

19. Please indicate which of the following challenges threaten your participation (for participants) or hold you back from participating (for non participants) to the EPWS scheme? Tick only one rank; from 1 to 5:

S/N	Challenge	Rank				
		1	2	3	4	5
1	Low profitability of PES					
2	Low technical capacity					
3	High investment cost					
4	Payment problems from the beneficiaries/implementers					
5	Poor social networking					
6	Poor information flow (being less informed)					
7	Land tenure problems					
8	Inadequate human resource					

**PART C: IMPACT OF EQUITABLE PAYMENT FOR WATERSHED SERVICES PROJECT TO THE LIVELIHOODS OF ECOSYSTEM SERVICE PROVIDERS:**

20. Please rank the accessibility and availability of the following **LIVELIHOOD** assets in relation to how EPWS has fostered or constrained each asset.

**(A) NATURAL LIVELIHOOD ASSETS**

IMPACT ASSET	1	2	3	4	Do you attribute any change to EPWS?
	Worsened	No change	Slight improvement	Great improvement	
Land productivity					
Non timber forest products					
Wildlife resources					
Livestock					
Medicinal materials					

**(B) HUMAN LIVELIHOOD ASSETS**

IMPACT ASSET	1	2	3	4	Do you attribute any change to EPWS?
	Worsened	No change	Slight improvement	Great improvement	
1. Health					
2. Nutrition					
3. Formal education attainment					
4. Vocational knowledge and skills					
5. Capacity to work					
6. Capacity to adapt to environmental and economic shocks					

**(C) SOCIAL LIVELIHOOD ASSETS**

IMPACT ASSET	1	2	3	4	Do you attribute any change to EPWS?
	Worsened	No change	Slight improve ment	Great improvement	
1. Networks and connections					
2. Trust and mutual support					
3. Common rules and sanctions					
4. Participation in various social events					
5. Leadership					
6. Trade associations					
7. Local governance institutions					

**(D) FINANCIAL LIVELIHOOD ASSETS**

IMPACT ASSET	1	2	3	4	Do you attribute any change to EPWS?
	Worsened	No change	Slight improvement	Great improvement	
Savings					
Credit systems					
Remittance					
Wages					
Access to markets					
Cash					

**(E) PHYSICAL LIVELIHOOD ASSETS**

IMPACT ASSET	1	2	3	4	Do you attribute any change to EPWS?
	Worsened	No change	Slight change	Great improvement	
Shelters and houses					
Water supply systems					
Energy resources					
Communication systems					

**PART D: OWNERSHIP OF PRODUCTIVE AND OTHER LIVELIHOOD ASSETS BEFORE AND AFTER THE PROJECT**

---

21. What is your average household income per month? (TSH) \_\_\_\_\_

22. How much of your monthly household income indicated in 21 above is contributed to by earnings from EPWS scheme, whether directly or indirectly? TSH \_\_\_\_\_

23. Please indicate the ways and means through which you accrue part of your household income from the project.

23.1 Direct cash payment as a compensation      23.2 Working as a labourer

23.3 Selling food to project workers/visitors      23.4 Renting apartments for project workers/visitors  
23.5 Others (Specify) 23.1 \_\_\_\_\_ 23.2 \_\_\_\_\_

24. How do you utilize the money you receive from the project? List them in order of importance 24.1 \_\_\_\_\_ 24.2 \_\_\_\_\_

24.3 \_\_\_\_\_ 24.4 \_\_\_\_\_

25. What are the major sources of energy in your household? Please list them in order of importance: 25.1. \_\_\_\_\_ 25.2. \_\_\_\_\_

25.3. \_\_\_\_\_ 25.4 \_\_\_\_\_

26. For each of the livelihood resources listed below, please indicate the quantity owned now and before the project.

Household item	Number owned before the project	Number owned after the project	Do you attribute any change to EPWS?

