EVALUATING IMPACT OF PAYMENT FOR ECOSYSTEM SERVICES (PES) ON HOUSEHOLD WEALTH AND LAND TENURE:

A CASE OF KASIGAU CORRIDOR REDD+ PROJECT IN KENYA

MASTER'S THESIS

BY

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DECLARATION

This thesis is my original work and has not been submitted for a degree course in any other university

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ABSTRACT

Human society depends on healthy ecosystem for their goods and services. However, the lack of market values for these ecosystem services (ES) has resulted into continued degradation through human activities in pursuit of economic development. Payment for ecosystem service (PES) has emerged as a market based approach that translates external, non-market values of the environment into incentives to encourage continued provision of these ES. Through PES, users of ecosystem services pay landowners who supply these services through land use activities. However, there are limited empirical studies evaluating the impact of PES.

Kasigau Corridor REDD project is one of the PES projects being implemented to address both environmental conservation and contribute to alleviate poverty hence improving the livelihoods. However, there are no empirical data to support the argument that a PES project can achieve these two objectives in Kenya. The purpose of the study was to evaluate the impact of PES on household wealth of those participating as well as find out how its implementation relates to land tenure systemsthat is, communal and private land tenure.

To study applied the propensity score matching (PSM) using the 'with and without' approach. This was done through the identification of a control and treated groups under similar conditions and comparing the difference between the two groups from a total sample of 250 households. Using the logistic regression analyses, the findings showed that the PES project recorded an increase of 11.1 per cent on the household wealth and that community land tenure was more favourable to PES implementation compared to private land tenure. In addition, the total land and education level of the participants were found to also significantly influence participation and implementation of PES. In conclusion, the study has indeed showed that indeed PES can be used to promote environmental conservation as well contribute to poverty alleviation. In addition, households in community land are more likely to participate in PES, therefore, security of land tenure is key to successful implementation of these program.

LIST OF ACRONYMS

ATT - Average effect of Treatment on the Treated

CDM - Clean Development Mechanism

CoK – Constitution of Kenya

COP - Conference of Parties

EIA - environmental impact assessment

ES – Ecosystem Services

GHGs – Green House Gases

IPCC - intergovernmental panel on climate change

LULUCF - Land Use, Land Use Change and Forestry

NCCRS – National climate change response strategy

NEP – National Environment Policy

NLP – National land policy

OC – Opportunity costs

PCA - Principal component analysis

PES – Payment for Ecosystem Services

PFPF - Forest Carbon Partnership Facility

PSM - Propensity Score Matching

UN – United Nations

REDD – Reducing emissions from deforestation and forest degradation

R- PIN - Readiness Plan Idea Note

R-PP - REDD readiness preparation proposal

SBSTA – Subsidiary Body for Scientific and Technological Advice

SESA - Strategic environmental social assessment

UNFCCC - United Nations Framework Convention on Climate Change

WW – Wildlife Works

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CHAPTER ONE: INTRODUCTION

1.1 Background of the Study on PES

Natural resources provide a wide range of ecosystem goods and services from which human beings benefit, and upon which all life depends. These ecosystem services and goods includes food, clean water flow, productive soil, climate regulation, aesthetic enjoyment, and many other services essential to sustain life (UNEP, 2005; The Katoomba Group, 2008). These benefits are known as ecosystem services (ES). The linkage between nature and the economy are often described using the concept of ecosystem services or the flow of value to human societies as a result of the state and quantity of natural capital (TEEB, 2010).

There are four categories of ES that contribute to human well-being. These are provisioning services (food, fresh water, plant-derived medicine etc), regulating services (e.g. climate regulation through carbon storage, water cycling, filtration of pollutants by the wetlands etc), cultural services and supporting services (e.g. soil formation, photosynthesis and nutrient cycling etc (MEA, 2005; UNEP, 2005). To support their livelihoods and engage in development activities, humans engage in exploitation of the ecosystems in the quest for ES. Over a period of time, human activities on these ecosystems have affected the equilibrium needed to ensure sustainable development to an extent that the human survival is in danger (MEA, 2005).

The benefits from ES are often public in nature thus the cost of ensuring their provision often is incurred by the landowners or land users hence causing externalities. Given that land is often used for private benefits, landowners aim to convert their land to alternative uses such as agriculture rather than maintain it in its natural state. Whereas not all form of conversion of natural ecosystem is undesirable, the existence of market failure means that natural capital depletion is often much greater than would be socially optimal (TEEB, 2010).

Approximately 60% of the ES are being degraded or being used unsustainably (MEA, 2005). Human activities have changed the ecosystems more rapidly and extensively to meet the rapidly growing demand for the same (UNEP, 2005). The transformation of these ecosystems has led to economic development and substantial net gains in human well-being. However, globally not all countries and groups of people have benefited from this process, instead many have been harmed

(UNEP, 2005). One such impact is the accumulation of greenhouse gases (GHGs) by industrialized countries that has led to global warming resulting into climate change that has led to serious impacts in developing countries. In fact, the resource dependent local communities in developing countries are vulnerable to the impacts of climate change due to poverty which limits their alternative options to adapt or mitigate (MEA, 2005).

Climate change is one of the most challenging environmental problems facing mankind nowadays given that it presents unique challenges for economic development. It is the greatest and widest-ranging market failure given that the damage caused by the GHG pollutants is an externality in both space and time (Stern *et al*., 2006; Tietenberg and Lewis, 2009). Spatially, the largest emitters (industrialized countries) have the greatest capacity to reduce emission, but they are not expected to experience as much damage from insufficient actions as the developing countries. Temporally, the cost of controlling greenhouse gases fall on current generations, while the benefits from controlling GHGs occur well into the future (Tietenberg& Lewis, 2009)

The fourth assessment report of the intergovernmental panel on climate change (IPCC) report indicates that 20% of global greenhouse gas emissions are associated with deforestation and forest degradation each year (IPCC, 2007b). This is mainly as a result of land use and land use changes through human activities which continue to be profitable in developing countries given the rising demand as a result of increasing population. According to the Stern Review, reducing deforestation is the "single largest opportunity for cost-effective and immediate reductions of carbon emissions" (Stern *et al*., 2006).

Just as deforestation and forest degradation has significantly contributed to climate change, sustainable forest management, prevention of deforestation, and the re-growth of forests have a significant potential to mitigate climate change through carbon sequestration. This has resulted into international attention on the use of forests ecosystem to address issues of climate change mitigation. It is believed that the maintenance and restoration of natural habitats are amongst the cheapest, safest and easiest solutions at the disposal in the effort to reduce GHGs emissions and promote adaptation to unavoidable change (Turner *et al*., 2009).

The command-and-control management system of forests only has not been totally successful in promoting forest conservation. As a result, the use of financial incentives through the market-based payment systems to halt deforestation and protect or undertake afforestation for carbon sequestration has recently received considerable attention and occupied the public dialogue. The market-based system emerged as a response to the growing concern of market failure for ecosystem service under the command and control management system (Vonada*et al*., 2011).

Formal carbon markets now exists, these are, the regulatory compliance and the voluntary markets. The basic logic is that, those that provide ecosystem services by foregoing alternative uses of the land should be compensated by the beneficiaries of that service. However, PES are not a universal panacea. A crucial issue is the overall national forest governance framework. Under conditions of weak governance it is verydifficult for payments for ecosystem services to be effective (Bond *et al*., 2009).

1.1.1 Evolution of REDDas a PES Mechanism under the UNFCCC

The international community, under the auspice of United Nations Framework Convention on Climate Change (UNFCCC) has proposed a new financial mechanism to reduce emissions from deforestation and forest degradation (REDD) in developing countries. The mechanism is to help internalize the carbon related ecosystem services provided by forests. The concept of REDD has evolved under the UNFCCC over several years now since the idea was introduced in 1997 within the Kyoto Protocol (e.g. article 2, item 1 and article 3, item 2) but became formal at the UNFCCC 13th Conference of Parties (COP 13) in Bali, Indonesia, 2007 (Tropical Forest Group, 2011; Holloway andGiandomenico, 2009).

One of the unclear issues under Kyoto Protocol that formed part of the debate in COP 7, in Marrakesh, along with other key debates was about the exact role of Land Use, Land Use Change and Forestry (LULUCF) in the global carbon cycle. This led to a compromise of allowing for REDD activities in Annex 1 countries to be allowed to be used to meet targets. However, they only allowed for afforestation and reforestation to generate eligible credits for trading under the Clean Development Mechanism (CDM). Leakages of carbon benefits, which is increase in emissions outside the project boundary as a result of the project interventions, was

one of the main reasons for not allowing REDD to generate carbon credits under CDM (Tropical Forest Group, 2011; Holloway andGiandomenico, 2009).

In 2005, at the 11th COP meeting of the UNFCCC in Montreal, Papua New Guinea, proposed integrating a mechanism to reduce emissions from deforestation (i.e. RED) within the post-2012 climate change regime. The proposal received widespread support and a formal process was created to examine this further by the Subsidiary Body for Scientific and Technological Advice (SBSTA). As a result it was noted that there indeed was need to address reducing emissions from deforestation in developing countries as part of mitigation efforts to achieve the ultimate objective of the Convention (Tropical Forest Group, 2011).

In 2007, UNFCCC adopted the Bali Action Plan (Decision 2/CP.13) which mandated negotiations of a post-2012 instrument to include, among others things financial incentives for forest-based climate change mitigation in developing countries. The role of forest degradation in carbon emission was also acknowledged and Plan (Decision 1/CP.13, Paragraph 1b(iii)) called for, "Policy approaches and positive incentives on issues relating to reducing emissions from deforestation and forest degradation in developing countries; and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries". It was also recognized that action to support REDD 'can promote co-benefits and may contribute to achieving the aims and objectives of other relevant international conventions and agreement' (Decision 2/CP.13)

In 2008, during COP 14 in Poznan, it was highlighted that forest conservation, management and enhancement were of high importance and the term REDD came into official use. As a result, this enlarged the scope of forestry activities for inclusion since its conceptualization, and could reward 'enhanced positive changes' through forest restoration/rehabilitation (Tropical Forest Group, 2011).

1.1.2 Safeguards for PES Implementation

The primary focus of the international PES under REDD is on climate change mitigation. This is consistent with the goal of UNFCCC which aims to achieve stabilization of GHGs in the

atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. This is expected to bring much more than just emission reductions and contribute to multiple benefits. In developing countries, the multiple benefits are expected to include poverty alleviation, indigenous rights, improved community livelihoods, technology transfer, sustainable use of forest resources and biodiversity conservation (Murphy, 2011). To achieve this, the focus on the international debates has shifted to incorporate policies and measures that address both direct and indirect impacts of REDD on communities and ecosystems.

The Cancun Agreement reached in COP 16 of UNFCCC in 2010 calls on parties to promote, support and reports on the implementation of seven social and environmental safeguards for REDD (Angelsen*et al.,* 2012). Safeguards can be understood as policies and measures that aim to address both direct and indirect impacts on communities and ecosystems, by identifying, analyzing, and ultimately working to manage risks and opportunities (Murphy, 2011).

1.2 Statement of the Problem

Although ecosystem services are public goods, the physical structure that provides them is often either privately or communally owned. The lack of markets for ecosystem services is a challenge because most of the vulnerable segments of society, primarily in developing countries are the providers of these ecosystem services especially carbon sequestration. This is because majority of the population depend on the ecosystems such as forests either directly or indirectly to support their livelihoods (Wunder, 2005; Milder *et al*., 2010). Therefore, without a mechanism that ensures they are compensated for the provision of the ES, there is potential for over-exploitation through conversion which might lead to degradation thus threatening existence of mankind (Kemkes*et al.*, 2009). However, it is important to note that the compensation for the provision of ES must be more than the opportunity cost to the land users of the alternative land uses (Pagiola*et al*., 2005).

Payment for ecosystem services (PES) is a policy intervention that provides incentives to land owners/users for the provision of a variety of ES. This approach is being fronted as having the potential to meet two objectives; first, promote conservation by making it more attractive to land

users and owners to provide ES. Secondly, poverty alleviation by providing additional and/or alternative income sources to land users and owners hence in the process improving their livelihoods. This is because in most developing countries, there is a relationship between the state of the environment and poverty level since a higher percentage of the population's livelihoods are linked to natural resources. Therefore, improving the condition and management of the ecosystem services is an essential component to reducing poverty (Vonada*et al*., 2011).

Despite their being considerable interest globally on the use of PES which is currently being implemented in most developing countries by donors, empirical research on PES and their impact on poverty alleviation remains scarce in developing countries. This is especially important given that international PES like REDD+ initiatives mostly target developing countries where the forest ecosystem support a large percentage of the poor rural population. In most of the studies on impact evaluation of PES, they make the case that it's an approach that can indeed alleviate poverty as long as certain factors are taken into account. However, there is limited field research and empirical data to support such conclusions hence a knowledge gap which this study aims to contribute towards by looking at the impact of PES on Household wealth and land tenure systems in Kenya.

The Kasigau Corridor REDD project, which was actually the first REDD project under the voluntary carbon market globally provides a unique opportunity to evaluate the impact of PES in developing countries. This project is being implemented in one of the poorest region in Kenya with majority of the population depending directly on land and natural resources to support their livelihoods. In addition, the land tenure system under which the PES is being implemented is under the group ranches, that is, community land. The project provides a good opportunity to undertake an empirical study to evaluate the impact of PES on household wealth as well as the influence of land tenure on the implementation of PES which would be useful to address the knowledge gap.

1.3Purpose and objectives of study

The purpose of the study is to evaluate the impact of payment for ecosystem services (REDD project) on household wealth and determine if property rights impacts on PES implementation

i. To assess the impact of the PES on the household wealth for participating households

ii. To assess the influence ofland tenure types on implementation of PES project in Kasigau

1.4Hypotheses

Household Wealth:

Payment for ecosystem services does not improve the wealth of participating households

Property Rights:

Land tenure system does not influence PES implementation in Kenya.

1.5 Justification and significance of the study

The two main justifications for this study are, first, despite the importance of ES in support of human survival, these ecosystem services have deteriorated very fast over time as highlighted by the Millennium Ecosystem Assessment report of 2005. One of the ecosystems that has mostly been affected and as a result contributed to climate change is the forest ecosystem which provides a crucial ES of carbon sequestration. However, markets do not exist to reveal the economic values of these EShence they experience market failures (Kemkes*et al*., 2009; Wunder, 2005; Engel *et al*., 2008; Swallow *et al*., 2007;USAID 2007).

These ES are provided as a result of certain land use activities carried out by the land owners and/or users. However, given the public nature of these services, the benefits from ES accrues to both the land owners/users as well as others who do not bear the cost of providing the service, also known as positive spill-over or positive externalities. With no incentives for the provision of the ES through certain land use activities, the land owners and/or users usually opt for alternative land uses hence convert the forests land for other uses (Pagiola*et al*., 2005; Wunder, 2005; Milder *et al*., 2010; Farley *et al*., 2010).

With Kenya having lost almost its forest cover from 12 per cent to the current 1.7 percent in the last 3 decades, the international focus of PES and especially REDD+ provides an opportunity to at least regain some of its lost forest cover (NCCRS, 2010). This opportunity can be extremely

beneficial to the local communities whose livelihoods are supported by the forests given that their land use activities will be incentivized hence are able to get additional alternative income.

Secondly, given that land is a critical asset for the rural poor, property rights over it and other land based natural resource like forests play a fundamental role in distribution of wealth and poverty (Meinzen-Dick *et al*., 2007). Therefore, land and forest tenure is a central issue for future REDD+ policies at national level and as a result determines whether the impact will be on the local communities or not (Corbera*et al*., 2011; Corbera& Schroeder, 2010; Bruce *et al*., 2011).

The world's most carbon-rich and biodiverse forests are found in regions with unclear and poorly defined property rights. Based on this, the international focus on REDD is bringing some focus on land and forest tenure and governance issues. Therefore, such PES programmes are able to increase the security of the tenure system on land and forest which influences the incentives to provide the ES needed. In addition, such initiatives will have the potential to substantially benefit the rural communities hence alleviate poverty (Knox *et al*., 2010; Lee andMahanty, 2009; Wunder*et al*., 2008)

Kenya's forests cover is less than the international set standards of ten percent national forest cover. Given that the government is committed to achieve at least achieve a ten percent forest cover as stated in the national climate change response strategy of 2010, Kenya's vision 2030 and article 69(b) of the Constitution. In the light of other national priorities in Kenya, it will not be possible to achieve this target of ten per cent forest cover by using public land alone, but, there will be need to use both private and community land as well. Therefore, PES through the REDD initiative provides an opportunity to address both the forest cover challenge, challenges surrounding property rights and governance of land and forest, and as well as incentivize the land owners to undertake certain land use activities thus providing additional sources of income and for the rural poor this might mean poverty alleviation.

CHAPTER TWO: LITERATURE REVIEW

2.1 Features and Importance of PES

Environmental economics literature offers an array of policy tools for the management of ES especially forest ecosystem services (Jack *et al*., 2008). They include command-and-control regulations, integrated conservation and development programs (ICDP), eco-labelling, and more recently the PES approach (Engel *et al*., 2008). The command-and-control regulations have been commonly used by most states Kenya being one of them, to protect forest resources. This approach has not been totally successful in promoting sustainable forest management given that it's associated with poor governance and high enforcement costs (Engel *et al*. 2008). In addition, the regulatory restrictions on the use of forests have increased the burden on poor people who depend on the forest for livelihoods thus its unpopularity.

