# HOW SUCCESSFUL HAS PAYMENT FOR ENVIRONMENTAL SERVICES IMPROVED WELFARE?

## The Case of Uluguru Mountain –Morogoro

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**M.A (Economics) Dissertation**

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## CERTIFICATION

The undersigned certifies that they have read and hereby recommends for acceptance by the university of Dar es Salaam a dissertation entitled ***"How Successefully Has Payment for Environmental Services Improved Welfare? (Case Of Uluguru Mountain –Morogoro)"*** in partial fulfillment of the requirements for the degree of Master of Arts (Economics) of the University of Dar es Salaam.

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Date……

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Dr. Godius Khayrara

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Date……

**DECLARATION**

**AND**

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I, John Innocensia, declare that this dissertation is my original work and that it has not been presented and will not be presented to any other University for a similar or any other degree award.

Signature……..

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# DEDICATION

I dedicate this dissertation to my parents, Mr. John Festo and Mrs. Theresia Anthony for their love, prayers, support and guidance throughout my life endeavors. They have always been my inspiration.

## ABSTRACT

This study was carried out to find out the impact of PES on the welfare of the communities in the Uluguru Mountains. The objective is to assess PES project which aims at conserving the environment (forest) and reducing poverty level. The assessment of the project is done by looking at the difference between the treatment group (those who participate in PES) and control group (households who do not participate).

The study employed a combination of questionnaire and field observation to collect primary data in combination with a detailed review of literature. In analyzing the information collected the study utilized Propensity Score Matching (PSM), Descriptive statistics, Perception and Logistic analysis. In all methods of analysis it has been found that the project has impact on poverty reduction as revealed by the difference in poverty status/socioeconomic status between the treatment and control group.

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## LIST OF ABBREVIATION AND ACRONYMS

| | |
|---|---|
| ATT | Average impact of treatment on the treated |
| CARE | The humanitarian organization fighting global poverty |
| CBFM | Community-based Forest Management |
| CIA | Conditional Independence Assumption |
| CMEAMF | Conservation and Management of Eastern Arc Mountain Forests |
| EPWS | Equitable Payment for Watershed Services |
| GDP | Gross Domestic Product |
| JFM | Joint Forest Management |
| LLM | Local Linear Matching |
| MACEMP | Marine and Coastal Environment Management Project |
| MNRT | Ministry of Natural Resources and Tourism |
| NFP | National Forestry Policy |
| NN | Nearest-Neighbor |
| NTFP | Non-Timber Forest Products |
| PCA | Principal Component Analysis |
| PES | Payment for Environmental Services |
| PFM | Participatory Forest Management |
| PSM | Propensity Score Matching |
| REDD | Reducing Emissions from Deforestation and Forest Degradation |
| TFP | Timber Forest Products |
| UMADEP | Uluguru Mountains Agricultural Development Project |

| | |
|---|---|
| UNR | Uluguru Nature Reserve |
| VLFR | Village Land Forest Reserves |
| WWF | World Wide Fund |

# CHAPTER ONE

# INTRODUCTION

## 1.1 Background Information

Payments for ecosystem services are an innovative approach which allows integrated solution to natural resource management. It is a new framework which is growing in popularity in many developing countries as a means of financing environmental and resources conservation, thus trying to jointly address poverty alleviation and sustainable management of natural resources (Landell-Mills and Porras, 2002). In practice the approach relies on contractual systems which include transfers (financial) between beneficiaries (for example users of a water supply system) and providers (managers of ecosystems for example forestry upstream of a watershed, farmers). Those payments systems tend to reduce negative externalities (contaminations, resources overexploitation) and to help positive externalities (hydro-systems regulation, habitat function of wet zones). (Lokina and Kahyarara 2009).

Many Payments for ecosystem services (PES) schemes were initially designed as means of financing natural resource management, with potential livelihood considerations added later. A major concern is that the poor will actually become worse off due to a PES scheme, for example as buyers of a service that was previously free. There is also the danger that the poorest and most marginalized will become further marginalized if they cannot participate effectively in the scheme, for example as buyers of a service that was previously free. Thus,

this study is intended to expand our understanding on how the poor will be affected as the PES approach grows. It has assumed that PES will contribute to poverty reduction by making payments to poor land users

In Tanzania, this sort of approach exists in the Ruvu River upper catchments in the Uluguru Mountains. It was initiated by WWF and CARE in 2006 but its actual implementation started in 2008 and proceeded till 2012. For example, the global carbon markets may provide a mechanism to pay the Tanzanian government to protect or expand the forest area. WWF developed a new, holistic PES approach that explicitly aimed to balance poverty reduction with conservation. PES is seen as one financing mechanism for conservation that, in the appropriate circumstances, will deliver both sustainable natural resource management and improved livelihood security for the rural poor.

The WWF seeks to promote the integration of environmental sustainability and social equity into economic development, the initiative within the program is focusing on how to scale-up current PES scheme so that they deliver substantial and long lasting conservation while alleviating rural poverty by giving special attention to increasing the participation of the rural poor in PES schemes. The participation of communities in a payment for ecosystem services scheme is essential for success and sustainability. This participation should go far beyond solely receiving the benefits from the transaction. For a payment for ecosystem services transaction to be successful, it is necessary that rural community members actively participate from the beginning of project identification and design (Vonada.et al., 2011).

However, poverty reduction and environmental sustainability through community participation are not always complementary. Without careful design, the poor are likely not to benefit from a PES scheme (see Wunder, 2005) and there is a danger that part of the poverty reduction will be met by unsustainable exploitation of natural capital. Equitable Payment for Watershed Services (EPWS) under WWF and CARE addresses this for the communities of Uluguru Mountains (especially KibungoJuu ward) by improving the welfare of the people, that is, poverty reduction and environmental management

### 1.2 Problem Statement

The PES programme's effectiveness depends heavily on the voluntary participation of landowners in order for its objective of conservation as well as poverty reduction level of the communities to be achieved. Since PES main aim is to conserve the environment in the Uluguru Mountains but little has been done to capture the role of PES in addressing the poverty level among the community involved in the conservation. This shows that there has not been clear cut evidence if participation of the communities in the Uluguru forest under PES has helped to reduce poverty and if the forest cover has increased. Therefore this study aimed at establishing the impact on welfare as well as improved forest cover as a result of PES.

### 1.3 Objectives of the Study

The main objective of the study is to evaluate the impact of PES on poverty reduction for the participating communities and increase of forest cover in the Uluguru forest areas where ecosystem services are often richest.

To accomplish this, the research will attempt to address the following specific objectives:

(i) Examine the impact of PES on the welfare of the communities in Uluguru.

(ii) Identify significant differences in poverty level between people who participate in PES and those who do not participate in the program

(iii) Examine the improvement in forest cover since the implementation of PES program

### 1.4 Research questions

In light of the discussion, the study poses the following analytical questions;

- Does PES have any impact on the welfare of the communities in Uluguru?
- Are there any significant differences in poverty level between people who participate in PES and those who do not participate in the program?
- Is there any improvement in forest cover since the implementation of PES program?

### 1.5 Significance of the Study

This study will add to the existing few literatures of PES on the effectiveness of the program in alleviating poverty for the participating community and knowing the situation

of the forest in the Uluguru catchment forest. It will also be the opening door for more literature in trying to assess the effectiveness of the program not only in the poverty alleviation but also will give grounds for other researchers in trying to assess the environmental conservation level reached through community involvement. Finally, even though it's academic it has policy relevance and it adds to the existing stock of knowledge on the environmental and natural resource economics field.

### 1.6 Scope of the Study

The study area is the Uluguru Nature Reserve which is part of the Eastern Arc Mountains (EAM), which run from Taita Hills in Southern Kenya to the Udzungwa Mountain in south central Tanzania. The Ulugugru Nature Reserve (UNR) is located in the Eastern part of Tanzania about 180 km from Dar es Salaam along the Dar es Salaam- Mbeya highway. The UNR is accessible through Bunduki to Nyachiro, Bunduki to Vinile, Morogoro to Morning site, Kola to Bigwa, Kinole to Tegetero, Matombo - Tawa to Nyingwa, Mvuha – Bwakilajuu to Lusange, Kibaoni – Nyandira to Tchenzema roads.The UNR is surrounded by 57 villages. The study will cover four villages namely Lanzi,Nyingwa,Kibungo and Dimilo where PES activities have been implemented.

# CHAPTER TWO

# AN OVERVIEW OF FORESTRY IN TANZANIA

## 2.1 Introduction

This chapter provides an overview of forestry in Tanzania, draws down to forestry sector in Morogoro and gives the state of the Uluguru nature reserve found in Morogoro. It goes further by explaining the Interactions of Uluguru communities with forest conservation as well as community involvement in conserving the forests in Tanzania and lastly gives a discussion on the Forest Policy 1998 and Forest Act 2002 in Tanzania.

## 2.2 FORESTRY IN TANZANIA

Tanzania has a large land area (94.5 million hectares), with a tropical climate, 10 ecological zones with different physiographic zones and complex topography. About 38 percent of Tanzania's total land area is covered by forests and woodlands that provide for wildlife habitat, unique natural ecosystems and biological diversity, and water catchments (Burgess, 2004). The forest total landmass, which is about 33.5 million hectares, furthermore, the country's forests contain such a high level of biologically diverse resources that Tanzania is one of the richest countries in terms of biodiversity in the world and among the 12 most diverse countries (FBDT 2006).Tanzania has Africa's largest number of mammals all harbored by the country's forests (MNRT 1998). The importance of these ecosystem to the economy of Tanzania and to the community in general is that the forests provide over 92 percent of the energy resources, support the development of other important sectors (such as agriculture and tourism) through provision of water resources

and catchments, maintain hydrological balance and soil protection, recycle atmospheric gases, provides construction materials, employment sources and other (URT 2005).

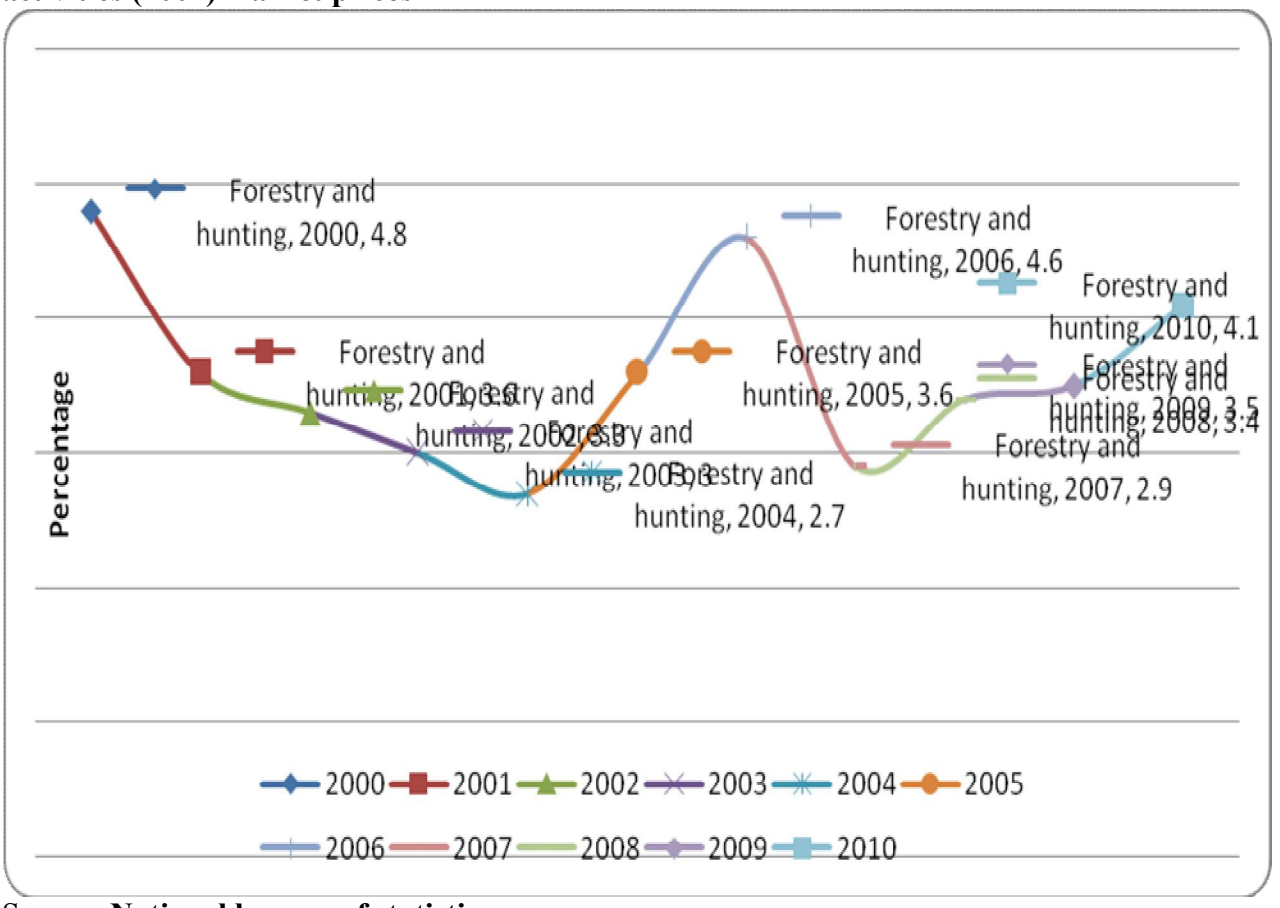
These forests are, however, faced with deforestation at a rate of between 130,000 and 500,000 hectares per year, which is a result of population pressure on agricultural expansion, livestock grazing, wild fires, overexploitation, and unsustainable utilization of wood resources and other human activities, mainly in the general lands (Tanzania 2001). Conservation in Tanzania then started in 1963 with the aim of conserving the forests in perpetuity for the present and future generations were powers are placed to foresters and ignored the people/community leaving adjust to the forest cover areas.

Forests in Tanzania can be divided into two broad categories: reserved forests and non-reserved forests. About 37 percent (12.5 million hectares) and 57 percent (19 million hectares) of forests are reserved and Non-reserved, respectively (Tanzania 2002b). Reserved forests include central and local government forest reserves, government-owned industrial plantations, and village land forest reserves (VLFRs) at the community level that have been gazetted by the central government. Unreserved forests are on “general” or “village” lands where forests and woodlands are not formally classified as reserves (Tanzania 2001).

The forestry sector has a very important role to play in Tanzania’s economy. Although in absolute terms, its contribution to total gross domestic product (GDP) is low, it has increased considerably during the past 10 years by about 35 per cent, from 2.6 to 3.4 per cent of GDP. Furthermore the contribution of Forestry and hunting sub sector grew by 4.1

percent in 2010 compared to 3.4 percent in 2009 (Economic survey 2010). The sharp change in the years 2004-2007 has not been investigated hence it is still unknown what could have attributed the change but the mere growth was mainly attributed by improved patrol with regard to harvesting, transportation and marketing of the forest products, and increase in demand for forest products in the domestic market. Figure 1 shows the trend of revenue from forestry and hunting activities from year 2000-2010.