Household item	Number owned before the project	Number owned after the project	Do you attribute any change to EPWS?
Poultry			
Pigs			
Cattle			
Shoats			
Hoes			
Milling machine			
Bechives			
Mobile phones			
Radios			
Bicycles			
Chairs			
Tables			
Beds			

**27. Please state the status of land that your household currently uses**

27. 1. Owned land    27. 2. Rented land    27.3. Rented and owned land

**28. Please indicate the size of land that you own and rent (acres)**

28.1 Land owned \_\_\_\_\_ 28. 2. Land rented (acres) \_\_\_\_\_

**Have you registered any land use and ownership changes after the EPWS project?**

29. Land use changes                      29. 1 YES                      29. 2 NO

30. Land ownership changes              30.1 YES                      30.2 NO

**31. Do you attribute the changes registered to EPWS scheme?**

31.1. YES    31.2 NO

**32. If YES in 29 and 30, please indicate amount of land owned and its uses before and after the project. If NO in both cases, please go to question 33**

Land uses		Land size owned/Rented (acres)		Income accruing from the land	
Before the project	After the project	Before the project	After the project	Before the project (TSH)	After the project (TSH)


**PART E: THE CONTRIBUTION OF EPWS SCHEME TO THE ADOPTION  
OF ENVIRONMENTALLY FRIENDLY AND LAND MANAGEMENT  
PRACTICES**

**33. Please indicate the type of land management practices that your household practices** 33.1. Fanya Juu terracing 33.2 Soil/stone banding 33. 3 Double ditch construction 33.4. Bench Terracing 33.5 Grass strips 33.6. Tree planting 33.7. None

**34. Which of the above land management practices your household has been applying before the scheme? Please tick as appropriate.**

34.1. Fanya Juu terracing      34.2 Soil/stone banding      34. 3 Double ditch construction      34.4. Bench Terracing      34.5 Grass strips

34.6. Afforestation/Reforestation      34.7. None

**35. Please state the current status of adopting the land management practices mentioned in 33.**

Adoption status		
Lower than before the project	No change	Higher than before the project
1	2	3

**Please indicate the impact of the land management practices adopted in question 34 to uphill soil loss and regulation of water flow before and after the equitable payment for watershed services.**

**36. State of uphill soil loss**

1	2	3	Do you attribute any change to EPWS project?
Lower than before the project	No change	Higher than before the project	

**37. State of water flow to main rivers and streams**

1	2	3	Do you attribute any change to EPWS project?
Lower than before the project	No change	Higher than before the project	

38. Do you use the agro-chemicals in your farms? 38.1. YES 38.2. NO

39. If Yes, please name them: 39.1 \_\_\_\_\_ 39.2 \_\_\_\_\_ 39.3 \_\_\_\_\_ 39.4 \_\_\_\_\_

40. Please rate the use of the agro-chemicals you mentioned in question 39 before and after the equitable payment for watershed services scheme.

Use of agro-chemicals		
1. Less intensive than before the project	2. The same	3. More intensive than before the project

41. What measures do you take to reduce the amount of agro-chemicals flowing into rivers and streams? 41.1 \_\_\_\_\_ 41.2. \_\_\_\_\_ 41.3. \_\_\_\_\_ 41.4. \_\_\_\_\_

42. Do you think the change in the utilization of the above-mentioned agrochemicals and land management practices has had any effect on crop yield/land productivity as cited from question 20 (A)(1)? 42.1. YES 42. 2. NO

43. If YES in 43, please indicate the quantity change in land productivity of major crops before and after the project. If NO, please ignore this question.

	Before the project (kg)/acre	After the project (kg)/acre
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		

## APPENDIX II: CHECKLIST FOR KEY INFORMANT INTERVIEWS

- i. Date of interview.....
- ii. Respondent's name.....
- iii. Age .....
- iv. Sex (M) (F) .....
- v. Institution/Organization.....
- vi. Position.....

- 
1. What do you know about the EPWS scheme?
  2. Can you explain how (you) the people were involved in the first place?
  3. Briefly state the criteria used in recruiting the participants for EPWS.
  4. How many smallholder farmers are currently involved in the project, as of November 2011?
  5. How many of these are women (Female heads of households)?
  6. Did you encounter any dropouts from the project?
  7. You are currently using the direct cash payment method to the participants. What are the reasons for choosing that method?
  8. How does the project make sure that the money disbursed to farmers is utilized in the intended manner? Are there monitoring any mechanisms?
  9. What are the problems that you face in the operationalization of EPWS scheme?
  10. What lessons have learned from this particular scheme?
  11. Do you think this scheme is successful? In which ways? And if not, please explain.

**APPENDIX III: CHECKLIST FOR FOCUS GROUP DISCUSSIONS**

Date of interview..... Name of Village.....