The ecosystem services which were previously provided for free by nature are becoming increasingly threatened and scarce since decisions to convert or alter natural habitat toward market based activities fail to take into account the total costs of service loss (Sommerville*et al*., 2009). From an economic aspect, one of the major causes of ecosystem service degradation is market failure associated with the nature of the ecosystem services being public goods in nature thus generating externalities (TEEB, 2010; UNEP, 2005). Consequently, the land users and/or owners fail to receive any compensation for conserving these ecosystem services thus do not incorporate them into their decision making which leads to socially sub-optimal land use change decisions (Wertz-Kanounnikoff, S., 2006).

The emergence of PES approach is seen as an approach that can better enhance provision of ES since it compensates individuals or communities for undertaking certain land use activities. This public policy approach acts a positive incentive to promote the conservation and recuperation of ecosystems, thus complementing and reinforcing existing command and control policies (Jack *et al*., 2008; Vonada*et al*., 2011). Wunder (2007) defines PES as a voluntary transaction involving at least one buyer and one seller, in which a well defined ecosystem service, or a land use that is likely to secure the ecosystem service, is bought if and only if the provider ensures the secured provision of the ecosystem services. Engel *et al*., (2008) and Sommerville*et al*., 2009 argue that the attractiveness of the PES model helps translate external, non-market values of the ecosystem

services into real financial incentives for the ecosystem services providers to continue the provision.

PES activities have at least four common features which make them distinct from other conservation approaches. These are conditionality, additionality, leakages and permanence (USAID, 2007; Cubbage*et al*., 2007; Capoor&Ambrosi, 2009). Conditionality implies that the economic rewards to ecosystem service providers are conditional on their continued performance. This is to say that service providers are to receive their payments only when they produce detectable changes both in quality and quantity of the service (USAID, 2007). Secondly, additionality requires that the payment should lead to the yield of ecosystem services that would otherwise not have been realized without it. If a land owner or user for instance was not planning to cut down trees, it is inefficient to pay him/her not to cut the trees down (USAID, 2007).

Thirdly, leakage is when a land owner being paid for the provision of an ecosystem service causes the environmental problem in another piece of land that is not under PES contract. This situation means that there is not any additionality thus it would be socially inefficient to make the payments (USAID, 2007). Lastly, permanence refers to the sustainability of environmental services, that is, long term supply of the services (Ibid). If the ecosystem service is discontinued, not only will it be unavailable, but all historic supplies of the service become invalid. A good example is when a tree is planted it sequesters carbon. However, when it is cut it not only disrupts the current carbon sequestration but it results into an emission of all the carbon that the tree ever sequestered between the time it was planted to the time of cutting.

PES is emerging as an umbrella of approaches to environmental management that uses financial incentives or other forms of compensation to act as provision of positive incentives to encourage ecosystem conservation and restoration to produce an environmental service (Milder *et al*., 2010). The incentives are meant to compensate those presently providing an environmental service or to incentivize those who would otherwise not provide the service (Sommervill*eet al*., 2009).

2.2 Impact of implementation of PES

The proponents of PES argue that most of the critical ecosystem services in developing countries are generated on rural lands owned and managed by the poor (Milder *et al*., 2010). Furthermore, spatial analyses indicate that poor people inhabit many of the lands that generate key ecosystem services in developing countries (Milder *et al*., 2010). Therefore, as markets and payment schemes for ecosystem services are emerging, the poor (low-income) land stewards stand to benefit from the compensations, rewards or payments they receive in exchange to the ecosystem services these lands provide (Ibid).

PES schemes aim to provide a net gain for participants through the positive incentives based on opportunity costs incurred by stopping a behavior that is detrimental to service delivery, or for taking actions to increase or maintain service delivery. Sommerville*et al*., (2009), Pagiola*et al*. (2005) and Swallow *et al*., (2007) are among those who are optimistic about the potential of PES to contribute to ecosystem management but feel that this function can be undermined if the same market based mechanism is used to also contribute to poverty reduction.

One of the major concerns of PES is its impact on the poor. The effectiveness of the PES programs in poverty alleviation depends on three factors: (1) the amount of cash payments; (2) poor peoples' ability to participate in the PES programs; and (3) the extent of poverty in the project area (Pagiola*et al*., 2005).However, PES approach was conceptualized as a mechanism aimed at improving the efficiency of natural resource management and not for poverty reduction (Pagiola*et al*., 2005).

Milder *et al*. (2010) indicates that several studies have evaluated the degree to which the poor (sellers of ecosystem service) have benefited or could benefit from PES. The findings indicate that PES has the potential to provide important livelihood benefits to the poor people at household or community level in the following forms: cash payments, enabling the transition to more profitable and resilient land-use systems, establishing secure land and forest tenure or strengthening social capital and supportive institutions (Milder *et al.,* 2010). The overall size and effect of pro-poor PES are yet to be quantified; therefore, the potential for PES to alleviate

poverty at a global level scale is largely unknown due to limited empirical studies aimed at evaluating the impact of PES on household wealth or income (Milder *et al*., 2010).

2.3 Constraints to implementation of PES

The effectiveness of a PES program to address poverty is largely dependent on the participation rate of households. Certain factors commonly influence participation in PES-programs, key among them are opportunity costs of land, socio-economic factors (farm size, land title, education of the decision makers in the family, family labour and off-farm income), time (the start of PES projects which are mostly top-down is usually low, but would increase over time once the project proves its efficient and effective), and transaction costs (Wunder, 2007; Zbinden and Lee, 2005; Kosoy*et al*., 2008; Pagiola*et al.*, 2008).

In their study of six carbon and two watershed projects in Latin AmericaGrieg-Gran *et al*. (2005) found out that some PES access rules discriminated against small landholders, such as formal tenure requirements in the form of a legal land title, and minimum area necessary for enrollment of such initiatives. To date, smallholders have largely been excluded from the regulatory carbon market because of limitations and complex rules related to land use based projects under the Kyoto Protocol's (Milder *et al.*, 2010).

The underlying structural constraints to PES identified by Wunder (2005) are mainly two. First, most of the poor often do not own or control any land, thus ruling them out as ecosystem service providers as long as the PES scheme is 'area-based'. Most of the poor who control land use activities and provide ecosystem services often do not have formalized or fully secure tenure. Therefore, PES by its nature is more relevant to non-poor small landholders who as Milder *et al.* (2010) puts it, offer some competitiveness in the provision of the ecosystem services, most often carbon sequestration.

Secondly, there are high transaction costs of dealing with many smallholders compared to only a few big landowners. This is even made worse by economies of scale in service provision, for example, the process of Kyoto certification required for carbon sequestration with elevated fixed costs (Wunder, 2005). The fact that the poor often control small tracts of land, they are disadvantaged since they have higher per-unit transaction cost compared to large landowners, who can sell a greater volume of ecosystem services per transaction (Wunder, 2005). A study of

carbon payments in Indonesia found out that payments for smallholders were feasible for farmers managing plots of 1.6 ha or larger, but infeasible for smaller farmers because of the proportionally higher transaction costs (Milder *et al*., 2010).

Further limitation into the access to PES participation for the poor communities who provide the ecosystem service is,the level of payment that sellers receive depends partially on their ability to negotiate a fair price. This underscores the need to access market information and have supportive local institutions in order to improve the bargaining position of rural poor landowners and communities (Milder *et al*., 2010). In addition, if the poor communities are providing an ecosystem service that is unique such as endemic biodiversity, their bargaining power will be significant. However, for ecosystem services that are more fungible and can be provided by many players (not unique to a limited number of service providers), especially carbon sequestration, prices are dictated by larger market forces, and poor people may find little flexibility in the price offered, in some instances it may lead to a situation where the payments are less than the landowners opportunity costs (Milder *et al*., 2010; Wunder, 2005).

The impact of PES also depends on which scale the mechanism is operating. The demand side of ecosystem service has different buyers who may choose to operate at different scales (Milder *et al*., 2010). If payments are made at a regional or central government, rather than at the community level, that is, individuals providing the ecosystem services, then attributing the positive incentive as the driving force for the provision of ecosystem service is not easy, although they drive the decision of the government to participate (Sommerville*et al*., 2009). Such PES interventions at the national level, may force the government to use a variety of negative incentives to ensure the local ecosystem service providers comply. The issues of the scale and PES approach are particularly relevant to REDD+ architecture/design under the UNFCCC as emissions credit are likely to accrue at the national level (Sommerville*et al*., 2009).

PES mechanism may be used as a program to influence attitude towards a regulation or a change in legal enforcement. Pagiola's (2008) analysis of the Costa Rica environmental service program (the PSA or *PagosporServiciosAmbientales*) which is the most advanced PES initiative of its kind within a developing country established to make a legislative ban on deforestation on private lands more palatable to landowners and to persuade them to cooperate. Under this

situation, PES is not being used to drive the change in behaviours, nevertheless, it is vital for the achievement of social support that may ultimately strengthen compliance within the anti-clearance law (Sommerville*et al*., 2009).

Property rights shape how people use natural resources, they define the incentives people face in undertaking sustainable and productive management (Meinzen*et al*., 2004). In addition, property rights of land affect the level and distribution of benefits from natural resources thus it affects people livelihoods. Secure tenure rights provide key assets for poverty reduction, allowing the poor to use it to invest in the land or using it as collateral for credit (Ibid). Therefore, land owners do not enjoy total freedom over the use of land because subjects and entities other than the land owner may have use rights over forests, such as rights of access, management or harvest. Thus, identifying "the land owner" only tells part of the story of who has the power to affect the carbon stock in a forest (Costenbader, 2009). Studies have highlighted how insecure land tenure can undermine the success of PES schemes, as participation in these programs often requires evidence of formal land title (Barbier&Tesfaw, 2011). However, tenure security does not necessarily require the possession of statutory land titles

2.4Forest Carbon Markets

There is a growing market for ecosystem services mainly covering carbon sequestration, watershed protection, biodiversity benefits and landscape beauty (Grieg-Gran *et al*. 2005). The carbon markets can be broadly classified as Kyoto compliant and voluntary markets (Jindal *et al*., 2008). The Kyoto compliant markets are those set up under the mechanisms of the Kyoto Protocol while the voluntary market is one where individuals and companies firms buy carbon credits for purposes other than meeting regulatory targets (Maness, 2009).

There are challenges in creating a market for land-use-based carbon credits accessible to the rural poor communities (Milder *et al.,* 2010; Wunder, 2005). Despite the carbon markets being the most advanced market for ecosystem services, only a small fraction of this volume is from LULUCF offsets, potentially affecting rural land stewards (Milder *et al.,* 2010). From the Kyoto protocol's Clean Development Mechanism (CDM), only afforestation and reforestation as the only allowable source of land use based carbon credits. To date, only 0.77 per cent of the projects focuses on afforestation and reforestation and out of 3542 project under CDM, Africa

only boast of 72, which is only 2.03 per cent yet it has the potential for more project related to LULUCF. Under the CDM facility, Kenya so far has only five (5) CDM projects out of which only one focuses on afforestation and reforestation which falls under the LULUCF (CDM, 2011).

With the Kyoto Protocol coming to an end in 2012, the future of regulated carbon markets is under negotiations and parties to UNFCCC seem to have agreed on the need to allow LULUCF projects, principally by reducing emissions from deforestation and forest degradation (REDD) (Westholm*et al*., 2011). This has the potential to provide opportunities to increase the participation of low-income communities in these markets given that it is land use based which supports the livelihoods of rural poor communities (Farley *et al*., 2010). In 2010, the United Nations Framework Convention on Climate Change (UNFCCC) negotiations in Cancun Mexico came up with a framework for payments for REDD and intends to have it included in future frameworks (Westholm*et al*., 2011). This means that REDD will be central to future international efforts to combat climate change.

Kenya was the first country globally to win a validation for REDD credits under Voluntary Carbon Standard and finally the country is now one of the REDD countries under the Forest Carbon Partnership Facility (FCPF) set up by World Bank in 2009. The FCPF assists tropical and subtropical forest countries develop the systems and policies for REDD and provides them with performance-based payments for emission reductions. Kenya has already undertaken some of the preliminary steps in effort to benefit from the funds that will be given to member countries to implement REDD by developing the Readiness Plan Idea Note (R-PIN) and the REDD Readiness Preparation Proposal (R-PP).

CHAPTER THREE: METHODOLOGY

3.1Analytical Framework

Effective development policymaking creates the need for reliable methods of evaluating or assessing whether an intervention had (or is having) the intended effect. Given that every policy intervention is always intended to have a certain effect, choosing an effective method of evaluation produces reliable information on what works and why. As a result, such information may be used to either modify or cancel ineffective programs, thus making the most of limited resources. In evaluating the impact of any policy intervention, it is important to note that it is the goal of an intervention that defines the metric by which to assess its effectiveness or whether it is having the intended effect (Essama-Nssah, 2006).

Payment for ecosystem services (PES) is one of those approaches seeking to support positive environmental externalities through the transfer of financial resources from beneficiaries of certain environmental services to those who provide these services (Mayrand&Paquin, 2004). PES can therefore be defined as the transfer of resources between social actors, which aims to create incentives to align individual and/or collective land use decisions with the social interests in natural resource management (Muradian*et al*, 2010).

It is being argued that PES offers major potential to raise funds for environmental conservation; target existing funds more effectively and in addition, secure environmental benefits that underpin business profitability, development initiatives and community livelihoods (Brink *et al*., 2011). However, it still remains unclear to what extent the objectives of environmental conservation, development and improved community livelihoods can be achieved simultaneously through market-based mechanisms.

3.1.1 Theoretical Framework

The theoretical foundations of PES lie in the principle of mutually beneficial bargain stated by economist Ronald Coase. PES attempt to put into practice the Coase theorem, which states that if the private property rights are clearly defined by enforceable contracts, then the providers of the ecosystem service and the beneficiaries of an externality can, through negotiations or bargaining, potentially reach an agreement that maximizes social welfare or is socially efficient in terms of

adequate allocation of environmental resources. This is possible regardless of the initial allocation of property rights over assets. (Farley *et al*., 2010; Muradian*et al*., 2010; Jindal &Kerr, 2007).

The theorem proposes that in the case of environmental problems, as long as transaction costs are low enough and property rights clearly defined, then individuals, communities and national entities would trade their rights away until a Pareto-efficient provision of environmental goods and services has been achieved (Muradian*et al.,* 2010). However, Coase theorem has limitations since environmental problems are usually associated with enormous transaction costs especially given the existence of multiple partied affected by an environmental service (Farley *et al*., 2010; Jindal & Kerr, 2007).

Transaction costs refer to the cost of negotiating a contract, implementing a payment scheme, and monitoring and measuring changes in the level of the environmental service (Jindal &Kerr, 2007). As a result of the high transaction costs attempts to address the externality and non-excludability in environmental services has been a challenge and therefore very few PES schemes achieve all the five standards proposed by Wunder (Farley *et al*., 2010; Swallow *et al*., 2007).

The Coasean approach emphasizes on the reduction of the transaction costs, allocating property rights and establishing bargaining process between the providers of environmental services and those willing to pay in order to enhance the provision of such services. In addition, property rights in the PES context is not limited to land ownership but also land use rights and rights to commercialize environmental services (Muradian*et al*., 2010). Therefore, PES reflects a de facto definition of property rights in as far as service providers acquire contract obligations to undertake or maintain certain land use activities and in some cases buyers also get the right to trade in the services (Muradian*et al.*, 2010).

The overarching principle of PES is ensuring that those who benefit from a particular ecosystem service compensate those who provide it, thus giving them an incentive to continue doing so. It assumes that the direct beneficiaries or users of ecosystem services are often willing to pay to secure the services that underpin their business e.g. continued emission of GHGs through industrialization and forest function to absorb the gases. Therefore, the private beneficiaries who

make voluntary PES contracts with service providers internalize (some) environmental externalities without investing in more expensive remediation in return for adopting land use practices that secure ecosystem conservation and restoration (Wunder, 2005; Brink *et al*., 2011).

By giving incentives to those providing the ecosystem services, PES aims to improve the incentives for land use and management practices that supply such services. However, it differs fundamentally from other conservation approaches given that instead of presupposing a win-win solution, it explicitly recognizes hard trade-offs with mounting land-user pressures, and seeks to reconcile conflicting interests through compensation. In other words, in situations where trade-offs exists between private and societal benefits from difference land use, it is argued that PES can tip the balance and make conservation-focused land use more profitable for the private owner/users with additional benefits for society. Through such bargaining, two parties may arrive at an adequate allocation of an environmental resource that is socially efficient. On the contrary, without such opportunities presented by PES, chances are that the owner/user would probably not choose the social optimum (Wunder, 2005; Brink *et al*., 2011).