**Figure 2.1 : Growth in National Income (real GDP growth) from forest economic activities (2001) market prices**




Source**; National bureau of statistics**

Government revenue from forestry grew by 46.6 billion in 2010 compared to 25.2 billion in 2009 which is equal to an increase of 85.1 percent, the increase was emanated from strengthening patrols in harvesting, transport and markets; decline in timber imports from neighboring countries; and increase in exports of forestry products i.e. increase in selling of timber in Sao Hill (economic survey 2010). The contribution of the forestry and hunting sub activity to GDP was 24.1 percent in 2010 compared to 24.6 in 2009. (National Bureau of Statistics 2010).From the data it can be said that an increase in national income is one of the indicators of improved livelihoods due to forest activities from timber and non timber products.

However this growth of the sector and its contribution to the national income, grossly underestimates the value of the forest sector to the national level (macro) and to the community adjacent to the forest (micro level). The contribution and growth presented above, it only covers the forest products with market prices, such as timber, logs etc. The estimates largely exclude the NTFP and other ecosystem services provided by the forest. For example in (Zahab,et.al,2004) showed that contribution of NTFP was about 287 million which is 57 percent of the total contribution to the economy which is not taken into account in GDP of which the rest is TFP.

The contribution of forests to local livelihoods and the Tanzanian national economy as a whole is significant, but is largely unrecorded and consequently unrecognized. The difficulty of examining forestry in the context of economic growth arises because no markets exist for ecosystem services. Many transactions related to forest products and services fall within the informal sector or are undertaken illegally and hence, not recorded.

Official gross domestic product (GDP) figures, on which the analysis of economic growth is made, do not reflect the "true" economic importance of the forest sector to the national economy (World Bank 2005). This "undervaluation" matters because the contribution to GDP and its growth determines decisions made by the government of Tanzania, and also to some degree its development partners, regarding the allocation of financial resources. For example from the share of GDP from the forest sector in non-monetary terms is low compared to the monetary, this shows that there is low account taken in the non-timber products hence a need to value ecosystem services

Between 1990 and 2010, Tanzania lost an average of 403,350 ha or 0.97% per year. In total, between 1990 and 2010, Tanzania lost 19.4% of its forest cover or around 8,067,000ha (TFI 2010). The loss was due to the increasing demand of forest goods for agricultural expansion, livestock, other land users, that required to make reforms in the conservation and management of forests in the 1990s. One of the introduced aspects on forest management was Participatory Forest Management (PFM) concept which advocates Community-based Forest Management (CBFM) and Joint Forest Management (JFM) approaches. PFM reflects its varying degrees of involvement of local communities in the management of forest resources. The recent approach of PFM however, also appears to have some problems including lack of incentives for the participating communities (Malimbwi, 2002, Kiss, 2004; Robinson and Lokina 2011). It is proposed by neo-market natural resources economists that, new ways and institutional set-ups to supply for such required incentives have to be developed (Winrock International, 2004). This implies that for environmental services to be provided for by local actors, financial incentives have to

be made available by international, national/regional and local actors. Thus, it is expected in the absence of any other incentive scheme, PES should be regarded as necessary for the sustainability of the conservation measures. The PES initiatives are expected to complement past forest reforms thereby contributing to generation of incentives for forest management by PFM projects. Under PFM, local communities that are managing natural forests by avoiding deforestation have to be compensated for their management efforts in order to reinforce their commitment to conserving natural forests and, in turn, safeguard their livelihoods.

### 2.2.1 The Forest Policy 1998 and Forest Act 2002 in Tanzania

Tanzania has experienced a number of policy reforms in recent years, and most of these policies have stressed the need for community participation and involvement in management of the environment and natural resources. The national forestry policy (NFP) and the Forest Act 2002 will be reviewed.

In 1998, the government of Tanzania reviewed its 1953 forest policy and adapted the NFP by focusing on sustainable conservation of forest resources, the new policy seek to achieve its policy goal of "enhancing the contribution of the forest sector to the sustainable development of Tanzania and the conservation and management of natural resources for the benefit of present and future generations. The NFP contains a number of statements in support of ecosystem conservation and management which promote community involvement in conservation and management.

Involvement of communities and other stake holders in conservation and management is encouraged through joint management agreements where biodiversity conservation and management will be included in the management plans for all protection forest. Also institution human resources is influenced by enhancing national capacity to manage and develop the forest sector in collaboration with other stakeholders like in a way that local communities will be encouraged to participate in forestry activities. This will ensure ecosystem stability through conservation of biodiversity, water catchment, soil fertility, sustainable supply of forest products and services by maintaining sufficient forest area under effective management and enhanced national capacity to manage and develop the forest sector in collaboration with other stakeholders this.

The Act supports Participatory Forest Management (PFM), is a strategy to achieve sustainable forest management by encouraging the management or co-management of forest and woodland resources by the communities living closest to the resources, supported by a range of other stakeholders drawn from local government, civil society and the private sector. To encourage and facilitate the active participation of the citizen in the sustainable planning, management, use and conservation of forest resources through the development of individual and community rights, whether derived from customary law or under this Act, to use and manage forest resources. While recommending positively the efforts by the government in conserving the forest sector through PFM, the sustainability of these efforts can only be guaranteed if sufficient incentives are given to the villagers adjacent to the forest. The schemes like PES and REDD+ are among the potential schemes

if appropriately implemented likely to ensure the sustainability of the conservation efforts by the Government (Robinson and Lokina 2011).

The NFP aims to create an enabling environment for the development of the forestry sector by decentralizing responsibilities for forest management to local communities and district councils, separating the normative and service delivery functions of the GoT through the establishment of an Executive Agency in the forest sector (Tanzania Forest Service), commercializing or privatizing the management of the forest and promoting greater involvement of the private sector and civil society in sustainable forest management.

## 2.3 OVERVIEW OF FORESTRY IN MOROGORO

Morogoro region has 47 Catchment Forest Reserves which are in four districts, Kilombero, Kilosa, Ulanga and Morogoro. Many of the reserves cover mountainous areas under a high rainfall and so are important catchments. The main mountain ranges are the: Uluguru and Nguru in Morogoro District; Udzungwa in Kilombero District; Mahenge in Mahenge District; and Ukaguru and Rubeho in Kilosa District (Lovett et.al, 2004).

In Kilosa district there are 10 Catchment Forest Reserves which are; Ikwamba, Mamboto, Mamiwa-Kisara (North), South Mamiwa-Kisara, Uponera, Mamboya, Talagwe, Pala Mountain, Ukwiva and Kihiliri. Ulanga District Catchment Office Administers Eight Reserves, which are Mahenge Scarp, Nawenge, Mselezi, Myoe, Muhulu, Sali, Ligamba and Nambiga. Morogoro District Catchment Office administers 22 reserves. Fifteen of these are

on or near the Uluguru Mountains, with the other seven on or near the Nguru Mountains (Lovett et.al, 2004). Kilombero District has seven catchment forest reserves, six of these reserves are on the eastern escarpment and foothills of the Udzungwa Mountains, which are: Lyondo, Matundu, Iwonde, Nyanganje, Mwanihana and West Kilombero scarp reserve which is administered by Iringa region. On the southern part of the escarpment is Udzungwa scarp catchment forest. Boundaries between the reserves are usually rivers.

### 2.3.1 Economic Profile of Morogoro

Morogoro region is one of the regions in Tanzania with great potential of economic development and prosperity. The Region has a very good climate and land favorable for agriculture and other economic investments. The Region contains Morogoro Urban centre which is its headquarters. Its Gross Domestic Product has been growing overtime. According to the National Accounts of Tanzania Mainland, the Region in 1996 recorded GDP at current prices of Tshs. 159,195 million which increased to Tshs. 439,142 million in the year 2003 and it was projected to Tshs, 619,792 million in the year 2004.

#### 2.3.1.1 Health

The growing population in all districts of the region has resulted to increased demand for health facilities. Deaths have considerably increased with the common killing diseases being malaria, pneumonia, HIV/AIDS and diarhorrea for both children under five years and over five years. Statistics show that malaria led with 69.59 % of all over fives years deaths in the region, pneumonia, anaemia and HIV/AIDS accounted for 15.09 %, 8.74 % and 2.75 % of all over fives years deaths during 2005 respectively.

Moreover there has been a decrease of 1.25 % of dispensaries in 2006 as compared to 1996. While government dispensaries have decreased from 240 to 237 (1.25 %). While there has been no overall change in the number of dispensaries in Kilombero and Ulanga, there has been an increment of 16.67 % for dispensaries in Morogoro Municipal. The decrease of dispensaries in Morogoro rural can be due to the creation of the new Mvomero district which was once part of Morogoro rural. Growing number of drug stores, improvement of government owned facilities as well as other private dispensaries are suggested to be among the reasons for shrinkage of the number of private owned dispensaries. Unlike the case of dispensaries, there has been a total increase of 19.23 % for health centers in Morogoro region from the year 1996 to 2006. Kilosa district, the most populated district in Morogoro region have an average of about 7,254 people served by one health facility, while Ulanga, the least populated district in the region has an average of about 5,919 people served by one health facility. The situation is relatively better in Morogoro Municipal district where there is a ratio of 2 health facilities to a population of 10,000. On the other hand, there is one health facility serving the population of 10,000 in Kilombero and Kilosa. Regional wise the ratio of health facilities to 10,000 populations is 1.61. Investment needed in this sector include the establishment of dispensaries and health centers; training of health personnel; and supplying of drugs, vaccines and equipment especially by opening up medical stores and shops in both urban and rural areas.

#### 2.3.1.2 Education

The education sector in Morogoro has improved, in the urban areas most of the children enrolled in primary education have gone through pre primary education as compared to the

rural areas. Most of these schools are under public ownership. Although they are still few in number, their contribution in complementing primary education is significant. The enrolment into pre-primary school is almost equal across sex of students**.** The number of pupils enrolled into Pre-Primary education has been fluctuating from year to year, with an increase in each year.

Currently, Morogoro Region like other Regions in Tanzania is facing a challenge of growing young population that demands education at all levels, namely, pre-primary education, primary education and secondary education. At the present the Region is campaigning to make sure that all standard seven leavers who pass their examinations continue with secondary education. The Government has left the doors open to private investors to chip in this sector. Private investors are greatly encouraged to invest in this sector so as to cope with the growing demand. The investments needed are building schools, hostels, teachers' training colleges and teacher's houses.

**2.3.1.3 Housing and Assets Ownership**

Housing and assets ownership by households are among the major development indicators in any society. The 2002 Housing and Population Census indicated that most of the houses in Morogoro Region are of temporary nature. This is shown by the fact that most of the households live in houses constructed by using temporary materials. Most of households in the Region lived in houses roofed by temporary materials such as grass, and grass and mud and walls constructed by using temporary materials such as poles and mud, timber, and grass, only 24.3 percent of the households lived in buildings with floor constructed by permanent materials. Looking district wise, Morogoro rural 1.7 of the households lived in

buildings constructed with permanent material unlike in districts like Morogoro urban were more than half of the households lived in such type of building i.e. 68.1 percent, this could be due to the fact that most facilities are available in that area. This can also be seen in Kilombero were 21 percent lived in buildings constructed with permanent material but it was different in districts like Ulanga with 7.9 percent, Kilosa with 15.8 percent and Mvomero with 17.4 percent. However 89 percent of the households from Morogoro rural lived in buildings of temporary material which was the same for districts like Kilombero with 78.7 percent, Ulanga with 91.1 percent Kilosa with 83.8 percent and Mvomero with 80.2 percent which is due to poor facilities available and remoteness making it costly to build a permanent house but Morogoro urban only 31.4 percent lived in such type of buildings.

Table 2.1 Type of Floor Material of the Main Building by Households in the Region

| Floor material | Morogoro (Urban) | Morogoro (Rural) | Kilombero | Ulanga | Kilosa | Mvomero |
|---|---|---|---|---|---|---|
| **Cement** | 37,202 | 6,153 | 15,536 | 2,943 | 16,728 | 10,228 |
| **Mud** | 17,163 | 51,165 | 58,253 | 33,786 | 88,869 | 47,212 |
| **Timber** | 115 | 137 | 104 | 103 | 448 | 215 |
| **Tiles** | 49 | - | 11 | 10 | 23 | 6 |
| **Other** | 4 | 1 | 95 | 255 | 34 | 1,175 |
| **Total** | 54,582 | 57,457 | 73,999 | 37,097 | 106,101 | 58,836 |

Source: 2002 Population and Housing Census, Tanzania

## 2.4 FOREST SECTOR IN ULUGURU MOUNTAINS

The Uluguru Mountains are found within Morogoro Rural District (majority), Mvomero District and Morogoro Municipality – all within Morogoro Region. The main Uluguru Mountains is a ridge running approximately north-south and rising to 2,630 m altitude at their highest point. The greater Ulugurus area also includes a number of isolated massifs surrounding the main block – Kitulangh'alo, Dindili, Mkumgwe, Mindu and NguruyaNdege. (Malimbwi et al 2005). The Uluguru range contains 7 Forest Reserves supporting Eastern Arc forest habitats within Morogoro Rural District (Uluguru North, Uluguru South, Kasanga, Mkangala, Mlaliwila, Ngambaula, Tongeniriver). Within Mvomero District an additional 5 Forest Reserves are found on the main Uluguru ridge (Bunduki IV, Bunduki VI, Bunduki VI, Bunduki I-III, Shikurufumi), which cover around 280 ha.

Formerly the Uluguru Nature Reserve (UNR) was managed by the Morogoro Regional Catchments Forest Project. It is classified as protected area whereby timber harvesting and other human activities are not allowed. The process to establish UNR started in 2004 with the support from the Conservation and Management of Eastern Arc Mountain Forests (CMEAMF) Project. The UNR is declared as the Nature Reserve in the Government Notice No. 296 of 7/11/2008. It covers 24,115.09 hectare and is comprised of the former Uluguru North Forest Reserve, Uluguru South Forest Reserve, Bunduki I and II Forest Reserves and Bunduki gap/corridor. Its owned by the Central Government through Forestry and Beekeeping Division of the Ministry of Natural Resources and Tourism (MNRT).

Uluguru Nature Reserve is surrounded by 57 villages with a total population of 91,426 (MPUNR 2008).The main ethnic group is waluguru, who constitute approximately 80 % of the entire population. Other ethnic groups include Wapogoro, Wandamba, Wahehe, Wanyakyusa, Wabena, Wazigua, Wasukuma, and Wakaguru. Population differs from one village to another due to moving from one village to other in searching for agricultural land, searching for employment, due to marriage and transfers. Statistics on population shows that some villages such as Mgeta and Bunduki are highly populated. For example, population density on the slopes of the Uluguru is over 159 persons per square kilometer with population increase range of 2.8% to 6.5% to the district population density which is 22.5% in the year 2002.

