

**INFLUENCE OF FOREST PLANTATION ESTABLISHMENT SCHEMES ON
COMMUNITY LIVELIHOODS: A CASE OF MAKUTANO FOREST,
KERICHO COUNTY, KENYA**

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REQUIREMENTS FOR THE AWARD OF MASTER OF
ARTS DEGREE IN GEOGRAPHY OF
MOUNT KENYA UNIVERSITY**

JULY 2025



DECLARATION AND APPROVAL.

Declaration

This thesis is my original work and has never been presented for my academic award in any institution.

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DEDICATION

I dedicate this thesis to my beloved wife Alice and my daughter Quinnasha for their continued moral support and ever understanding whenever I was absent.



ACKNOWLEDGEMENT

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ABSTRACT

Population growth has intensified pressure on forest land, prompting countries like Kenya to adopt forest plantations to restore forest cover while supporting community livelihoods. Through the Plantation Establishment and Livelihoods Improvement Scheme (PELIS), communities are allowed to grow food crops alongside trees. This study examines whether PELIS has achieved its dual goal of enhancing forest cover and improving livelihoods in Makutano Forest, Kenya. The specific objectives of this study was to investigate the influence of; forest land cultivation under forest plantation establishment schemes, forest products available under forest plantation schemes and community involvement in forest plantation activities; on community livelihoods. This study adopted the decentralized forest management theory in line with the devolved functions of managing and conserving the forests to the communities with the help of Kenya Forest Service (KFS). Cross-sectional research design was adopted to help gather data from a representative sample of the Forest adjacent community (FAC). The data was then used to make inferences. Quantitative and qualitative methods were employed in data collection and analysis. The target population was 1719 which included FAC households around Makutano forest, and CBO leaders of Makutano forest station. From this a sample of 212 was selected. Systematic sampling was used in selecting the households and snowball sampling in selecting the CBO leaders involved in focused group discussion. The researcher then prepared and administered questionnaire schedules among the households' members. Focus group discussions were conducted among the CBO leaders. The data collected was then subjected to the SPSS program for analysis. Since most of the data collected was categorical, logistic regression was used to analyze these data while in case where numerical data had been collected, ANOVA was employed. Means, frequencies, and percentages were also used in analyzing the data. The key findings of the study indicates a significant influence of PELIS on community livelihood ($f = 221.642, p=0.000$). A strong relationship between the frequency of attending CFA and CBO meetings, the level of involvement in decision making and planning of forest activities ($B= 3.479, P < 0.5$) was noted. The size of land available for cultivation was found to be statistically significant to food security among the community ($f = 221.642, p= 0.000$). Those near the forest registered to have derived more economic benefits than those far away from the forest ($f= 3.127, p= 0.000$). The most important and most utilized forest products were firewood at 95%, fodder at 71% and droppers from tree pruning at 68%. Further research is needed on how more benefits from products like herbs, wild vegetables and honey could be realized. Based on the findings, the study recommends that the Kenya Forest Service enhance community awareness of PELIS through regular seminars, improve land allocation by harvesting mature trees, and promote sustainable use of underutilized forest products like herbs and honey. It also calls for better road infrastructure and the establishment of monitoring frameworks to strengthen community engagement and maximize both extractive and non-extractive forest benefits.

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LIST OF ABBREVIATIONS AND ACRONYMES

ALPs-	Alternative Livelihood projects
CBNRM-	Community based natural resources management
CBOs-	Community based organizations
CCF-	Continuous Cover Forestry
CFA-	Community forest association
CFUGs -	Community forest user groups
CIFOR -	Center for international forestry research
FAC -	Forest adjacent communities
FAO -	Food and Agricultural Organization
FRA -	Forest resources assessment
FUGs -	Forest user groups
JFM -	Joint forest management
KEFRI -	Kenya forest research institute
KFS -	Kenya Forest Service
KNBS -	Kenya national bureau of statistics
MACOFA -	Makutano community forest association
MCPFE -	Ministerial Conference on the Protection of Forest Europe
MTS -	Modified taugya system

NTFPs -	Non-timber forest products
PELIS -	Plantation establishment and livelihood improvement scheme
PES -	Payment of ecosystem services
PFM -	Participatory forest management
RFM -	Rotation Forest Management
SFM -	Sustainable forest management
SPSS -	Statistical package for social sciences
UNCED -	United Nations Conference on Environment and Development



CHAPTER ONE

INTRODUCTION

1.1 Background of the study

Forests form part of the most important ecosystems to the human race. Many people depend either directly or indirectly on forest products and services. The American journal of Agriculture, (2016) notes that, the livelihoods of 1.6 billion people globally depend on healthy forests: of this, 1 billion are among the poorest people of the world. It further states that, destruction of forests have tangible impacts on the lives of poor communities. Deforestation and forest degradation has resulted to massive erosion of fertile agriculturally viable soils thereby threatening food security. This, in turn affects the lives of people living at the forest peripherals and even those away from the forests. Agevi *et al.* (2016), identifies that, Forest Adjacent Communities (FAC), that is, people living at a 10 km radius from the forest edge highly rely on the forests for their livelihoods.

Deforestation and forest degradation has greatly reduced land under forest in the world. The exponential increase in world's population has resulted to overdependence on forest products and services hence the increase in deforestation and degradation of the forests. It is estimated that the total forest cover in Africa would drop by about 3.9 million hectares from the year 2010 to 2020, which would be the highest net loss rate in the world (FAO, 2020; Hoang and Kanemoto, 2021; Xiao *et al.* 2022). This has created the need for the establishment of forest plantations. About 4% (123.7 million ha.), of the world's 3.4 billion hectares under forests, is estimated to be under forest plantations (Musyimi *et al.* 2018). These forests are essential for the provision of different forest goods such as timber, fuel, medicine, honey, poles, paper and food; also, these forests

provide services such as recreational services, research, carbon sink/air purification, and climate modification, conservation of water catchment areas and biodiversity.

In establishing forest plantations and ensuring sustainability in forest management, resources are needed. It has been noted that there was a remarkable increase in forest cover in well of countries like North America, Europe and China while in the tropics, there was a decrease. The biggest drop was recorded in countries like Democratic Republic of the Congo (DRC), Zambia, Nigeria, Tanzania, Botswana, Sudan, Namibia, Somalia, Angola, Ethiopia, Cameroon, Mozambique, Cote D'Ivoire, and Chad (Xiao *et al.* 2022). This shows that the African countries have a lot to do in terms of increasing the continent's area of forest cover. Musyimi, (2018) notes that forests in Africa accounts for 21.4% of the total land surface of which is about 674 million hectares.

If well managed, forest plantations can, to a great extent, serve the needs of the ever increasing population and at the same time prevent further destruction and degradation of the existing natural forest. In comparison to natural forests, plantation forests have been noted to produce better quality of wood and non-wood forest products (NWFP) not forgetting that they take relatively short period of time of 3-30 years to grow (Hashim *et al.* 2011; Hashim *et al.* 2015). Further argues that, the forest plantations with short rotational time and that have high yielding species and varieties has enabled sustainable supply of timber and non-timber products from smaller areas of land. Forest plantations therefore offers an opportunity in supplementing wood demands, thus reducing the resource exploitation of natural forests, and also help in recovering degraded lands and improve biodiversity conservation for the benefit of future generations (Parrotta 1992, 1995; Hashim *et al.* 2015). Nevertheless, management of

this forest plantation has been faced by various challenges in terms of maintaining the forest ecosystem, biodiversity, soils, and adaptation to the changing climate.

The establishment of forest plantation schemes is often poorly linked to community livelihoods, creating a significant disconnect between conservation goals and local socio-economic needs. Most plantation initiatives prioritize commercial timber production and environmental restoration without adequately considering how these schemes can support local populations who depend on forests for their survival. This approach fails to integrate community participation in planning processes, neglects traditional forest uses such as medicine, food, and cultural practices, and provides limited economic opportunities for local residents during the long rotation periods of 3-30 years. Consequently, communities may lose access to diverse forest resources they have traditionally relied upon for income generation, subsistence, and cultural identity, while receiving little to no benefit from the plantation schemes established in their vicinity. The lack of benefit-sharing mechanisms, employment opportunities, and integration with existing agricultural systems means that forest plantations often become isolated commercial ventures rather than community-centered initiatives that could enhance local livelihoods while achieving conservation objectives. This disconnect undermines both the sustainability of plantation schemes and the well-being of forest-dependent communities, highlighting the urgent need for more participatory approaches that align conservation efforts with community development priorities.

Here in Kenya, the Ministry of environment and Forestry in its report of (2018), notes that, of Kenya's total land area, 7.4 percent is estimated to be covered by forests. This is below the 10% forest cover as recommended globally. It further states that, of this 7.4 percent forest cover in Kenya, only about 2% is closed canopy forest and which is

mainly montane. This is still below the average Africa's and world's continuous forest cover of 9.3% and 21.4% respectively. Logging and forest clearing in Kenya's natural forest has been in a very high rate. Numerically, the report notes that in Kenya, the rate of forest depletion is about 5,000 hectares per annum. This calls for concerted efforts to save the forests from further degradation and deforestation. Currently, it is noted in the same report that, gazetted forest reserves are the most hit and are in the process of being rehabilitated by starting up forest plantation with an estimated 135,567 hectares having been developed by 2018. Many of these tree plantations are found in the five major Kenya's Water Towers which includes, Mount Kenya forest, the Mau Complex, Aberdare forest, Cherangani Hills and Mount Elgon.

In Kericho County, there are eight forest stations. These forest stations includes: Londiani, Makutano, Kuresoi, Sorget, Malagat, Tendano, Masaita, and Kericho. The largest part of these forest stations is made up of forest plantations or are in the process of being reforested after the natural forest were cleared. 3561.84 Ha of Makutano forest is occupied by exotic trees while 1343.01 Ha is covered by natural indigenous trees. Of the eight forest stations, Makutano station is noted to have the second largest area of natural forest (KFS, 2019).

1.2 Statement of the Problem

The Plantation Establishment and Livelihood Scheme (PELIS) was initiated in Kenya to increase forest cover while improving community livelihoods through participatory forest management. Makutano Community Forest Association (MACOFA) was established in 2008 to facilitate community participation in forest plantation activities.

Despite the program's potential, forest adjacent communities around Makutano forest face significant challenges in accessing and benefiting from plantation establishment schemes. Research shows that 93.3% of CFA members in other counties depend on forest farm cultivation for their livelihoods (Tobias, 2015), yet similar benefits have not been realized in Makutano forest area. The 2019 government ban on maize cultivation in forest areas has further limited livelihood opportunities for these communities. Additionally, weak benefit-sharing frameworks and limited community participation in forest plantation activities have restricted the potential socio-economic gains from the program.

The specific problems include: inadequate utilization of available opportunities under forest plantation schemes by the Makutano forest adjacent community; limited understanding of how forest plantation activities translate to improved household livelihoods; and low levels of household participation in forest plantation establishment despite the policy framework provided by the Forest Act 2016.

Without addressing these challenges, the forest adjacent communities will continue to experience limited livelihood improvements, potentially leading to increased pressure on forest resources and reduced community support for forest conservation efforts. This study seeks to investigate the influence of forest plantation establishment schemes on community livelihoods in Makutano forest area.

1.3 Purpose of the Study

This study purposed to find out the influence of forest plantation establishment schemes on community livelihoods.

1.4 Research Objectives

- i. To establish the influence of land cultivation under plantation establishment schemes on community livelihoods.
- ii. To investigate whether forest products available under forest plantation establishment schemes influences community livelihoods.
- iii. To assess the influence of community involvement in forest plantation establishment activities on community livelihoods.

1.5 Research Questions

- i. What is the influence of forest land cultivation under forest plantation establishment schemes on community livelihoods?
- ii. What influence does forest products available under forest plantation establishment schemes have on community livelihoods?
- iii. How does community involvement in forest plantation establishment schemes activities influence community livelihoods?

1.6 Justification and significance of the study

Makutano forest station is one of the eight forest stations in Kericho County. This site was selected because of its location and diversity in terms CFA membership. Its name 'Makutano' is derived from the fact that it is at the edge of three counties, namely; Kericho, Baringo and Nakuru. The membership of the Makutano forest CFA is drawn from the three counties who are of different communities. It is also part of the larger Mau forest, a major water tower in Kenya and East Africa, and therefore is of great interest to many in ensuring a balance in environmental conservation and taking care of livelihoods of the communities living around the forests.

For a long time, the government has been establishing forest plantations in the gazetted forests in Kenya. Mainly, the plantations have been established where natural forests

had been cleared. By establishing community forest associations (CFAs) in such areas, as stipulated in the forest Act No. 7 of 2005, and the subsequent forest conservation and management Act of 2016, communities have been involved to a greater extent. Besides, several environmental legislations have been enacted to help enhance community participation in environmental and natural resource management. The initialization and implementation of the PELIS strategy was one of the ways to help start up forest plantations and at the same time help the community around meet their livelihood needs. It was also meant to reduce the cost of starting up the forest plantation by charging a small fee for each parcel allocated to the farmers and involving them in establishing the forests.

The United Nations (UN) and FAO has done several studies on forest sustainability and forest resource assessment all around the world. Here in Kenya also, we cannot underscore the much that has been carried out by bodies like Kenya Forest service (KFS), KEFRI, KWS institutions and even individuals on forest plantation establishment and how they help improve community livelihoods. Nevertheless, there is still much more that needs to be addressed in order to achieve the concept forest plantation establishment and at the same time improve community livelihoods among people living adjacent to the forests. The communities around, who are the custodians of the forests, ought to be enlightened on plantation establishment and how it could help them alleviate poverty. Failure to this PELIS may end up not achieving part of its objectives.