3.1.2 Conceptual framework

Several factors influence the outcome of a PES in terms of the impact it may have where implemented. This study focused on the following factors and how they influence participation in the PES and that can be measured to determine the level of impact of the scheme. These research studied the influence of the following factors on PES, these are, property rights, demographic and socio-economic status of the households which is illustrated with the conceptual framework shown below

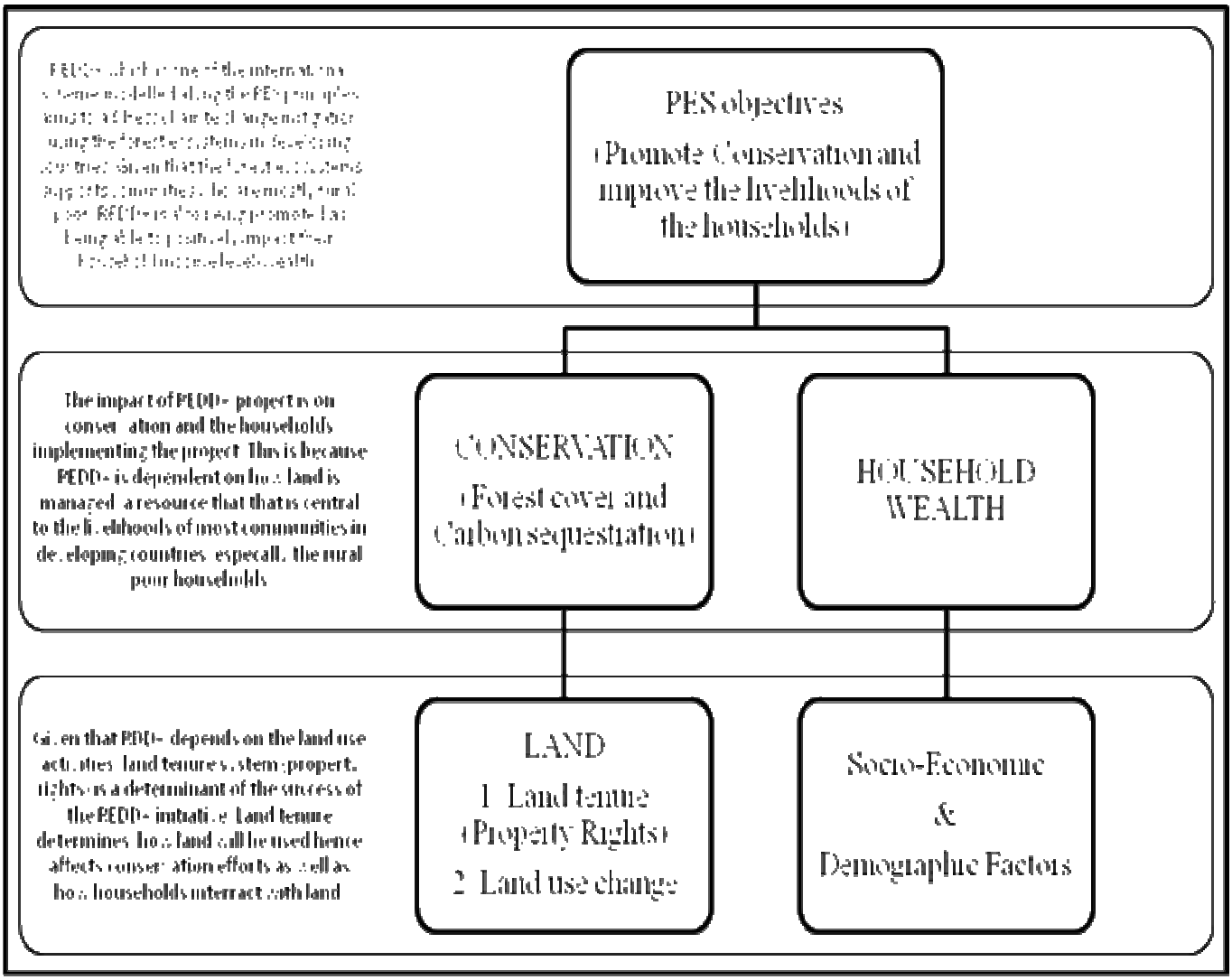

Figure 3.1: A conceptual framework of the PES programme, its impacts and variables for the Research

3.2 Methodsand Study Design

3.2.1 Study Area

The Kasigau Corridor REDD Project is located in South-East part of Kenya, approximately 150 kms North-West off Mombasa a city, in the Marungu Sub-location, Voi Division, TaitaTaveta District, Coast Province, Kenya. The project area includes the land that falls between Tsavo East National Park and Tsavo West National Parks south and east of Voi town, and includes over a dozen communities including Maungu, Itinyi, Buguta, Marungu, Kale, Mwakasinyi, Sasenyi, Kilibasi, Mackinnon Road, Sagalla, Mwatate, Rukanga, Jora, Bungule and the privately held

group ranches of Kasigau, Taita, Amaka, Maungu, Mgeno, Kambanga, Wangala, Buchuma, Washumbu, Dawida, Sagalla and Wananchi which are owned by various local community members, in some cases with 50 shareholders, in others with as many as 2500 (PDD, 2011).
There are estimated to be approximately 100,000 people within 5 km of the project boundaries (PDD, 2011). Currently, the project is within TaitaTaveta County which according to the KIHBS of 2009, has a total population of 284, 657. The county covers an area of 17,084 Km^2 which translates into a population density of 17 people per Km^2. The poverty rate of the county is 54.8 per cent with 72.4 per cent of the population leaving in rural areas.

Climate

The climate in this region of Kenya is semi-arid, with average annual rainfall in the 300-450mm range. Historically rains occurred seasonally twice a year, in December and April, known as the grass rains and the long rains respectively. However in the past ten years local climatic conditions appear much more irregular and there have been two periods of extended drought in the last ten years (PDD, 2011;PDD, 2012).

Geology

This area is dominated geologically by the remnants of the Eastern Arc Mountains, which include the Taita Hills, Mt. Kasigau, and lesser hills such as Sagalla, and the Marungu Range that runs North-South down the Western boundary of the Project Area. These hills are home to remnant patches of montane or cloud forest, and to several endemic species of bird and flora (PDD, 2011;PDD, 2012).

Types and Condition of Vegetation at the Project Area

The vegetation in the Project Area has been stratified into four strata roughly corresponding to different elevations that range within the Project Area from 1500-3500 feet above sea level.

Montane Forest

On the slopes of the Marungu Range from 2000-3500 ft elevation, that forms the western boundary of the Project Area, there are still fragments of montane forest (1%), similar in composition to forest fragments of the Taita Hills that are located 50kms NW of the Project

Area. The Taita Hills forest fragments in Southeast Kenya currently cover an area of only $3Km^2$. This reflects a 98% reduction in indigenous forest cover over the last 200 years, mainly due to clearance for agriculture (PDD, 2011; PDD, 2012).

Despite the small size of the twelve remaining forest fragments (range 1-179 ha, 9 fragments < 10 ha) these remnants are of global conservation importance because of their long list of rare and endemic species, both flora and fauna. The fragmentation of this strata occurred prior to the REDD project as a result of illegal harvest for building poles and fuelwood by members of the communities adjacent to the Project Area in the years of early population colonization of the community lands located there (PDD, 2011). There are still some patches of primary forest in this area.

Dryland Forest

The majority of the Project Area (86%) is comprised of Acacia-Commiphoradryland Forest, where the dominant species are drought specialists (PDD, 2011:PDD, 2012).

Savannah Grassland

At the lowest elevations of the Project Area (8%) and in a band that runs irregularly through the Project Area the thick Acacia-Commiphora Forest thins and eventually transitions to patches of grassland. The Grassland stratais comprised of indigenous savannah grasses and shrubs, with the occasion Acacia zanzibarica (PDD, 2011).

Historical background

There are essentially two communities living in the project area (TaitaTaveta County), these are, the Taita and Duruma communities, with the Taita tribe being the vast majority. The Taita are subsistence agriculturalists, so they cleared the dryland forest and planted maize, with little success. Before Wildlife works came into the area, the only formal employer in the project area was Taveta Sisal estate. Other economic activities in the project areas are service business, small shops, bars etc (PDD, 2011; PDD 2012).

Legal title to most land in Kenya was originally held by the “Crown” during the colonial period, and then reverted to the Government of Kenya post-independence (1963). Over the years the Government has issued leasehold title deeds to land in the project area, but only for large blocks of land known as Group Ranches, which applies to all the ranches in the project area, that is,

Kasigau Corridor in TaitaTaveta County (PDD, 2011;PDD 2012). For a long time, the villages and communities maintained a traditional community trust land system in the land areas outside of the Group Ranches, where the Chief (which is the highest appointed administrative officer at the Location level) can allocate land to a family for farming, but the family has no formal legal rights on the land. However, this was not successful as some of the indigenous local communities (immigrant Duruma) cleared the vegetation for human settlement and to get agricultural land within the community land zone (PDD, 2011)

The process of land adjudication and subdivision for rural land schemes by the government commenced in the community trust lands with the aim of giving families individual titles to land. The process of allocation of individual title to forested land has not been successfully completed. For the time being the majority of the land in the project area is part of legally allocated group ranches in which Public companies owned by local shareholders. Given that the area is within the ASALs zone, most of the attempt to engage in agriculture has not been successful. In addition, given that most of the local communities do not practice large scale cattle ranching, the ranches have in the past few years experienced illegal charcoal trade. The balance of the land in the project area is still community trust land although much of it is in the process of being subdivided for farming plots (PDD, 2011).

3.2.2 Benefit Sharing Arrangement for the Kasigau Corridor REDD+ project

The KasigauREDD+ project is involved in the sale of the sequestered carbon from avoided deforestation and forest degradationto the existing carbon markets market. Given that the ecosystem service of carbon sequestration is as a result of land use changes by the local communities and land owners in Rukinga Ranch, they receive financial incentives as compensation. From the sale of the carbon which is done every quarter by Wildlife Works, the revenue received is split evenly, with one third of the funds devoted to project administration, another third devolved to the ranch owners (owners of the land) and a final third shared with local communities living within the ranches via the Wildlife Works Carbon Trust.

The Wildlife Works Carbon Trust is an institution created with the aim of ensuring the money set aside to directly benefit the community is used transparently and for the right purpose. Members of the communities within the project zone access the money either by writing proposals for community-based development to be funded by Wildlife Works Carbon Trust. The Project

proposals are submitted by an association which brings together several community based organizations (CBOs) within each ranch and are composed of ocals within the project area. The proposals are then submitted to a Locational Carbon Committee (LCC) of which there is one in each ranch and they mainly act as a liaison between the Carbon Trust and local communities within each ranch.

The LCC's are composed of seven community members, with both genders and youth represented and drawn from the local CBOs. The approved proposals receives the financial incentives from the sale of carbon and in consultation with other community members in each ranch agree on how to best to utilize the resources based on the intended purpose. Most of the proposal focus on the immediate needs of the communities, which are, access to water, bursaries, building and repair of classrooms in schools, rural electrification, and supporting the payment of some teachers in public schools among others.

Note: The communities who benefit from the sale of carbon do not receive money directly, but through community institutions set up to ensure that the revenue from the sale of carbon has an impact to the community.

Roles of various institutions within the benefit sharing arrangement

Wildlife works carbon company: They are the once who once the verification of the carbon is done are involved in the sale of carbon in the market place and receive the funds.

Landowners or Ranch Owners: These are the shareholders within the Ranch, though Wildlife Works Carbon is the majority shareholder

Wildlife Works Carbon Trust: This is a trust that only holds the money for the community for disbursement. They have no influence in the decisions made by the communities apart from ensuring transparency and accountability in the utilization of the carbon funds. However, it does not have a representative from the community or the land owners.

Locational Carbon Committees (LCC) – Also referred to as Local Development Committee: These are elected community members who link the community with the wildlife works carbon trust by playing an advisory role in terms of how the carbon funds are to be utilized through identified community projects.

Community Institutions (CBOs): These are community institutions bringing together community members e.g. women groups, youth groups. They act as a link between the Trust and the community where the identified projects are implemented They are mainly involved in receiving of proposals from the community members and submitting them to the LCCs directly of through an association that brings together several CBOs for considerations.. Each of the association and CBOs are governed by a Constitution

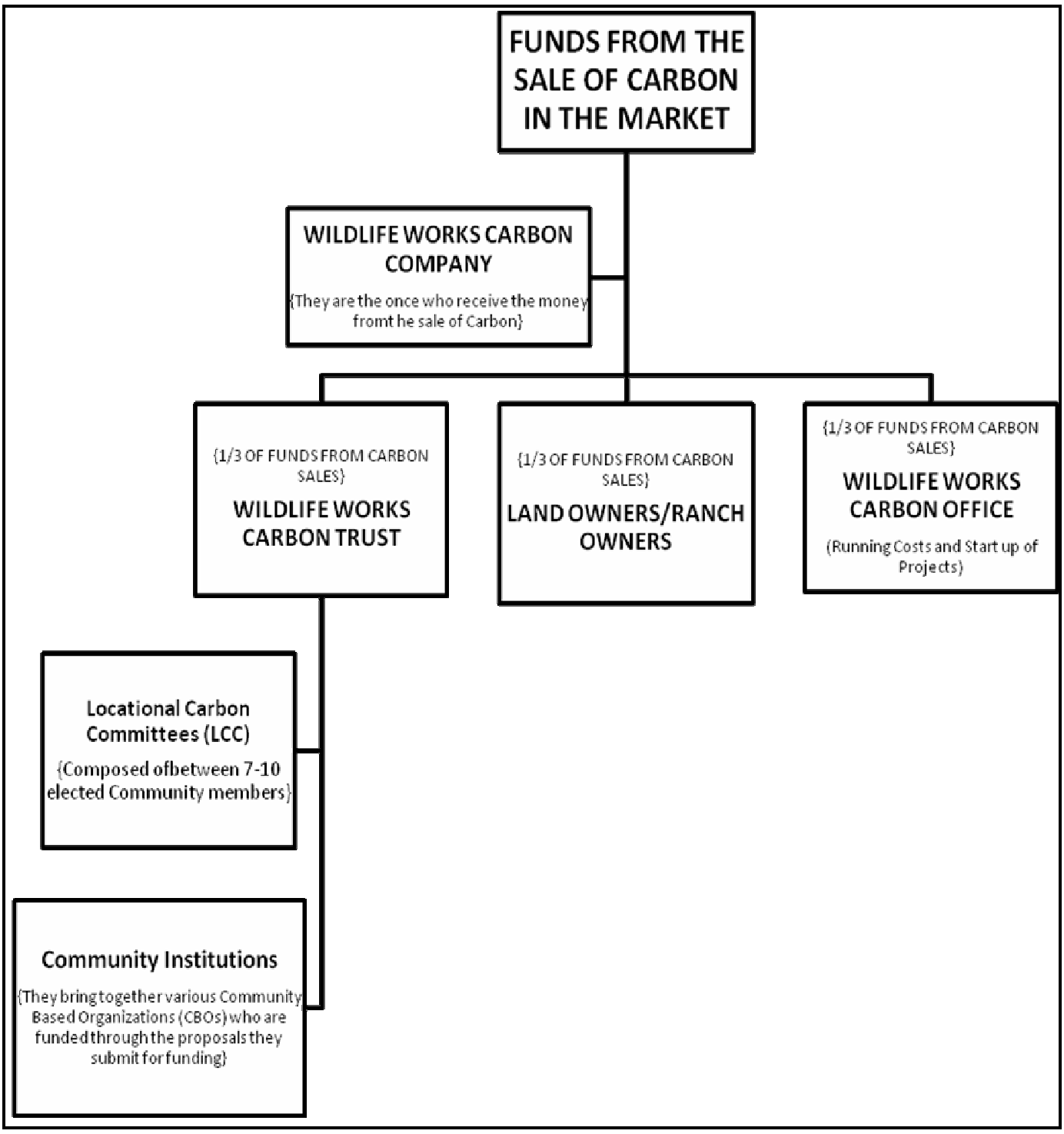

Figure 3.2 Flowchart showing Benefit Sharing Model for the Kasigau Corridor REDD+ Project

Table 3.1: List of all the 14 blocks under the Kasigau Corridor REDD project with the land ownership

	RANCH	AREA D	OWNERSHIP
1.	Taita Ranch	35,612 ha	Taita Ranching Company Ltd a collection of indigenous local shareholders
2.	Mgeno Ranch	21,232 ha	Mgeno Ranching (DA) Company Ltd., a collection of indigenous local shareholders
3.	Maungu Ranch	21,619 ha	Maungu Ranching (DA) Company Ltd. a collection of indigenous local shareholders
4.	Kasigau Ranch	21,186 ha	Kasigau Ranching (DA) Company Ltd., a collection of indigenous local shareholders
5.	Wangala Ranch	2,023.5 ha	Livingstone and AlphonceIkonge, local indigenous shareholders
6.	Kambanga Ranch	12,948 ha	Kasigau Ranching (DA) Company Ltd., a collection of indigenous local shareholders
7.	Dawida Ranch	4,046.86 ha	Dawida Ranching Group Company Ltd., a collection of indigenous local shareholders
8.	Washumbu Ranch	14,501 ha	Washumbu (DA) Ranching Company Ltd., a collection of indigenous local shareholders
9.	Amaka Ranch	5,998 ha	Amaka Development Limited., a collection of indigenous local shareholders
10.	Sagalla Ranch	17,402 ha	Sagalla Ranchers Limited, a collection of indigenous local shareholders
11.	Ndara Ranch	1834.77 ha	Eliud Timothy Mwamunga, a local indigenous stakeholder
12.	Choke Ranch	5,076 ha	Raymond Joel Mwangola a local indigenous shareholder
13.	Kutima Ranch	5,076 ha	Kutima Investments Limited, a collection of indigenous local shareholders