Almost 57 villages touch the Nature reserve boundary. The UNR is an Eastern Arc type of forest with species of restricted distributions and endemism. With the exception of rock outcrops, the UNR consists sub montane (below 1500m a.s.l), montane (above1600-2400m a.s.l) and upper montane (above 2400m a.s.l) forests. Also there are interesting features such as the upland grassland with swampy areas called Lukwangule plateau, and Kimhandu and Lupanga peaks. These features attract local and foreign tourists. However, some areas of the UNR are inaccessible due to steep rocky outcrops. UNR is endowed with many rivers namely, Ruvu, Mgeta, Morogoro, Tangeni, Mfizigo, Mmanga, Mzinga, Ngerengere, Mvuha, Mbezi, Mngazi, Bigwa, Kilakala, Bamba and Kikundi Rivers. All rivers provide water to the local communities where as Ruvu River also supplies water to Dar es Salaam, Coast and Morogoro Regions used for both domestic and industrial purposes.

The main threats to the Uluguru Mountains are fires that spread from farmlands and into the forest, intensive fire wood collection in higher, colder and more densely populated areas, deforestation of unprotected forests (in the north), encroachment into the reserves in the south, and the presence of invasive species (*Rubus* in the south and *Maesopsis* in the north).

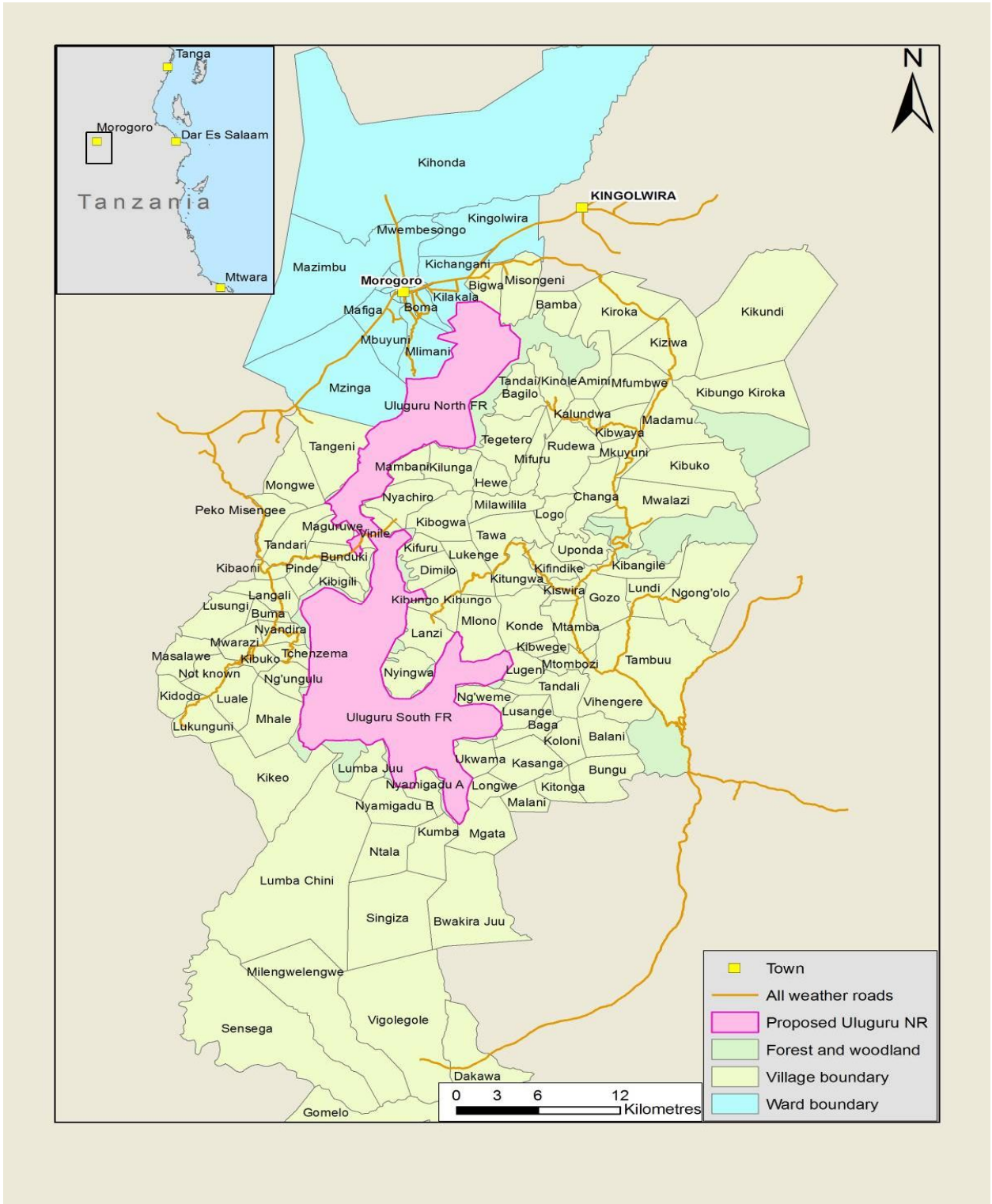



Figure 2.2 : **Detailed villages adjacent to UNR (Source: Chamshama *et al.* 2008)**

The mode of farming is different in regards to the aspect of the Uluguru Mountains. On the western side, which includes villages such as Bunduki, Vinile, Tchenzema and others, cultivation is mainly by use of terraces and intensive vegetable production. Most people in this part of the Uluguru Mountains are also involved in animal husbandry. On the eastern side, which includes villages such as KibungoJuu, Lanzi and others, cultivation is mainly without use of terraces with intensive production of banana and fruits. This area receives heavy rainfall and has fertile land which promise higher returns than other areas, though road network have continued to be a problem. But these villages now have been motivated to use terraces due to steep slopes that cause low yields of crops.

Livestock keeping is not a major economic activity to communities around UNR. The Waluguru are said to have no culture of keeping cattle together with use of related technologies such as oxen ploughs. Domesticated animals include goats, sheep, pigs, chickens and rabbits. The keeping of dairy goats in the Uluguru (especially Nyandira area) had been promoted mainly by Uluguru Mountains Agricultural Development Project (UMADEP)

Through various project interventions, residents of Uluguru have planted different tree species for purposes of meeting different needs related to forests. The main forest products used by the local communities include timber, poles, withies, and ropes, fuel wood, charcoal and medicinal plants. Others include honey, wild fruits, thatch grass, wild birds, bush meat, wild vegetables, insects, mushrooms and roots/tubers. These products are utilized at different level of intensity

The UNR is surrounded by farmers who cultivate maize, potatoes, yams, bananas, beans, cassava, tomatoes, vegetable and fruits which are used as both food and cash crops. Land in the surrounding communities is customarily owned. However, substantial portion of these customarily owned lands is covered by *Eucalyptus* and *Cedrella* which reduce wood demand from the reserve although they are invasive species to the UNR. Agricultural practices are not environmental friendly though major parts of the land are found in steep slopes.

Local people surrounding the UNR do benefit from the forest through eco- tourism, collection of medicinal plants, firewood and wild vegetables. However, this is done under the supervision of staff from the reserve. Worshiping in sacred sites, visiting cemmentary places; visiting tour attraction sites as well as collection of water for domestic use are some of the prominent benefits that UNR offers to the local communities. This shows that the UNR adjacent communities to some extent depend on the UNR for their livelihood. For that matter therefore, there is a need of establishing modalities that would assist the UNR adjacent communities to live in harmony with the forests.

### 2.4.1 Interactions of Uluguru communities with forest conservation

The main activities of the local communities in the Uluguru Mountains are dryland and contour terrace agriculture, livestock, wage labour and a range of commercial activities. However the local communities adjacent to Uluguru forest depend indirectly on the forest products like wild animal, wild medicine, fire wood, building materials for their livelihoods which results into human-conservatives conflict since they are not allowed to enter the

forest as it's a reserved forest. However declining state of Tanzania's forests and their consequent increasing inability to provide either sufficient ecosystem services or livelihood opportunities brought the need of Participatory Forest Management (PFM) which was introduced in Tanzania in 2002. PFM is the community involvement in conserving the forest which will result in villagers being responsible for taking on the costs of protecting the forests, but losing their current *de facto* rights to collecting Non Timber Forest Products' (NTFP's) such as fuel wood and forest vegetables and fruits. Villagers are more likely to support community involvement in conservation if household benefits are linked to forest protection, households have continued access to forest resources, especially as forests regenerate, benefits to the village and individual households from the introduction of Community involvement are at least as great as the costs and if the benefits are shared appropriately and transparently among the nearby Communities and households (Lokina et al 2008).

Local Communities like Lanzi, Kibungo, Dimilo and Nyingwa which live near to the Uluguru forest may understand that they get greater benefits from well managed forests: directly through collection of timber and non-timber forest products, and indirectly from improved moisture levels. They may also recognize that well managed forests benefit people living further away, through the provision of water to distant cities; and in contributing to global biodiversity. But many villagers feel worse off as a result of the introduction of PFM because of their reduced access to forest (Lokina and Banga 2010). In order to improve livelihoods and reduce conflict and making the protection of the forest more sustainable and more equitable, Payment for environmental services (PES) as part of

a conservation paradigm that explicitly recognizes the need to bridge the interests of landowners and outside beneficiaries through compensation payments.

The principle behind the method is that the beneficiaries of the environmental services pay for the services that they receive to the land users who generate those services. In turn land users manage forest, reforest or implement other conservation-friendly resource management schemes that will ensure the sustainability of the environmental services that the beneficiaries receive.

PES schemes include carbon sink functions, watershed protection, and biodiversity. There are few examples in Africa at the moment, but PES has been discussed in relation to the Uluguru Mountains and their role in ensuring water supplies in the cities of Dar es Salaam and Morogoro in Tanzania, (Lokina and Robinson, 2009). PES compensates communities to change current land use practices, increase tree planting and conservation farming so that to improve conservation of the forest in the Mfizigo sub catchments which makes the Ruvu River. A total of 420 acreage in the Kibungo sub catchments is involved in the conservation activities which is 33% of the targeted land. As shown in Table 3, Nyingwa village is the largest of all in terms of the number of households as well as population wise. In this village about 50% (approximately 700 acreage) of total land area is targeted for conservation under the PES scheme. Communities are expected to benefits from this scheme through increased productivity as a results of improved farming techniques for example terracing (CARE, 2007).Therefore it is important to identify ways of securing benefit streams to household/individual so as to facilitate conservation of the forest and improve their livelihoods.

Table 2.2: Demography of the villages involved in the implementation of PES in conserving the Uluguru forest

| Village name | Household | Males | females | Total |
|---|---|---|---|---|
| **Kibungo** | **316** | **593** | **697** | **1290** |
| **Dimilo** | **234** | **511** | **542** | **1053** |
| **Lanzi** | **303** | **613** | **617** | **1284** |
| **Nyingwa** | **319** | **695** | **797** | **1492** |
| **Total** | **1586** | **2904** | **3393** | **6297** |

**Source; ward office;** All of the villages are in the Kibungojuu ward of Morogoro Rural District

# CHAPTER THREE

# LITERATURE REVIEW

## 3.1 Introduction

This section reviews ways in which poverty can be measured by looking at the monetary and non-monetary dimensions of poverty. First the review on theoretical literature on different measure of poverty and the Propensity Score Matching (PSM) as well as its limitations and potential data sources then the empirical literature but its worthy noting that there few studies conducted in this area.

## 3.2 Theoretical literature

### 3.2.1 Poverty

Poverty is a complex concept. It entails a complex interconnection of descriptors surrounding the livelihood status of people in communities. According to the World Summit for Social Development held in Copenhagen in 1995 "Poverty has various manifestations including lack of income and productive resources sufficient to ensure sustainable livelihoods; hunger and malnutrition; ill health; limited or lack of access to education and other basic services; increased morbidity and mortality from illness; homelessness and inadequate housing; unsafe environments; and social discrimination and exclusion. It is also characterized by lack of participation in decision making and in civil, social and cultural life"

Poverty is multidimensional but specific to a location and a social group. However the striking common features in the experience of poverty is that poor people's lives are

characterized by powerlessness and noiselessness which constrain the people's choice and define the relationship and influence they are able to make with institutions in their environment. The prevalence of diseases related to hunger and malnutrition is high in coastal villages, and the problem becomes more serious during the 'hunger' months which are the period of cultivation. Food insecurity becomes particularly intense in times of natural disasters. Intra-household differences in access to food exist; they take the form of differences in variety, quality, quantity and frequency of food intake. Combating poverty is high on the agenda of governments and the international community. In September 2000, 189 nations committed themselves to work towards the Millennium Development Goals (MDGs), a set of 8 goals aimed at halving the number of people living in poverty by 2015.

Tanzania signed up to the Millennium Development Goals (MDGs). The First MDG commits Tanzania to reduce poverty between 1990 and 2015 by 50%. In 1991/92 poverty was 38% in Tanzania, so the objective was to reduce poverty to 19% by 2015 (Development Partner Group, 2008). However, surveys carried out by the NBS showed the absence of any noticeable poverty reduction. Between 2001 and 2007 the fraction of poor people in Tanzania declined very little (NBS 2001; 2007). The decline was so small that it is not possible to say with a high degree of certainty whether poverty actually went down, or whether it remained unchanged.

Table 3.1 Poverty Incidence Since 1991

| | 1991 | 2001 | 2007 |
|---|---|---|---|
| **Dar es Salaam** | 28.1 | 17.6 | 16 |
| **Other Urban** | 28.7 | 25.8 | 24.2 |
| **Rural** | 40.8 | 38.6 | 37.4 |
| **Tanzania Mainland** | 38.6 | 35.6 | 33.4 |

**Source**: **National Bureau of Statistics 2001 and 2007**

To capture the effect of PES in poverty alleviation the study compares two groups those participating in the program and those not participating using the propensity score (PS) technique, introduced in the 1980's (Rosenbaum and Rubin,1983) and has its roots in a conceptual framework which dates back even further (Rubin, 1987).

Its simplistic approach to estimating the programme effect would be to compare the outcome of programme participants with those of non-participants. This would be a valid approach were those participating in the programme a random sample of all those eligible.

PSM use quasi experimental methods which selects project beneficiaries and non-beneficiaries who are as similar as possible in terms of observable characteristics expected to affect project participation as well as outcomes. The difference in outcomes between the two matched groups can be interpreted as the impact of the project on the beneficiaries (Smith and Todd, 2001).

The key assumption made in PSM is that selection into a programme can be captured with observable data that are available to the evaluator. This is known at the Conditional Independence Assumption (CIA) (Heckman and Hotz 1989). For this identifying

assumption to be plausible, one must be able to control for all characteristics affecting both participation and the outcome of interest. In our case we are looking at the effect of participation in PES in conserving the forest if it has helped to reduce poverty.