**LIST OF ATTENDANTS**

S/N	Name of Attendant	Sex (M/F)	Age
1			
2			
3			
4			
5			

1. What do you know about the equitable payment for watershed services scheme?
2. Can you boldly explain how the watershed was before the project?
3. How are you participating in the EPWS scheme?
4. In which ways do you air out your opinions?
5. Did you have special needs (as a group) that you wanted to be taken care of by the project?
6. Have you noticed the inclusion of any of the views you aired out?
7. If YES, please mention them;
8. Did you show some special preferences that the project ought to consider?
9. In which aspects do you think the project has both fostered and constrained your livelihood?
10. Can you rank the list of project attributes and their respective levels with regard to how you prefer them? Remember the first 3 will be used for household survey.
11. If, YES, can you list them?
12. Any other burning issue that concerns EPWS scheme and your livelihoods in general?

## APPENDIX IV: AN ORTHOGONAL DESIGN FOR CHOICE EXPERIMENT

CARD ID (PROFILE)	MODE OF PAYMENT OF PARTICIPATING ECOSYSTEM SERVICE PROVIDERS	CHANNELING OF PAYMENTS	IMPLEMENTATION MECHANISM OF WATERSHED AND ENVIRONMENTAL CONSERVATION ACTIVITIES	RANKING BY ECOSYSTEM SERVICE PROVIDERS (8 most preferred, 1 least preferred)
1	Direct cash payment	Payment through Local government offices	Household-based implementation	
2	Direct cash payment	Payment through Local government offices	Group-based implementation	
3	Direct cash payment	Payment through Project implementers	Household-based implementation	
4	Direct cash payment	Payment through Project implementers	Group-based implementation	
5	Voucher system for accessing agricultural inputs	Payment through Project implementers	Household-based implementation	
6	Voucher system for accessing agricultural inputs	Payment through Local government offices	Group-based implementation	
7	Voucher system for accessing agricultural inputs	Payment through Project implementers	Group-based implementation	
8	Voucher system for accessing agricultural inputs	Payment through Local government offices	Household-based implementation	

**APPENDIX V: Livelihood assets and responses on livelihood impact of EPWS**

Livelihood capital	Selected livelihood items	Percentage response (%)								Mean Score	
		Worsened (1)		No change (2)		Slight improvement (3)		Great improvement (4)			
		PP	NP	PP	NP	PP	NP	PP	NP	PP	NP
Natural capital	Land productivity	0	0	8.4	65	58.3	35	33.3	0	3.25	2.38
	Access to and availability of NTFPs	38.3	40	58.3	60	1.7	0	1.7	0	1.67	1.60
	Availability of wildlife resources	1.7	3.3	61.6	78.3	26.7	18.4	10.0	0	2.45	1.60
Human capital	Health and nutritional improvement	0	0	26.7	91.7	66.7	8.3	6.6	0	2.80	2.10
	Vocational knowledge and skills	0	0	16.7	91.7	41.7	5	41.7	3.3	3.25	2.12
	Capacity to work	3.3	1.7	5.0	95.0	45.0	1.7	46.7	1.7	3.35	2.07
	Capacity to adapt to environmental and economic shocks	0	0	5.0	93.3	51.7	6.7	43.3	0	3.38	2.08
Social capital	Networks and connections	0	0	5.0	93.7	76.7	6.3	18.3	0	3.13	2.10
	Trust and mutual support	0	0	71.7	95	23.3	5	0	0	3.18	2.07
	Common rules and sanctions	0	1.7	6.7	85.0	70.0	11.7	23.3	1.7	3.17	2.15
	Participation in various events	0	0	3.3	100	71.7	0	25.0	0	3.22	2.02
	Leaderships skills	1.7	0	66.7	98.3	26.7	1.7	5.0	0	2.35	2.03
	Governance	0	0	70.0	91.7	25.0	8.3	5.0	2.2	2.35	2.10
Financial capital	Savings	0	1.1	35.0	81.7	53.3	18.3	11.7	0	2.77	2.20
	Access to credit	0	0	86.7	90.0	8.3	10.0	5.0	0	2.18	2.13
	Wages and employment	0	0	81.7	95.0	13.3	5.0	5.0	0	2.23	2.07
	Access to markets	3.3	0	73.3	96.7	21.7	3.3	1.7	0	2.22	2.05
	Shelters and houses	0	0	68.3	83.3	26.7	11.7	5.0	5.0	2.37	2.25
Physical capital	Energy resources	28.3	25.0	66.7	75.0	5.0	0	0	0	1.77	1.75
	Communication systems	3.3	0	76.7	91.7	15.0	8.3	5.0	0	2.22	2.10
	Water supply systems	6.7	1.1	91.6	100	1.7	0	0	0	1.95	2.00