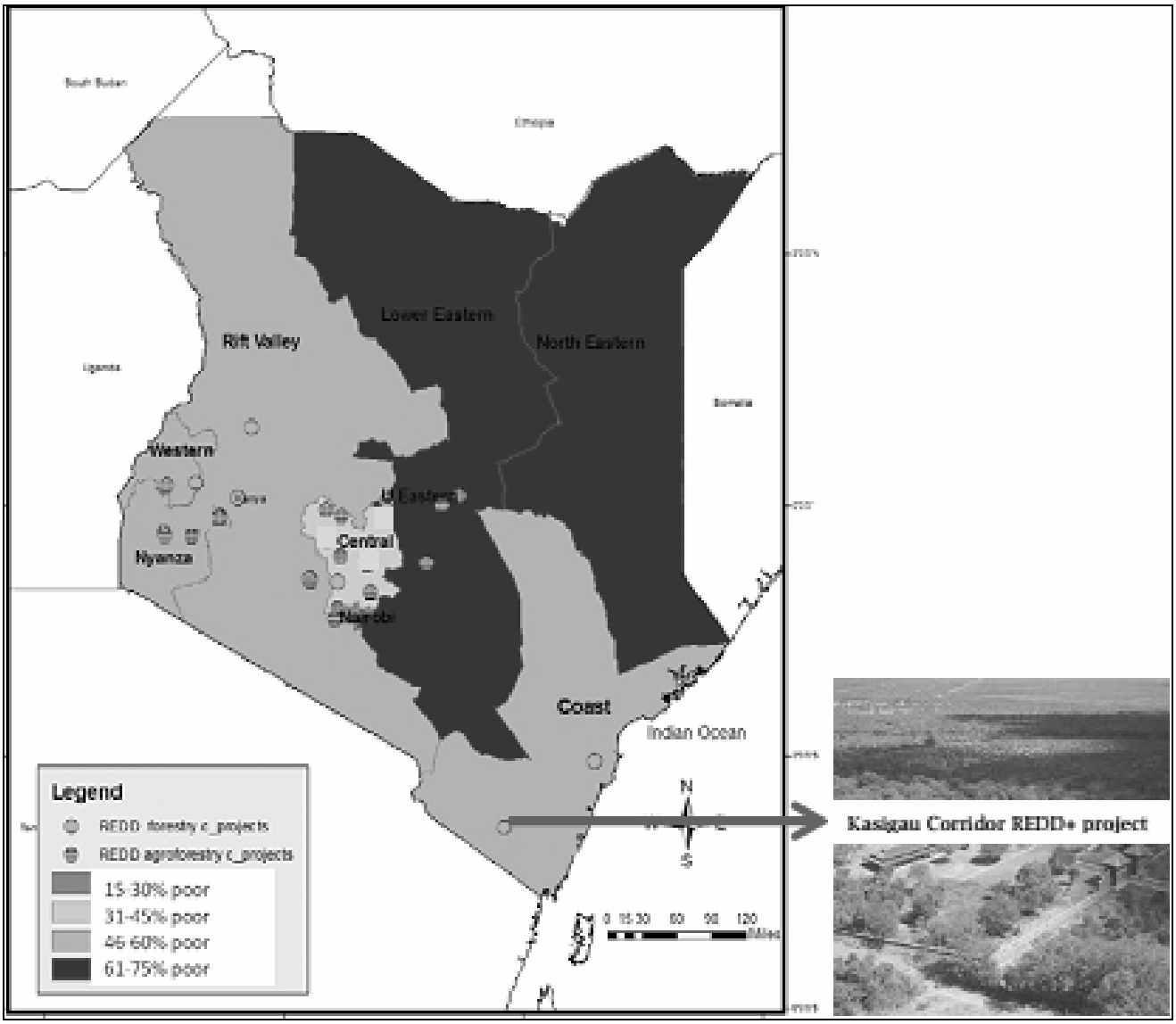

Figure 3.3: Map of TaitaTaveta where the Kasigau Corridor REDD project is being implemented

3.2.3Empirical Framework

The evaluation of the impact of the Kasigau REDD project will require a model of causal inference, that is, show a cause-and-effect relationship between the program or intervention and the outcome on the intended target group. This PES projects just like most others is designed to at least meet two primary objectives, that is, promote environmental conservation as well as improve the livelihoods of the participating communities. Therefore, of fundamental interest in

evaluating the impact of the project is whether the interventions (REDD), as designed, is effective in accomplishing these two objectives.

Based on this background, the study has appliedtwo fundamental concepts in evaluating the impact of the REDD project on the household wealth (meant to measure the impact of PES on rural livelihoods). These are, first is the counterfactual outcome, that is, an estimate of what outcome (Y) would have been for a participant in the program (P) in its absence and secondly, determining the causal effect of the program (Gertler*et al.*, 2011).

Since the counterfactual outcome is never observed, it has to be estimated using statistical methods. This PES projects just like most others is designed to at least meet two primary objectives, that is, promote environmental conservation as well as improve the livelihoods of the participants. Therefore, of fundamental interest in evaluating the impact of the project is whether the interventions (REDD), as designed, is effective in accomplishing these two objectives.

A credible impact evaluation is based on at least two fundamental concepts, first is the counterfactual outcome, that is, an estimate of what outcome (Y) would have been for a program (REDD Project) participant in the absence of the program (P) and secondly, determining the causal effect of the program(Gertler*et al.*, 2011).Since the counterfactual outcome is never observed, it has to be estimated using statistical methods. Therefore, random assignment is used to assure that participation in the intervention is the only differentiating factor between treated and the control groups, so that the control group can be used to assess what would have happened to participants in the absence of the intervention.

However, one of the main challenges of impact evaluation is to determine what would have happened to the beneficiaries if the project, program or intervention, in this case, if the REDD project had not existed. A beneficiary's outcome in the absence of the intervention would be its counterfactual. Although one can observe and measure the outcome (Y) for program participants $(Y|P = 1)$, there are no data to establish what their outcomes would have been in the absence of the program $(Y|P = 0)$ {Note – in basic impact evaluation formula, $(Y|P = 0)$represents the counterfactual} (Gertler*et al*., 2011).

Finding an appropriate counterfactual constitutes the main challenge of an impact evaluation. With no information on the counterfactual, the alternative is to compare outcomes of treated households with those of a comparison group of households very similar to the treated group or households, such that those who received treatment would have had outcomes similar to those in the comparison group in absence of treatment.Careful random selection of the control group (or the counterfactual) is critical in ensuring comparability, elimination of selection bias and being able to calculate the treatment effect (of difference in outcomes) between two groups. This means that there is need to ensure randomization which could be conducted purely randomly where treated and control groups have the same expected outcome in absence of the program (Khandker*et al*., 2010).

The difference in outcome between the treated and the control group is as a result of various factors and/or programme, but impact evaluation helps to overcome the challenge of establishing causality empirically. This is done by establishing to what extent a particular programme, in this case the REDD project contributed to the change in outcome. To establish causality between a program (REDD Project) and an outcome, we use impact evaluation methods to rule out the possibility that any factors other than the program of interest explain the observed impact.

The causal effect of the program (REDD Project), **P** on the outcome **Y**, is given by the basic impact evaluation formula:

$$\propto = (Y|P = 1) - (Y|P = 0) \quad \text{.....3.1}$$

This formula shows that the causal impact (α) of a program (P) on an outcome (Y) is the difference between the outcome (Y) with the program (in other words, when P = 1) and the same outcome (Y) without the program (that is, when P = 0). That is, if P denotes the REDD project and Y denotes household wealth, then the causal impact of the REDD project (α) is the difference between a household wealth (Y) after participating in the REDD project (in other words, when P = 1) and the same household income (Y) at the same point in time if the household had not participated in the program (in other words, when P = 0) (Gertler*et al*., 2011).Therefore, random assignment is used to assure that participation in the intervention is the

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3.2.4Methods of Counterfactual Estimates

These two methods for estimating the counterfactual applied in this research are, (a) before-and-after or pre-post comparison that compares the outcomes of an intervention in the treated group prior to and subsequent to the introduction of the project/program; and (b) with-without comparison between those participating and those not participating, that is, treated and a control or comparison group. The research applies with-and-without comparison in evaluating the impact of project on household wealth for those participating.

To evaluate the impact of the project on household wealth between the treated and the control, that is, those participating and non-participants, the research applies the with-and-without method. Therefore, the group that is taken as control should have similar characteristics to the treated group such that one can say that if it were not for the project intervention (in this case the REDD project) then the treated group would end up being like the control group.

3.2.5Data needs, types and sources:

The data needs for the study were both primary and secondary data under categories of socio-economic, farm level and institutionalfactors. In terms of the data types, the studyrelied on both quantitative and qualitative. Under quantitative, the study used both nominal and ratio data types from the primary data gathered. In terms of the sources to be used, for quantitative data types, the study used questionnaires while for qualitative interviews, focused group discussions and desktop review of documents was used.

3.2.6 Sampling procedure and data collection:

The research applied a multi-stage sampling method. This included, purposive samplingwhere the ranches in TaitaTavetacounty were indentifiedsince there already exists a PES project being implemented in 13 ranches. The next stage involved a random identification of one ranch (Maungu) that would be used as the treated ranch from the 13 ranches. Within the identified ranches which were acting as the treated group, we randomly identified three (3) villages out of 5 villages within Maungu ranch. The sampling of the households which were interviewed within the treated group were randomly selected using simple random sampling.

On the other hand, the sampling procedure for identification of a control group was random given that the 13 ranches where the PES project is being implemented in TaitaTaveta are boarded by other ranches. The control group was randomly selected from the ranches that neighbours the project area and that had similar characteristics to the identified treated group. The sampling of the villages and households within the control group was done in a similar way as in the treated group, that is, randomly identified three (3) villages as well as the households to be interviewed. However, to ensure that there was almost an equal proportion of gender interviewed, stratified random sampling was applied at the household level.

The project area has an estimated population of 350,000 people, that is, within the 13 ranches where the PES project is being implemented. The total estimated population within the project area and in adjacent ranches is 450,000 people. From the 2009 household census survey, it indicates that the average household size in TaitaTaveta is four (4), therefore, the total average household from a population of 450,000 is approximately 112,500 households.

To determine the sample size for the households, we used the Cochran method with a confidence level of 95%.

$$n_0 = \frac{Z^2 pq}{e^2}$$

From this method, the result was a sample size of 384 which was to be distributed equally between the control and the treated group. However, due to limited financial resources, we could only sample 250 households which was divided equally between the control and treated group.

The questionnaires used for data collection were coded, to distinguish between those used in the control and treated groups. Data collection was done with the assistance of experienced research assistants from the area.

3.2.7 Data analysis:

The primary data collected after interviewing the households in both the treated and control groups were entered into both an excel sheet and SPSS programme. This was followed by cleaning up the data for any errors that may have occurred during the data entry stage. After cleaning the data, they were coded within both the excel spreadsheets and the SPSS programmes to make it easy for running certain analysis. The coding was for both quantitative and qualitative data that was collected.

After the coding, descriptive analysis from the primary data was done using both the excel spreadsheets and SPSS programmes. This was mainly to generate graphs, pie-charts, tables as well as undertake t-test analysis to help in determining the statistical significance of the mean differences between the two groups, that is, treated and control groups. For ease of analysis, data analysis were organized around three (3) Sub-themes, these being; a) demographic –age, sex, marital status, level of education, household size; b) socio-economic status which includes average monthly household income, distance to certain facilities (schools, health facilities and shopping centre), distribution of the income levels amongst various economic activities, natural, physical, human, social and financial capital; and, c) institutional status such as the different types of land tenure systems, the decision making mechanisms in land management and land use activities within the area.

Econometric analysis was done using STATA programme to analyze for the propensity scores of the various variable to determine how they affect participation in the PES programme. In addition, the estimation of the average treatment effect of the PES programme was conducted using matching estimators like nearest neighbour, radius matching and kernel matching methods.

3.2.7.1 Computing Wealth index using principal component analysis

Generally, households are endowed with varying levels of different assets each of which could potentially contribute to their wealth statuses. Therefore, ranking households based on their economic statuses without normalizing (or weighting) the assets in a way that eliminates

distortions due to different measurement scales (Langyintuo, 2008). Once normalized, the indices can be constructed and aggregated to facilitate ranking. The study applied the principal component analysis (PCA) to compute household indices. It factors in several main components (factors) that constitute what contributes to household wealth from different income sources. The components or factors considered by the study as having an influence on peoples' livelihoods and determines how they are endowed with assets or capital are, natural capital, physical capital, human capital, social capital and financial capital. The indicators under each component are as shown in table 4.4 below:

The PCA is a technique for extracting from a set of variables those few orthogonal linear combinations of the variables that capture the common information most successfully (Ibid, 2008). The first principal component of a set of variables is the liner index of all variables that capture the largest amount of information that is common to all the variables. This is done by specifying each variable normalized by its mean and standard deviation.

The selected variables are then expressed as linear combinations of a set of underlying components for each household (Ibid, 2008).

$$a_{ij} = v_{11}A_{1j} + v_{12}A_{2j} + \cdots + v_{1k}A_{kj}$$

$$\ldots \qquad V_j = 1, \ldots, j \qquad (1)$$

$$a_{k1j} = v_{k1}A_{1j} + v_{k2}A_{2j} + \cdots + v_{KK}A_{Kj}$$

where the A_s are the components and the v_s the coefficients of each component for each variable (and do not vary across households). Since the solution to this problem is indeterminate since only the left-hand side of each line is observed, PCA overcomes this by finding the linear combination of the variables with maximum variance, usually the first principal component A_{1j}. and then the second linear combination of the variable, orthogonal to the first, with maximal remaining variance, and so on. The "scoring factor" from the model are recovered by inverting the system implied by equation (1) and yield a set of estimates for each of the *K* principal components.

$$A_{ij} = f_{11}a_{1j} + f_{12}a_{2j} + \cdots + f_{1k}a_{kj}$$

$$\ldots \qquad V_j = 1, \ldots, j \qquad \textbf{(2)}$$

$$A_{K1j} = f_{K1}a_{1j} + f_{K2}a_{2j} + \cdots + f_{KK}a_{Kj}$$

The first principal component, expressed in terms of the original (un-normalized) variables, is therefore an index for each household based on the expression.

$$A_{1j} = f_{11}(a^*_{1j} - a^*_1)/(s^*_1) + \ldots + f_{1K}(a^*_{Kj} - a^*_K)/(s^*_K) \qquad (3)$$

The assigned weights are then used to construct an overall 'wealth index', applying the following formula:

$$W_j = \sum_{i=1}^{k} [b_i(a_{ji} - x_i)]/s_i \qquad (4)$$

where: $\boldsymbol{W_j}$is a standardized wealth index for each household; $\mathbf{b_i}$represents the weights (scores) assigned to the (k) variables on the first principal component; $\mathbf{a_{ji}}$is the value of each household on each of the k variables; $\mathbf{x_i}$is the mean of each of the k variables; and $\mathbf{s_i}$the standard deviations.

A negative index ($-W_j$) means that, relative to the communities' measure of wealth, the household is poorly endowed and hence worse-off while a positive figure (W_j) signifies that the household is well-off. A zero value, which is also the sample mean index, implies the household is neither well-off nor worse-off. One of the advantages of PCA is that it estimates the contribution of each variable to the underlying common phenomenon, and thus enables the ranking of indicators according to their importance in determining a household's level of wealth.

Table 3.2: Field Survey indicator variables

	MAIN COMPONENT	SUB-COMPONENT
1.	**Natural Capital**	Total size of land owned
		Land Placed under Cultivation
		Area of land under the REDD Project
2.	**Physical Capital**	**Types of House** • Brick/stoned • Wooden • Mud
		Livestock • Dairy Cattle • Bulls • Goats • Sheep • Donkey • Poultry • Pigs
		Farm Equipments • Tractors • Ox-Plough • Wheelbarrow • Generator • Panga/Jembe
		Others • Motor Vehicle • Bicycle/Motorcycle • Scotch Cart • Television • Radio • Water tank • Mobile phone • Computer)
3.	**Human Capital**	Number of Family members employed
		Number of family members contributing to the household income
4.	**Social Capital**	Membership to an association
		Benefits received from the association
5.	**Financial Capital**	Benefits received by participating in the REDD+ project
		Access to credit Facility

3.2.7.2 Propensity Score Matching

An impact evaluation is simply a problem of missing data since one cannot observe the outcomes of participants in a program if they were not beneficiaries. Therefore, with counterfactual information, comparison can be done between the outcomes of treated households or individuals with those of a comparison group that has not been treated. The attempt is to get to compare the treated group with one that is very similar to it, such that those who received treatment would have had similar outcomes to those in the comparison group (untreated or control group) in absence of treatment (Khandker*et al*., 2010).

Resonbaum and Rubin (1983) define matching as a method of sampling from a large reservoir of potential control to produce a control group of modest size in which the distribution of covariates is similar to the distribution in the treated group. Matching methods relies on observed characteristics to construct a comparison or control group, thus it requires a very strong assumption of no unobserved differences in the treatment and control or comparison group also associated with the outcomes of interest. Matching essentially uses statistical techniques to construct a comparison group by identifying for every possible observation under the treated group a non-treatment observation (or set of non-treatment observations) that has the most similar characteristics possible (Rosenbaum &Rubin, 1983; World bank, 2010; World bank, 2011). The challenge of matching arises when there are numerous differences between the treated and control (untreated) group/units which is a dimensionality problem that is common when we have multiple observable dimensions (that is, with many variables).