Trojano (2007) Propensity score methods are increasingly being used in observational studies in which, baseline characteristics differ between the exposed and unexposed groups; exposure is relatively common; the number of measured characteristics or potential confounders is relatively large; and the number of events is relatively small. The choice of propensity score matching over regression analysis methods is that, PSM does not make linear functional form assumption that regression does and PSM addresses common support problem in a way regression does not. (Dehejia and Wahba, 1998).

Rosenbaum and Rubin (1983) demonstrate that the propensity score captures all of the variance in the covariates relevant for adjusting between-group comparisons. As a result, one can simply match the two (or more) groups based on this single variable. Propensity Score Matching can be implemented in the form of probability weights for use in analyses of treatment and outcomes.

IFPRI (2008) used PSM to estimate the Average impact of treatment on the treated (ATT) for impacts of the Fadama II project on household productive assets, incomes, and indicators of access to rural infrastructure and impacts of this. The PSM method matches project beneficiaries with comparable non-beneficiaries using a Propensity Score, which is the estimated probability of being included in the project. Only beneficiaries and non-

beneficiaries with comparable propensity scores are used to estimate the ATT. Those who do not have comparable propensity scores are dropped from the comparison groups.

In doing matching different approaches are used to match participants and nonparticipant on the basis of PS, which include nearest-neighbor (NN) matching, caliper and radius matching, stratification and interval matching and kernel matching and local linear matching (LLM). PSM is useful only when observed characteristics are believed to affect program participation.

The main advantage of PSM relies on the degree to which observed characteristics drive program participation. It also doesn't necessarily require a baseline or panel survey although in the resulting cross section, the observed covariates entering the logit model for the PS would have to satisfy the conditional independence assumption by reflecting observed characteristics X that are not affected by participation. It imposes few constrains on the treatment model and few assumptions about the distribution of the error term.

### 3.3 Empirical literature

Studies undertaken in America(Costa Rica, Mexico, Brazil, El Salvador and New York) by Rosa et al, (2003) on the compensation for environmental services and rural communities found that Compensation for environmental services is not a cure-all for rural poverty and environmental degradation and that PES schemes can be valuable for diversifying livelihood strategies and improving natural resource management. In order to reduce poverty PES schemes need to be part of wider strategies that expand and defend the whole basket of assets in the hands of the poor; otherwise, they could fail to benefit the poor, or

even have adverse effects on them. Under the right conditions, PES schemes focusing on poor, rural communities can help to address both.

Tacconi, et al (2009), undertook a study in assessing the livelihood impacts of payments for environmental services scheme that involved communities in the implementation of REDD which have several benefits. It is established that PES is likely to reduce transaction costs (which have been found to be a major barrier to the participation of the poorest in PES activities, building on local community institutions and supporting new ones would strengthen social capital, thus increasing the resilience of the community and by supporting community infrastructure and services, it would establish longer lasting foundations for the improvements of local livelihoods than simply providing monetary income that in some cases is rapidly dissipated.

Hope et al.,(2005) conducted a survey on if payment for environmental services contributed to poverty reduction in small-scale land owners in the upper water catchment area of a tropical Montane cloud forest in the northern Tilaràn range of Costa Rica. The study findings suggested that programme design and impacts may be improved by clarification of resource claims and environmental service provision rights, and simplifying programme goals to defensible biophysical and/or socio-economic criteria.

A study by Theresia. (2006) to determine the extent to which ecotourism has improved the livelihood of rural people and conservation of forest resources on Uluguru mountains, found out \that majority of the people about 81.4% benefited directly and indirectly. Some benefits were income, improvement of infrastructure and provision of social services. The

major conclusion of the study is that ecotourism development in the study area has managed to improve local communities' livelihood by increasing their income and has contributed to the conservation of the forest thus reducing degradation of the forest.

Lokina and Robinson, (2009) and Robinson and Lokina (2010), while assessing the effectiveness of the participatory forest management, in two regions of Tanzania found that though there was evidence to support improved forest cover where PFM was implemented, there was no sufficient evidence to support improving the livelihood of the forest adjacent communities.

Mkenda (2007) assessed the extent to which marine parks improve household welfare and reduce poverty in the Tanzanian coastal areas. Household survey data was collected from 24 villages along the coast of Tanzania mainland and Zanzibar. To achieve its objective, the study employed the axiomatically preferred poverty indices to assess relative poverty between villages currently in the marine parks and those outside the marine parks. In estimating the poverty indices the study used data from household consumption collected through the administration of questionnaires to randomly selected households in each 24 villages involved in the study. The study found out that, poverty was quite high and widespread in all the villages and there was no notable difference in poverty between the villages in the marine park and the one outside the marine park in Mafia (Mkenda, 2007).

A study by Gervas (2010) on the impact of MACEMP project in Mafia district towards reducing poverty. Four types of analysis were employed, Principal Component Analysis (PCA), Descriptive analysis, ANOVA analysis and Logistic regression analysis. The study

revealed that there is a difference in welfare between households who are under the MACEMP project and those ones who are not under the project. From the PCA, the assessment showed that a big percentage of the households with lower index value fall under the non–supported group which is 70% of all households falling in poor category of the study area while from the supported group only 30% was found to fall under the poor category. For Logistic regression variables it was found that socio-economic and demographic variables to significantly contribute to the less likely to fall under poor category. Logistic results confirm that MACEMP project has impact in Mafia community. It was also proved using the ANOVA analysis that the existing difference in poverty status was the result of the existence of the project in the study area. Therefore, from the perceptions of the households, it was found the households are satisfied by the efforts of the MACEMP project on the coastal and marine management.

A study by Ellis (1999) examined the livelihood diversification as a survival strategy of rural household in developing countries. This study was undertaken in light of the increasing awareness of livelihood diversification in approaches to rural development, in order to consider the interactions among diversification and poverty, farm productivity, natural resource management and gender relations in rural areas; and to advance the policy understanding of diverse rural livelihoods. The study found out that the diversity of livelihoods is an important feature of rural survival but often overlooked by the architects of policy. Diversity is closely allied to flexibility, resilience and stability. In this sense, diverse livelihood systems are less vulnerable than undiversified ones; they are also likely to prove more sustainable over time precisely because they allow for positive adaptation to

changing circumstances. The researcher suggested that practical applications of the sustainable livelihood framework need to place diversity high on the policy, agenda; it is well to recognize that the benefits of diversity are context specific. These distinctions reveal that policies aimed to achieve more resilient or more sustainable rural livelihoods need to recognize not just the positive attributes of diversity for achieving those ends, but also distinctions about the differing nature of that diversity between individual's households and larger social or economic arenas.

# CHAPTER FOUR

# METHODOLOGY

## 4.1 Sampling strategy

A purposive sampling of the villages of Morogoro Rural district was done to households adjacent to the Uluguru Mountains and those which are involved in the PES project. A total of 57 villages are found in the Uluguru Mountains some being involved in the program. Household were randomly sampled from KibungoJuu Ward in four selected villages of Lanzi, Nyingwa, Dimilo and Kibungo to ensure adequate representation of the villages. Selection of household for the study was done to ensure representativeness i.e. having mixed kind of respondents in terms of age composition, gender, economic status, harvesting and use of resources, economic activities etc. In each selected household, a head of household or elder member of the household was interviewed using a structured questionnaire

### 4.1.1 Sample Size and Composition

The study covers 200 respondents, of which 100 (or 50%) comprise of the treatment group and 100 (or 50%) of the comparison group. Poverty status of these two groups was examined to find out if there is any difference on welfare status between the supported and not supported groups. Table 6 below shows the composition of the sampled villages and group members (participants and Non participants) from Kibungo, Lanzi, Dimilo and Nyingwa (study areas) in Morogoro rural district

**Table 4.1 Sample Composition**

| Village | Treatment Group | % | Control Group | % | Total | % |
|---|---|---|---|---|---|---|
| **Kibungo** | 25 | 25 | 25 | 25 | 50 | 25 |
| **Nyingwa** | 25 | 25 | 25 | 25 | 50 | 25 |
| **Dimilo** | 25 | 25 | 25 | 25 | 50 | 25 |
| **Lanzi** | 25 | 25 | 25 | 25 | 50 | 25 |
| **Total** | **100** | **100** | **100** | **100** | **200** | **100** |

**Source: Author's Computation (2012)**

### 4.1.2 Primary Data

In this study the primary data collection was done using questionnaires to the sampled population in the study area. The questionnaire aimed at collecting, among others, data on household size and composition; length of residence in Uluguru and place of origin, Education level of household head, Equipment owned by the household (tools, transport, etc.), level of cash income, Livestock ownership, Land area (total, and farmed); main livelihood activities (e.g. farming, livestock, business, employment, remittances), and their perceived relative importance to the household, income from involvement in PES project. For each of main livelihood activities, annual production, proportion sold and home consumption; relative importance of different livelihood sources (including forest product) over the year, cost of wild animal damage to crops (if any), livestock, etc.

The focus group discussions was held to collect information of a generally applicable nature, e.g. on seasonality, markets and prices. Other information collected includes agricultural practices and the corresponding prices. The study also collected community/village level data. The aim of collecting village level data was to get general data at high level which form the basis for validation of information from individual

respondents. The village data collected include main economic activities, population data, available facilities such health, schools, extension services, environmental management practices, general welfare of communities etc.

### 4.1.3 Secondary data

Secondary data were collected from different sources, including ; Resource Economic Analysis of Catchment Forest Reserves in Tanzania; Economic Surveys; Tanzania National Forestry Policy Document; Tanzania Forest Conservation and Management Project; Morogoro Economic Profile, The Uluguru Catchment Baseline study, WWF annual reports, Ministry of Natural resources and Tourism, National Bureau of statistics and among others.

### 4.1.4 Field Observations

In order to verify the information collected with other sources of data, the field/physical observation was applied. From the field observation it was found that, in 4 years of the EPWS project in Kibungo Juu, the project has managed to train Farmers on improved land use and agronomic practices in the communities. About 14 farmers (10 males, 4 females) were trained on proper utilization of stabilizer planting materials and crop production (spacing and use of manure). Also, the farmers were trained on proper harvesting by leaving all trashes in the field for decomposition and record keeping for harvested products and sales. It was also observed that in all four villages in spite of being assisted with EPWS or not, some households are still living in poor houses and others not being able to afford 3 meals per day.

## 4.2 Propensity Score Matching

In an attempt to obtain an estimate of the impact of PES, in comparing the outcome of the treated individuals with that a similar control group we make use of Propensity Score Matching (PSM) which will be used since observed characteristics are believed to affect program participation.

Since it's a single treatment then Logit model will be more appropriate to calculate Propensity Score (PS). Let $P_i$ represent the probability of a person participating in the program and $1 - P_i$ is the probability of the person not participating. And we have the outcome $1$ if the person participates and $0$ if he does not, then we have the following.

$$\Pr(Y_i = 1) = P_i \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 4.1$$

$$\Pr(Y_i = 0) = 1 - P_i \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 4.2$$

The probability of a person to participate is given as

$$P_i = E(Y = 1 \mid X) = \frac{e^{(\beta_0 + \beta' X)}}{1 + e^{(\beta_0 + \beta' X)}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 4.3$$

Where, X is a vector of independent variables and β is a vector of their respective coefficients.

For ease of expression and understanding, equation 4.3 is thus simplified

$$\text{as } P_i = E(Y = 1 \mid X) = \frac{e^{(\beta_0 + \beta' X)}}{1 + e^{(\beta_0 + \beta' X)}} = \Lambda(\mathbf{x}, \beta) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 4.4$$

Notation $\Lambda(\mathbf{x}, \beta)$ indicate the logistic cumulative distribution function.

The probability therefore of a person not to participate can thus be given as

$$(1 - P_i) = E(Y = 0 \mid X) = \frac{1}{1 + e^{(\beta_0 + \beta' X)}} = \Lambda(\mathbf{x}, \beta) \quad \text{.....4.5}$$

The logistic distribution (Logit) always gives larger probabilities to Y=0 when **x** β is extremely small and smaller probabilities to Y=0when β **x** is very large. This is fairly different to the normal distribution (Probit).

It is noted from equations above that $P_i$ranges from0 to 1 and is non-linearly related not

only to the regressors but also to the parameters thereby causing some estimation problems in as far as ordinary least squares (OLS) estimation technique is concerned. Due to non linearity which will lead to estimation problem then we can reformulate these equations in terms of the odds ratio of the probability of the person to participate to the probability of the person not participate. And this equation will be as follows:

$$\left(\frac{P_i}{1 - P_i}\right) = \frac{1 + e^{(\beta_0 + \beta' X)}}{1 + e^{-(\beta_0 + \beta' X)}} \quad \text{.....4.6}$$

Where $\left(\frac{P_i}{1-P_i}\right)$ is simply the odds ratio in favor of a person who participate and can thus be simplified as follows:

$$\left(\frac{P_i}{1 - P_i}\right) = e^{(\beta_0 + \beta' X)} \quad \text{.....4.7}$$

Then we take the natural logarithms of the equation to get the Logit model and it can be observed that the log of the odds ratio is not only linear in $X$ ,but also in the parameters $\beta$;

$$\ln\left(\frac{p_i}{1-P_i}\right) = L_i = \beta_0 + \beta' X \quad \text{.....4.8}$$

The interpretation of Logit as odds-ratio is an attractive feature of Logit model. Since Logit gives log of the odds and that is the reason for the Logit estimates sometimes to be referred as log-odds estimates. Therefore odds ratio can be calculated simply by exponentiation the Logit estimates. Interpretation of odds ratio depends on whether the coefficients are greater, less or equal to $1$. Expressed in this way, it is a little easier to see what is going on with the odds ratio. When the probability of a one ("*success*") is less than the probability of a $0$ ("*failure*"), then the odds ratio will be less than$1$. When the probability of a one is greater than the probability of a 0, the odds ratio will be greater than 1. When the odds ratio is exactly 1, this says the odds of success and failure is even. Therefore when interpreting an odds ratio, if the value is greater than 1 then any change in variable will favor success and when the coefficient is less than 1 then any change in variable will favor failure. Also in interpreting odds ratio it is often helpful to look at how much it deviate from 1.

Any standard probability model can be used to estimate the propensity score. On the other hand, a variable should only be excluded from analysis if there is consensus that the variable is either unrelated to the outcome or not a proper covariate. If there are doubts

about these two points, Rubin and Thomas (1996) recommend to include the relevant variables in the propensity score estimation.

When using all the available covariates, bias arises from selecting a wide bandwidth in response to the weakness of the common support, using a lower number of covariates, common support is not a problem but the plausibility of the confoundedness assumption is. Moreover, this trade-of also affects the estimated standard errors, which are smaller for the minimal specification where the common support condition poses no problem. Finally, checking the matching quality can also help to determine the propensity score specification.