PELIS was started in Kenya as one of the ways to decentralize forest management and improve the lives of the people. There has been several times when the community has been barred by the government from use of forest land and access to forest products on

the bases of forest conservation. This is done without considering the impacts it brings to the communities especially the FACs. This brings out the question whether the PELIS strategy best suits the aspect of forest sustainability and at the same time guarantee a sustained community livelihood. It is through tangible data that governments make decisions on the involvement of the communities in resource management. Consequently, this study endeavored to finding out how plantation establishment and livelihood improvement schemes have been influencing community livelihoods and provides concrete answers to these questions through its findings and recommendations.

This study comes in handy for the community around the forest area in realizing and appreciating their crucial role in ensuring that forest resources are sustainably utilized and sustainably improves their livelihood. This can only be achieved by exploring all the opportunities available to the community under the program and how these opportunities could be utilized to the maximum to improve on their livelihoods. The research also shares lessons and recommendations on how we can better manage our forests sustainably through the CFAs as a decentralized mode of forest management. Policy makers will find the findings of this study significant in integrating more the aspect of forest sustainability by involving the community more in developing forest management policies and consequently addressing the issue of livelihood improvement among FACs.

1.7 Scope of the Study

This study was conducted in Makutano Forest, part of the Londiani Forest Block in Kericho County. It focused on forest-adjacent communities, drawing a sample from

1,649 households to examine the influence of plantation establishment schemes on their livelihoods.

1.8 Limitations and Delimitations of the Study

Language barrier was one of the limitations since the community around is made up of different ethnic groups. This was overcome through hiring of an interpreter.

Poor terrain, water logged soils and harsh weather conditions also presented a challenge during the study since the study was done during the rainy season.

The researcher was conversant with one of the languages of the ethnic groups in the area hence easy to communicate while being assisted by an interpreter in communicating with the other ethnic groups. Considering the limitations of time and resources especially funds, this study covered only one of the eight forest stations found in Kericho County.

1.9 Assumptions of the Study

This study was carried out with assumptions that the respondents would be friendly, cooperative and would give honest responses to research tools. The researcher hoped to get up-to-date information on the plantation records from the relevant authorities. It was also expected that there was a well-established CFA for the forest station comprising of different CBOs. Finally, the researcher assumed that the sample selected would be sufficient making accurate inferences of the entire study population.

1.10 Operational Definition of Terms

Cultivation -	improvement of land for growing food crops
Food security-	a food secure person, household or community is one that has the capacity to access food in good quality and quantities to meet their dietary needs for a healthy and active life.
Forest management-	can be defined as a process of coming up with a plan and implementing it in a way that would help in sustainably utilizing forest resources.
Livelihoods-	are a set of activities involving the use of the available resources in order to earn a living or aid in meeting the community needs. The activities could either be carried out individually or as a group sustainably and with dignity.
Plantation schemes-	are forest planting programs started by the government of Kenya through Kenya forest service in collaboration with the forest adjacent communities.
Poverty-	is a state where an individual or community lacks material income and becomes vulnerable, exposed to risks, is powerless and is not given an opportunity to be heard especially in times of decision making.

Silviculture- is an art and a science of growing and taking care of trees in a controlled way with an aim of establishing desired quality forests.

Sustainable forest management - this refers to the process of developing a plan and implementing it to help utilize forest resources to meet the needs of the present generation and at the same time safe guarding the plight of the future generations and the environment.

Sustainable Livelihoods - is a livelihood where activities carried out by a person, group or a community, by utilizing the available resources, are able to help them earn a living and at the same time maintain or even enhance the resources to help the next generation earn a living from them.

Taugya - It was a strategy adopted by the Indians in 1890s where communities were allowed to grow food crops and at the same time plant trees and take care of them for a period of 1 to 3 years when tree canopy developed and they would shift to other areas.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

The chapter looks at both theoretical and empirical literature review related to the influence of forest plantation establishment schemes on community livelihoods. The chapter also reviews the independent variables in relation to the dependent variable. In addition, it identifies the gaps in knowledge that exists, in relation to this study based on the theoretical and empirical literature reviewed.

2.2 Empirical Literature

2.2.1 Influence of forest land cultivation under forest plantation establishment on Community Livelihoods

Land is identified as one of the most important factor of production and an essential resource. Many of the common people living around the forest have small or even do not have land for cultivation. They therefore depend on the forest land for cultivation. This has been made possible through the establishment of the PELIS program. Here, the farmers are allowed to form user groups which then form one CFA and are allowed to access forest land for cultivation within the first three years of forest plantation establishment. Apart from land scarcity among the forest adjacent community, the forest land is preferred for cultivation by these communities as it is considered fertile having not cultivated for long. Less fertilizer is used, and since the soil is less contaminated, there is less pest and disease control. This translates to lower production cost and higher returns as compared to the farming in their farms where cultivation has taken place for many years.

The forest adjacent communities are allowed to cultivate forest land under the program of plantation establishment and livelihood improvement scheme. The cultivation

involves acquiring forest land for a small fee for a period of 1-3 years before tree canopy is established. Forests and water are the major global natural resources that enhances economic benefits for the community, biodiversity and ecosystem (Garbac *et al.*, 2014; Summers *et al.*, 2012; Anna, *et al.* 2018). Estimates show that a quarter of the poor's population livelihoods in the world depend either directly or indirectly on the forest land for food production and other needs (World Bank, 2013; Anna, *et al.* 2018). Tropical forest areas are a big contributor to both subsistence and income to many people who depend on forests through activities they are involved in (Shearman *et al.*, 2012; Zuzana *et al.*, 2015). Land is a scarce resource especially among the poor populations and when made available can change their lives. Decentralization of forest management, which led to the formation of CFAs, made it easier for the communities living adjacent to forest access arable land as forest plantations were being established. Besides PELIS achieving its main objective of promoting forest plantation development, it has brought with it other benefits such as availing land for agriculture to the landless and contributing to food production (Paul O. *et al.*, 2013; Tobias, 2015). Further, Agevi, (2016) notes that the program has bettered the peoples' livelihoods through increased and varied food supplies of beans, potatoes, maize, carrots and kales. This has in turn assured the community of enough food supply throughout the year as well as increasing their income made from sales of the surplus harvests.

In the planted forest, clear cut tree harvesting method is used. After the land is left free of trees, every block demarcated using firebreaks is assigned to a particular user group who are members of a given CFA. The land is subdivided into half acre plots. Members of the user groups lease the half acre plots land at a small fee of Ksh. 1000 per year paid to the KFS through the leaders of the user groups. During the first year of cultivation, the land is prepared for forest plantation establishment. In the second year,

the farmers with the guidance of the KFS officers plant the tree seedlings. They take care of the tree seedling in the second and third years of cultivation. When the tree canopy is high enough and does not allow for cultivation, the farmers vacate the land. Other ways in which the community utilize forest land is by grazing especially along the firebreaks, collecting firewood from the pruned branches, and keeping of beehives. These user rights are given after acquiring a permit from the KFS. Most of the poor populations living near forests depend on agriculture but the land for cultivation is either inadequate or have no arable land. They therefore struggle to lease land from the better off members of the community at a cost and with no security for the land, the farming activity becomes untenable.

According to Prince Osei *et al.*, (2008) as quoted by Tobias, (2015) every community member who is involved in modified taugya system (MTS), a modified form of PELIS, is hardworking, has been able to access land for trees and food crops cultivation. This has reduced cases of food shortage which was previously a big burden to the people. Many of these community members involved in the MTS are able to grow crops especially for subsistence and the surplus sold to get money to cater for other household needs.

2.2.2 Influence of forest products available under forest plantation establishment schemes on community livelihoods

Apart from land for cultivation, the community is involved in the pruning of the trees. The pruned branches are used as firewood or rafters for construction and fencing. According to a survey done by Elizabeth *et al.*, (2018) at the Aberdare forest ecosystem, identifies water, firewood and grazing land as the most vital forest products derived from the forest ecosystem at 98%, 70% and 67% respectively. The article

further notes that, 14% of the people were cultivating land which was under the forest plantation establishment and livelihood improvement scheme (PELIS) and 16% relied on forest land for grazing of their animals like cattle and sheep.

Establishing forest plantations require resources in terms of finances and manpower. At initial stages, funds are required in tree nursery preparation and establishment. In establishing the forest plantation, much of the costs are incurred during the first year of establishment, Florencia *et al.*, (2005) putting it at 68 percent of the total cost of forest establishment. This mainly involves land clearance, digging of holes, planting and weeds control. Other costs involved are in pest control and pruning the trees. In reducing this costs, the KFS allow the community to access some of the forest products as the offer labour in establishing the forest plantations.

According to a survey done by Elizabeth *et al.*, (2018) at the Aberdare forest ecosystem, it reflected that, there were payments in kind from the forest ecosystems where 98% of the community derive their water from there, 70% collect firewood while 67% are grazing their animals in the same forest land. She further notes that, establishment of forest plantations has assisted at least 14% of the FACs benefit from the forest arable land. One of the benefits envisaged in the PELIS strategic policy guidelines is to help boost incomes for the poor in the society. Many conservation managers today look forward to accelerating income flows for the poor communities living adjacent to the protected areas (Adams *et al.*, 2004; Caroline *et al.*, 2018). Tobias (2015) quotes Prince Osei *et al.*, 2008 as having found out that, MTS was of great benefit to the whole community since the parents could now afford to take their children to senior high schools where enrolment had increase significantly. This

demonstrates that the proceeds from the surplus food produce from the forest plantation arable land had enabled the community pay for their children education.

In the quest to conserve and maintain forest cover, forest plantations have been identified as one of the ways to achieve this. A well conserved forest has been noted to support the livelihood of many people living near such forests. The food could be acquired either through buying, own production or grants from governments, family members or other well-wishers. The food should be sufficient, safe and nutritious (International Federation of Red Crescent Societies, 2006).

The productivity of a society highly depends on food security. It is estimated that most of the poor people in the sub-Saharan Africa are rural dwellers (90%), and they mainly rely on crop cultivation as a source of livelihood (Oksanen *et al.*, 2003; Higman *et al.*, 2004; Kiyangi *et al.*, 2015). Many of the populations in Kenya living near forests are poor and food security is a problem to them. Malnourishment is a big threat among such populations. The start of forest plantations better known as PELIS in Kenya today aimed to improve food security among these communities. Shamba system gives high return to farmers by close to Ksh.120, 000 per hectare per year thereby creates employment to farmers and ensures food security (Kagombe, 2009; Tobias, 2015). The parcels of land allocated to the forest user groups are used to produce fast maturing crops like peas, potatoes, beans and vegetables. Okumu (2017) notes that, the nutritional value from consumption of these produce leads to higher productivity due to improved health. It is a joy for farmers to benefit from PELIS as some peoples' small pieces of land whose productivity is low can now generate enough profits to raise even healthier families (Manyaka, 2015; Tobias O., 2015)

A study by Kiyingi *et al.*, (2015) in Ugandan on-farm plantation forestry, provides empirical evidence that this kind of farming is a significant system in helping eradicate poverty among small scale farmers and ensure the society is food secure. Forest land has also been noted to be fertile and hence high production. Many farmers prefer to take up forest land when establishing forest plantation so as to realize high food production which could be able to cater for their family nutritional needs as compared to their small shareholdings of land where soils have been impoverished. In such soils, they are forced to use lots of fertilizers which most of them do not afford or when used eats up to their profits.

Forest structure and complexity is vital in ensuring forest productivity and provision of ecosystem services like protecting other surrounding ecosystems, erosion control and carbon sequestration. Forest tree diversity is also important in supporting various niches and flora found in baseline forests (Bosile *et al.*, 2008; Meriadec *et al.*, 2017). Establishment of forest plantations is a way of improving the forest structure and complexity thereby helping in controlling soil erosion and carbon sequestration which are important aspects in agriculture for food production. Forest arable land has also been noted to reduce the use of inorganic fertilizers for the soils are more fertile therefore maximizing production.

2.2.3 Influence of community involvement in forest plantation establishment schemes activities on community livelihoods

The government in its quest to successfully establish plantation schemes came up with Participatory forest management (PFM) program which started in Kenya back in 1997, aimed at increasing community involvement in forest conservation and management. Under this, the forest adjacent community would be involved in different forest

activities in the plantation establishment schemes. Bremer *et al.*, (2014), argues that the extent to which local communities participate and benefit from plantation establishment schemes had a big influence on the sustainability and success of the programs. Additionally, Josphine *et al.*, (2016) delves in understanding the factors influencing level of participation of CFA members in PFM and identifies perceived benefits as the major factor. Thunen, in his theory on the spatial distribution of forestry and agriculture stipulates that, decisions on land-use are mainly based on the economic considerations (Von Thunen 1842; Puettmann *et al.*, 2015). Forest land is not exceptional. Forests and water are the major global natural resources that enhances economic benefits for the community, biodiversity and ecosystem (Garbac *et al.*, 2014; Summers *et al.*, 2012; Anna, *et al.*, 2018), with one quarter of the world's poor population directly or indirectly depending on it for their livelihood (World Bank, 2013; Anna, *et al.*, 2018). Tropical forests are major source of subsistence and revenue to millions of forest-dependent people (Shearman *et al.*, 2012).