To solve the problem of dimensionality, Rosenbaum and Rubin (1983) proposed the calculation of the propensity score which they defined as the conditional probability of receiving a treatment given pre-treatment characteristics (Rosenbaum & Rubin, 1983). Rosenbaum and Rubin (1983) findings forms the theoretical basis of PSM, that is, when it is valid to match units based on the covariates X, it is equally valid to match on the propensity score. In other words, the probability of participation summarizes all the relevant information contained in the X variables. The major advantage realized from this is the reduction of dimensionality, since it allows for matching on a single variable (the propensity score) instead of on the entire set of covariates.

$$p(X) \equiv Pr\{D = 1|X\} = E\{D|X\} \quad (1)$$

Where $D = \{0,1\}$ is the indicator of exposure to treatment, and X is the multidimensional vector of pre-treatment characteristics. Rosenbaum and Rubin (1983) show that if the exposure to treatment is random within cells defined by X, it is also random within cells defined by the values of the mono-dimensional variable p(X). As a result, given a population of units denoted by *i*, if the propensity score $p(X_i)$ is known the Average effect of Treatment on the Treated (ATT) can be estimated as follows:

$$\begin{aligned} \tau &\equiv E\{Y_{1i} - Y_{0i}|D_i = 1\} \quad (2) \\ &= E\{E\{Y_{1i} - Y_{0i}|D_i = 1, p(X_i)\}\} \\ &= E\{E\{Y_{1i}|D_i = 1, p(X_i)\} - E\{Y_{0i}|D_i = 0, p(X_i)\}|D_i = 1\} \end{aligned}$$

where the outer expectation is over the distribution of $(p(X_i)|D_i = 1)$and Y_{1i} and Y_{0i} are the potential outcomes in the two counterfactual situations of (respectively) treatment and no treatment.

The primary purpose of the propensity score is that it serves as a balancing score. The main idea behind balancing tests is to check whether the propensity score is an adequate balancing score, that is, to check to see if at each value of the propensity score, X has the same distribution for the treatment and comparison groups (Wang, 2006). Therefore, propensity score matching constructs a statistical comparison group based on a model of probability of participating in the treatment using observed characteristics. Participants are then matched on the basis of this propensity score, to non-participants (control group). Using this, the average treatment effect of the program is then calculated as the mean difference in outcomes across these two groups. The validity of PSM depends on two conditions: (a) conditional independence (namely, that unobserved factors do not affect participation) and (b) sizable common support or overlap in propensity scores across the participant and nonparticipant samples (Khandker*et al.*, 2010).

Using the propensity score method, the procedure for estimating the impact of a program can be divided into three straightforward steps (Heinrich *et al.,* 2010): a) estimate the propensity score using a model or a function; b) choose a matching algorithm that will use the estimated propensity scores to match untreated units to treated units; and c) estimate the impact of the intervention with the matched sample to calculate the average treatment effect (ATT) and the standard errors.

This study uses a Logit model in the first stage to analyze the probability of participation in PES project. The dependent variable in this case is whether a household is participating in the programme, which is not continuous. It takes a value of 1 for a household that is participating in PES project and 0 for non-participants. Such models are estimated using qualitative variable models such as Logit or Probit. Both the Logit and Probit models estimate parameters using maximum likelihood. The Probit model assumes normally distributed error term whereas the Logit model assumes a logistic distribution of the error term. The Logit model is often preferred due its consistency in parameter estimation associated with the assumption that error term in the equation has a logistic distribution (Ravallion, 2001; Baker, 2000).

Using Stata Software, different approaches can be used to match participants and nonparticipants on the basis of the propensity score, using the logit function given that the treatment is typically dichotomous (i.e. P=1 for the treated and P=0 for the control-untreated). It is critical that a flexible functional form be used and that all relevant covariates that relate to treatment status and outcomes are included in this model to account for differences between treated and untreated units. Some of the most common matching algorithms are, nearest-neighbor (NN) matching, radius matching, stratification matching, and kernel matching. Regression-based methods on the sample of participants and non-participants, using the propensity score as weights, can lead to more efficient estimates (Khandker*et al*., 2010; Gertler*et al.,* 2011)

3.2.7.3 Estimating the Average Treatment Effect (ATT) using the matching algorithms

i. Nearest Neighbour Matching Method

The nearest neighbour matching method is the commonly used method where each treated unit (household)is matched with a unit (household) from control group with the closest propensity score with or without replacement. In the nearest neighbour matching method with replacement,

an untreated individual can be used more than once while without replacement the untreated individual is considered only once. Replacement increases the average quality of the matches and reduces bias especially with data where the propensity score distribution of the treated and the control group differs greatly (Caliendo&Kopeinig, 2008).

However, replacement reduces the number of distinct untreated individuals usedto construct the counterfactual and increases the variance of theestimator (Smith & Todd, 2005).Once each treated unit (household) is matched with a control unit, the difference between the outcome of the treated units and the outcome of the matched control is computed (Smith & Todd, 2005). The ATT of interest is then obtained by averaging these differences.

ii. Kernel Matching Method

This method is a nonparametric matching estimator that compares the outcome of each treated units (households) to a weighted average of the outcomes of all the untreated units (households) scores closest to the treated individual. One major advantage of these approaches is the lower variance, which is achieved because more information is used (Heckman *et al.,* 1998).

iii. Radius Matching Method

This method specifies 'caliper' or maximum propensity score distance by which a match can be made. The advantage with this method is that it uses not only the nearest neighbor within each caliper, but all the comparison/control group members within the caliper. Matching with replacement minimizes the propensity score distance between the matched comparison units and the treatment unit, instead each treatment unit can be matched to the nearest comparison unit, even if a comparison unit is matched more than once.

This method is beneficial since it reduces bias (Dehejia&Wahba, 2002). On the contrary, matching without replacement, when there are few comparison units similar to the treated units, may result into matching treated units to comparison units that are quite different in terms of the estimated propensity score. This increases bias, but it could improve the precision of the estimates (Dehejia&Wahba, 2002). After all the units have been matched, the unmatched units are all discarded and are not directly used in estimating the treatment impact.

CHAPTER FOUR: RESULTS AND DISCUSSIONS

4.1 Descriptive Analysis of Sampled Households

The data set covers two (2) ranches and constitutes a total of 250 sampled household. However, two (2) questionnaires were incomplete and could not be used for analysis, leaving 248 questionnaires. Out of the 248 questionnaires, 128 of them were sampled from Ndara B Ranch (Control) and 120 questionnaires were from Maungu Ranch (treated). This translates to 52% and 48% of the households' sampled being from the control and treated groups respectively.

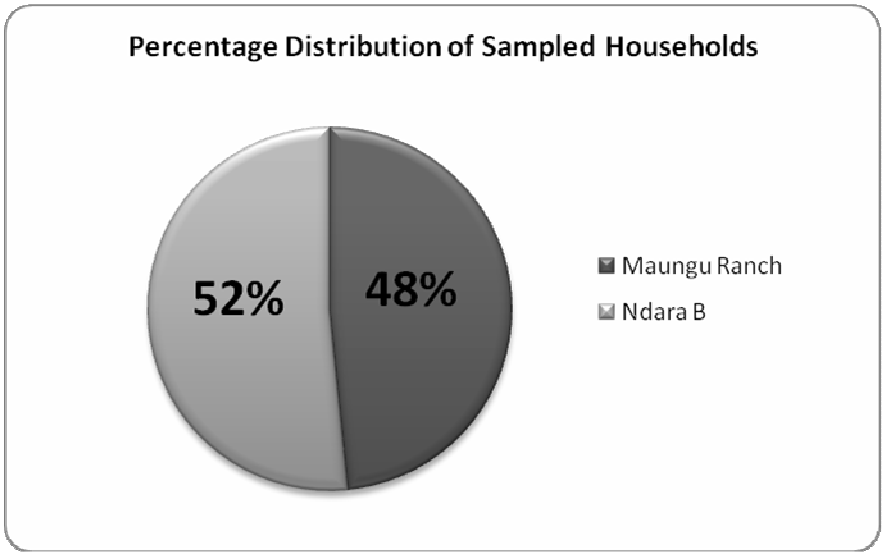

Figure 4.1: Distribution of the total (248) sampled households

Out of the total sampled households sampled, 79% were from the indigenous community and 21% were non-indigenous communities who have relocated in to the area. This shows that the population of the sampled households is not homogenous with regards to the ethnic groups living in the area. Given that Mombasa Highway is only a few meters from the project area, it has attracted a lot of non-indigenous communities who have migrated to the area to start businesses as well as seek employment. Figure 4.2 below shows the percentage of indigenous communities within the respective ranches, that is, 83 per cent and 76 per cent for Maungu Ranch and Ndara B respectively. Therefore, the control group (NdaraB ranch) has a higher percentage of non-indigenous people, whoare either women married in the area or people who have bought or

leased land from the indigenous people for their use, hence a demonstration of sub-division of land.

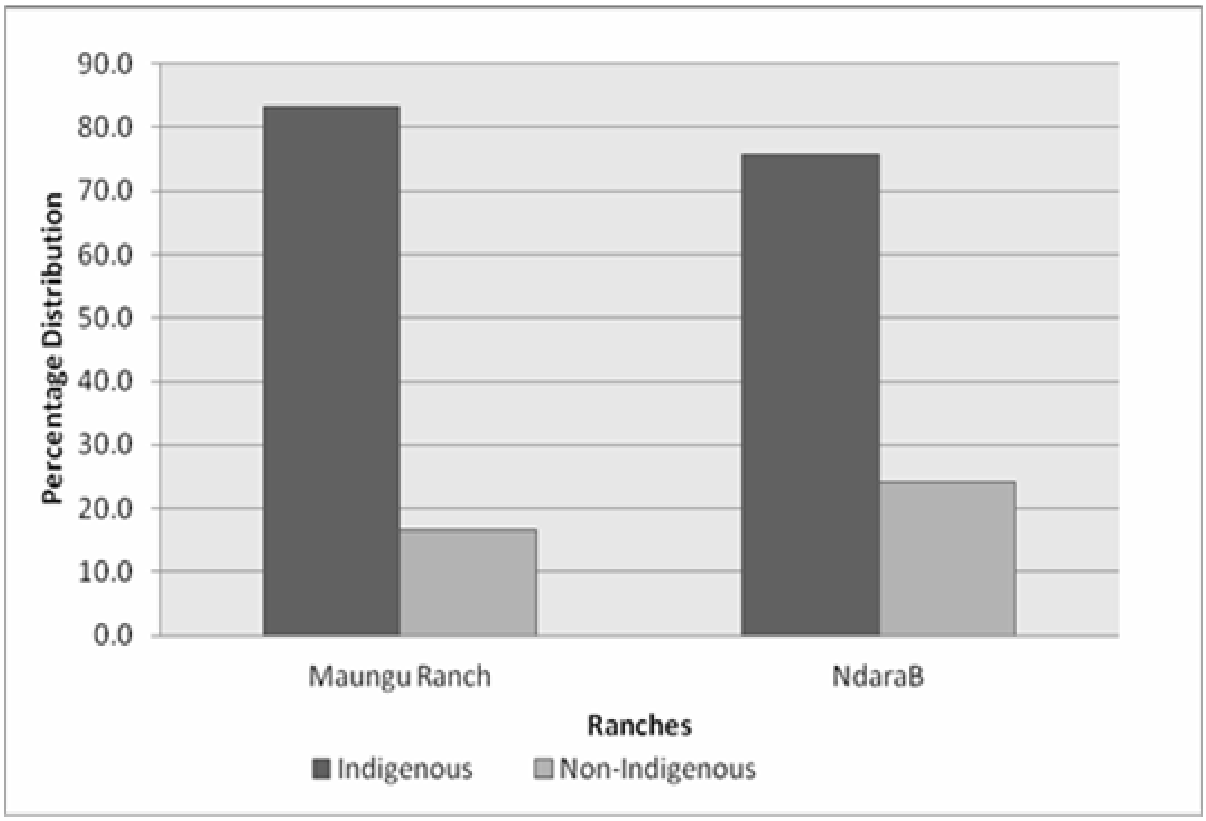

Figure 4.2: Distribution of indigenous and non-indigenous communities of respondents

4.1.1 Demographic Characteristics

The demographic characteristics of the sampled households analyzed in this section are: age, gender, marital-status, level of education, household size and the origin of the respondent.

a) Household characteristics (Age and Household size)

The overall mean age of sampled households is 41years, however, the average age for the two ranches were, 43 years and 40 years for Maungu Ranch and Ndara B Ranch respectively. The t-test analysis shows that the difference in the mean age of the households was statistically significant at 5% level of significance since the probability of error (p) was found to be 0.037, which is less than 0.05. This means that the treated groups, that is, the sampled household members were much older than their counterpart in the control. On the other hand, the average household sizes were 4 and 5 persons for Ndara B and Maungu Ranch respectively. This

difference in mean was not statistically significant given that the probability of error (*p*) was found to be 0.06 which is greater than 0.05.

Table 4.1 Age and household size of respondents

Statistics	Ndara B Ranch (N=128)		Maungu Ranch (N=120)		Overall (N=248)	
	Age	Household size	Age	Household size	Age	Household Size
Mean	40	4	43	5	41	5
Std. Deviation	13.29	1.99	15.64	2.44	14.55	2.25
Minimum	18.00	0.00	20.00	0.00	18.00	0.00
Maximum	78.00	9.00	80.00	16.00	80.00	16.00

b) Education level

The research area falls within former TaitaTaveta district, now County which has very low literacy level. This can either be attributed to having very few schools in the area or high poverty levels which hinders access to good education. From the overall sample of 248 households, 53% of the respondents had attended school upto primary level; 24% managed to get to the secondary level of education; 19% did attend school at all thus have no formal education, while only 4% of the sampled households have studied upto the tertiary level.

The difference in the level of education between the two ranches is evident as shown in figure 4.3 below which shows that Ndara B (Control) has a higher literacy level compared to Maungu Ranch (Treated group). From the t-test analysis, we conclude that difference in means within the various levels of education between the two groups is statistically different at 1% level of significance because the probability of error *(p)* is 0.000.

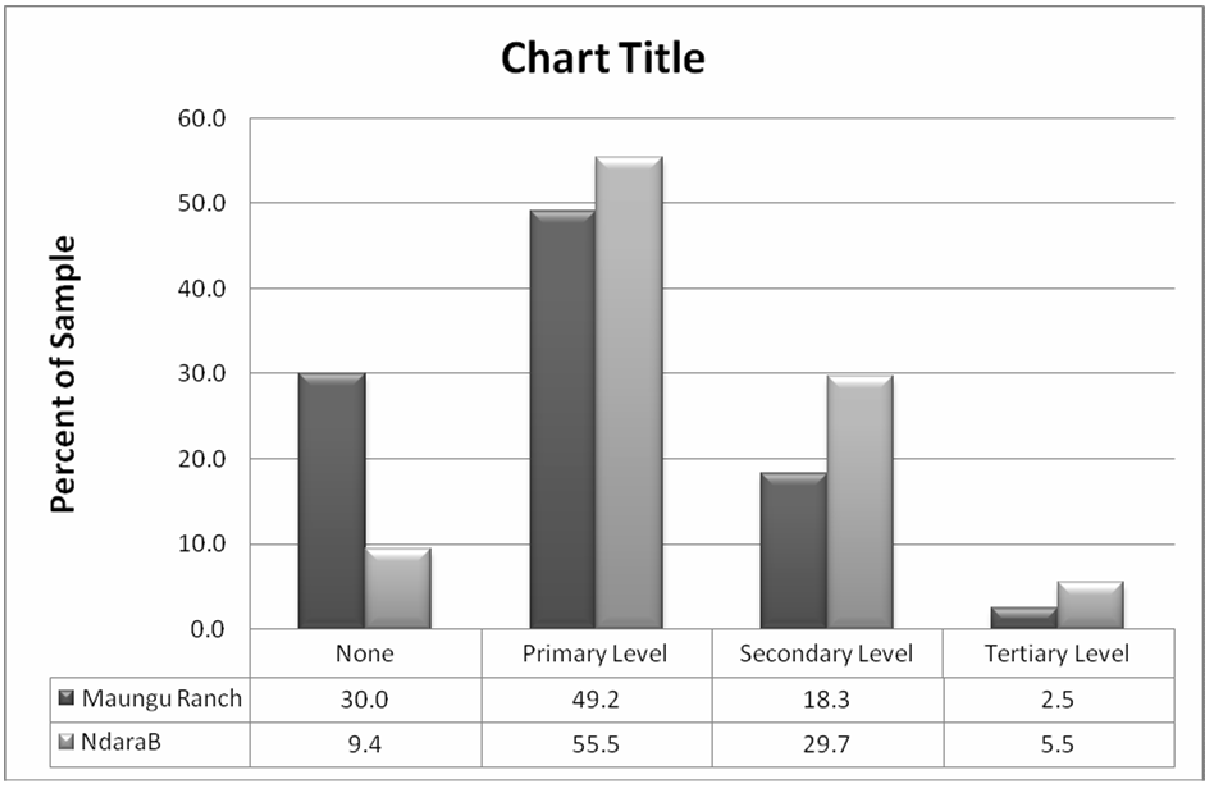

Figure 4.3 Distribution of the level of education within the treated and control

4.1.2 Socio-Economic Status

According to theKenya Integrated Household Budget Survey *(*KIHBS) of 2009, TaitaTavetacountyhas a poverty rate of 54.8% and an urban population of 22.6% which means the rest (77.4%) of the population live in rural areas within the county.Based on this, most of the population, especially the local communities (indigenous) depend directly on the land for agriculture and natural resources to support their livelihoods. From the sampled households, the main socio-economic activities most of the respondentsare subsistence crop and liveestock agriculture. However, other socio-economic activities undertaken by the households are, charcoal production and off-farm activities such as sand harvesting, quarrying and entrepreneurship in the neighbouring centres.

a) Occupation and household income level

Charcoal production forms part of the livelihood of six percent (6%) of the total 248 sampled households from both Maungu Ranch and Ndara B Ranch. Within the respective ranches, the percentage of the sampled households that engage in charcoal production is 2.5% and 9.4% for Maungu Ranch (Treated) and Ndara B Ranch (Control) respectively. The percentage of those households engaging in charcoal production is lower in the treated group since by virtue of them participating in the PES programme, they are compensated for avoided deforestation and forest degradation by Wildlife Work from the sale of carbon. These incentives from the PES program are aimed at changing the behavior of the households towards land use change of converting forests into agricultural land or for charcoal production. This acts as an alternative source of income for the participants within the treated group which the control group does not get.