After the $PS$ equation is estimated the predicted values of participating from participation

equation are obtained. The region of common support is defined where distributions of PS for treatment and comparison group overlap. We use the kernel and local linear matching for matching the participants and non participants since with the other methods only a small subset of nonparticipants will ultimately satisfy the criteria to fall within the common support and thus construct the counterfactual outcome. With kernel and Local Linear Matching (LLM) use a weighted average of all nonparticipants to construct the counterfactual match for each participant.

If $P_i$ is the $PS$ score for participant I and $P_j$is $PS$ of nonparticipant$j$, the weights for Kernel

matching are given by;

$$\omega(i,j)_{KM} = \frac{K\left(\frac{P_j - P_i}{a_n}\right)}{\sum_{k \epsilon c} K\left(\frac{P_k - P_i}{a_n}\right)}$$

K (.) is a kernel function and $a_n$ is a bandwidth parameter. Kernel matching is analogous to regression on a constant term whereas LLM uses a constant and slope term, so it is linear. LLM can include a faster rate of convergence near boundary points (Fan 1992, 1993).

The nearest neighbor matching is used to be precise with Kernel, $NN$ match treated and control units taking each treated unit and searching for the control unit with the closest propensity score; i.e, the Nearest Neighbor. Although it is not necessary, the method is usually applied with replacement, in the sense that a control unit can be a best match for more than one treated unit.

The formula for of the $NN$ matching estimator is:

$$ATT^{NN} = \frac{1}{N^T \sum_{i=wi=1} \left[ Y_i{}^{obs} - \sum_{j \in C(i)M} W_{ij} Y_j^{obs} \right]}$$

$N_T$ is the number of observations in the treated group

$N_i^C$ is the number of controls matched with treated observation i

$W_{ij}$ is equal to $\frac{1}{N_i^P}$ if **j** is a control units of i, and zero otherwise

The basic idea behind propensity score matching (PSM) is to match each participant with an identical nonparticipant and then measure the average difference in the outcome variable between the participants and the nonparticipants. Propensity score matching is 'data hungry' not only in terms of the number of variables required to estimate participation and outcomes, but also in the number of participants and non-participants entering the matching process

Conditional independence is a strong assumption and is not a directly testable criterion it depends on specific features of the program itself. If unobserved characteristics determine program participation, conditional independence will be violated and PSM will not be an appropriate method.

By using the asset index, the socioeconomic status of the households was categorized into two groups, that is poor and non poor and the two categories were given the value of 0 and 1 consecutively. This categorization is basing on the NBS 2001 and 2007 rural poverty incidence which was 38.5%. Furthermore the project impact was analyzed by looking on the economic difference between the participants and non-participants groups. From there the significance of the socioeconomic status was tested with ANOVA analysis. This was done to find out if the difference was the results of the project or was to be there even without the establishment of the PES project

# CHAPTER FIVE
# MAJOR FINDINGS AND INTERPRETATION

## 5.1 Introduction

This chapter presents results and discussion from the study area. This study has employed the Propensity Score Matching (PSM) in assessing the poverty status of households between the participating group of the EPWS project and non–participant group.

## 5.2 Descriptive Analysis

In this section data is described to see their behavior before undertaking PS analysis. This will help to understand the nature of the sample data collected. Data was collected from four villages in Kibungo Juu ward found in Morogoro rural district for participants and non participants in PES activities. A total sample size of 200 households, 50 from each of the four villages, was randomly selected. A head of household or a single person involved decision making of the household was interviewed. From the sample data collected 44% and 55% of the respondents are females and males respectively. The mean age of respondents was 39 years old and the majority of these could read and write, as about 76% completed primary education. The average household size in Kibungo Juu ward is 5.2 which is relatively less than the national average of 6 household members (HBS 2007). Table 5.1 provides the summary of the population of the surveyed village and the sampling.

**Table 5.1 Overview of surveyed villages**

| Village | Population | No of HHs | Surveyed HHs | Share interviewed |
|---|---|---|---|---|
| Nyingwa | 1492 | 319 | 50 | 15% |
| Dimilo | 1053 | 234 | 50 | 21% |
| Lanzi | 1284 | 303 | 50 | 16% |
| kibungo | 1290 | 316 | 50 | 15% |

**Source**: Ward office

The sample was randomly selected and all the respondents surveyed were aware of PES but not everyone participated due to factors like sickness, some decided not getting involved, some were busy with family activities, some had family problems that prevented them from participating. It was also observed that some didn't understand the benefits of the PES. From the sample it was found that about 42% participated immediately when the program started 8% joined later and 50% didn't not participate at all (non-participants).

It is hypothesized that the factors that mainly determined participating in the program are ownership of land, the respondent's age, the education level, their gender, the household size and the consumption expenditure. It is important to note that the participation into the program is voluntary. Table 5.2 gives the mean value of the variables determining ones participation.

**Table 5.2 Summary of descriptive Statistics of the variables used in the analysis**

| Variable | Description | Mean | Std. dev | Min | max |
|---|---|---|---|---|---|
| Age | Actual age of respondent in years | 39.83 | 13.78 | 17 | 83 |
| Education | Education level of the respondent; 1=professional and above, 0 otherwise | 0.89 | 0.31 | 0 | 1 |
| Household Size | Number of households | 5.26 | 3.09 | 1 | 21 |
| Gender | 1=Male; 0=Female | 0.55 | 0.49 | 0 | 1 |
| Cons. Expenditure | Household consumption expenditure in Tshs | 6985 | 2622.78 | 2000 | 14000 |
| Land | Size of Agriculture land owned by the respondent in acres | 2.87 | 3.69 | 0.5 | 40 |
| Marital Status | Marital status of the respondent;1=married, 0 otherwise | .55 | .49 | 0 | 1 |
| Assets Owned | Number of assets owned by the household | 12.94 | 1.355 | 9.8 | 18.93 |
| Years Lived in the Village | Number of years lived in the village by the household | 30.115 | 17.03 | 1 | 83 |
| Food Security | measured by number of meals per day | 2.29 | 0.63 | 1 | 4 |
| Welfare | perception of household after 2008 | 2.21 | 0.89 | 1 | 3 |
| Participation into PES | Households participation in PES activities; 1=Yes,0=No | 0.5 | 0.50 | 0 | 1 |
| Forest Product | Households commonly harvested forest products; 1= food products, 0=non-food products | 0.22 | 0.41 | 0 | 1 |
| Change in Plot Ownership Size | Amount of plot that has increased due to PES | 0.89 | 0.313 | 0 | 1 |
| Number of Years Owned the Plot | Number years the household owned the plot | 16.3 | 15.86 | 1 | 82 |
| Type of Land Tenure (Titled) | Households legal title or ownership rights for the plot of land | 4.22 | 1.20 | 1 | 5 |

## 5.3 Quantitative Results

### 5.3.1 Social Economics and Livelihood Data

Based on the survey, the socio-economic characteristics of the households in KibungoJuu community were analyzed specifically on the villages supported by the PES project to assess the impact of the projects on sustainable livelihood. Main characteristics of interest are those related with livelihood assets possessed by household members and therefore are for the household as whole. Three types of livelihoods assets are distinguished, these are physical, human and social assets are included in the analysis.

### 5.3.2 Housing and asset

The well-being of the households was also recorded using information about the type and quality of the houses people lived in. More than 35% of all households' main dwelling was made out of poles and mud and more than 40% had grass-thatched roofs. The households claimed to have better quality houses compared to those they had before PES, as it was easy to obtain building materials from the trees they planted. The participating group was seen to have better housing, as more than 60% of their houses were built from permanent materials while non-participants had houses made mostly of poles and grass-thatched roofs. This showed a significant difference between the two groups. Figures 5.1.1 and 5.1.2 summarize the details.

**Figure 5.1.1 Building Materials for the Walls of Household's Main Dwelling**

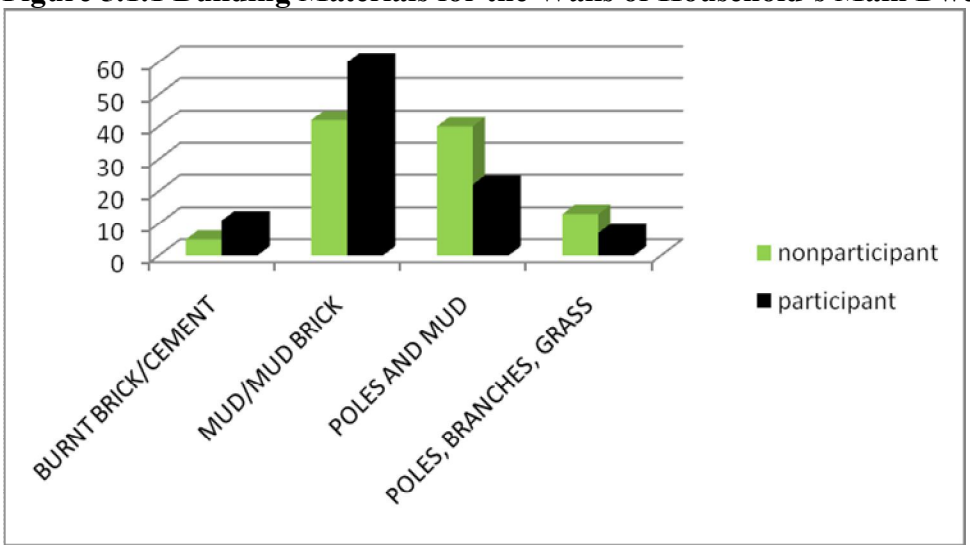
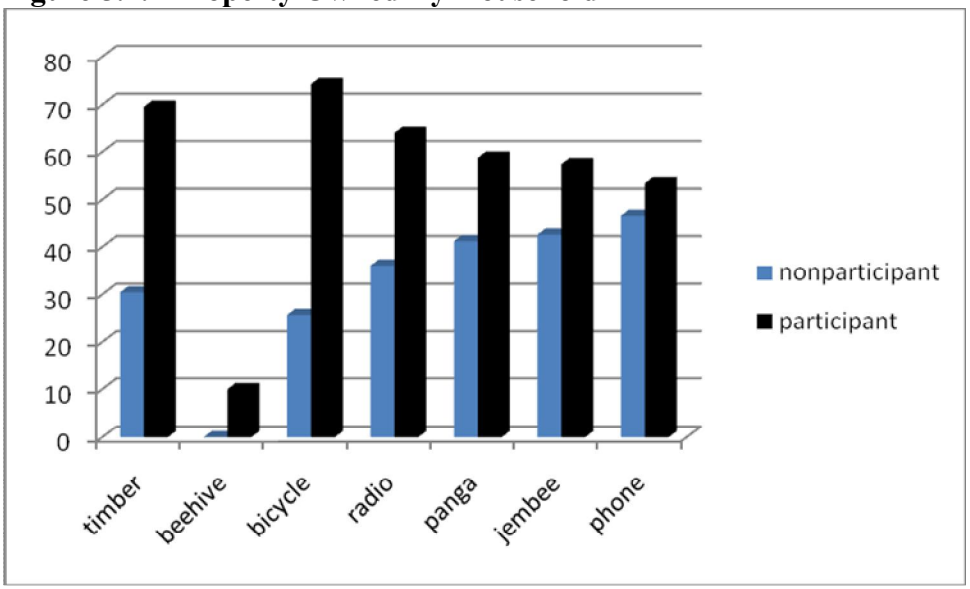



Figure 5.1.1 shows that participating household has more houses made of burnet/cement brick compared with those of non-participant. Although the difference seem to be significant, but there are indications that their involvement in the PES initiative it has improved their wealth status. There are also significant decrease in the number of houses made of poles and mud as well as branches and grass. This is important achievement of the program.

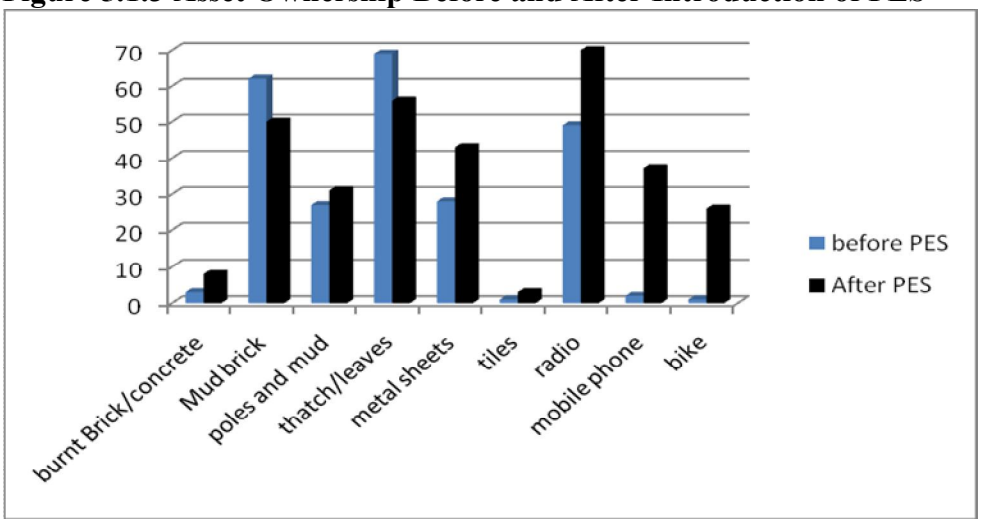
**Figure 5.1.2 Property Owned By Household**



Of significant improvement is the diversification of household income as can be shown in Figure 5.1.2. One of the advocated benefits of forest conservation is to make the household use of the forest to improve their welfare. As seen in Figure 5.1.2 with PES there are significant increase in the number of household with beehives, the increase is almost from none to about 10 households. This is a clear demonstration of the efforts to diversify the household income, which is important in the sustainability of the PES initiative. Field observation further indicates that majority of the households owning bicycles are using them as business investment, thus generating employment to the youth as well as income to the households. Hence refraining the youth from engaging into harvesting of forest for charcoal and timber.

Further the situation before and after the implementation of PES has a positive effect on the households as shown in Figure 5.1.3. There has been increase in the ownership assets like phones and bicycles compared to how it was before, the quality of the houses has also improved. This all shows a positive impact of the program to the households.