Other factors found to influence the level of community participation in forest activities included; range of total farm size, gender of the household head, level of awareness, and training in forest conservation and management. Kenya forest service target to improve forest management and community livelihoods of forest adjacent communities through Participatory forest management. According to Mbuvi *et al.*, (2006) in Kakamega and Arabuko Sokoke state forests, Community Based Organizations (CBOs) are involved in seedling production, ecotourism enterprises among other activities.

Many people derive their livelihood from exploiting this resource such as, firewood, timber, pulp, poles, medicinal herbs etc., and services derived from the forest such as recreational services and research. It is estimated that globally, forests support the livelihoods of 1.6 billion people. In Africa, 6% of the GDP is credited to forest and

forest resources. These statistics are the highest in comparison to other continents. This means there is overexploitation of the forest and forest resources not forgetting that most of the global poor live in sub-Saharan Africa with a rising poverty index, reported to be at 41% as of 2015. The PELIS strategy was initiated in Kenya with one of its objectives being to reduce the cost of forest plantation establishment. This was to be achieved by increasing community involvement in forest management under PFM. In allocating community members forest land through forest associations, they would be involved in clearing, planting, weeding for and pruning of the trees for free as they benefit from crop cultivation and collection of firewood from the pruned branches. A study conducted by Tobias (2015) at Uasin Gishu County indicate that the cost of forest plantation establishment had reduced by 27.9% as compared to those established without PELIS. This indicates a win-win situation where the government benefit by reduced forest plantation establishment cost while the community become food and financially secure through the sale of the surplus food.

Kenya is noted to have a forest cover of about 6.9% of the total land mass which is below the 10% threshold recommended internationally. Among other factors, forest cover decline has been attributed to poverty. As of 2016, the poverty index in Kenya was noted to be at 36.1%. This was 10.5 percent decline a decade back. This is however still high and measures ought to be put in place to improve the livelihood of the people living adjacent to the forest.

Zuzana *et al.*, (2015) notes that, most of the tropical forests are being used for timber production which is mainly for revenue generation (FAO 2005; Putz & Romero 2014; Zuzana *et al.*, 2015). Anna *et al.*, (2018) observes that livelihood products obtained from forest are significantly associated with distance from the forest edge and activity

of household in participatory forest management (PFM). However forest adjacent communities as the case of Nabkoi experience inadequate equipment and knowledge needed to create a high income production from forest resources through value addition (Carr *et al.*, 2010; Anna, *et al.*, 2018).

Forest plantations have widely been adapted in many countries as an easier way to ensure continuous supply of timber and wood to the exponentially growing population. The planted tree species are selected according to their economic value, market conditions, ease in management, and the time they take to mature with an aim to maximize returns. Nevertheless, developing a forest with different tree ages and species also helps economically. This is more so applicable when there are changes in market conditions and hence it becomes easy to adopt a more flexible harvesting strategy (Knoke and Wurm 2006; Puettmann *et al.*, 2015).

Most studies agree to the fact that many of the communities living along the forests are poor communities. In particular the studies conducted around and in the entire Mau complex, the communities haven't been very stable economically due to challenges of displacements as a result of election violence and state declarations. Therefore, the introduction of PELIS aimed at transforming their lives economically. Elizabeth *et al.*, (2018) notes that most of the forest adjacent communities are within very poor and poor category. These category of people highly depended on the forest for their livelihoods. However, studies like that by Agevi *et al.*, (2017) shows that with the implementation of PELIS program, many have been able to diversify on their sources of livelihood. For example Agevi in his study at Malava forest identifies that, 90% of the population had reduced forest dependency.

2.3 Theoretical Framework

This study relates to the theory of decentralized forest management which is derived from the concept of decentralization. The concept of decentralization is where powers from the central governments are transferred to institutions and lower levels of administrators (Agrawal and Ribot, 1999). This takes place when the central government appoints representatives at the local levels and relegates some powers to them. In the decentralized forest management, the local communities are given the rights to manage and conserve the forest resources through their selected leaders who link them to the central government. Under the right circumstances, the theory has been noted to work very well by having seen to improve efficiency, equity, democracy and resource management (Larson and Ribot 2004).

Luca (2007) identifies some four hypothesis that guide this particular theory. These hypothesis are: (i) the democratic decentralization hypothesis which raises the question of the implications of fully devolving forest management to the locals. Decentralized forest management theory emphasizes on the benefits derived from involving the community more in managing the forest resources through community based natural resources management (CBNRM). (ii) Hypothesis about CBNRM and sustainable forest management. This hypothesis raises concerns on the importance and the advantages of common-pool resource management. The communities are meant to benefit from the resources at their reach by being involved in their conservation and management as commons and not as private entities. (iii) Hypothesis about rural people's benefits from the forest and its conservation. According to this theory, people living adjacent to forest benefits from the forest and conserves the forests. It is assumed that the livelihoods of such people are dependent on the forests and they live in harmony with the forests. They are able to utilize forest products and services to better

their lives and at the same time conserve the forest. (iv) The environmental success assumption. The theory through this hypothesis asserts that with successful decentralization, there is sustainable forest management and sustained livelihoods among the communities involved.

Some of the factors influencing the social and environmental outcomes of decentralized forest management have been identified to be; legal structures, mediating factors and decisions made at the local government level. In case structures are not well laid down for successful decentralized forest management, communities are likely to overexploit the resources at the expense of conserving them especially where the benefits derived are not directly beneficial to the communities.

2.4 Identification of Research Gaps

Literature review in this study mainly dwelt on forest plantation establishment schemes, in its relation to community livelihood. Much of the studies reviewed on PELIS mainly examine the role of PELIS on forest cover change and the economic benefits derived from the program by the CFAs members. It is of no doubt that forest cover in Kenya has progressively increased from 2007 when the program was introduced and implemented through well-established and managed CFAs. Humphrey *et al.*, (2016) affirms this through his study, which agrees with other studies conducted around Kakamega forest on possible causes of increased forest cover. The increase was attributed to the PELIS program. According to him, the program contributed to a remarkable increase in forest land cover around the country. His findings noted a remarkable increase of forest land cover from 2933 ha in 2010 to 9939 ha by 2013. There were also other studies that dwelt with the effects of forest plantation establishment on community livelihood improvement. Studies like that by Musyimi *et*

al., (2018), Adreas *et al.*, (2015), Tobias (2015), KEFRI (2014), and Okumu *et al.*, (2017) mainly dwells on the contributions of plantation establishment on forest cover effects on the livelihood of the FACs.

Forest land cultivation is still coursing a heated debate in Kenya with those advocating for environmental conservation being against it or recommending for its review. From studies conducted at Arabuko Sokoke forest, that from Uasin Gishu forest stations, Londiani forest block and at Ontulili and Ngare Ndare forests, farmers preferred the growing of maize. The government of Kenya outlawed the growing of maize in forest lands in Kenya in the year 2019 and this raises the question whether the FAC still have the guarantee of their livelihoods which highly depend on the forest land, whether they still continue to participate in forest activities and what opportunities are left for them today. In some areas, cultivation has been halted after the trees had established. There are still gaps of information on the state of food security for community members after the burn of maize growing in the forest plots. Okumu *et al.*, (2017) in a study on economic valuation of forest ecosystem services in Kenya acknowledges that knowledge about the extent of the benefits of forest ecosystem services is quite scant. The basis of this study is to bridge this knowledge gaps identified from the reviewed literature by exclusively looking at how plantation establishment has affected the livelihood of forest adjacent communities.

2.5 Conceptual Framework

The conceptual framework shows the two variables behind the study plus the

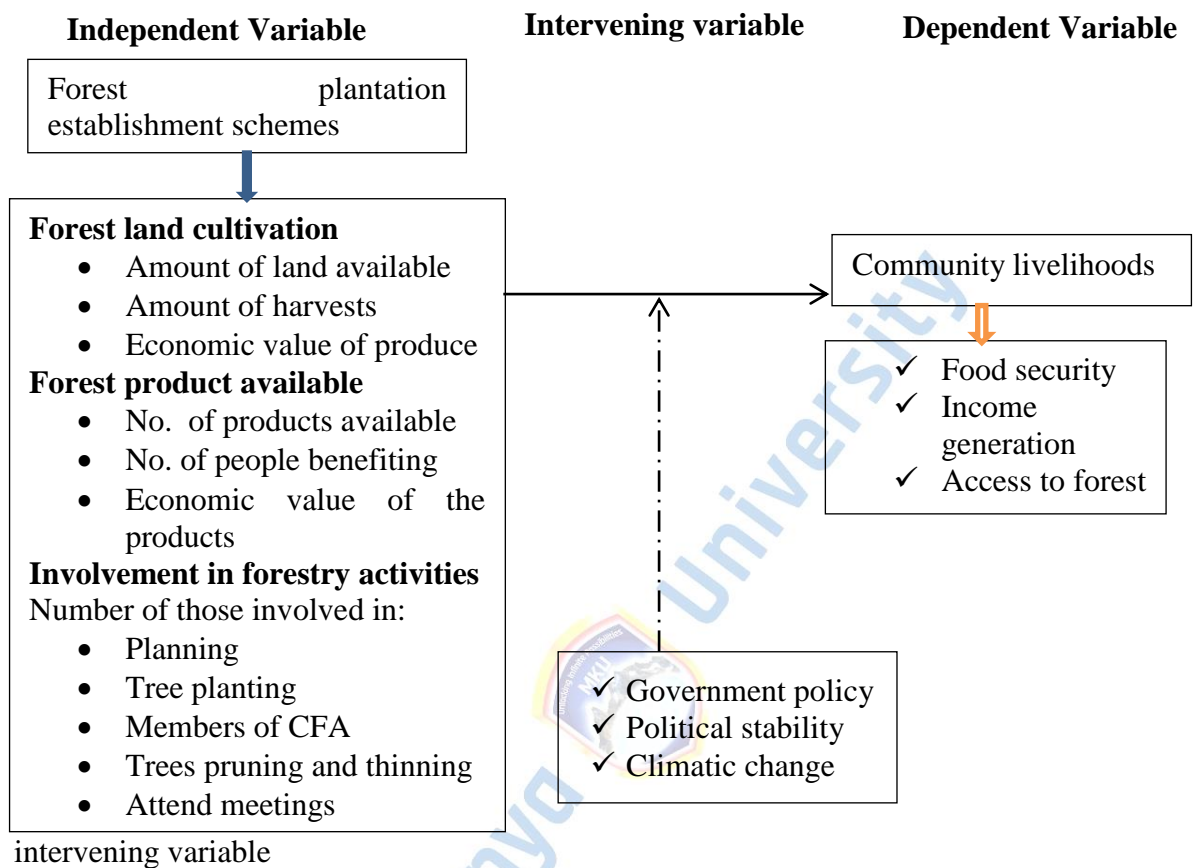


Figure 1: Conceptual Framework

Source: Researcher, 2024

The independent variable in this study is forest plantation establishment scheme while the dependent variable is community livelihoods. For cultivation of land available under the scheme, the indicators included amount of land available for crop cultivation, number of crops that the farmers are allowed to grow and the amount of harvest realized per unit, economic value of the produce and other social benefits from the produce. In the course of establishing forest plantations, there are several opportunities available to the forest adjacent community that are meant to involve the community

through CFAs in collaboration with the KFS office. The community is involved in these activities as an incentive in assisting establish and conserve forests as a way of devolving forest management to the local communities. The expected activities include, planting of the tree seedlings, crop cultivation before tree canopy establishes, establishing of tree nurseries, grazing especially at the firebreaks, fetching firewood and bee keeping. In return, these activities are expected to influence the peoples' lives positively by reducing their poverty levels hence improving their livelihoods. The activities ensure that the community has access to forests and forest resources such as forest land and fodder, they are cushioned against hunger through food security from farm produce as well as a stable source of income from the sale of the surplus produce. The intervening variables include, government policy, political stability and climate change.

2.6 Summary of Literature Reviewed

There was a wide range of literature reviewed in this study that dealt on forest plantation establishment schemes in relation to forest adjacent communities' livelihoods. Many of these studies discuss opportunities available under forest plantation establishment, costs involved under forest plantation and its impacts the livelihoods of the FACs and the level of household participation in forest activities, forest cover, and tree survival rates planted under the scheme. The studies also reveals the successes and challenges of PELIS in the Kenya's forest reserves mainly the Mau complex, the Kakamega forest, Nabkoi, Arabuko Sokoke, Kieni forest and Kereita forests in Kiambu county and at the Aberdare forest.

CHAPTER THREE

RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

This chapter covers the research design, location of the study, general demographic information of Kericho County, target population, procedures and techniques used in sampling, sample population, constructing of the research instruments, validity and reliability testing, methods and procedures of data collection, data analysis techniques used and procedures and ethical considerations.

3.2 Research Design

The study adopted a cross-sectional research design. This design was preferred because the data collected aimed to represent a very large population. Hence helped gather data from a representative sample of the forest adjacent community; which included the CFA members, and was used to make inferences about the whole population (Helen *et al.*, 2011). Questionnaires with both open and close-ended questions was used in collecting data from the CFA members who formed the largest group of the representative sample population. For the key informants who include the CBO leaders, a focused group discussion was conducted.