With regards to the average income from the 248 sampled households, Table 4.2 below shows that the average income for the sampled households is Kshs. 9,758.92. For each ranch, the average monthly income is Kshs 8,568.00 and Kshs 11,042.24 for Ndara B Ranch and Maungu Ranch respectively. From this, the sampled households in Maungu Ranch earn more monthly income compared to their counterpart in Ndara B Ranch. A t-test analysis shows that the difference in the mean of the average monthly income between the two groups is statistically significant at 5% given that its probability of error (*p*) is 0.049 which is less 0.05.

Table 4.2:Household monthly income for treated and control groups

Statistics	**Ndara B Ranch (N=128)**	**Maungu Ranch (N=120)**	**Overall (N=248)**
Mean	8,568.00	11,042.24	9,758.92
Std. Deviation	9,509.05	9,876.97	9,746.68
Minimum	1,000.00	0.00	0.00
Maximum	70,000.00	67,000.00	70,000.00

From the questionnaires and focused group discussions, 37 per cent of the sampled households attribute the declining trend in their average monthly income to climate change while 9 per cent of them attribute the decline to land use changes, that is, deforestation for expanding agricultural land and charcoal production. In total, 46% of the respondents attributed the decline in their

average monthly income to climate change which they largely attribute to land use change, mainly deforestation for agricultural land and human settlement. Another indicator of climate change in the area is human-wildlife conflict which affects 2.4 per cent of the sampled households.

b) Access to Amenities

Access to social amenities/facilities is an indicator of the level of development in an area and, in addition it has both direct and indirect impact on the livelihoods of the surrounding population. Therefore, improving access to social amenities is fundamental in improving the quality of life of the citizens. This is used in the study to compare the impact of the payment for ecosystem service incentive scheme. It is premised on the fact that given that the project is being implemented in a largely rural setup, there are few social amenities that may not be in a good condition or are not accessible by all the neighbouring communities' e.g. lack of enough school fees to access school facilities and education.

The study identified three (3) social amenities, namely, schools, shopping centres and health centres as the main indicators. The results as shown in table 4.3 below indicate that average distance to the nearest school (primary or secondary) is 2.28Km, while the distance to the nearest Health Centre and Shopping Centre were 3.48 Km and 4.46 Km, respectively. Within the respective ranches, the average distance to the nearest school (primary and/or secondary) were, 2.65 Km and 1.88 Km for NdaraB ranch (control) and Maunguranch(treated) respectively. This means that the students in Maungu Ranch travel a much shorter distances to schools compared to their counterparts in Ndara B.

Table 4.3: Average distance (km) of respondents to social amenities

	NDARA B RANCH			Maungu RANCH			OVERALL		
	Nearest school	Nearest Health Centre	Nearest Shopping Centre	Nearest school	Nearest Health Centre	Nearest Shopping Centre	Nearest school	Nearest Health Centre	Nearest Shopping Centre
Mean	2.65	3.93	4.25	1.88	3.00	4.69	2.28	3.48	4.46
Std. Dev	1.87	2.11	1.70	1.19	1.74	2.74	1.62	1.99	2.28
Minimum	0.05	0.30	0.50	0.10	0.20	0.20	0.05	0.20	0.20
Maximum	10.00	10.00	10.00	6.00	7.00	15.00	10.00	10.00	15.00

The overall average distance to access to health centres is 3.48Km, while for each ranch, the distance is 3.93Km and 3Km for Ndara B Ranch and Maungu Ranch respectively. This means that the local communities in Maungu Ranch (treated) walk for a shorter distance to the nearest health facilities than their counterpart in Ndara B (control). On the other hand, the residents in Ndara B (control) travel for a slightly shorter distance to the shopping centre compared to their counterpart in Maungu ranch. An analysis of the t-test shows that the difference in means for the distance to the nearest school and health centres between the two ranches is statistically different at 1% level of significance (p =0.000). On the other hand, the t-tests show that the mean difference on distance to the nearest shopping centre between the two ranches is not statistically different (p=0.124).

4.1.3 Land Tenure Status (Property Rights)

From the 248 sampled households, the distribution of the land tenure system was as shown in Figure 4.4 below which shows community land as the most common type of land tenure system at 65% from both ranches.

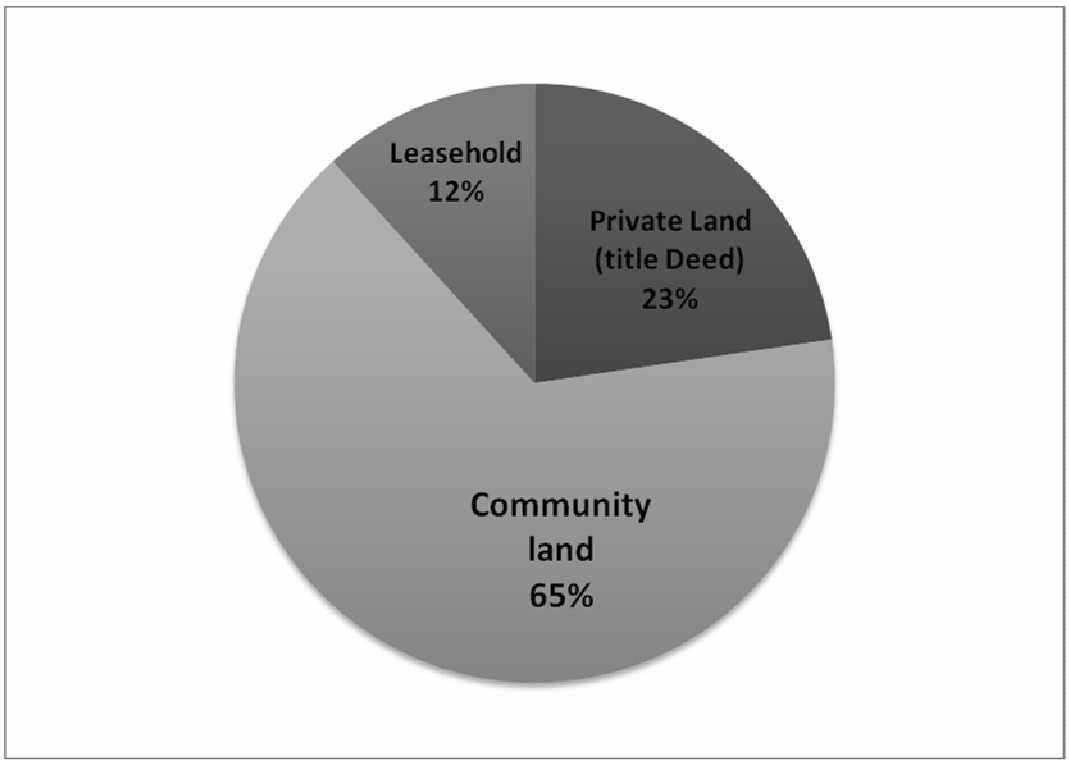

Figure 4.4: Percentage distribution of the Land Tenure System of the respondents

However, for the distribution of the various land tenure systems in each ranch, Figure 4.5 below shows that from the sampled households in Maungu Ranch (treated), none of those sampled households had privately owned land. Instead, the study found that only 10% of the respondents in the treated group had access to land through leasehold system, while 90% of the respondents owned community land registered as a group ranch. Within the control group (Ndara B Ranch), the study found that 44.1% of the sampled households had their land under private land tenure with title deeds, 13.4% were under leasehold tenure system and 42.5% were under community land tenure system.

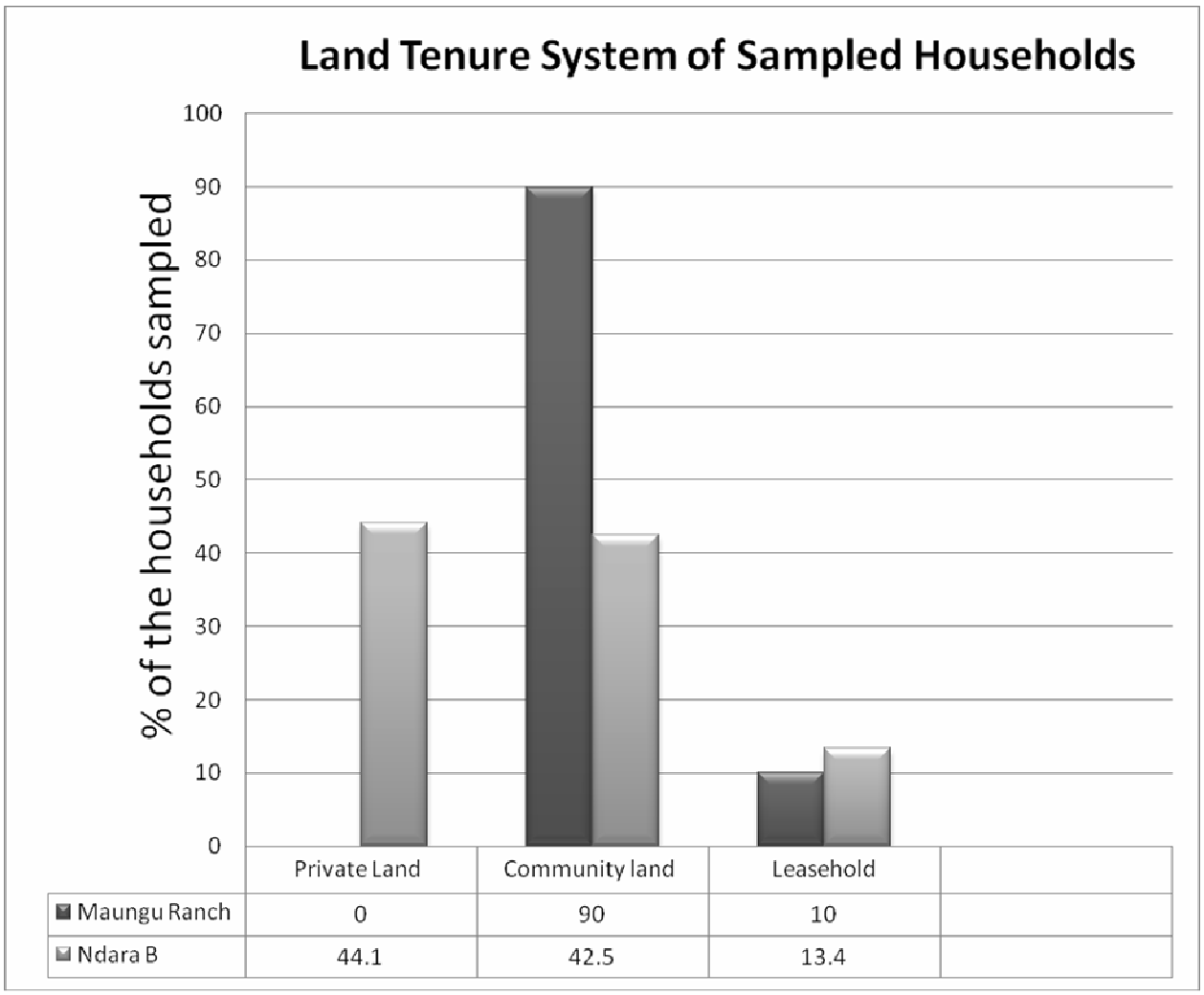

Figure 4.5: Distribution of land tenure system (Property Rights) within the Ranches

4.2 Econometric Analysis of Sampled Households

4.2.1 Wealth Distribution of the Households

From the principle component analysis (PCA) which was used to generate the wealth index of the households, the study shows that from the sampled households of 248, 60% of the households were poorly endowed, that is, their wealth index is < 0, and only 40 % of the household were well endowed, that is, their wealth index is > 0.

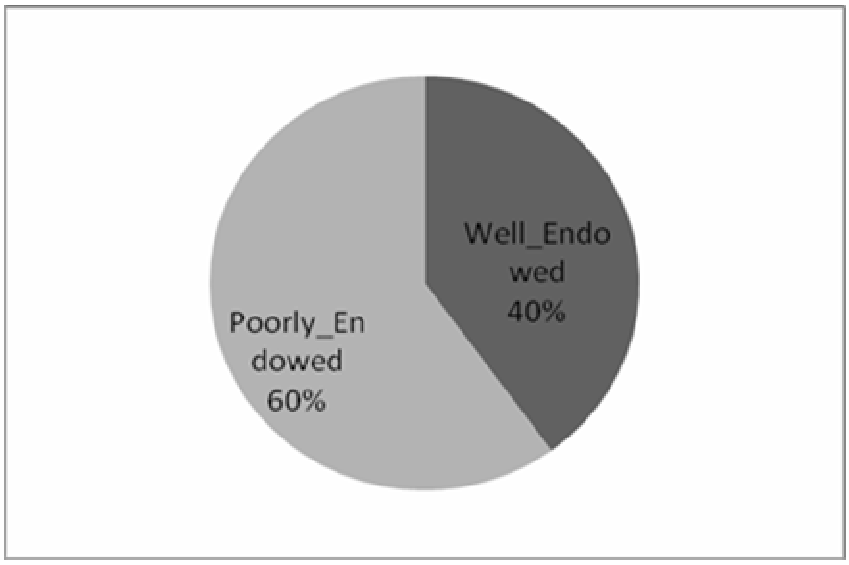

Figure 4.6: Wealth distribution within the sampled households

This almost matches the poverty level for the TaitaTaveta from the Census that was conducted in 2009, which is 56.9% hence one of the poorest region within the country. As a result, most of the population depends directly on natural resources for their livelihoods. As for the wealth distribution within the total sampled households in the two ranches is as shown in figure 4.7 below.

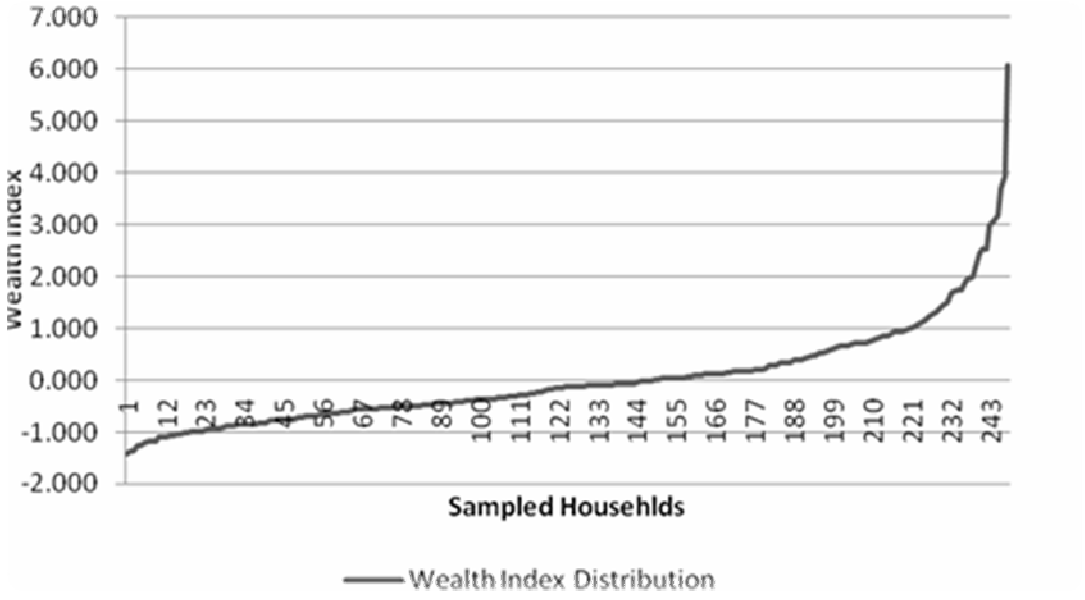

Figure 4.7: Distribution of households according to wealth groups

Within the respective ranches (groups), figure 4.8 shows that the sampled households within the treated group (Maungu Ranch) have 47 % of households are well-endowed with 53% being poorly-endowed. On the other hand, the control group (Ndara B Ranch) has only 34% of the households well-endowed with 66% of the households being poorly-endowed.