**Figure 5.1.3 Asset Ownership Before and After Introduction of PES**



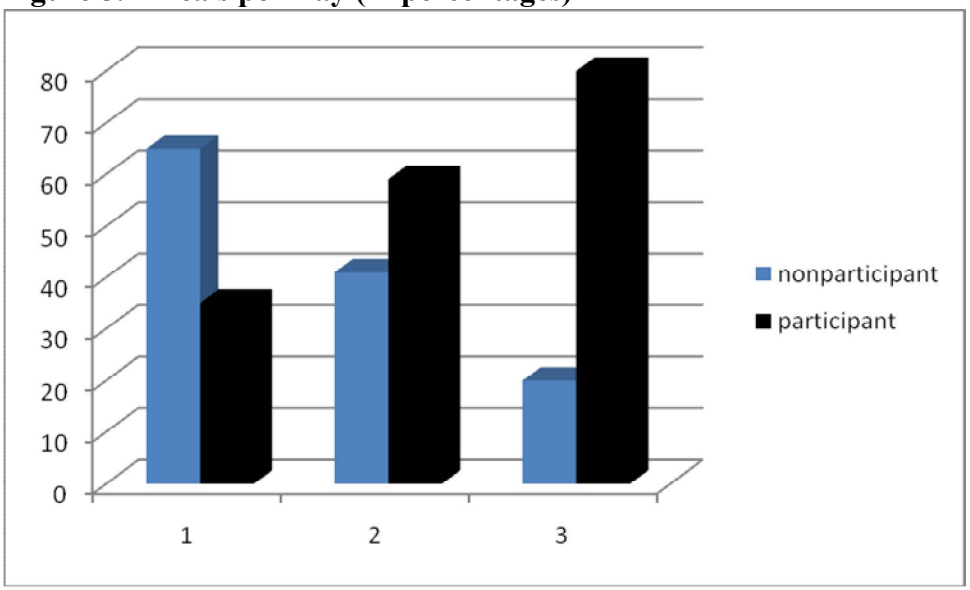
### 5.3. 3 Food Security

One way of assessing the welfare is by looking at the food security of the households because it is one of the important aspects of the household wellbeing.

#### 5.3.3.1 Meals per Day

In this case, households were asked to state the number of meals they can afford per day on average. The average number of meals at the household is three meals per day, any household having meals less than three is considered to be in the food insecurity category.

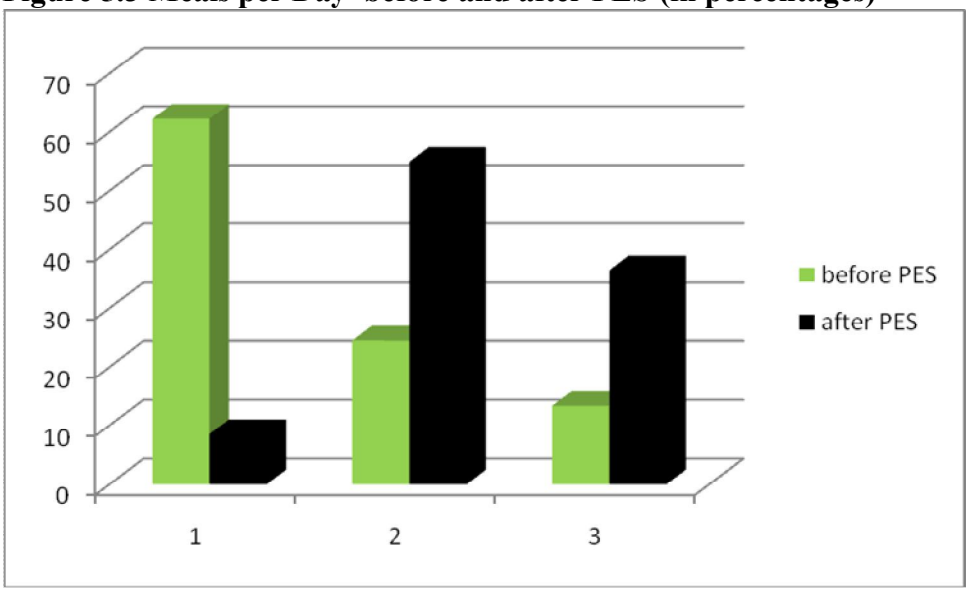
**Figure 5.2 Meals per Day (in percentages)**




From Figure 5.2, results indicate that people from the supported group are likely to afford 3 meals per day than those from the non–supported group. As shown in Figure 5.2, 76% of households from supported group can afford 3 meals. The overall results show that the percentages from the non–supported group increases toward the fewer meals while that of the supported group increases as the number of meals per day increases. More importantly,

these results suggest that the non–supported group is the ones that suffer more from food insecurity.

**Figure 5.3 Meals per Day before and after PES (in percentages)**




From Figure 5.3, results indicate the situation before and after PES on households' ability to afford 3 meals a day. The results indicate that 62% could afford only one meal a day before PES, whereas with PES, this proportion reduced to 13%, as more households could afford more than one meal a day. The proportion of households that could afford 3 meals a day increased from 13% before PES to 36% after PES. This can be attributed to the higher yields as a result of the households' training in better farming techniques, such as, contour farming and the use of manure, which made the farm land more fertile.

### .5.3.4 Consumption Patterns

Households were asked to show their consumption patterns in some selected foods which are: meat, fish, beans and milk consumption since it gives information on their spending for food per day. For the two groups the results are demonstrated in Table 5.3.

**Table 5.3 Consumption Patterns**

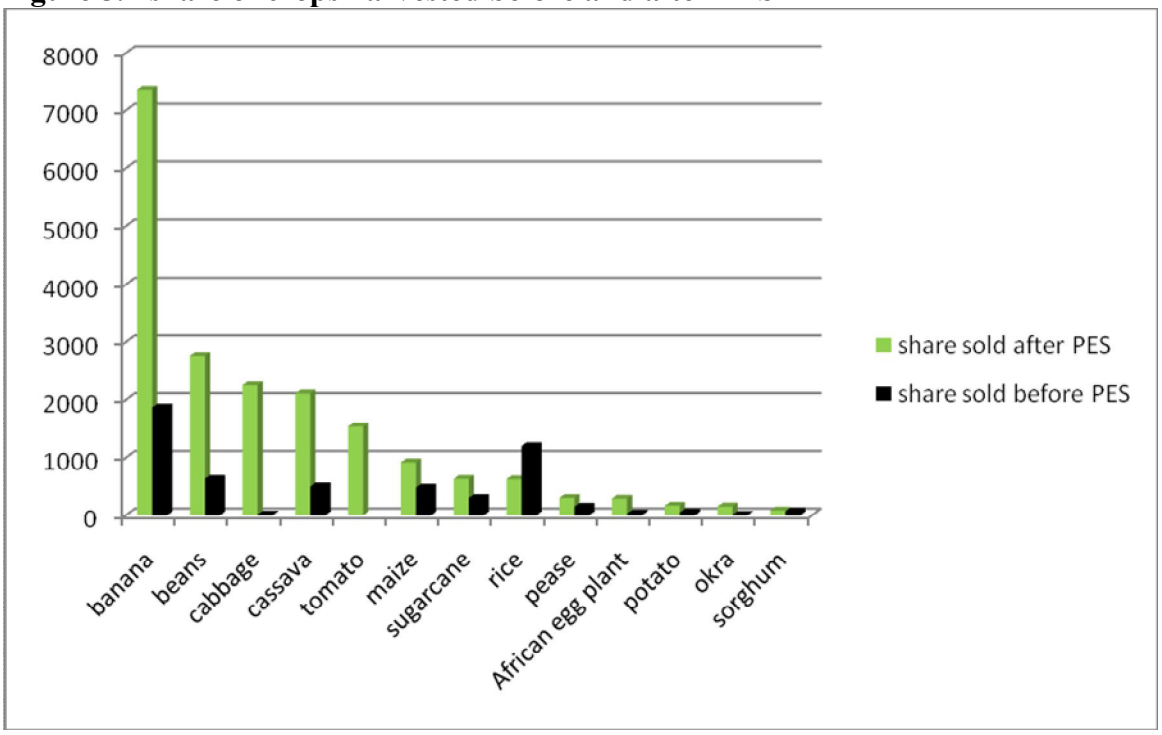
| | Participants | | Non-participant | |
|---|---|---|---|---|
| Variables | Mean | Std. Deviation | Mean | Std. Deviation |
| Meat consumption | 1.88 | 1,25 | 1.81 | 1.01 |
| Fish consumption | 1.47 | 0,83 | 1.33 | 0.88 |

In this question the households were required to mention the days they have been consuming meat and fish per week. In responding to this question it was found that 61.5% of the households ate meat for the past seven days and 27% ate fish for the past seven days. Also found that 55.5% of the households from the supported group ate fish for the past seven days and 44.4% of the not supported ate fish for seven days for the past seven days. Other percentages were taken with those who took meat and fish between 1 up to 6 days. These results suggest that, in the study area meat is the main source of protein. Results shows that there is no significant difference in consumption of meat between the two groups, and the consumption of meat is a bit high compared to that of fish. However there is a significant difference in consumption of the two types of food selected by the two groups.

### 5.3.5 Crop information

As can be seen in Figure 5.4 maize, bananas, beans, cabbage and cassava are grown by a majority of our respondents. Other crops like rice, tomato, maize and peas are also harvested by a fair share of farmers.

**Figure 5.4 share of crops harvested before and after PES**




As can also been seen from Figure 5.4, the share of the harvest that is sold varies considerably depending on the crop. From the figure we can see an increase the share of the crop sold compared to what was sold before PES started, this can be seen well in crops like bananas, beans, cabbage and cassava. There were also new crops grown like tomato, cabbage, African egg plant (*nyanyachungu*) and Okra (*bamia*). Based on the value of the

different crops, about half the harvest is sold, 10% farmed completely for subsistence and for 52% of respondents half the harvest was kept for food

If crops are sold, most households sell in the farm, as can be seen in Figure 5.4 although this is true for crops like cabbage and bananas, there is some variance depending on the crop. Beans and maize are mostly sold on the road side or directly to homes but bananas are also sold right at the local market with young men who carry baskets.

### 5.3.6 Perceptions

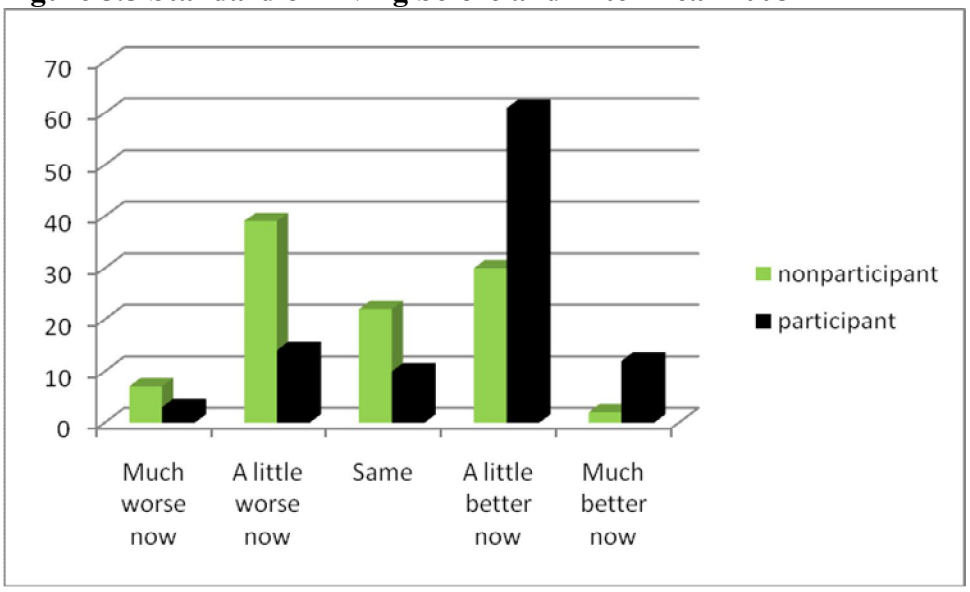
This section provides and discusses the results on how the households perceive their standard of living, size of the forest and availability of biodiversity. Here the respondents were asked to compare the mentioned situations by giving out their perception on the situations before and after the establishment of PES.

#### 5.3.6.1 Standard of Living Before and After Year 2008

Respondents were also interviewed on how they compare their household welfare after year 2008.The main intention for this was to look at how they perceive their standard of living after the establishment of the PES project. As noted earlier that the project started in 2008. Participants viewed to be better than they were before while majority of the nonparticipants said things are the same or had improved a bit. More than 67% of the participating group said their lives had improved compared to how it was before due to the increase in harvest of crops which increased the income and food. This was due to the improved farming techniques that they were taught like contour/terrace cultivation and the use of manure. But

on the contrary, only 29% respondents from the non–participating group agreed that the living standard is a little better now. See more results in Figure5.5)

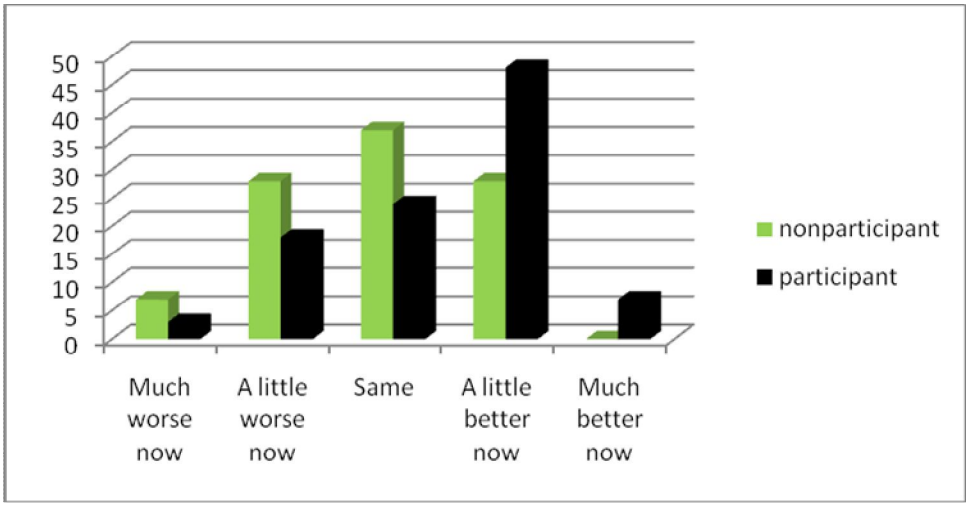
**Figure 5.5 Standard of Living before and After Year 2008**




### 5.3.6.2 Comparison of the Household's Standard of Living with Others in the Community

Furthermore, each household was also required to compare his or her living standard with other households in the community. In response to this question, the results points out that, respondents from the supported group perceive their standard of living as somehow good compared to other households in their community (See more results in Figure5.6).