3.3 Location of the Study Area

The study was carried out at Makutano forest which borders Masaita forest block to the south and is part of the Mau conservancy to the west. Most of the areas of the forest are well drained with several streams coming from here like river Githee while a few are poorly drained with waterlogged soils. The forest is about 2100m above sea level experiencing tropical type of climate with double maxima around May to July and September to November. The forest station office is situated in Kipkelion East sub-

county, Kericho County, Kenya. The forest station office can be accessed from Makutano at Nakuru-Eldoret highway. The forest is approximately 9km from Londiani town along Nakuru-Muhoroni road. It lies at latitude $0^{\circ}5'59''$ South to $0^{\circ}0'5''$ South and longitudes $35^{\circ}36'16''$ to $35^{\circ}39'26''$ East. Appendix A shows the map of Makutano forest around Kericho-Nakuru boundary which forms the study area for this study. The forest is managed by Kenya Forest Service (KFS) in collaboration with the Makutano CFA. The forest area is approximately 5474.09 hectares. Of this, 3561.84 hectares is covered by exotic plantation while 1343.01 hectares is covered by natural forest. Makutano forest station has the second largest portion of natural forest among the eight forest stations in Kericho County (KFS, 2019).

3.4 General Population Size and Composition of Kericho County

Makutano forest station, where the study was conducted from, is in Kericho County, Kipkelion East sub-county, Londiani division. The entire forest spreads over two counties, that is, Kericho and Nakuru but the biggest percentage of the forest users is drawn from the side of Kericho County. The population of Kericho County as documented by Kenya National Bureau of statistics, 2019 Kenya Population and Housing Census report, was 901,777. Of this, 450,741 were men and 451,008 were women. Kipkelion East has a total population of 137,580 and Tendeno/Sorget ward where most of the Makutano forest users live and where the forest station is located had a population of 10,899 (2019 Kenya Population and Housing Census report, 2019).

3.5 Target Population

The target population was 1719. The population is stratified as shown in Table 1 below;

Table 1: Target population

Strata	Total Population
FAC households	1649
CBO leaders	70
TOTAL	1719

3.6 Sampling Procedures and Techniques

3.6.1 Sampling Procedures

The first strata of target population was the forest adjacent community. The FAC was made up of 14 CBOs. To help come up with the number of households in each CBO, to which household questionnaires would be employed upon, the following formula of assigning proportions (Bowley, 1926; Raghunath, 2017) was used;

$(X/Y)*N$ where X=the number of households in each CBO

Y=total number of FAC households, and

N=sample size.

Systematic sampling method was used in selecting particular FAC households. For the case of the second strata of the target population, the 14 CBOs had five leaders each totaling to 70. Snowball sampling was employed in selecting one leader from each CBO. The leaders were then randomly placed into two groups for the focused group discussions. This method was preferred because of its ease, convenience and reduced chances of biasness. According to Kothari (2004), the law of Statistical Regularity is achieved when random sampling method is used. This means that, on average, the sample chosen is a random one, and hence is a good reflection of the composition and characteristics of the whole population.

3.6.2 Sampling Techniques

With a population of less than 10,000 as proposed by Mugenda and Mugenda, (2013) a sample size of 10% to 30% would be enough. The target population for the study was 1719. In coming up with sample size for first strata with a target population of 1649, Nassium (2000) formula was used. Nassium (2000), observes that, most surveys adopts a variation coefficient of between 21% and 30% and a 2% to 5% standard error range which in most cases are acceptable. This study employed a 30% variation and a 2% standard error. Nassium (2000), gives the formula as follows; $n = \frac{Nc^2}{c^2 + (N-1)e^2}$.

Where;

n= Sample size,

N= population,

c= covariance

e= standard error.

For the sample population from each stratum, the method of proportional allocation was used.

3.7 Sample Population

Nassium (2000) formula was used to calculate the sample population for the households adjacent to the forest.

$$n = \frac{1649(0.3)^2}{0.3^2 + (1649-1) 0.02^2} = 198$$

Target population sample size is 198.

The total sample population therefore was 212 comprising of 198 households plus 14 CBO leaders. The table 2 below illustrates a summary of the sample population;

Table 2: Sample Population

Strata	Target population	Sample population
CFA members	1649	198
CBO leaders	70	14
Total	1719	212

3.8 Research Instruments

The study relied on both primary and secondary sources of data. Questionnaires formed the major tool for collecting primary data from the FAC. The questions forming the questionnaire were structured so as to save on time and the associated costs. Questions were also framed for a focused group discussion with the CBO leaders. For secondary sources, research journals, books, magazines, reports, thesis, worldwide web, executive letters and official records were used.

3.9 Testing for Validity and Reliability

Validity and reliability of the research instruments was done to ensure meaningfulness and consistency of the results.

3.9.1 Validity of Research Instruments

It was important to check for the research instruments validity so as to help check the questions content, correction in the wording sequencing and improve on the overall quality, before the actual study. Before the instruments were administered, the researcher sought for advice and opinions from the supervisors, and the Londiani KFS officers to ensure that the research instruments were valid. Revision and modification was then done where necessary to ensure the instruments were authentic.

3.9.2 Reliability of Research Instruments

Mugenda and Mugenda (2003) defines reliability of data collection instruments as ones whose measurement can be considered to be consistent and that can be assessed frequently through a test-retest reliability method. Ensuring reliability of the research instruments would help in identifying any ambiguity and (or) inadequacy in the items and hence guarantee consistency, dependability and trustworthiness of the instruments.

The test-retest method was used by issuing questionnaires to a group identified to possess similar traits to those of the actual sample population at an interval of one week. The results from the two tests was then used to check on the reliability of the instruments.

3.10 Data Collection Methods and Procedures

Permission was sort from the relevant authorities before collecting any information. Research assistants with the guidance of the researcher administered the questionnaires. The researcher plus the research assistants, on each day, reconciled those questionnaires that had been filled as a way of taking stock of the day and to help avoid any compromise of the data collected.

The day for the focused group was scheduled in collaboration with the participants and with the help also of the assistant, the participants were informed on the date and venue.

3.11 Data Analysis Techniques and Procedures

After data collection, cleaning and coding were conducted using SPSS version 28.0 and Microsoft Excel 2019. Binary logistic regression was the primary analytical technique used for categorical dependent variables, where outcomes were coded as binary (1/0) such as food security status, forest product access, and participation in decision-

making. The logistic regression model specification followed $\log(p/1-p) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_n X_n$, allowing for interpretation through odds ratios. Independent variables included land size (continuous), household demographics (ordinal/binary), and participation frequencies (ordinal). Model assumptions were tested including linearity of logit, multicollinearity assessment ($VIF < 5$), and goodness of fit using the Hosmer-Lemeshow test.

For each research objective, specific analytical approaches were employed: Objective 1 used binary logistic regression to examine the relationship between land cultivation variables and food security outcomes, with ANOVA for continuous variables like economic value of harvests across different groups. Objective 2 applied multiple binary logistic regression models for each forest product access outcome, complemented by Spearman correlation analysis for ordinal welfare ratings. Objective 3 utilized binary logistic regression to analyze decision-making participation with meeting attendance frequency as the key predictor, while ordinal logistic regression was used for activity importance ratings. All analyses included descriptive statistics, maintained a significance level of $\alpha = 0.05$, and incorporated effect size measures including odds ratios with 95% confidence intervals, ensuring robust statistical inference and meaningful interpretation of results.

3.12 Ethical Considerations

In a bid to consider ethics, permission was sought from the relevant authorities before collecting any information. The identity of the respondents as in the consent form was sealed, kept separately from the data collection tools. These documents were not and shall not be disclosed to any third party. Information provided by the respondents was purposely for academic reasons; it was and shall be treated with a lot of confidentiality.

The relationship between the researcher and the respondents was mutual. All the activities carried out during this study, were done in a manner that, no one ended up being exposed to any harm or suffering as a result of the study.



CHAPTER FOUR

RESEARCH FINDINGS AND DISCUSSIONS

4.1 Introduction

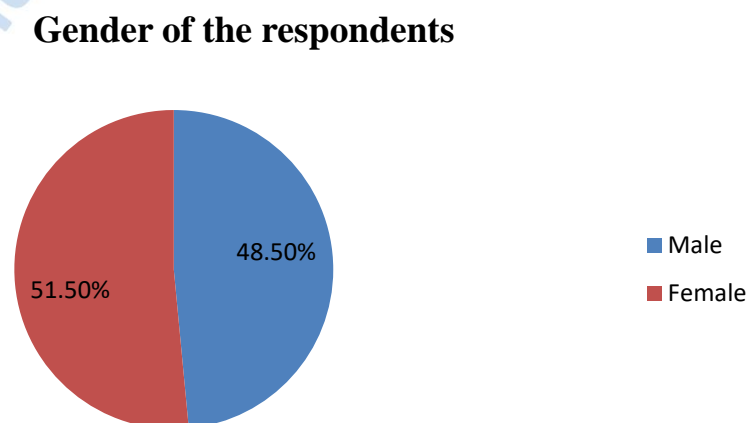
This chapter presents thesis findings, analysis and presentation of the study. The foundation of any study is based on the demographic information of the target population (Gall *et al*, 2007). Therefore, the first part of this chapter, is the analysis and discussion of the basic information about the households. This included gender, who the household head was, religion of the household head, ethnicity, education level, household membership, age, and source of income of the household. While in the second part, it presents the analysis and discussion on the influence of forest plantation establishment schemes on community livelihoods in line with the three objectives of the study.

4.2 Households' basic information

4.2.1 Gender

Data on the gender of the respondent was collected, recorded and analyzed as shown in the figure 2 below.

Figure 2: Gender of the respondents

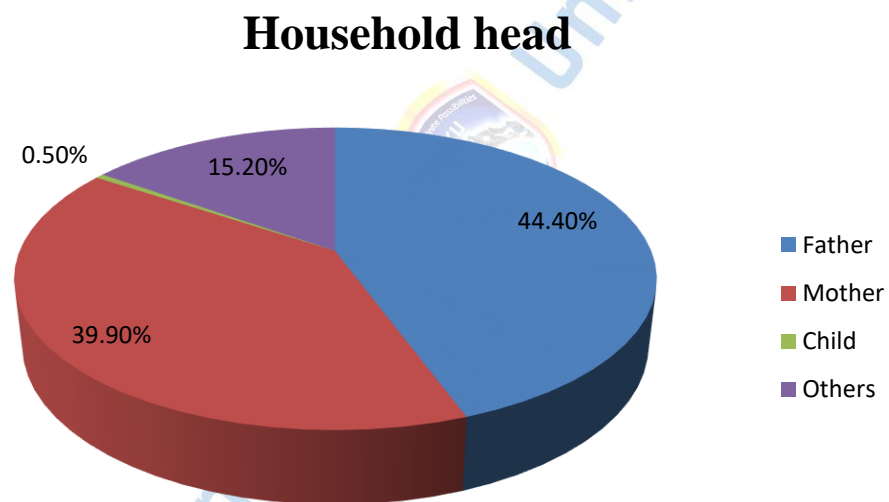


From the figure above, more women (51.5%) than men (48.5%) were involved in the study. This was a good representation in terms of gender balance in the study since the disparity was not a big margin.

4.2.2 Household head

Household headship was another important data that was collected in order to know the role that the household head played in the welfare of the household. The responses are analyzed in Figure 3 below.

Figure 3: Household head

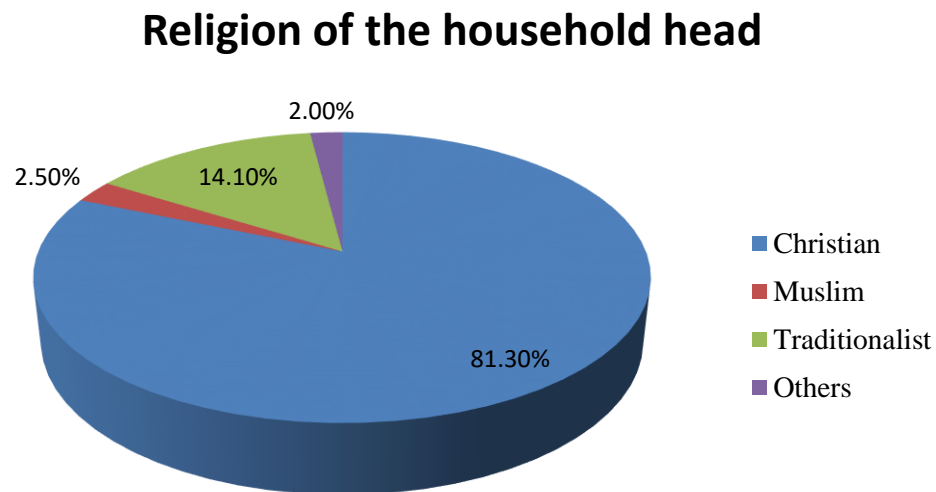


Majority of the households sampled were headed by fathers at 44.4%, followed by those headed by mothers at 39.9%, others who included people like grandparents at 15.2% and those headed by children stood at 0.5%. This indicates that most of the families were stable and the few headed by children and grandparents may be attributed to the demise of the parents.

4.2.3 Religion of the household head

The research also sought to understand the religion of the household heads and the responses are analyzed in figure 4 below.