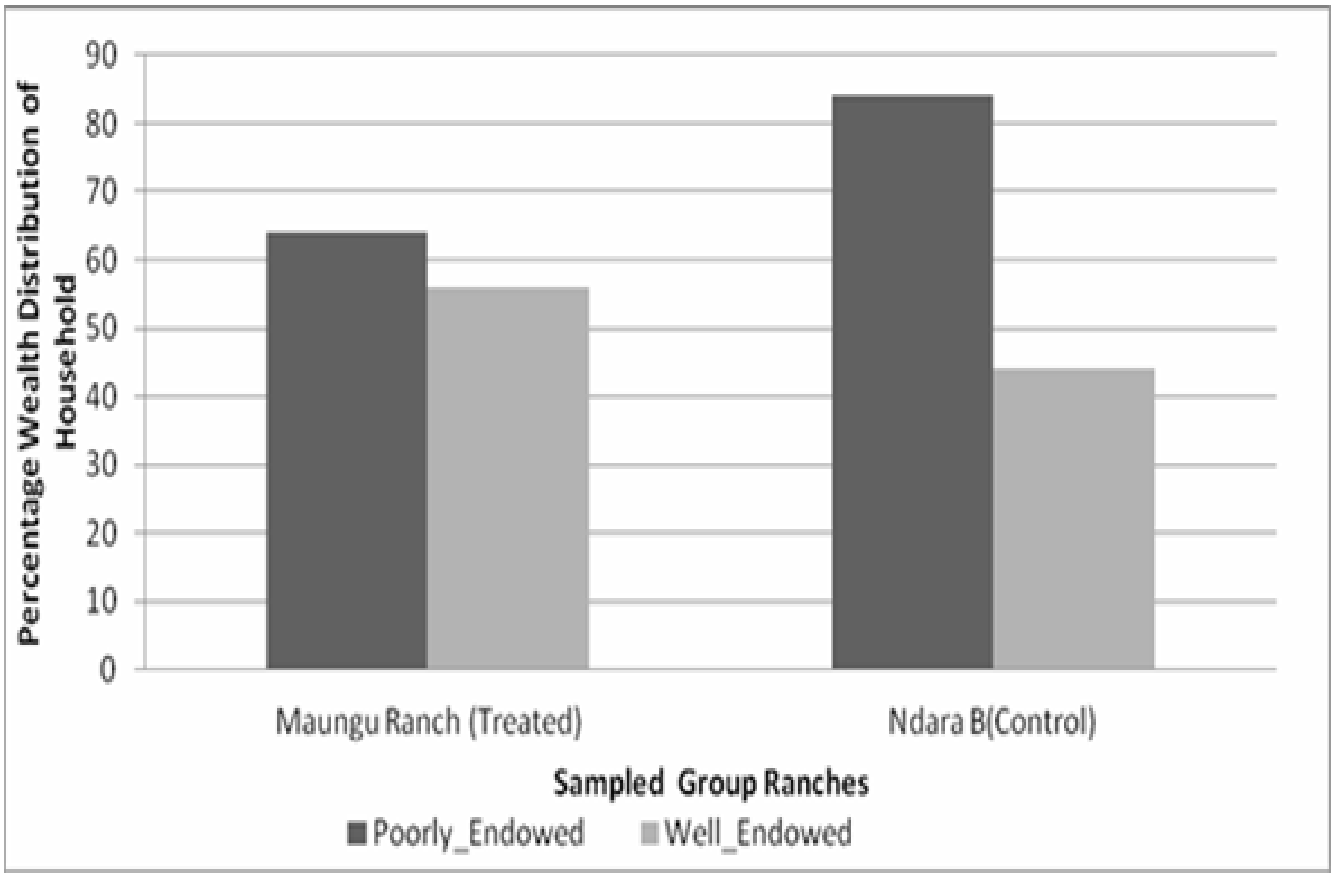

Figure 4.8: Comparison of the household wealth distribution within the two groups

4.2.2Propensity Score Results and Analysis

The dependent variable the study used to calculate their propensity score to enable determine how it influences participation in the PES program as shown in table 4.5 below.

Table 4.4: Description of the variable and expected impact on PES participation

Variable Name	Variable Description	Expected Sign
PAR	Participation in PES	Independent Variable
AGE	Age	+ve or –ve
GND	Gender	+ve or –ve
MAR	Marital Status	+ve or –ve
HS	Household Size	+ve or –ve
D2S	Distance to school	+ve or -ve
D2HC	Distance to Health Centre	+ve or -ve
D2SP	Distance to Shopping Centre	+ve or –ve
TSL	Total size of land	+ve or –ve
Propr (Land Tenure)	Property Right to Land	+ve or –ve
ed2, ed3, ed4	Education dummy variables	+ve or –ve

4.2.2.1 Factors influencing participation in PES program

Table 4.5shows how each of the variables influences participation in the PES (REDD project), that is, the relationship between the independent and dependent variables. From the results, the strongest determinant of participation in PES is property rights i.e. land tenure system of the household members. The study analyzed at private land tenure system and community tenure system in relation to implementation and participation in the PES program. The results show that those with private land tenure system have 51.3% chance of not participating in the PES project. This means that households under community land tenure system are more likely to participate in a PES project.

Furthermore, the results show that the total size of land (TSL) also influence participation in the PES project and this is statistically significant given that the probability of error (*p*) is 0.022. Participants with large parcels of land have a higher chance of participating in the PES project compared to those with small parcels of land. This might be a challenge for the poor to participate given that they usually do not own large parcels of land but depend on access rights on communal land to support their livelihood. The two results, that is clearly shows that the type

of land ownership (property rights) and the total size of land are key determinant for household participation in a PES.

Table 4.5: Factors influencing participation in PES (REDD) project

Variable	dy/dx (Coefficient)	Standard Errors	Z	P- Values
AGE	**0.0000136**	0.0034	0.0000	0.9970
GND (Gender)	**-0.1544637**	0.0853	-1.81	0.0700
MAR (Married)	**0.0938660**	0.0912	1.09	0.2760
HS (Household Size)	**0.0211063**	0.0206	1.03	0.3040
D2S(Distance to School)	**-0.0617152**	0.3321	-1.86	0.0630
D2HC (Distance to health Center)	**-0.0459638**	0.0237	-1.94	0.0520
D2SC (Distance to Shopping Center)	**0.0283110**	0.0185	1.5300	0.1260
TSL (Total Size of Land)	**0.0378287**	0.0165	2.29**	0.0220
Propr (Land Tenure)	**-0.5129425**	0.0604	-8.49***	0.0000
ed2 (Education)	**-0.2862351**	0.1154	-2.48**	0.0130
ed3 (Education)	**-0.3120165**	0.1118	-2.7900**	0.0050
ed4 (Education)	**-0.2714888**	0.1451	-1.8700	0.0610

Number of observations = 246; LR chi2 (10) =246.99; Prob> chi2 = 0.0000; Pseudo R2 = 0.7248

{**represents level of significant at 5%:*** represents level of significant at 1%}

4.2.2.2 Education level and participation in PES

In addition,looking at ed2, ed3 and ed4in table 4.6 above, which represents those households that at least have some formal education there is an indication that education significantly influences participation in a PES project. The results shows that there is a 31.2 per cent chancethat those educated (ed3) would not participate in a PES project compared to the less educated and this is statistically significant at 1% since the probability of error (*p*) is 0.005. From the qualitative analysis, the study showed that the mean difference in the level of education (literacy level) was statistically significant with the control (Ndara B) recording of a higher literacy level than the

treated group. From the findings, the study deduces that, those who are educated are more aware of more ways in which they can use their land compared to the less educated.

4.2.2.3 Gender and Participation in PES

With regards to gender, women have a 15.4% more chance of participating in the PES project than men. This may be because most women unlike men within the rural set-up use the land more as a means of providing for the households. Therefore, they may view PES as an activity that provides additional income for the households. However, given that in most Africa cultures, men are key decision makers in matters related to land, there is need to ensure that women too have equally secure rights in land management given that REDD+ project are all based on land use activities.

From the sampled households, the results on decision making related to land management, figure 4.9 below shows that 54 per cent of the sampled households have women involved in decision making while 46 per cent of the households have men as the sole decision makers.

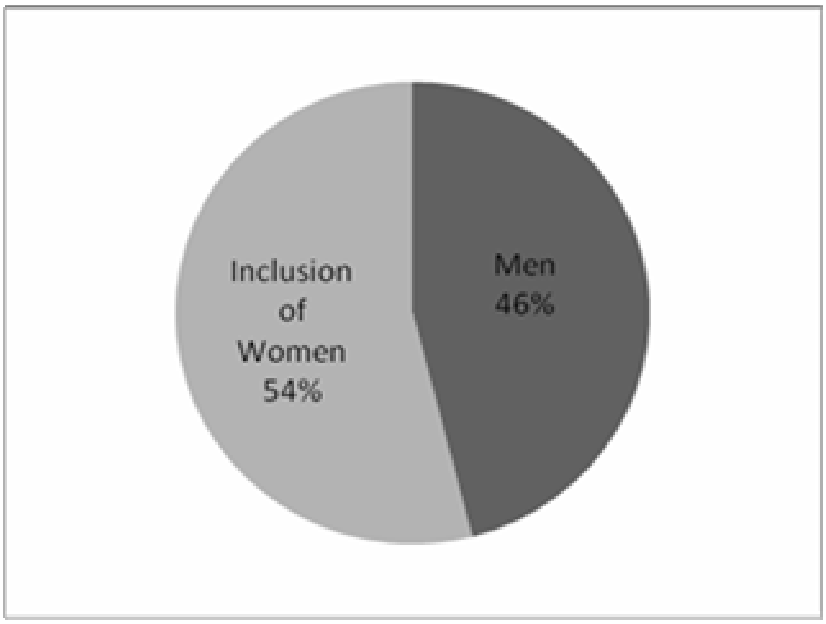

Figure 4.9: Households percentage representation of decision making relating to land management

4.2.3Impact of PES on Household Wealth

Results from the three (3) matching methods used to determine the ATT of the PES program on the treated group in comparison to the control group is as show in table 4.7 below.

Table 4.6: Results of Average Treatment Estimation (ATT) of PES on Household Wealth

Method Applies	No. of treated Households	No. of Control Households	Average Treatment Effect (ATT)	Standard Error (SE)	T-test level of statistical significance (T)
Nearest Neighbour Matching Method	120	128	0.111	0.054	2.060**
Kernel Matching Method	120	128	0.111	0.060	1.838*
Radius Matching Method	120	128	0.111	0.055	2.022**

{* represents level of significant at 10%; **represents level of significant at 5%; *** represents level of significant at 1%}

The result shows that those participating in the PES project have their household wealth increased by 11.1 percent (ATT value of 0.111 multiplied by 100%). However, only the nearest neighbour and radius matching methods are statistically significant at 5 per cent. Therefore, we can conclude that participation in the PES project has made the participants better off compared to their counterparts who are not participating in the PES program. With 53% of the sampled households within MaunguRanch(treated) being poorly endowed, the results indicates that the PES program can contribute to poverty alleviation if the poor participate.

4.2.4 Summary of Analysis

Some of the other benefits of participating in the project are, employment, receiving an energy saving jikos or contracts with Wildlife Works to supply seedlings. All this together impact on the disposable income of the households participating thus are able to invest in other income generating activities or other uses. This finding is similar to those of Miranda et al., 2003 in their study of the social impacts of payment for ecosystem services in Costa Rica. In addition, apart

from the financial incentive from participating in a PES program, other benefits that are non-income are social and cultural benefits that can positively impact the lives of participants.

Regarding land size and property rights, the results have shown that households with community land are more likely to enroll in a PES project than one with private land tenure system. In addition, the total size of land also influences participation in PES projects, therefore, households with larger farm area are more likely to participate in PES project. Based on this finding, we reject the null hypothesis, “Property rights do notimpact PES implementation in Kenya” and instead accept the alternative hypothesis “Property rights doimpacts PES implementation in Kenya.” Property rights are fundamentally important in implementation of PES because the ES are the result of particular land use activities under the PES program upon which payments are made to land users and/or owners. Therefore, this makes the ownership of land of security of tenure critical for PES to impact households.

Finally, the results in table 4.5 above have shown two critical findings, that is, households that are educated are less likely to enrol in a PES program (statistically significant) and that women are more likely to enrol into a PES program This findings show the vulnerability of the poor rural population that are most likely to enrol for PES program which if poor designed and implemented may deprive them of their livelihood. This is because, more often than not, the poor rural population are the once who are less educated or have a high illiteracy level. Coupled with the fact that they mostly depend on communal property rights to support their livelihood which are not usually secure in developing countries due to influence from the elite. Table 4.8 below highlights the relationship between the findings and how they relate to laws and policies in Kenya related to PES.

From the findings of the study, there are several theoretical implications of PES implementation and land tenure system. These are, most PES program will target community land more that private land tenure system. This may be because compared to private land, community land provides two advantages, first, is the reduced transaction cost given that it is a consolidated parcel of land. Secondly, for a PES program under REDD, it requires large parcels of land which are mostly available in community land formerly trust land than private land. Given the history of poor management of community land under the Trust Land Act of Kenya due to weak

property rights, there is need to strengthen the security of land tenure under community land for proper implementation of PES.

CHAPTER FIVE: CONCLUSION AND POLICY RECOMMENDATIONS

5.1Conclusion

The study has shown that there is a clear difference in charcoal production between the treated and control groups, with the control having a higher percentage of households making a livelihood from charcoal production. It is evident the impact of the REDD+ project has contributed to a reduction on charcoal production given that it focuses on avoided deforestation and forest degradation. To achieve this reduction in charcoal production, Wildlife Works Carbon introduced some alternative source of energy to reduce reliance on charcoal production by the households within the treated group. This has been done as one of the measures to reduce leakages in the project area as well as reduce reliance on charcoal as a source of energy. The benefits received by the households in the project are such as energy saving jikos, eco-charcoal, and organic greenhouse.

Other interventions by the company is providing an alternative source income for the local communities to reduce reliance on the natural resources to support their livelihoods is through employment of the some of the local communities to act as rangers and workers within the factories operated by WW and introduction of dryland farming scheme. Apart from financial incentive which is given to the local communities within the project area, these are some of the benefits they receive from the PES initiative that has the potential to impact on household wealth and as a result contribute to poverty alleviation.

In addition to also engaging in crop and livestock farming and charcoal production, some of the other economic activities common within the control group (NdaraB ranch) that negatively impact the environment are sand harvesting, quarrying for building materials and mining activities. Though the income from these economic activities may be more at the moment, they are not sustainable over a long period of time and they reduce the quality and quantity of some ecosystem goods and services.

It is important to note that despite the t-test on the average monthly income indicating that the differences in mean between the two groups being statistically significant, this cannot be entirely be attributable to the REDD project only but a combination of various factors. Some of the benefits the participants in the REDD project are receiving that may be contributing to them having more disposable income than their counterpart in the control are, bursary schemes, energy saving jikos, employment by wildlife works carbon company, contract to supply seedling to WW and water projects thus household members use less time to fetch for water and are able to use that time to engage in other income generating activities.

The wealth index distribution shows that 60 per cent of the sampled households are poorly endowed. Given that it is a rural set-up, the households depend directly on land and natural resources to support their livelihood. Therefore, the governance of land and land based resources directly influences the sustainability of their livelihood. Given that the matching estimators of the impact of PES on household wealth clearly indicate that participation in the PES improves the household wealth by 11.1 per cent, it shows that indeed PES has the potential to contribute towards poverty alleviation. Based on this outcome, it then follows that in this case study, PES has been able to provide alternative sources of income through land-use activities by the land-owners, hence resulted into improving the household wealth of those participating in such a project while providing the ES.

Based on the above, the study rejects the Null hypothesis that “Payment for ecosystem services does not improve the household wealth of participants” and instead accepts the alternative hypothesis, “Payment for ecosystem services does improve the household wealth of participants”. The study has proved that PES can indeed increase the household wealth of those participating in the program. Given that the participants in this case receive payments directly through community institutions e.g. associations, they use the financial proceeds to either pay school fees, development of water project among other development initiative.

The research findings provides some support for the view that although PES schemes are conceptualized and undertaken as a mechanism to improve the efficiency of natural resource management such as forests, it can also have a positive impacts on poverty. Therefore, the introduction of the market mechanism for environmental services has the potential to benefit

rural ecosystem service provides, in economic terms, if the payment they receive more than compensates the opportunity costs of giving up more rewarding activities such as charcoal production land use but which are less environmentally friendly thus not sustainable (Greig-Gran, 2005). These can be benefits that results into diversification of income sources, reliable and sustainable payments, employment and other benefits that increases the amount of disposable income of a participating household member.

Land is a primary means of both subsistence and income generation in rural economies. Secure property rights, more so land tenure system is a crucial component in addressing land and natural resource management. From the PSM analysis of the various factors that influence participation in PES, the result show that property rights to land significantly influence participation in the PES project as well as the total land size of the household.

The land tenure system in the treated group is communal land registered as a group ranch. This implies the application of the common property regime that brings together a group of resource users who share collective ownership over the land or over a single environmental resource. These users share rights of access to and management of natural resources and rely on both community and state based institutions or authorities to assert their claims, establish management rules and exclude outsiders, while the state retains alienation rights. Within this arrangement (group ranch), members of such a common property regime can also hold full or partial private property rights over farming and grazing lands, which may be transferable to third parties, depending on legal and customary provisions (Corbera, *et al.,* 2011).

The control group on the other hand has a combination of various land tenure systems since it is changing from a pure group ranch tenure system to a situation where you have individual land owners and still others under community land tenure system raising issues of insecure property rights. The lack of a secure tenure system and unclear property rights is a key element that can hinder the any long-term investments in land.Therefore, the long-term ecosystem service provision such as the REDD projects cannot take place unless a landowner has secure and enforceable property rights to the land (BarbierandTefaw, 2011). The research findings have shown that households under communal land tenure (group ranch) can be efficient in providing long-term ES, such as carbon forestry simply because of security in land tenure.

The study has shown that implementation of REDD projects requires clarifying and securing of property rights on land and forest. This is because, secure forest and land rights are an indispensable precondition to ensure the long-term permanence of forests and of the carbon sequestered. In developing countries, where REDD projects are being envisioned, there are several challenges since land and forest tenure are usually weak, poorly defined and recorded (Corbera*et al.*, 2011; Costenbader, 2009; Angelsen*et al.*, 2009).