**Figure 5.6 Comparison of the Household's Standard of Living with Others in the Community**




### 5.3.6.3 Perceived changes in the forest

Almost all respondents had witnessed changes in the forest and biodiversity over the past years. When asked to specify the changes on the quality and availability of resources in the village/community after the introduction of PES program in terms of the forest size, 68% said they were satisfied since there are restrictions in entering the forest while 31% said they were not satisfied with the situation. This tells that more people see the improvement of the forest size after the introduction PES activities in the communities**.** On the part of biodiversity in the forest 75% said they were satisfied with presence of wild animals in the forest 12% said that it had become harder to find forest products, Figures 5.7.1 and 5.7.2 summarizes the details. As can be seen from the figure majority of the respondent are satisfied with the improved forest cover as a result of PES program. Respondents at Nyingwa were more satisfied with the improved forest cover compared with other villages where nearly 40% agreed that there is a huge improvement due to PES

**Figure 5.7.1Size of the forest after the introduction of PES program**

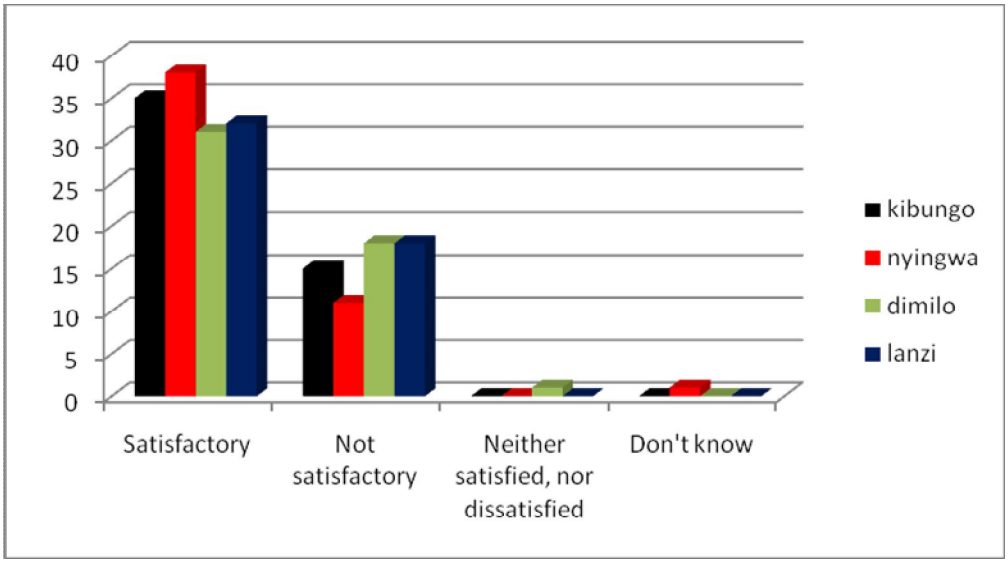
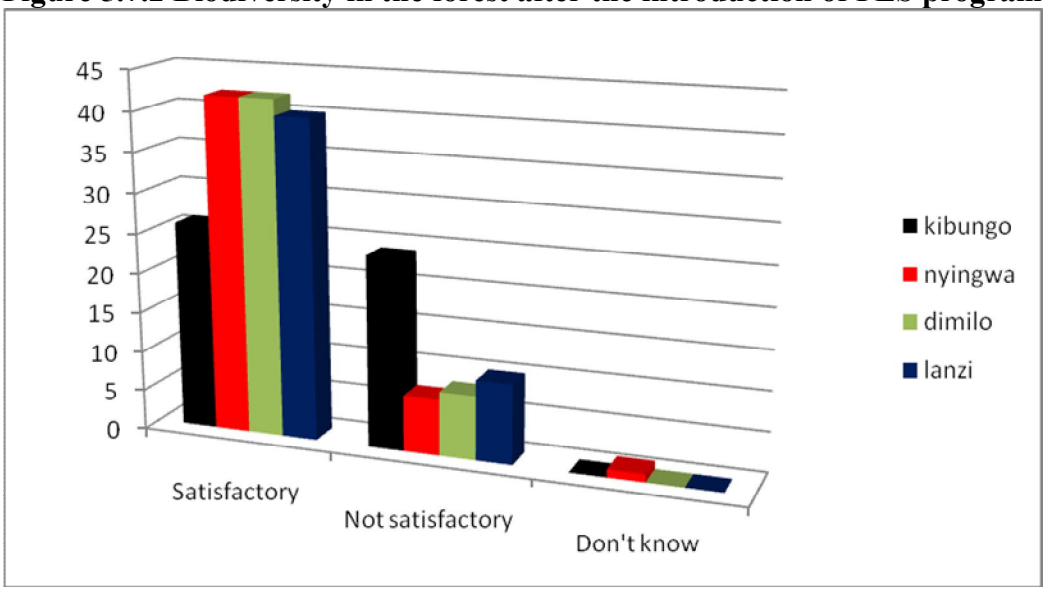
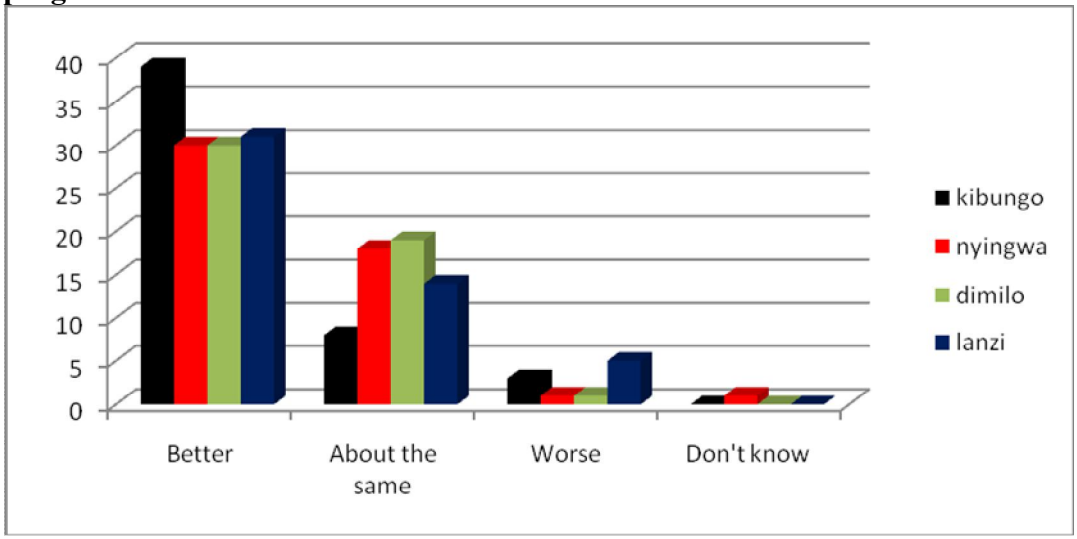



**Figure 5.7.2 Biodiversity in the forest after the introduction of PES program**




Furthermore, respondents were asked their perception on how they viewed the forest cover before PES in terms of the forest size if it became better or worse and 65% said it was satisfactory and 29.5% said they were not satisfied. On the part of biodiversity in the forest 52% said they were satisfied with the improved biodiversity in the forest example increase tree species, presence of animals in the forest. See Figure 5.7.3 for further details.

**Figure 5.7.3 Perception on the size of the forest before the introduction of PES program**




## 5.4 Construction of Wealth Index (WI) and Comparison of Poverty/Welfare between Participants and Non–Participants

The wealth index categorises (asset index) households into two groups as poor and non–poor. The constructed index takes two values which is 0 for poor and 1 for non–poor. As presented in Table 5.4 categorization is based on the NBS (2001 and 2007) rural poverty incidence of Tanzania and field survey where by 38.5% of the KibungoJuu households are considered as poor and 61.5% to be non–poor.

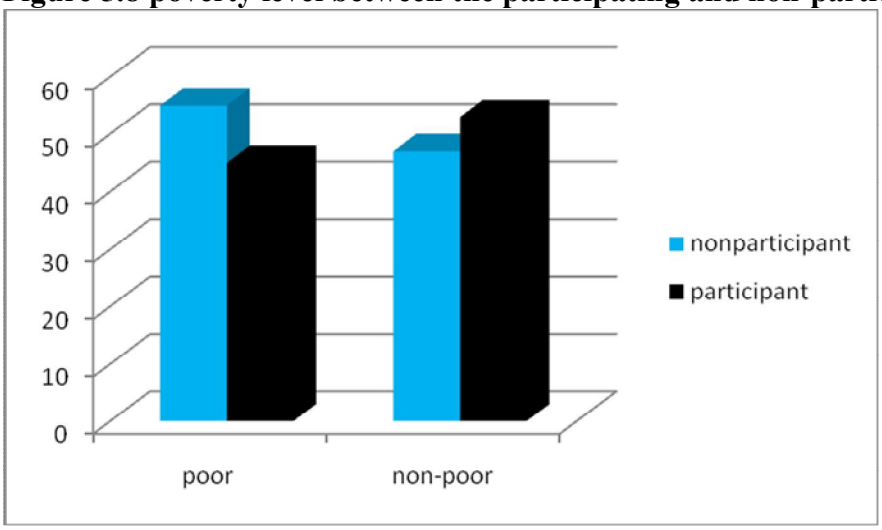
**Table 5.4 Household Wealth Categories**

| Category | WI values | %Households |
|---|---|---|
| **Poor** | 0 | 38.5 |
| **Non-poor** | 1 | 61.5 |

Basing on this asset index it has been found that, households who are nonparticipants of PES have large proportions of households into poor category than that from the supported. The results show that out of poor households in the study area 55% of poor household

comes from the non-participants while the participants group takes only 45%.See Figure 5.8 for further details.

**Figure 5.8 poverty level between the participating and non-participating group**




The analysis went further by looking on if this difference in welfare between the two groups was a result of PES project in the community. This was achieved by using ANOVA analysis where by the results were found to be significant at 5%. This is significant enough to prove that the project has impact on welfare difference between the households who are participating in the project and those ones who do not participate. This is a significant finding in this study as is contrary to the earlier findings by Mkenda, (2007, 2009), where he could not find the significant difference between the sample of under RUMAKI and those outside the RUMAKI programme. It is however, consistence with the findings by Gervas (2010), where it was shown that there were significant improvements of welfare of communities participating in MACEMP compared to non-participating communities.

**Table 5.5** ANOVA Results for Project Impact

| | Sum of squares | df | Mean Square | F | Sig |
|---|---|---|---|---|---|
| **Between groups(combined)** | 0.428 | 1 | 0.42 | 1.707 | 0.019 |
| **Within groups** | 49.57 | 198 | 0.25 | | |
| **Total** | **50** | **199** | | | |

## 5.5 Econometrics Model

### 5.5.1 Propensity score matching results

### 5.5.2 Diagnostic Tests and Model Validation Results

The propensity scores were computed using binary Probit regression models. We estimated logistic model for comparing PES beneficiaries with all non-beneficiaries, the dependent variable in the model is a binary variable indicating whether the household was a beneficiary of the PES project. The explanatory variables used in computing the propensity scores are those expected to jointly determine the probability to participate in the project and the outcome. The focus was on the determinants of participation and productive assets when selecting the independent variables for computing the principle score matching.

**Table 5.6.1 Logistic Regressions Estimates for Participation in PES**

| Participation | Coefficient | Robust Std. Err | Z | P>\|Z\| |
|---|---|---|---|---|
| Gender | -0.230 | 0.198 | -1.16 | 0.246 |
| Age | 0.013 | 0.008 | 1.53 | 0.127 |
| Education | 0.297 | 0.329 | 0.90 | 0.366 |
| Household size | 0.087** | 0.035 | 2.50 | 0.012 |
| Land | 0.037 | 0.058 | 0.64 | 0.525 |
| assets Owned | 0.249** | 0.109 | 2.28 | 0.023 |
| Consumption Expenditure | 0.396*** | 0.154 | 2.57 | 0.010 |
| Marital Status | -0.303 | 0.225 | -1.34 | 0.180 |
| Years lived in the village | 0.004 | 0.006 | 0.60 | 0.547 |
| Constant - | -7.974*** | 1.891 | -4.22 | 0.000 |
| Sample size | 200 | | | |
| Prob >$\chi$2 | 0.0000*** | | | |
| Pseudo R2 | 0.157 | | | |
| Log likelihood | -116.76618 | | | |

The study found that PES participants are more likely to be households with a large size who participate more in PES activities with a 0.087 treatment effect. Comparing with nonparticipants, participants also tend to be older and have more land.

Ownership of assets was one of the factors also mentioned by the respondents that influenced participation and from our model we see a 0.249 treatment effect. Example an

interview with some of the households who did not participate one of their reason of not getting involved was lack of land to cultivate and farming tools like hoes (*jembe*) and bush knife (*panga*)

Consumption expenditure of the respondents is marginally significant in influencing the participation into the program suggesting that the PES might have been more attractive to the people in earning more for their consumption, from our model there is 0.396 treatment effect.

The model results were used to compute the propensity scores that were used in the Propensity Score Matching (PSM) estimation of Average Treatment effect for the Treated. Further testing of the comparability of the selected groups was done using a "balancing test" (Dehejia and Wahba, 2002), which tests for statistically significant differences in the means of the explanatory variables used in the model between the matched groups of PES participants and nonparticipants. In all cases, that test showed statistically insignificant differences in observable characteristics between the matched groups, supporting the contention that the PSM ensures the comparability of the comparison groups.

The region of common support is [0.097, 0.998] where only 198 observations are matched with control observations with a mean of 0.503 and Std. Dev 0.215 with 4 blocks. The number of blocks ensures that the mean propensity score is not different for treated and controls in each block and the balancing property is satisfied. The final distribution of treated and controls across blocks are tabulated together with the inferior of each block.

**Table 5.6.2 Inferior bound, the number of treated and controls for each block**

| Inferior of block of Pscore | Do you participate in PES activities | | Total |
|---|---|---|---|
| | No | Yes | |
| 0.0971367 | 23 | 4 | 27 |
| 0.25 | 47 | 33 | 80 |
| 0.5 | 23 | 37 | 60 |
| 0.75 | 5 | 26 | 31 |
| **Total** | 98 | 100 | 198 |

Table 5.6.2 shows that only 98 of non participants matched with 100 participants in the common support of the sample of 200. Several methods are possible for selecting matching observations (Smith and Todd, 2001). We used the kernel matching method (using the normal density kernel), which uses a weighted average of "neighbors" (within a given range in terms of the propensity score) of a particular observation to compute matching observations. Unlike the nearest-neighbor method, using a weighted average improves the efficiency of the estimator (Smith and Todd, 2001). Observations outside the common range of propensity scores for both groups (i.e., lacking "common support") were dropped from the analysis. This requirement of common support eliminated about some of the total number of observations, indicating that few of the observations from the various strata were not comparable.

**Table 5.6.3 Bootstrap statistics**

| Variable | Reps | Observed | Bias | Std. Err | [95% Conf. Interval] | |
|---|---|---|---|---|---|---|
| **bs1** | 5 | 0.2996474 | 0.1689467 | 0.1350903 | -0.0754233 | 0.6747181 (N) |
| | | | | | 0.3524641 | 0.6263694 (P) |
| | | | | | 0.1468518 | 0.6316998 (BC) |

N = normal, P = percentile, BC = bias-corrected

**Table 5.6.4 ATT estimation with the Kernel Matching method Bootstrapped standard errors**

| n.treatrement | n. control | ATT | Std. Err. | t-statistics |
|---|---|---|---|---|
| 100 | 89 | 0.3 | 0.135 | 2.218 |

The results in Table 5.6.4 are consistent, showing that participation increases the outcome variable by 30 percent, at a 5 percent significance level. 89 households out of the 100 of the control group (non-participants) are matched with 100 of the treated group (participants). Only a few households from the control group are left in matching showing a significant effect of the PES program in effecting the program outcome.