Figure 4: Religion of the household head



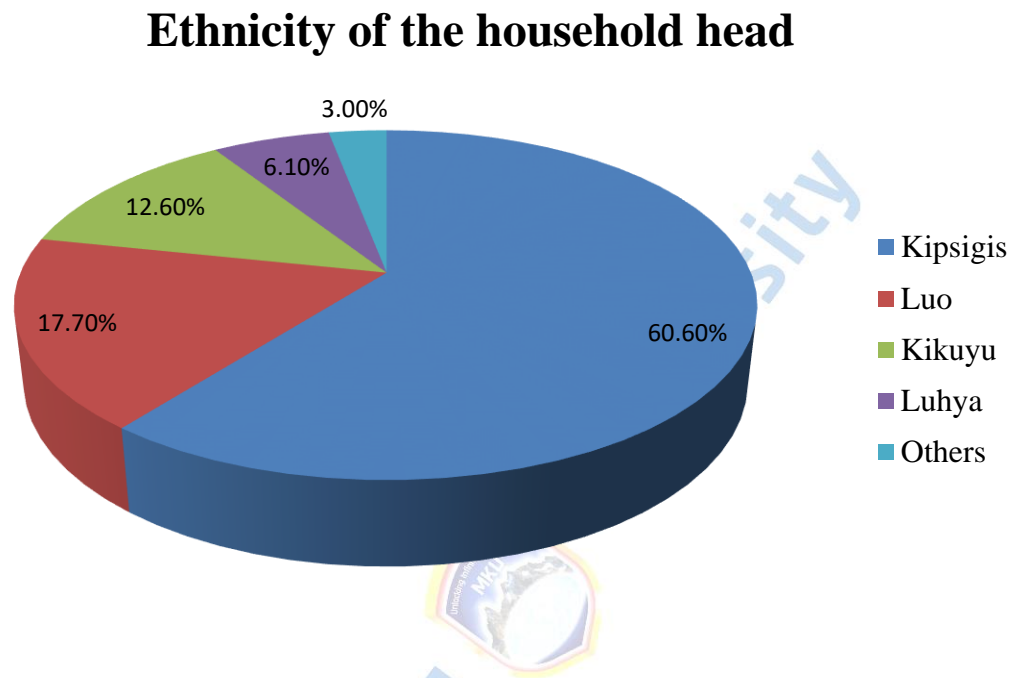
The highest number of the household survey respondents were Christians at 81.3%, followed by traditionalists at 14.1%. The Muslims were very few, five in number represented by 2.5% while other religions stood at 2.0%. The Muslims and other religions were noted to be those in or near the town center of Makutano while the Christians and traditionalists were from the rural areas.

4.2.4 Ethnicity of the household head

The Makutano forest adjacent community comprises diverse ethnic groups whose varied cultural practices and traditional forest management systems influence their participation in forest plantation establishment schemes. Understanding the ethnic composition of household heads was crucial for assessing how different communities

engage with forest conservation initiatives and benefit from plantation schemes. The ethnic distribution of household heads is presented in Figure 5 below.

Figure 5: Ethnicity of the household head



The findings revealed that the majority of household heads (60.6%) were Kipsigis, the predominant ethnic group in Kericho County, who have traditional ties to the land and established forest management practices. The Luo community constituted 17.7% of household heads, followed by Kikuyu at 12.6%, and Luhya at 6.1%. Other ethnic groups collectively represented 3.0% of the sample. This ethnic diversity is significant for forest plantation schemes as different groups bring varying levels of traditional ecological knowledge, land tenure arrangements, and cultural attitudes toward forest conservation, which influence their participation in and benefits from plantation establishment programs.

4.2.5 Household membership

Understanding household size and migration patterns was essential for assessing how forest plantation establishment schemes affect different family structures and the stability of the forest adjacent community. The demographic characteristics relating to household composition are presented in Table 3 below.

Table 3: Household membership

	Household membership	Members migrated
Valid	198	198
Mean	5.75	1.51
Mode	5	1
Range	8	5
Minimum	2	0
Maximum	10	5

The study revealed that households in Makutano forest adjacent area had an average size of 5.75 members, which is significantly higher than both the Kericho County average of 4.4 persons per household and the national average of 3.9 persons per household (Kenya National Bureau of Statistics, 2019). The largest household comprised 10 members while the smallest had 2 members, giving a range of 8. The modal household size was 5 members, indicating this as the most common family structure in the area.

Regarding migration patterns, the data shows minimal out-migration from the area, with an average of 1.51 household members having migrated per family. This low migration rate suggests that the majority of household members remain within their home communities. The retention of family members in the area may be attributed to livelihood opportunities provided by forest plantation schemes, including cultivation

activities and forest-based income generating activities that reduce the need to seek employment elsewhere.

4.2.6 Respondents' educational level

The researcher sought to know the educational level of the respondents. This was important so as to understand how to interact with them and how well they could interpret the PFM policy and laws. Table 4 illustrates the educational levels attained by respondents.

Table 4: Educational level of the respondents

Level of Education	Frequency	Percent	Valid Percent	Cumulative Percent
Never been to school	21	10.6	10.6	10.6
primary level	101	51.0	51.0	61.6
Secondary	59	29.8	29.8	91.4
Tertiary	17	8.6	8.6	100.0
Total	198	100.0	100.0	

The data showed that 177 (89.4%) of the respondents had at least acquired some form of basic education though out of those, majority (51.0%) had only been up to primary level. Those who had never attended school were 10.6%. This indicates that most of the respondent could at least read and employ proper farming methods and could easily take up education on forest conservation offered through their CFA and the Kenya forest service. The literacy levels could also help in communication and coordination of the forest programs with ease.

The fact that over half of the respondents had only attained primary education implies limited exposure to advanced literacy and technical training, which may affect their ability to fully comprehend complex forest policies, legal frameworks, or advanced agroforestry techniques. However, this education level is still sufficient for basic literacy and communication. It indicates that forest conservation awareness programs

and PFM training should be designed in a simplified, practical, and vernacular-friendly manner to enhance understanding and participation. This group is likely to benefit from hands-on demonstrations, visual materials, and peer-to-peer learning methods. The relatively low education level also underscores the importance of continuous capacity building through the Community Forest Associations (CFAs) and Kenya Forest Service (KFS) to ensure effective community participation and compliance with forest management practices.

4.2.7 Age bracket of the respondents

The researcher also sought to understand the age of the respondents. Age is one of the parameters of how active and able the society is in terms of producing viable labour. This would in turn help in exploiting the available resources effectively and efficiently. The results were as recorded in table 5 below.

Table 5: Age bracket of the respondents

Age bracket	Frequency	Percent	Valid Percent	Cumulative Percent
21-30	15	7.6	7.6	7.6
31-40	37	18.7	18.7	26.3
41-50	75	37.9	37.9	64.1
51-60	57	28.8	28.8	92.9
over 60	14	7.1	7.1	100.0
Total	198	100.0	100.0	

The results shows that majority of the respondents (56.6%) were of the age bracket of 31-50 years. This was a good percentage of the productive age bracket, who still had their children in school. This vibrant age bracket was ideal for the program of forest plantation establishment for they could easily take up the education on sustainable use of the forest resource to improve their livelihoods, not forgetting those of their children. The young people were few at 7.6% of the respondents. Those who were of age over 60 years and could be considered as aged and less productive, were also very few at 7.1%.

4.2.8 Household heads' main source of income

The main source of income in the household usually contributes to the largest part of the households' budget and therefore may be the largest contributor to the social welfare of the people. The researcher therefore sought to know the main source of income of the household heads. The results were as indicated in table 6 below.

Table 6: Main source of income of the household head

Main source of income	Frequency	Percent	Cumulative Percent
formal employment	23	11.6	11.6
business	27	13.6	25.3
farmer	123	62.1	87.4
informal employment	25	12.6	100.0
Total	198	100.0	

Majority of the household heads (62.1%), derived their livelihoods from farming. This was a significant portion owing to the fact that the main activity they could be involved in, during the process of forest plantation establishment was farming. This group of people would help in planting tethering and taking good care of the trees as they cultivate the forest land. Those whose main of source income was business came second with 13.6%, while from informal and formal employment trailed with 12.6% and 11.6% respectively.

4.2.9 House Characteristics

Understanding the physical characteristics of households provides insight into the socio-economic status of the community and their potential capacity to engage in forest plantation establishment schemes. The house characteristics were observed during the field visits and recorded without directly asking the respondents.

4.2.9.1 House Ownership

House ownership patterns reflect the stability and investment capacity of the community. The ownership distribution is shown in table 7 below.

Table 7: House ownership

Ownership Status	Frequency	Percent	Valid Percent	Cumulative Percent
Own	156	78.8	78.8	78.8
Rented	42	21.2	21.2	100.0
Total	198	100.0	100.0	

The results indicate that majority of the respondents (78.8%) owned their houses while 21.2% were living in rented accommodation. This high level of home ownership demonstrates community stability and suggests strong potential for long-term engagement in forest conservation activities. Households that own their properties are more likely to invest in sustainable practices and participate consistently in forest plantation schemes, as they have a vested interest in the long-term environmental benefits of their locality. The relatively small proportion of renters may be attributed to those working in formal employment or business who may have migrated to the area temporarily.

4.2.9.2 Wall Construction Materials

Wall materials indicate the economic status and building practices within the community. The distribution of wall construction materials is presented in table 8 below.

Table 8: Wall construction materials

Wall Material	Frequency	Percent	Valid Percent	Cumulative Percent
Mud	89	45.0	45.0	45.0
Timber	67	33.8	33.8	78.8
Bricks/stones	35	17.7	17.7	96.5
Iron sheets	7	3.5	3.5	100.0
Total	198	100.0	100.0	

The findings show that mud walls were the most common (45.0%), followed by timber walls (33.8%). Together, these traditional building materials accounted for 78.8% of all houses, reflecting the rural nature of the community and availability of local materials. Brick/stone construction represented 17.7% of houses, indicating a portion of households with higher economic status. Iron sheet walls were least common at 3.5%. This distribution aligns with the farming-based economy where 62.1% of household heads derive their livelihoods from agriculture, suggesting that most households utilize locally available and affordable building materials.

4.2.9.3 Roofing Materials

Roofing materials provide additional insight into household economic status and modernization levels. The distribution is shown in table 9 below.

Table 9: Roofing materials

Roofing Material	Frequency	Percent	Valid Percent	Cumulative Percent
Grass-thatched	23	11.6	11.6	11.6
Iron sheets	167	84.3	84.3	95.9
Tiles	8	4.1	4.1	100.0
Total	198	100.0	100.0	

Iron sheet roofing dominated at 84.3%, indicating significant modernization from traditional grass-thatched roofs which represented only 11.6% of households. Tile roofing, representing the highest economic tier, was found in 4.1% of houses. The prevalence of iron sheet roofing suggests that most households have invested in durable roofing materials, which also facilitate rainwater harvesting - an important consideration for communities adjacent to forest areas where water conservation is crucial.

4.2.9.4 Floor Construction

Floor materials further indicate living standards and household economic status. The results are presented in table 10 below.

Table 10: Floor construction materials

Floor Material	Frequency	Percent	Valid Percent	Cumulative Percent
Earth	112	56.6	56.6	56.6
Cement	79	39.9	39.9	96.5
Wood	7	3.5	3.5	100.0
Total	198	100.0	100.0	

Earth floors were most common at 56.6%, followed by cement floors at 39.9%, while wooden floors were least common at 3.5%. The significant proportion of cement floors (39.9%) indicates improved living standards compared to many rural areas, suggesting that the community has some level of economic stability. This finding, combined with the high rate of home ownership (78.8%), indicates that the community has invested in housing improvements over time.

4.2.10 Household Source of Light

Understanding energy sources reveals modernization levels and potential environmental impacts on the forest adjacent community. The lighting sources are analyzed in table 11 below.

Table 11: Household source of light

Light Source	Frequency	Percent	Valid Percent	Cumulative Percent
Electricity	45	22.7	22.7	22.7
Solar	78	39.4	39.4	62.1
Paraffin lanterns	71	35.9	35.9	98.0
Others	4	2.0	2.0	100.0
Total	198	100.0	100.0	

Solar energy was the most common lighting source at 39.4%, followed closely by paraffin lanterns at 35.9%, while electricity access was limited to 22.7% of households. The high adoption of solar energy (39.4%) demonstrates environmental consciousness and suggests that the community is receptive to sustainable energy practices, which may correlate with positive attitudes toward forest conservation. The reliance on paraffin lanterns by over one-third of households indicates limited grid electricity infrastructure in the area, highlighting the rural nature of the community. This energy profile suggests that forest conservation education programs should consider alternative communication methods that do not rely heavily on electricity-dependent media.

4.2.11 Household Source of Water

Water security is crucial for understanding community needs and the importance of forest conservation for watershed protection. The water sources are analyzed in table 12 below.

Table 12: Household source of water

Water Source	Frequency	Percent	Valid Percent	Cumulative Percent
River/stream	89	45.0	45.0	45.0
Own well	54	27.3	27.3	72.3
Shared well	31	15.7	15.7	88.0
Rain harvest	19	9.6	9.6	97.6

4.3 Influence of forest land cultivation under forest plantation establishment on community livelihoods

The first objective of the study was to establish the influence of forest land cultivation under forest plantation establishment, on community livelihoods. Data was collected and analyzed as indicated in the subsections that follows.

4.3.1 Size of forest land available

The size of land available to the household for cultivation was one of the independent variables used. The researcher sought to find out whether there was any significance influence of the size of forest land available for cultivation on the food security of the forest adjacent community. The average size of land that the households cultivated in the forest was found to be 1.9 acres. The household with the largest parcel having 4 parcels and the minimum being 1 parcel, each of half an acre.