Given that insecurity of land tenure tends to be most acute for poor rural communities even where it is well defined especially in developing countries, PES especially REDD can improve the land tenure security for participating landowners and communities. However, where poor communities lack secure land tenure and enforceable property rights, PES and especially REDD may increase inequality by increasing competition for control over resources, eviction of weaker groups e.g. indigenous groups or women, by more powerful entities (Landell-Mills andPorras, 2002).

The Stern Review on the Economics of Climate Change (2006), mentions that 'At a national level defining property rights to forestland and determining the rights and responsibilities of land owners, communities, and loggers is essential to effective forestmanagement for carbon sequestration.' They further mention the need to involve local communities in forest management and to respect informal rights and social structures, work with development goals and reinforce the process of protecting the forests. Similarly, the Eliasch Review (2008) states, 'Only when property rights are secure, on paper and in practice, do longer-term investments in sustainable management become worthwhile.' (Angelsen*et al.*, 2009; Costenbader,2009).

Therefore, tenure reforms which are aiming to clarify property rights including statutory recognition of customary claims could improve REDD in terms of its effectiveness, efficiency and equity. Therefore, implementation of REDD national provides an opportunity to comprehensively address land and forest tenure issues as an end in itself, and not just as a means to help in REDD+ implementation (Costenbader, 2009). However, whereas secure tenure for land and forests are fundamental in the success of REDD project, it is important to note that secure tenure may also lead to more forest conversion. This therefore calls for the need to change

the incentives structure that currently seems to favour conversion of forestland which is what REDD+ attempts to achieve (Angelsen*et al.*, 2009).

Existing literature like Landell-Mills and Porras (2002) warns that given that PES may increase the value of marginal land, there is a possibility that such programs could increase the incentive for powerful groups to take control of such land. As a result, exacerbate problems in situations where tenure is insecure. In addition, Kerr (2002b) cautions that the livelihoods of the landless poor who are non-participants in PES program and whose livelihoods depends on access to forest products (non-timber) may be harmed of PES conditions limits their access to forested land.

Furthermore, the findings that women are more likely to participate in PES projects, weak property rights on land makes them vulnerable since it threatens their access and ownership rights to land. This is despite the fact that women are the once who mostly undertake land management within the African set-up, Kenya not being an exception hence it's this activities that contribute to provision of desired ES. The consequences of these weak property rights related to women's access and ownership is inequitable benefit sharing. Therefore, women are vulnerable under PES if their rights related to land are not secured.

An unexpected result from the study was, households that are educated are less likely to participate in PES program, this means that those less educated are more likely to participate in program. This shows that the poor rural populations who mostly have a low literacy level are more likely to enrol in PES. Therefore, there is need to ensure that with regards to negotiating benefits sharing the rural poor households are safeguarded to ensure equity.

5.2 Policy Recommendations

From the empirical study, there is need for the government to take into account the following lessons as it aims to implement REDD project under the UNFCCC arrangement:

Given that the study has shown that PES programs can indeed improve household incomes, the use of incentives in the management of environmental services is important. This is especially so given that the most poor are generally the once who by virtue of their livelihoods being so directly depend on these natural resources, contribute to their management e.g. Forests. With the

current forest cover being below the internationally recommended 10% forest cover, PES programs has the ability to contribute to the improving the forest cover as well as contributing to poverty alleviation.

Full implementation of PES systems fundamentally requires well defined and secure land tenure systems especially community land which has been poorly governed since independence compared to private land tenure. Therefore, the ongoing process of land reforms is key to preventing the obstacles that might face REDDprogrammes. Of importance will be community land which provides a good opportunity for implementation of REDD projects while at the same time aiming to alleviate poverty given that most of the community land are in a rural setting where the livelihoods of the households are directly linked to the environment and natural resources due to high poverty levels.

Given the previous poor governance of trust lands which were held by the local authorities in trust for the locals, there is need to ensure improvement in land administration and management. One of the reasons why community land has faced challenges in its governance is because in both the colonial and post-colonial period, the customary tenure has been ignored. The traditional resource management system that ensured equitable access to land for all, land use planning, among others have not been incorporated into the current state laws which advocates for individualization of landresulting into insecure land tenure on communal land.. Therefore, one of the ways of ensuring security of tenure to community land is to integrate customary laws and customs into the state laws.

The results show that there is a high chance of women to participate in PES programmes than men. Given the status of women and level of gender inequality to some extent may affect the degree to which PES, especially REDD programs include women in decision making, they are designed and even benefit sharing mechanisms. Given that in most societies, it is women who are involved in the daily land management in order to provide for the households thus play a critical role in addressing poverty alleviation. However, if PES projects are not designed and implemented with a gender perspective, they will not be as efficient and effective in poverty alleviation and, at worse, could contribute to an increase in the gender gap given that it is men

who are involved in decision making on matter related to land management as well as they are mostly the once to be directly paid through PES schemes thus inequitable benefit sharing.

Insecure forest tenure is more the cause of high deforestation and degradation. Therefore, forest tenure needs to be clarified both to create incentives for those managing the forests and for proper allocation of benefits as well as to protect people whose rights could be usurped if REDD leads to increasing the value of forests or a command-and-control measures to protect forests. Forest tenure in not generally clear in developing countries, Kenya being an example where people who live in forest like the Ogiek are often at a disadvantage since most of their customary rightsare not well recognized and protected by the state.

In addition, even where there are clear statutory rights or title for local people, these laws may not be properly enforced e.g. the Kaya forests in the coastal region. From the empirical analysis, communal land seem to be the most preferred than private land to implement REDD projects, given that in this land we also have community forest, there is need to ensure that the forest tenure system governing this forest are clearly clarified through tenure reforms (clarification of property rights including statutory recognition of customary claims which are often informal) in order to improve REDD in terms of effectiveness (REDD+must engage legitimate stakeholders whose claims to forest benefits are backed up by law and will be defended in the event of any dispute), efficiency (sequestering carbon at minimum cost, then responsibilities and rewards in REDD+ must be stable and predictable) and equity (benefits distribution needs to only involve appropriate stakeholders and beneficiaries).

Given that PES is usually dependent on land use activities, there is need for the government to develop clear land use policy that would that would then ensure that REDD+ is implemented only where it is economically viable. This is because, without a land use policy and the adoption of REDD+ is unregulated, it may result into reducing the land under cultivation since it may be giving more returns compared to other land use activities like agriculture and might result into increasing the opportunity costs of REDD+ which might cause increase in food prices, increase in the prices of land and pressure on land and forests where REDD+ is not being implemented, this can be within Kenya or neighbouring countries.

There is need for the country to begin undertaking an economic valuation of ES since this would inform the application of PES and even inform the areas where they can best be implemented. In addition, the economic valuation of ES is fundamental in determining the opportunity costs of REDD+.

Appendix 1: Summary of key national documents supporting PES programs like REDD+ related to the study

Key Thematic REDD+ issue	CoK or Ongoing legal and Policy Reform	Issue addressed
Land Tenure	• CoK: Article 63-Community land • National Land Policy (NLP) – section 63-66 • Vision 2030	Secure community land rights: Under the land reforms, community land shall be vested and held by the communities identified on the basis of ethnicity, culture or similar community interests. This is because historically there has been widespread abuse of trust in the context of both Trust land and Group Ranches
Forest Tenure Reforms	• Draft Forest Policy • Draft National Environment Policy (NEP) of 2012 – Policy statement under the Forest Ecosystem • CoK – Article 69 (1b) • NCCRS (2010)	They all obligates the state to increase forest cover; The NCCRS aims to address the issues of reduced forest cover through the REDD+ mechanisms;
Customary Rights: Respect for knowledge and rights of Indigenous people and local communities	• CoK – Article 10 – National values Principles of governance; Article 11-culture; Article 42 – Environmental Rights; Article 69(1c) – protect indigenous knowledge	• The National values and principles of governance mentions inclusiveness, non-discrimination and protection of marginalized; • Article 11 on culture acknowledges that culture is the foundation of the nation hence obligates the state to recognize indigenous technologies in the development of the nation. Indigenous technologies or knowledge includes the management of natural resources such as forest e.g. the Ogiek community. • The Constitution has entrenched environmental rights for every person by giving them a right to a clean and health environment

Full and effective public participation	• CoK – Article 10 – National values Principles of governance; Article 69(1d); Article 174 – Objects of devolution • Draft Forest Policy of 2007 – Policy statement 1.1.3; 1.2.4 • Draft NEP of 2012 – mentioned as one of the guiding principles under section 3.3 • National Land Policy (NLP) of 2009	• Upholds the principle of public participation in land and environment management
Benefit Sharing	CoK – Article 69 (1a) and (1h); Article 71	• Aims to ensure that the use of the environment and natural resources also benefits the local communities
PES and REDD+	• Draft NEP of 2012 – policy statement under the Forest Ecosystem, and Freshwater and wetlands Ecosystems • NCCRS, 2010	• Takes into account the market-based mechanisms in the protection of its ecosystems and its given as a policy recommendation. It takes cognizant of the emerging carbon markets and call for the development of a strategy to for Rehabilitation and Restoration of degraded forest Ecosystems, this could include PES. • NCCRS of 2010 identifies provision of financial incentives to rural communities through REDD+ mechanisms as one of the interventions needed to address the challenges facing the forestry sector.

Appendix 2: Questionnaire

Title of study: Impact evaluation of payment for ecosystem services (PES) on household wealth: A case of kasigau corridor redd+ project in kenya

PART 1: INFORMED CONSENT

Instruction to Enumerator: The following statement must be read to every household head/ respondent.

Mr. Kevin Mugenya, a Masters student of Environmental Policy at the University of Nairobi is conducting a study on (*Refer to the title above*). In order to undertake the study, it is important to collect some data from the resident of the area. The information is being collected for academic purposes only and there are therefore no personal benefits or risks to your participation. The information received will be handled with utmost confidentiality; therefore, the only identifier on the questionnaire will be the questionnaire code. The interview will take approximately fourty-five (45) minutes and we'll appreciate if you can answer all the questions. For more information about this study, please contact the researcher on the following number (0724-960275 or 0737-124364) or email (mugenyakevin@yahoo.com).

1. Consent Granted: YES (proceed with interview)

   NO (thank person and look for next respondent)

The enumerator is required to keep this questionnaire whether the respondent agreed to participate or not.

2. Questionnaire Code: _____

3. Interviewer Name _____

4. Interview date _____Time:_____

5. Name of the Village _____

6. Participants in the REDD Project: YES:_____ NO: _____

Note:

Collect all information in this questionnaire for both participating and non-participating households

PART 2: IMPACT ON HOUSEHOLD WEALTH (INCOME)

A: DEMOGRAPHIC INFORMATION:

Q.	QUESTIONS	RESPONSE	SKIP
1.	Age of Respondent	{ }Years	
2.	Sex of Respondent	Male : { } Female: { }	
3.	Marital Status	Single { } Married { } Widow/Widower { }	
4.	What is the highest level of education attained?	• Not attended Any { } • Primary School { } • Secondary School { } • Tertiary { }	
5.	What is the House-hold size		
6.	Are you from the indigenous community or non-indigenous?	i. Indigenous { } ii. Non-Indigenous { }	
7.	Accessibility to the Education: How far is it to the nearest School (Primary and Secondary)		
8.	Accessibility to Health Care Facility: How far is it to the nearest Health Centre		

B: SOCIO-ECONOMIC INFORMATION

Q.	QUESTIONS	RESPONSE	SKIP
	How far are you from the nearest town centre of shopping centre in Km?		
1.	What are your sources of income/ likelihood	i. On-going REDD project { } ii. Crop Farming { } iii. Livestock Farming { } iv. Charcoal Production { } v. Out-off Farm/Ranch { } vi. Tourism Ventures { } vii. Others- (Pls indicate) { }	
2.	How much is your average monthly income earning from each of your sources of income stated above (No.1) since start of the REDD project	**(Amounts in Kshs**.) i. On-going REDD project {Kshs} ii. Crop Farming {Kshs } iii. Livestock Farming {Kshs } iv. Charcoal Production {Kshs } v. Out-off Farm/Ranch {Kshs } vi. Tourism Venture {Kshs} vii. Others- (Pls indicate) {Kshs }	
	NOTE: QUESTION 3, 4 AND 5 SHOULD BE ASKED SPECIFICALLY TO HOUSEHOLDS PARTICIPATING IN THE REDD PROJECT ONLY		

3.	Has there been any increase or decrease on your household income level since 2006 to date?	i. Increase { } ii. Decrease { } iii. No Change { }	
4. a)	If there has been an increase in 3 above, how much or by what percentage has it changed?		
4.(b)	If there has been a decrease in 3 above, how much or by what percentage has it changed?		
5.(a)	Which economic activity can you attribute to have contributed to the increase, decrease or stagnation in household income level? (Increase in income level)? Please list them in the order, from the most likely cause to the least	i. On-going REDD project { } ii. Crop-Farming { } iii. Livestock Farming { } iv. Charcoal Production { } v. Out-off Farm/Ranch { } vi. Tourism Venture { } vii. Other Factors (List 2/3) { }	
(b)	Brief Explanation to 5 (a) above:		
6.	**Natural Capital:**		
(a)	What is your total land size in acres/ha?		
(b)	What is the total area of your land under cultivation?		
(c)	What is the total area of your land under the REDD project		

7.	**Physical Capital**		
	Please indicate which is the following physical capital you do have?	**House type and number** • *Brick/Stoned walled House* { } • *Wooden House* { } • *Mud House* { } **Livestock type and number:** • *DairyCattle*: - No.s{ } • *Bulls*: - No.s { } • *Goats*: - No.s { } • *Sheep*: - No.s { } • *Donkeys*: - No.s { } • *Chicken*: - No.s { } • *Pigs* : - No.s { } **Farm Equipments type and numbers:** • *Tractor* - No.s { } • *Ox-plough*: - No.s{ } • *Wheelbarrow*: - No.s { } • *Generator*: - No.s{ } • *Pangas/Jembes*: - No.s { } • *Hybrid seeds*: - No.s{ } **Others (types and numbers):** • *Motor vehicle*: - No.s{ } • *Bicycle/Motorcycle*: - No.s{ } • *Scotch Cart (Mkokoteni):*- No.s{ } • *Television:*- No.s{ } • *Radio:*- No.s{ } • *Water tank:* - No.s{ }	

		• *Mobile phone*: - No.s{ } • *Computer:* - No.s{ }	
8.	**Human Capital**		
(a)	Have you been employed or any member of your family employed by the initiative	Employed: Yes { } No { } No. of Family Members Employed: { }	
(b)	How many members of your family provide labour that contributes to the household income?		
9.	**Social Capital:** Do you belong to any association e.g. Farmers Association	YES { } NO { } **State the main function of the association:**	
10.	**Financial capital**: What are the financial capitals you have received since the start of the project?		
(a)	Benefits from projects – Types and year benefited e.g. water project, bursary schemes, development of health facility etc		
(b)	Have you been able to access credit facilities?	YES { } NO { }	
11.			

NOTE: (To Capture the Behaviour Change of the Communities on Conservation)

What are some activities you are undertaking that are linked to conservation? How has it benefited you?

C. INSTITUTIONAL STATUS (PROPERTY RIGHTS & LAND)

Q.	QUESTIONS	RESPONSE	SKIP
1.	What is estimated area of land owned by your household in acres or hectares?		
2.	How much area of your land has been placed under: a) REDD Project? (acres/ hectares)		
	(b) Other income generating initiatives mentioned in (B.1) above?	i. Livestock Farming { } ii. Crop Farming { } iii. Livestock Farming { } iv. Charcoal Production { } v. Out-off Farm/Ranch { } vi. Tourism Ventures { } vii. Others- (Pls indicate) { }	
3.	What is the type of land ownership?	i. Private property (title deed) { } ii. Community land { } iii. Leasehold { } iv. Inherited/Ancestral Land { }	
4.	What is the process of decision making on land management?		
4.	What are the current land use activities?	i. Grazing { } ii. Crop farming { } iii. Charcoal burning { } iv. Tourism venture { } v. Others (list) { }	

PART 3: IMPACT ON CONSERVATION

IMPACT OF PAYMENT FOR ECOSYSTEM SERVICES ON CONSERVATION (Target Interviewees – Wildlife Works Company & Other Researches in the Area)

Q.	QUESTIONS	RESPONSE	SKIP
1.	What is the total area of land under the REDD project? i.e. Phase I (Acres or Hectares)		
2.a)	What has been the total amount of carbon sequestrated in the area under the project over the following years?	• 2005 – { } • 2006 – { } • 2007 – { } • 2008 – { } • 2009 – { } • 2010 – { } • 2011 – { }	
b).	What has been the total amount of carbon sequestrated in the adjacent ranches outside the project area for a similar period as above?	• 2005 – { } • 2006 – { } • 2007 – { } • 2008 – { } • 2009 – { } • 2010 – { } • 2011 – { }	
3.	What has been the changes in percentage tree cover in Rukinga Ranch since the inception of the project		
4.	What factors may have contributed to the situation in 3 above and 2(a) above		
5.	How much does Wildlife Works receive from the REDD project (Conservation) under the Voluntary Carbon Market per Year		

6.	How is the amount mentioned in 5 above shared? (Contractual Arrangements) – (what percentage goes to the community)		
7.	How is the amount in 5 above channelled to the beneficiaries(communities)		
8.	Apart from monetary benefits what are the other benefits to the community resulting from the REDD project? (list at least 5)		

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