### 5.5.2.1 Checking Robustness of Average Treatment Effect

Furthermore on checking the robustness of the findings, one approach is to estimate the propensity score equation and then use the different matching methods like with kernel above. Another way to check robustness is to apply direct nearest-neighbor matching. We estimate the average treatment effect on the outcome with the interest of using direct nearest-neighbor matching with one match per treatment to see if the results are consistent with earlier ones.

A 36.9 percent positive impact of PES participation is seen at a 5 percent significance level which is not far different from the ones obtained in the kernel matching technique.

**Table 5.6.5 Matching estimator: Average Treatment Effect for the Treated (ATT)**

Weighting matrix: inverse variance Number of observation = 200

Number of matches (m) = 1

| Outcome | Coefficient | Std. Err. | Z | P>\|z\| | [95% Conf. Interval] | |
|---|---|---|---|---|---|---|
| **SATT** | 0.3984768 | 0.1773457 | 2.25 | 0.025 | 0.0508855 | 0.7460681 |

Matching variables: gender age education household size, consumption expenditure, land assets time village marital

The study used bootstrapping to compute the standard errors of the estimated ATT, generating robust standard errors because the matching procedure matched nonparticipating households to participating households "with replacement" (Abadie and Imbens, 2002 and 2006) on the use of bootstrapping for inference in matching estimators. In kernel matching, all treated, as well as all controls (in the common support which has been imposed here), are used. The estimate of the ATT is quite close to the one obtained with nearest-neighbor matching.

**5.6 Perception on Welfare as a result of PES**

The study also adopted multinomial probit to estimate the perception of household on there welfare before and after 2008.

**Table 5.7: Results of Marginal effects after MNP for welfare**

*** Significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level**

| | outcome 1(worse) | | outcome 2(same) | | outcome 3(better) | |
|---|---|---|---|---|---|---|
| Variable | dy/dx | P>z | dy/dx | P>z | dy/dx | P>z |
| Gender | 0.022 | 0.765 | 0.021 | 0.698 | -0.043 | 0.594 |
| Age | 0.010*** | 0.002 | 0.0007 | 0.783 | -0.011*** | 0.004 |
| Marital Status | 0.057 | 0.476 | -0.0187 | 0.757 | -0.038 | 0.664 |
| Education | 0.153 | 0.118 | -0.085 | 0.421 | -0.068 | 0.609 |
| Household Size | -0.049*** | 0.008 | 0.0041 | 0.73 | 0.045** | 0.014 |
| Log of Consumption Expenditure | 0.017 | 0.747 | .00068 | 0.986 | -0.017 | 0.765 |
| Log of Assets Owned | -0.169 | 0.129 | -0.1247 | 0.226 | 0.293** | 0.019 |
| Log of Land | 0.123 | 0.247 | 0.105 | 0.285 | -0.229* | 0.053 |
| Biodiversity After PES | 0.038 | 0.71 | 0.101* | 0.099 | -0.139 | 0.222 |
| Forest Size After PES | 0.039 | 0.677 | -0.077 | 0.316 | 0.037 | 0.734 |
| Years lived in The Village | -0.001 | 0.679 | -0.0006 | 0.756 | 0.001 | 0.57 |
| Participation | -0.308*** | 0.000 | -0.111** | 0.048 | 0.420*** | 0.000 |
| Forest Products | 0.108 | 0.266 | -0.122** | 0.027 | 0.013 | 0.895 |

The study found that the probability of a household perceiving welfare improvement increases with assets availability and household size but decreases with the age of the household. If a household owns assets, it is likely to perceive that the welfare has been improved by 0.293 units. Furthermore the household size is likely to be perceived to make welfare better by 0.045 while it decreases the probability of the household perceiving that their welfare has been worse by 0.049

The results further show that the age of household head is likely to determine how they perceive their welfare, For example an increase in the age reduces the probability of belonging to the group that perceive their welfare as being better by 0.011 units, since with old age the ability to obtain forest products is reduced due to the distance to obtain and hence make use of the trees planted due to PES project.

Moreover the probability of a household perceiving that their welfare is better increases with household participation in PES program by 0.420 units but household participation reduces probability of welfare being perceived worse or being the same by the household by 0.308 units and 0.111 units respectively. The results further show that if the household own land is likely to perceive that their welfare is better but with an increase in the ownership of land reduces the probability of perceiving welfare better due to PES by 0.229 units since land ownership could have been a result of clearing more forest land so as to acquire land for agriculture.

An increase in Biodiversity availability after PES introduction is likely to increase the probability of household perceive welfare being the same by a 0.101 units but its not the case with availability of forest products as an increase in forest products reduces the probability of households perceiving welfare being the same by 0.122 units.

It is surprising to find that majority of the variables that characterize the household's welfare are not significant under *"same" or "better"*. Consumption expenditure for their daily livelihood could be the earliest signal on whether their welfare has become better or is

still the same. Variable like education level which is likely to explain they perception on welfare was found insignificant. The education level is likely to influence the perception on welfare improvement as a result of the PES since more educated people are likely to perceive welfare gain from PES as compared to uneducated people. The insignificant of education variable could be due to the lack of significant variation in education level among the households. Majority of the households have primary level education.

**5.7 Household Perception on Forest Size and Biodiversity.**

**Table 5.8 Marginal Effects of Probit Regression Results on perception of the forest size**

| Variable | dy/dx | Std. Err. | z | P>z |
|---|---|---|---|---|
| Gender | 0.147** | 0.074 | 1.97 | 0.048 |
| Age | -0.004 | 0.003 | -1.5 | 0.132 |
| Education | -0.031 | 0.11 | -0.27 | 0.788 |
| Marital Status | 0.0349 | 0.083 | 0.42 | 0.675 |
| Household Size | 0.0242 | 0.017 | 1.37 | 0.172 |
| Years lived in the Village | 0.0075*** | 0.0026 | 2.83 | 0.005 |
| Log of Assets | -0.137* | 0.078 | -1.76 | 0.078 |
| Log of Consumption Expenditure | -0.054 | 0.052 | -1.04 | 0.298 |
| Log of Land | 0.1116 | 0.073 | 1.52 | 0.128 |
| Forest Size After PES | -0.306*** | 0.074 | -4.1 | 0.000 |
| Biodiversity After PES | -0.200** | 0.089 | -2.22 | 0.026 |
| Forest Products | 0.1826** | 0.072 | 2.51 | 0.012 |
| Participation | 0.0575 | 0.076 | 0.75 | 0.455 |

*** Significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.**

Table 5.8 presents marginal effects of the Probit model estimates of the determinants of the change in forest size which gives the situation on the quality of the forest from introduction of PES. The marginal effects show that one unit increase in the independent variable increases/decreases the probability of the dependent variable by the magnitude of the change.

Gender is positive and statistically significant at 5% this suggests that the probability of perception as the forest size increase if the household is male headed. Furthermore, one year increase in the time lived in the village by household increases the probability on their perception of forest size change from PES activities by 0.0075 which is statistically significant at a 1%.

The increase in Forest size as a result of PES activities reduces the probability of perceiving the forest has been destructed. Among the strategies of PES is to encourage villages to plan tree in their own farm, which they can make use for their fuel wood and other NTFP needs at the household level.. This is also the case on the perception of Biodiversity availability in the forest after PES activities which reduce the probability by 0.2 units of perceiving further loose of biodiversity.

Moreover an increase in forest products increases the probability of perceiving an improvement in the forest cover by 0.182 units since with PES people are able to obtain forest products from the trees that they planted in their own farm. An increase in the asset ownership reduces the probability on the perception of the improved forest cover by 0.137 units.

**Table 5.9 Marginal Effects of Probit Regression Results on perception of biodiversity in the forest**

| Variable | dy/dx | Std. Err. | z | P>z |
|---|---|---|---|---|
| Gender | 0.084 | 0.0814 | 1.04 | 0.297 |
| Age | -0.006* | 0.003 | -1.88 | 0.06 |
| Education | -0.003 | 0.131 | -0.03 | 0.979 |
| Marital Status | 0.0214 | 0.089 | 0.24 | 0.81 |
| Household Size | 0.0171 | 0.017 | 1 | 0.319 |
| Years lived in the Village | 0.0104*** | 0.0029 | 3.52 | 0.000 |
| Log of Assets | -0.066 | 0.089 | -0.74 | 0.46 |
| Log of Consumption Expenditure | 0.010 | 0.057 | 0.19 | 0.853 |
| Log of Land | 0.0744 | 0.083 | 0.89 | 0.375 |
| Forest Size After PES | 0.059 | 0.107 | 0.56 | 0.579 |
| Biodiversity After PES | -0.372*** | 0.090 | -4.09 | 0.000 |
| Forest Products | 0.363*** | 0.07 | 4.59 | 0.000 |
| Participation | 0.0489 | 0.084 | 0.58 | 0.564 |

*** Significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.**

Table 5.9 presents marginal effects of the Probit model estimates of the determinants of the change in biodiversity as a results of the introduction of PES.

Age is negatively and statistically significant at 10%. This suggests that the higher the age of a household head, the lower the probability of perceiving an improved change of biodiversity in the forest. Thus as the age of a household head increases, there is a 0.006

units chance of the household perceiving a reduction in the availability of biodiversity. Furthermore, one year increase in the time lived in the village by household increases the probability on their perception of a change in Biodiversity from PES activities by 0.0104 units which is statistically significant at 1%.

An increase in forest products increases the probability of perceiving an improvement in biodiversity by 0.363 units since with PES people are able to obtain forest products from the village forest which is a result of planting trees by the households. The perception of Biodiversity availability after PES activities reduces the probability by 0.372 units.

Given the two scenarios, before and after PES, on the quality and availability of resources, it is observed that there is a difference with regard to the forest products. This difference as reported by the results from the Probit model are attributed to the dependent variable used. Using the opinion of households concerning the forest size and biodiversity as dependent variables in the Probit model may have impacted the results as regards to availability of forest products of the households. This is the case because some households make use of forest products like reeds, palms as building materials while others sell them as a source of income. With PES activities, the availability of such products has decreased, since households are prevented from entering the forest. This explains the differences in households' perceptions in regard to changes of the forest size and biodiversity.

## 5.8 Chapter Summary

This chapter presents the results and interpretation of data concerning the impact of PES project in Kibungo Juu ward towards reducing poverty. Four types of analysis were employed. These include; Propensity Score Matching (PSM), Descriptive analysis, ANOVA analysis and Probit regression analysis. This assessment has revealed that there is a difference in welfare between households who are under the PES project and those that are not under the project. From the PSM, the assessment shows that there is a 36.9 percent positive impact of PES participation of the outcome. From the wealth index assessment shows that a big percentage of the households with lower index value fall under the non–participating group which is 55% of all households falling in non-poor category of the study area while from the supported group only 45% were found to fall under the poor category.

The results from the Logistic regression indicate that; Age, Household size, asset ownership, land, availability of forest products are significant. This shows that these variables contribute to the socioeconomic status of the households. The participation variable is also found to be significant, implying that the households supported by PES are less likely to fall under the poor category. The study findings from the ANOVA analysis also show that; the existing difference in poverty status is as a result of the existence of the PES project in the study area. More so, from the perceptions of the households, the results show that the households are satisfied by the efforts of the PES project in regard to; improvement in their welfare, increase in the forest size and the availability of biodiversity.

# CHAPTER SIX

# CONCLUSIONS AND RECOMMENDATION

## 6.1 Introduction

This chapter provides concluding remarks based on the field survey and from the analysis. Based on the findings, some policy implications to address welfare issues were formulated. We conclude by suggesting areas for further studies that were identified but could not be explored.

## 6.2 Main Conclusions

This study main objective was to evaluate the impact of PES on poverty reduction for the participating communities, mainly the significant differences in poverty level between participants and non- participants in the program. Four villages from Uluguru that are in the program were chosen for this study. Sustainable livelihood in this study was defined in relation to two outcomes, which are poverty reduction and improvement of resource base. The project main focus is on conservation practices to ensure sustainable flow of water, while addressing issues related to poverty alleviation.

The PES project is as an attempt by the Government of Tanzania through WWF and CARE to improve the management of a substantial and long lasting conservation while alleviating rural poverty by giving special attention to increasing the participation of the rural poor in PES schemes as a view to contributing to economic growth. In this regard PSM was employed to assess the difference in welfare status between participants and non-participants.

Thus, the study singled out two groups in the communities in the four different villages which receive assistance from PES project. Given the fact that the study was addressing the comparison between the two groups, no one theory was found to be sufficient to address this issue. The main research questions that have been addressed in this study were to find out if PES has any impact on the welfare of the communities in Uluguru. If there is any significant differences in poverty level between people who participate in PES and those who do not participate in the program. If there are any improvement in forest cover since the implementation of PES program and the benefits that have been obtained by Uluguru communities for having PES. In the process of exploring what more should be done by the project so as to improve the household's standard of living. The aim has been to come up with the recommendations for what the project can do more in order to achieve its objective of poverty reduction.

The study found that, there is difference in poverty status between participants and non-participants in the study area. Using wealth index it was revealed that households who don't involve themselves in PES are the ones who have a large percentage of poor people in their community. This was proved by ANOVA analysis that the difference in welfare status between the two groups in the study area was as a result of the impact of PES project in the community. The impact of the project was also supported by the Multinomial probit regression results which found that the household who is in the project is more likely not to be poor

From the results it was observed that households from the study area have benefited from PES project. The project has assisted several targets in this study, by providing them with

bush knifes, goats, hoes, tree and crop seedlings, and manure. Also the respondents were able to provide their views on how they perceive their standard of living before and after the project. From this it was found that there was difference between the two time periods. In assessing the availability of the resources after the PES project, it was revealed from the households that the project has an impact on the forest Biodiversity and size. Generally, material life of the households were found to be poor in case of houses and the construction material, where it was found that many houses in the study area are poor made of mud and poles in terms of wall materials, roofed with grass and having earth floors. Here the difference between the groups was found to be small.

### 6.3 Recommendations and Agenda for Future/Further Research

The study set out to assess the impact of PES project in Kibungo Juu. This study discovered that the forest conservation project needs to know what the households prefers more to be done before they start any implementation since it was observed during this study stakeholders concentrated more on the project success than the success of it and improvement of the households welfare. For example they insisted households to plant food crops and trees so as to conserve water sources but there were no incentives given for planting the trees as they promised them or provide them with markets for the crops harvested.

Furthermore, not all the areas covering Uluguru Nature Reserve were taken into account in the PES project because the core source of water in the Ruvu river was considered but the down stream villagers were known in conducting illegal activities like mining which made the water dirty. Therefore in order to improve conservation activities and welfare for the

households along Uluguru Mountains that live along the Ruvu River Basin there is a need to cover a bigger area. It could thus be interesting for future studies to take in consideration of other villages not included in this study.

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