Table 13: Size of the forest land available for utilization by the forest adjacent community

ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	20.883	1	20.883	221.642	.000 ^b
	Residual	21.482	197	.094		
	Total	42.365	198			

a. Dependent Variable: Are the produce harvested enough to feed your family throughout the year?

b. Predictors: (Constant), How many plots do you own?

The size of land available for cultivation was found to be statistically significant to food security among the community ($f= 221.642, p= 0.000$). From the coefficients' table, the chances of a household being food secure or able to get harvests enough for the whole year would increase by 70.2% if the land available for food crop production was increased by 1 acre. It was therefore noted a need to clear the already mature trees in order to increase land for cultivation and establish the plantation afresh.

From the focused group discussions, the average size of forest land allocation done to each household is two parcels, which were equivalent to one acre. The maximum amount of land that could be allocated to each farmer was not set but was dependent on the amount of forest land available in relation to the number of farmers. As of the time of this study the amount of forest land available for cultivation at Makutano forest station stood at 1200 acres. Of these, almost half of it had young trees which could not allow cultivation in the next two years.

Table 14: Size of the forest land available for utilization by the forest adjacent community

ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	20.883	1	20.883	221.642	.000 ^b
	Residual	21.482	197	.094		
	Total	42.365	198			

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4.3.2 Amount of harvests

The amount of harvest realized from the forest land was another indicator of a cushioned community livelihood. The harvests could be used to feed the people or sold to generate income and help in educating their children or in diversifying the community livelihoods. First, the researcher sought to know the crops grown, mainly in the forest land, and whether the harvests realized were enough to feed their families throughout the year. From the 198 respondents, 100% admitted to grow maize, 55% grew potatoes, 48% grow beans, 30% grow peas and 13% grow pumpkins. Most of these crops were grown together in the same parcel of land. The results on whether the harvests were enough to feed their households were as shown in the table 15 below.

Table 15: Are the produce harvested enough to feed your family throughout the year?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no	48	24.2	24.2	24.2
	yes	150	75.8	75.8	100.0
	Total	198	100.0	100.0	

The largest population of the respondents (75.8%) admitted that the harvests were enough to feed their families throughout the year, while only 24.2% were not able to get enough harvests to take them through the year. This shows how important the harvests realized from forest land cultivation are to the forest adjacent community. The 75.8 percent was a good representative to indicate that there was food security among the forest adjacent community which largely could be attributed to forest land cultivation.

It was also important to understand where the households, who did not get enough harvests from the forest land get food to feed their people for the rest of the year. Table 16 below shows this.

Table 16: Source of food for those who do not get enough harvest from the forest land

	Frequency	Percent	Valid Percent	Cumulative Percent
Harvest from my own farm	13	27.1	27.1	27.1
Donations	14	29.2	29.2	56.3
Buying	20	41.7	41.7	98.0
Other sources	1	2	2	100.0
Total	48	100.0	100.0	

Most of these households were well cushioned from extreme lack of food since they could be able to buy the food from other sources of income (41.7%) while 27.1% could get other harvests from their own farms to supplement the harvests from the forest. Only 31.2% of the 48 households were venerable; that is, those who relied on donations at 29.2% and those who relied on other unspecified sources at only 2%.

4.3.3 Economic value of harvested products from forest land cultivation

The research sought to understand the economic value of the harvests realized per year by the farmers. This would help to measure and tell how much the forest adjacent community accrued from the harvests. The economic value of the harvests was measured against household size, education level of the household head, distance of the household from the forest, and the size of the land allocated per household. The results were as illustrated in table 17 below.

Table 17: Economic significance of the total harvest in relation to; household size, level of education, land size, and distance of the household from the forest.

ANOVA		Sum	of df	Mean	F	Sig.
		Squares		Square		
total membership of household	Between Groups	127.314	44	2.894	1.264	.145
	Within Groups	423.473	185	2.289		
	Total	550.787	229			
level of education of the respondent	Between Groups	24.574	44	.559	.881	.683
	Within Groups	117.269	185	.634		
	Total	141.843	229			
How many plots do you own?	Between Groups	94.685	44	2.152	99.152	.000
	Within Groups	4.015	185	.022		
	Total	98.700	229			
How far is the homestead from the forest	Between Groups	62.767	44	1.427	3.127	.000
	Within Groups	84.390	185	.456		
	Total	147.158	229			

The results indicates that the income realized from the sales of the produced was highly dependent on the number of plots/size of the land allocated per household ($f=99.152$, $p=0.000$), and the distance from the forest ($f=3.127$, $p=0.000$). This indicates that the chances that the household would gain more economically from the forest harvest would increase by 99.152 percent if land allocation was increased by one acre, and by 3.127 percent if the distance from the forest land was reduced by one kilometer. Those with bigger parcels were noted to benefit more as compared to those with smaller parcels. Also, those at the radius of about 2-3 kilometers from, the forests realized higher economic benefits from the sale of the harvests as compared to those at a radius of one and the extreme four to five kilometers from the forest. However, the total household membership and the educational level of the household head did not have any significance to the much realized from the sales with ($f=1.264$, $p>0.05$) and ($f=0.881$, $p=0.683$) respectively.

4.4 Influence of forest products available under forest plantation establishment schemes on community livelihoods

This was the second objective of the study. Under this, the variables examined included, the products available to the community under the program, the number of people benefiting from the products and the economic value of the products. The researcher sought to understand the significance of these variables to the community livelihoods in terms of food security and income generation for improved livelihoods. The results are presented in the subsequent subsections.

4.4.1 The number of forest products available to the community and the number of people benefiting from the scheme

The respondents were requested to state the products that they were able to access from the forest as a result of forest plantation establishment schemes initiated at Makutano forest. These products were from the predetermined list and they had the liberty to add to the list any other products that was from the list and they could access from the forest. The summary of the responses given is as shown in table 18 below.

Table 18: Are you able to access the following from the forest plantation?

		Fodder droppers	firewood	wild vegetables	herbs	Honey	other products
N	Valid	198	198	198	198	198	198
	Missing	0	0	0	0	0	0
Mean		.71	.68	.95	.17	.06	.01

The results indicates that 95% of the respondents were able to access firewood from the forest. From the focused group discussion, the community was allowed to collect firewood from the forest provided they had a permit from the forest office. They were also able to get firewood from pruning of the trees tantamount to the same condition of having a permit and a pruning saw from the forest office. This statistics shows a high reliance on firewood as a source of energy among the adjacent forest community. Falling at number two, in terms of accessibility was fodder at 71%. Many of the people around the forest fetch fodder for their animals from the forest or graze them there. This is an indication that the community highly depend on the forest for the feeding of their animals'. Droppers were at 68%, wild vegetables at 17%, herbs at 6%, honey at 1% and other products at 0% accessibility. The 0% accessibility of other products indicates that only the six predetermined products were accessible to the community. Very few

community members were involved in bee keeping for honey production at only 1%. This was one product that had the potential of improving the community livelihoods but was not yet well utilized.

4.4.2 Influence of the available forest products on the community livelihoods

The products identified as having been made available under the forest plantation schemes, could be sold to generate income, and help the community in their day today expenses like educating their children, feeding their families or even used in starting of other income generating activities. The researcher sought to find out whether the access to these products significantly influenced the peoples' livelihoods. Table 19 below is a summary of the products available and their benefits that the community accrued from them.

Table 19: Benefits accrued from product derived from the forest plantation scheme

Benefits	fodder	Droppers	Firewood	Wild vegetables	Herbs	Honey	Others
Subsistence	65.7	76.5	90.9	20.9	5.2	0.4	0
Cash income	0.4	7	1.7	0	0	0.1	0
Both	0.9	6.1	4.8	0	0	0.9	0

Not applicable 33 10.4 2.6 20.9 94.8 98.6 0

From the statistics above, firewood stood out as the product that the community mostly

exploited at 90.9% for subsistence use, 1.7%, for cash income and 4.8% for both subsistence and cash income. The community heavily relied on firewood as a source of heat. At second, and third places were droppers (76.5%) and fodder (65.7%) respectively, both at subsistence level. Very few of the community member exploited these products for commercial purposes. Honey was the least exploited product at all levels.

Additionally the research sought to understand whether there was any correlation between the benefits accrued from the products and the contribution of the products to the household welfare. This is illustrated on table 20 below.

Table 20: Correlation between products' benefits and their contribution to the household welfare.

Correlations		Pbenefit	Pwelfare
Pbenefit	Pearson Correlation	1	.033**
	Sig. (2-tailed)		.000
	N	198	198
Pwelfare	Pearson Correlation	.033**	1
	Sig. (2-tailed)	.000	
	N	198	198

** . Correlation is significant at the 0.01 level (2-tailed).

The table shows a strong relationship between the benefits accrued from the products and the contribution of the products to the household welfare with a correlation coefficient of $r=0.033$ and $p =0.000$. There was immense contribution of the forest products available under the forest plantation establishment schemes to the community livelihoods. The households were able to meet their needs like food and educating their children from the benefits accrued from the collection, use and sale of the products.

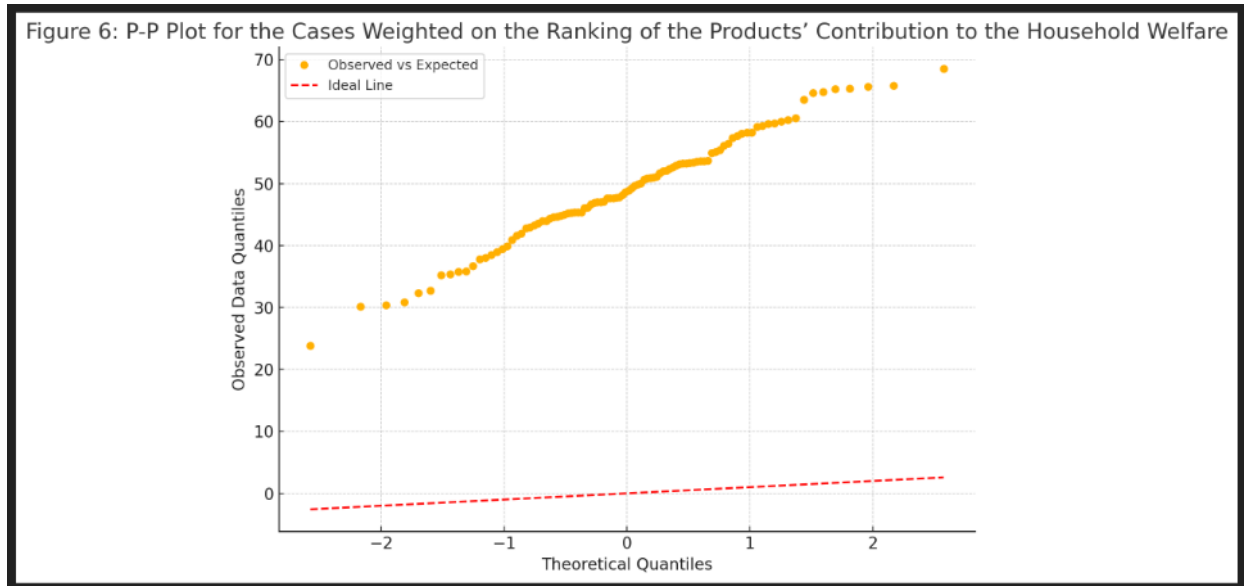


Figure 6: P-p plot for the cases weighted on the ranking of the products' contribution to the household welfare.

The P-p plot above illustrates a normal distribution of the weighted contribution of forest products and the household welfare. It shows a strong correlation between the forest products and the peoples welfare ($R^2=0.994$).

4.5 Influence of Community Involvement in Forest Plantation Establishment Activities on Community Livelihoods

The third objective of this study was to assess the influence of community involvement in forest plantation establishment activities on community livelihoods. Key variables examined included participation in activities such as tree planting, pruning, and thinning, as well as attendance at forest-related meetings where planning and decision-making take place. All respondents in this study were members of the Makutano Forest Station Community Forest Association (CFA), identified through the snowball sampling method. The analysis sought to determine whether and how engagement in these forest-related activities impacted the economic and social wellbeing of the forest-adjacent communities.

4.5.1 Influence of Meeting Attendance on Decision-Making and Planning

A binary logistic regression analysis was used to examine the relationship between meeting attendance and participation in decision-making regarding forest activities, with gender included as a control variable.

Table 21: Influence of Frequency of Meeting Attendance on Involvement in Decision-Making and Planning

Variable	B	S.E.	Wald	df	Sig.	Exp(B)
Howfreq	3.479	.442	61.881	1	.000	32.411
Gender	-.011	.372	.001	1	.976	.989
Constant	-6.336	.968	42.855	1	.000	.002

The results show a statistically significant relationship between the frequency of attending CFA and CBO meetings and the level of involvement in decision-making and planning ($B = 3.479$, $p < 0.05$). This suggests that individuals who attended meetings more frequently were significantly more likely to participate in important forest governance processes. Active participation translated into better access to information, involvement in setting forest priorities, and informed contribution to planning decisions.

This involvement directly contributes to improved livelihoods, as better-informed community members are more likely to understand the rules governing forest product access and to participate in income-generating opportunities sanctioned by the CFA and Kenya Forest Service (KFS). Therefore, regular meeting attendance does not only

facilitate governance inclusion but also strengthens individual and collective economic prospects.

The variable gender was not statistically significant ($p = 0.976$), indicating no major gender-based disparities in involvement in planning and decision-making, which is a positive sign of inclusivity in forest-related activities.

4.5.2 Influence of Community Participation in Plantation Activities on Livelihoods

Community members reported being involved primarily in tree planting, pruning, and thinning, all of which were approved and regulated by KFS. All sampled respondents (100%) participated in at least one forest activity. These engagements formed the foundation of their interaction with forest conservation and also served as a key source of livelihood.

To understand the perceived impact of these activities on household welfare, respondents rated each activity on a scale of 0 to 5 based on its importance to their livelihoods.

Table 22: Rating of Forest Activities by Importance to Community Livelihoods

Activity	0	1	2	3	4	5
Others	100	0	0	0	0	0
Tree pruning	0	0.9	1.7	20.0	46.1	31.3
Tree planting	0	24.8	40.9	19.6	11.3	3.5
Bee-keeping	99.1	0	0	0	0.9	0
Thinning	97.8	0.9	0.9	0.9	0.4	0
Tree nursery	96.1	0.9	0.9	0.9	1.3	0

The results show that tree pruning (77.4%) and planting (14.8%) were the most valued activities due to their tangible benefits. Pruning, in particular, provides community members with access to firewood and materials for construction, while planting activities are often linked to incentives or access to land for cultivation under the PELIS system.

However, low participation in potentially lucrative activities like bee-keeping (0.9%), thinning (3.2%), and tree nursery establishment (3.9%) reflects underutilization of these opportunities, which could otherwise enhance household incomes and livelihood diversification. This gap highlights a need for capacity-building and awareness programs to encourage broader participation in these less popular but high-potential activities.

From focused group discussions, it was also noted that attendance in workshops and seminars was low (45%–50%) compared to plot allocation or payment meetings (80%–90%). This suggests that while the community is motivated by direct financial benefit, there is less interest in activities perceived as purely educational or long-term. The mode of communication (posters and public announcements) may not be sufficient, and more engaging and interactive communication channels might increase participation in knowledge-sharing sessions.

Community involvement in forest plantation establishment activities significantly influences livelihoods by providing both direct benefits (such as firewood, income from pruning, and planting) and indirect benefits (such as decision-making power, training, and increased access to forest resources). However, the low uptake of certain forest-related enterprises indicates untapped potential that, if addressed through training and

sensitization by KFS and CFAs, could substantially uplift community livelihoods while ensuring sustainable forest management.

4.6 Discussions

The study's demographic findings indicated balanced gender representation, suggesting inclusivity in participation and enhancing the reliability of data from both male and female perspectives. Most households were found to be parent-headed, which reflects a degree of household stability and decision-making autonomy, critical factors for active participation in livelihood and conservation programs. The predominance of Christianity (81.3%) also suggests potential for effective communication and dissemination of forestry-related information through shared religious networks. Similarly, the shared ethnicity among many respondents could ease communal engagement and mobilization in forest management activities. Furthermore, 62.1% of the respondents identified farming as their main source of livelihood. This presents an opportunity for Kenya Forest Service (KFS) to integrate forest conservation with agricultural practices, particularly under the Plantation Establishment and Livelihood Improvement Scheme (PELIS).

The study established that forest land cultivation significantly contributes to the community's livelihoods. Variables such as land size under cultivation, volume of harvest, and economic value of forest produce demonstrated a statistically significant positive relationship with household food security ($F = 221.642$, $p = 0.000$). This suggests that access to forest land for cultivation plays a vital role in enhancing food availability and income among forest-adjacent communities. These results align with Nicodemus (2013), who found that in Gathiuru Forest, cultivation was the most practiced activity (92.8%) and had substantially improved food security (mean score =

4.32). Therefore, the forest plantation scheme appears not only to support environmental goals but also to directly enhance community welfare by addressing food insecurity and poverty.

Findings further revealed a positive influence of forest products on community livelihoods. Forest products such as firewood, droppers, and fodder were the most utilized, with firewood being dominant for both subsistence (90.9%) and income (4.8%) use. The correlation between benefits from these products and household welfare was statistically significant ($r = 0.033$, $p = 0.000$), indicating that forest-derived resources are integral to the socio-economic wellbeing of the community. This supports Rahman et al. (2021), who highlighted the significant impact of non-timber forest products (NTFPs) on rural family incomes. In addition, products like poles and droppers served dual purposes—income generation and in-kind use for construction and fencing—demonstrating their multifaceted value. Elizabeth et al. (2018) similarly found firewood and grazing land to be the most vital forest resources at the Aberdare ecosystem, underscoring the generalizability of these findings to other forest-dependent communities in Kenya.

The third objective investigated the relationship between community participation in forest activities and livelihoods. Results indicated a strong association between frequency of meeting attendance, involvement in decision-making, and the benefits accrued ($B = 3.479$, $p < 0.05$). This affirms that active community engagement enhances access to information, ownership of forest activities, and subsequent livelihood improvements. Kwayu et al. (2014) supports this view, noting that information access significantly enhances participation in decision-making. The most valued activities were pruning (77.4%) and planting (14.8%), which provided both cash

and in-kind benefits. Conversely, minimal participation in potentially high-benefit activities like beekeeping (0.9%), thinning (3.2%), and nursery establishment (3.9%) signals a need for targeted awareness and capacity-building programs. Promoting these less-exploited but promising ventures could diversify income sources and reduce pressure on more commonly used resources like firewood.



CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMEDATIONS

5.1 Introduction

In this chapter, the researcher made a summary of the research findings, the conclusions made from the findings and some recommendations to the authorities for implementation, and also has recommended some other areas that need further research.

5.2 Summary of the findings

The result findings of the study were hereby summarized according to the research objectives as presented in the subsections below.

5.2.1 Influence of forest land cultivation under forest plantation establishment scheme on community livelihoods

Results show that 75.8 percent of the community highly depend on forest land cultivation to be food secure throughout the year. This is a significant portion of the population and indicates how important forest land cultivation, under the program 'plantation establishment and livelihoods improvement scheme,' is influencing the community livelihoods. The harvests from the forest land significantly influenced the community livelihoods by improving their income generation ($f=221.642, p=0.000$).

The size of the forest land allocated to each household was one of the variables that affected the income generated by the households ($f=99.152, p=0.000$). This indicates that the chances that the household would gain more economically from the forest harvest would increase by 99.152 percent if land allocation was increased by one acre.

Distance from the forest was also another factor showing how households derived their livelihoods from the forest land ($f=3.127, p=0.000$). This indicates that the chances that

the household would gain more economically from the forest harvest, would increase by 3.127 percent if the distance from the forest land was reduced by one kilometer.

5.2.2 Influence of the available forest products on the community livelihoods

From the findings of this research, livelihoods of the forest adjacent community were highly dependent on the extractive products from the forest. These products included, firewood at 90.9 percent, droppers from the pruned trees at 76.5 percent, fodder/grass cutting and grazing at 65.7 percent, wild vegetables at 20.9 percent and herbs at 5.2 percent. The findings also indicated a good correlation between forest products' benefits and the community welfare ($r= 0.033, p=0.000$).

5.2.3 Influence of community involvement in forest plantation establishment activities on community livelihoods.

The findings on community involvement in forest activities indicated that there was a significant influence on community livelihoods for those who involved themselves in these activities. All the respondents (100%), were involved in one or many forest activities which built up their livelihoods. From the statistics 77.4% in tree pruning and 14.8% in tree planting attached involvement to these activities with very high benefits. There were very few people who attached involvement in bee keeping (0.9%), thinning (3.2%), and tree nursery establishment (3.9%) to have gained any benefits to them. On involvement in any paid labour, only 3 percent of the respondents or a member of their household admitted to have been involved.

The results also indicated a significant influence of the frequency of attending CFA and CBO meetings on the level of involvement in decision making and planning of forest activities ($B = 3.479, p < 0.05$). Esther *et al.*, (2021), pegs participation of communities in forest activities on the benefits derived from the activities. This was the case with the

findings of this study where those who involved themselves with forest activities were able to derive more benefits from those activities. However the level of participation in terms of gender in this study deferred from that of Esther *et al.*, (2021), where the gender parity was larger with women being less involved in forest activities.

5.3 Conclusions

This study examined the influence of forest plantation establishment schemes on community livelihoods at Makutano forest Kericho County. From the findings of this study, it is evident that community livelihoods are highly influenced by the forest plantation establishment scheme. The community has been involved in various activities like food crop cultivation in the forest land before tree canopy, tree planting, grazing and fodder collection from the forest, tree pruning, and tree nursery establishment. This participation in forest activities helped the community in improving their livelihoods. Some of these activities like tree nursery establishment and tree planting offered paid labor for them. Most of the households were noted to be food secure courtesy of the food produced from forest land cultivation. They are also able to extract some of the forest products like firewood, which was the main source of energy for majority of the households. Other products extracted were wild vegetables, herbs and honey. The sale of the farm produce and the other forest products have helped them diversify their income sources like buying of more daily animals for milk production, buying motorbikes for transport purposes, buying land for agriculture and settlement, among others. The harvests were also found to be a key driver to their children education since they were used in the school feeding programs and the surplus sold to cater for school fees. It was also noted that the community involvement in different forest activities across both gender and age groups was fare. In terms of gender there was a 51.5% representation of women and 48.5% men. This was a good representation

in terms of both gender being involved in forest activities since the disparity was not by a big margin.

5.4 Recommendations

The study recommends the following, based on the findings;

1. It was noted that the community were not aware of the main reason for the initiation of PELIS program. That the community through the forest officers in charge of the forest stations, hold seminars and meetings more frequently that would help educate the FAC on the importance of conserving the forests and not focusing more on the farming aspect in the forest. The frequent meetings were also noted to increase the interest of the community in involving themselves in forest activities like tree planting.
2. The size of the forest land available for cultivation was also noted to highly influence the community livelihoods. However, the land available for cultivation in relation to the number of people who required the land was limited. There was need for the authorities to consider cutting down the already mature tree in order to pave way for establishment of new plantations and at the same time create room to accommodate more farmers with at least a sizeable piece of land for cultivation.
3. On the issue of the available forest products accessible to the community, it was noted that the products were still limited and under-utilized. This study recommend that sensitization be done among the community members through seminars and workshops on how they could sustainably access those products and how well they could improve their livelihoods through the utilization of such products like honey and herbs.

4. The Kenya forest service together with the community forest associations, to develop a research and monitoring plan within each forest station and ensure it is implemented so as to deal with the challenges brought by the ever changing dimensions of the FACs. This would help in devising ways in which the community would be made aware of even the non-extractive forest benefits that they could be used in improving their livelihoods and reduce the over-reliance on cultivation and extractive forest products. The monitoring plan be geared in devolving more responsibilities of monitoring forest activities and management.
5. The study also recommends the improvement of forest access road which most of them was in deplorable conditions and some even impassable during the rainy season. This posed a great challenge to farmers especially during the harvesting season where they had to use donkeys for transport. This was tedious and costly thereby eating reducing their profits margins.

5.5 Recommendations for further research

The study recommend a further study on the following areas;

1. Factors that trigger farmer's preference to maize crop farming, on forest land, which was found to be the most preferred crop, rather than other crops.
2. How the community livelihoods can be sustained even after 100 percent tree canopy has been achieved.
3. An in-depth analysis of the linkage between forestry and food security in a country.
4. An investigation on modern, affordable and viable sources of energy that could be introduced for use by the forest adjacent communities.

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APPENDICES

Appendix A: Letter of Introduction and Informed Consent

Dear potential research participant

My name is Nduati Paul Mwaura, a student at Mount Kenya University pursuing a Masters of Arts degree in Geography. I am carrying out research on the influence of forest plantation establishment schemes on community livelihood. To help conduct this study, I look forward to collecting data from you either through questionnaire or focused group discussion of which will purely be for academic purposes.

As I endeavor to collect data from potential respondents like you, I am soliciting for your voluntary participation of which will highly be appreciated. In so doing, neither will you get any compensation nor will you face any adverse consequences for not participating. Collecting data from you is estimated to take less than 30 minutes of your time.

Please be advised that your confidentiality will be preserved at all times. Your name and other personal identifiable information will not be collected on the research instruments. This letter and the instruments will be collected and kept separately to avoid any matching. I and my research assistant helping me in data collection and analysis will be the only people to handle your data. I take full responsibility for this project and therefore, please feel free to honestly answer all questions without fear. The data collected will be stored for not more than three years after which it will be destroyed.

For any questions or clarification, please feel free to contact me on paulmwaura300@gmail.com or 0711232952

.....

.....

Signed: Nduati Paul Mwaura

Date

I..... consent to participate in this research study as described above.

Signature: Date:



Appendix B: Household Questionnaire

Part I: Household basic information

1. Household number.....
2. Location of the household.....
3. Household village
4. Approximate distance of the household from the forest
5. Who is the head of the household?
- #1=Father, 2= Mother, 3= Child, 4= others (specify)*
6. What is the religion of the household head?
- #1=Christian, 2= Muslim, 3=Traditionalist, 4=others (specify)*
7. Does the household head belong to the largest ethnic group in the area?
.....
- #1= Yes, 2=No*
8. What is the main source of income for the household head?
#1=formal employment; 2=business; 3=farmer; 4=informal employment; 5= others (specify)
9. What is the total membership of the household?
10. How many members of the household have migrated?
11. What is the gender of the respondent?
- #1=Male; 2= Female*
12. What is the relation of the respondent to the household head?
- #0= Self; 1=wife; 3=child; 4=others (specify)*
13. What is the age bracket of the respondent?

1 = 21-30 []

2 = 31-40 []

3 = 41-50 []

4 = 51-60 []

5 = Over 60 years []

14. What is your level of education?

#1= Never been to school; 2=Primary level; 3=Secondary level;
4=Tertiary level

15. House characteristics (to be observed and not asked)

a) Ownership..... #1=own; 2=rented

b) Walls..... #1=mud; 2=timber; 3=bricks/stones; 4=iron sheets;
5=others (specify)

c) Roof..... #1=grass-thatched; 2=iron sheets; 3=tiles; 4=others

d) Floor..... #1=earth; 2=wood; 3=cement; 4=others (specify)

16. What is the household source(s) of light?

#1=electricity; 2=solar; 3=paraffin lanterns; 4=others (specify)

17. What is the household source(s) of water?

#1=own well; 2=shared well; 3=dam; 4=river/stream; 5=rain harvest; 6=
others (specify)

**Part II: Influence of forest land cultivation under forest under forest
plantation establishment scheme on community livelihoods.**

18. Do you own a plot(s) in the forest land?

#Yes=1; No=0

19. If yes, how many?

20. How much do you pay to the KFS for each plot?

21. In the table below, in column two indicate the number of sacks harvested
per year for each crop grown. In column three indicate the number of sacks

consumed in your homestead per year. For column four, what is your average income generated from sales of the crop per year?

Crops grown	Amount harvested per year (Sacks)	Influence to household welfare	
		Domestic use (Sacks)	Average sales per year.
Maize			
Beans			
Peas			
Potatoes			
Pumpkins			
Vegetables			
Others			

22. Are the produce harvested enough to feed your family throughout the year?

.....

#Yes=1; No=0

23. If no, where do you get food for the rest part of the year?

#1= Buying; 2=Donation 3=others (specify)

24. In case of drought and there are no harvests, how do you or would you get food?

1=Buying using my wages/salary; 2=Sell my animals; 3=Borrow from relatives

4=Ask for donations; 5=Sell my assets; 6=Grow the food by irrigation;

7=others (Specify)

Part III: Influence of forest products available under forest plantation establishment schemes on community livelihoods.

25. In the table below, indicate the forest products you have been able to access in the last 12 months with 1 or 0, benefits accrued from the products as 0=not applicable, and 1= accessed. Also indicate how you benefited from the product as follows: 1=subsistence income, 2=cash income or 3=both cash and subsistence income.

Forest product	Able to access (1=yes, 0=not)	Benefits (1=subsistence income, 2=Cash income, 3=Cash and subsistence income)
Fodder/Grazing		
Droppers/rafter		
Firewood		
Wild vegetables		
Herbs		
Honey		
Others		

26. Have you ever sold tree seedlings to the KFS during the tree planting in the forest?

#Yes=1; No=0

Part IV: Influence of community involvement in forest plantation establishment schemes activities on community livelihoods.

27. Are you a member of the Makutano forest CFA?

#Yes=1; No=0 (If yes, proceed to 29)

28. If **no**, why not?

1= Not aware of the association; 2=Not interested; 3=I am new in the area; 4=There are no benefits in joining; 5=other reasons

29. Has any members of your household ever been involved in paid labour offered by KFS?

#Yes=1; No=0

30. If yes, how many?

31. Are you involved in any forest activities?

#Yes=1; No=0

32. If yes, to a scale of 0-5, rate the following activities and any other you may have been involved in according to importance in terms of benefits accrued from them with 0=*not important* and 5=*very important*.

Activity	Rate
Tree pruning	
Tree planting	
Beekeeping	
Thinning	
Tree nursery	
Others (specify)	

33. Do you or any member of the household attend forest meetings?

#Yes=1; No=0

34. If yes, how frequent?

1= really

2 = Frequently

35. Do feel having been fully involved in decision making and planning of forest activities in the CFA or even in your CBO?

0 = No; 1= Yes

Appendix C: Focused group discussion questions

1. Influence of forest land cultivation under forest plantation establishment scheme on community livelihoods.

- a) What is the size of each parcel of forest land allocated to farmers?
- b) Is there a maximum number of parcels that you can allocate a farmer?
- c) How much land has been allocated to the CBOs for cultivation?
- d) What criteria do you follow in allocating forest land to the CFA members after trees have been cleared?
- e) Are there non-members who are allocated forest land for farming?

2. Influence of forest products available under forest plantation establishment schemes on community livelihoods.

- a) Apart from land for cultivation, what other forest products are available for the forest adjacent community?
- b) Is there certification for accessing these products?
- c) What is the procedure in accessing these products?
- d) Are there payments required for one to access these products?
- e) After collecting these monies from different forest user group members, is there a percentage left with the CBOs for their running or all the amount is forwarded to the CFA and to the KFS?
- f) Are there any dividends that the members of your respective CBOs get?


3. Influence of community involvement in forest plantation establishment schemes activities on community livelihoods.

- a) How frequent do you hold your meetings?
- b) How do you pass information to your members?
- c) What is the average attendance of the meetings that you hold?

- d) What activities do you involve your members in the course of establishing the forest plantation?
- e) Do you involve non-members in other forest management activities?
- f) Do your office organize any workshops or seminars to enlighten the community on how they can sustainably utilize the forests and forest resources?



Appendix D: University ERC approval certificate


Mount Kenya University

DIRECTORATE OF GRADUATE STUDIES

MAGE/2017/78551
24th February, 2023

National Commission for Science, Technology & Innovation (NACOSTI)
Off Waiyaki, Upper Kabete
P.O Box 30623- 00100
NAIROBI, KENYA

Dear Sir/Madam,

RE: NDUATI PAUL MWAURA - REGISTRATION NO. MAGE/2017/78551

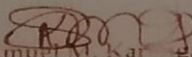
The purpose of this letter is to introduce the above named student who is pursuing Master of Arts in Geography in the department of Psychology, Languages and Humanities in the School of Social Sciences.

The title of the research is *"Influence of Forest Plantation Establishment Schemes on Community Livelihoods: A Case of Makutano Forest Kericho County, Kenya."*

It has been cleared by the University's Ethics Review Committee (Certificate attached) and now has to proceed to the field to collect data between February 2023 and April, 2023.


Any assistance accorded to the student will be highly appreciated.

Thank you


Dr. Samuel M. Karaga, Ph.D
Director, Graduate Studies
Enc.

Main Campus: General Kapiti Road, P.O. Box 342-01000 Thika. Tel: +254 67 2820 000.
Cell: +254 720 790 98 0709 153 700
Email: info@mku.ac.ke Web: www.mku.ac.ke
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Appendix E: Introduction letter from MKU


Mount Kenya University

REF: MKU/ISERC/2628 Date: 14 February 2023

TO: NDUATI PAUL MWAURA

REG: MAGE/2017/78551

Dear Sir/Madam,

RE: INFLUENCE OF FOREST PLANTATION ESTABLISHMENT SCHEMES ON COMMUNITY LIVELIHOODS: A CASE OF MAKUTANO FOREST KERICHO COUNTY KENYA

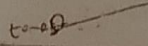
This is to inform you that **Mount Kenya University** has reviewed and approved your above research proposal. Your application approval number is **1700**. The approval period is **14/02/2023 - 13/02/2024**.

This approval is subject to compliance with the following requirements;

- i. Only approved documents including informed consents, study instruments, MTA will be used
- ii. All changes including amendments, deviations and violations are submitted for review and approval by **Mount Kenya University**
- iii. Death and life-threatening problems and serious adverse events or unexpected adverse events whether related or unrelated to the study must be reported to **Mount Kenya University** within 72 hours of notification
- iv. Any changes, anticipated or otherwise that may increase the risks or affect the safety or welfare of study participants and others or affect the integrity of the research must be reported to **Mount Kenya University** within 72 hours
- v. Clearance for export of biological specimens must be obtained from relevant institutions
- vi. Submission of a request for renewal of approval at least 60 days prior to expiry of the approval period. Attach a comprehensive progress report to support the renewal
- vii. Submission of an executive summary report within 90 days upon completion of the study to **Mount Kenya University**

Prior to commencing your study, you will be expected to obtain a research license from National Commission for Science, Technology and Innovation (NACOSTI) <https://research-portal.nacosti.go.ke> and also obtain other clearances needed.






Yours sincerely,



Dr. Peter G. Kirira
Chairman, Mount Kenya University ISERC

Main Campus, General Kago Road, P.O. Box 342-01000 Thika, Tel: +254 67 2820 000,
Cell: +254 720 790 795, 0709 153 000
Email: info@mku.ac.ke, Web: www.mku.ac.ke
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Appendix F: NACOSTI research license

 <p>REPUBLIC OF KENYA</p>	 <p>NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY & INNOVATION</p>
Ref No: 760987	Date of Issue: 02/March/2023
RESEARCH LICENSE	
	
<p>This is to Certify that Mr.. Paul Mwaura of Mount Kenya University, has been licensed to conduct research as per the provision of the Science, Technology and Innovation Act, 2013 (Rev.2014) In Kericho on the topic: influence of forest plantation establishment on community livelihoods: a case study of makutano forest station kericho county kenya for the period ending : 02/March/2024.</p>	
License No: NACOSTI/P/23/23914	
760987 Applicant Identification Number	 Director General NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY & INNOVATION
Verification QR Code	
	
<p>NOTE: This is a computer generated License. To verify the authenticity of this document, Scan the QR Code using QR scanner application</p>	
See overleaf for conditions	

Appendix G: Turnitin report



PAUL MWAURA

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- University

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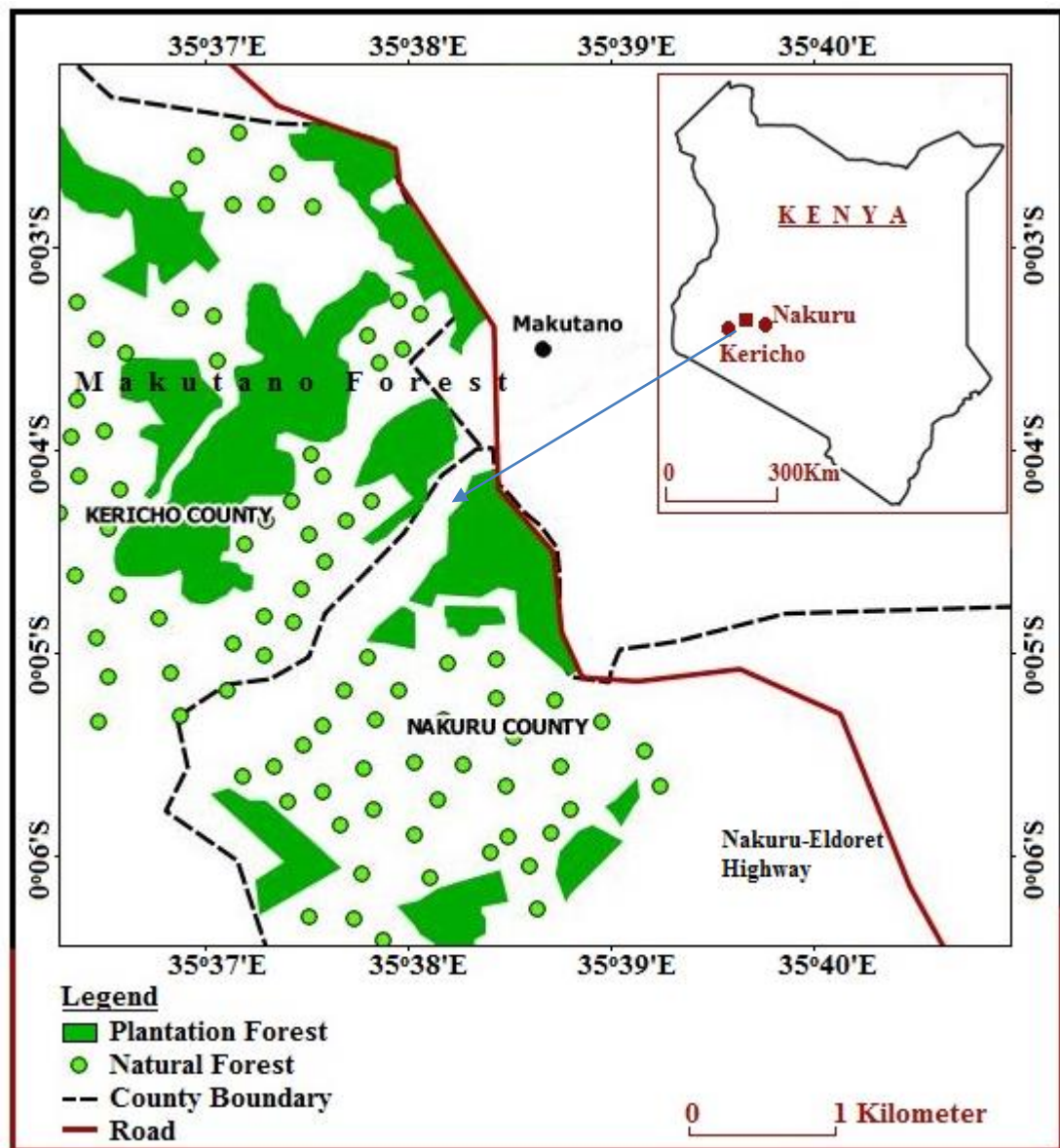
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Appendix H: Research site map



Makutano Forest

Source: Researcher, (2024)