INFLUENCE OF PLANTATION ESTABLISHMENT LIVELIHOOD IMPROVEMENT SCHEME ON LIVELIHOOD OF FOREST ADJACENT COMMUNITIES: A CASE OF GATHIURU FOREST NYERI COUNTY

BY

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DECLARATION

This research project report is my original work and has never been presented by anybody in any university for award of any degree.

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L50/69442/2011

This research project report has been submitted for examination with my approval as the university supervisor.

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DEDICATION

I dedicate this work to my wife Betty and my children Joy, Love, Loveness and Happyan for their moral and spiritual support during my study.

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ABREVIATIONS AND ACRONYMS

APF	Adaptation Policy Framework
CBO	Community Based Organization
CDM	Clean Development Mechanism
CFA	Community Forest Association
DFID	Department For International Development
FAO	Food and Agricultural Organization
FRA	Forest Resource Assessment
FSK	Forest Society of Kenya
GCFA	Gathiuru Community Forest Association
GOK	Government of Kenya
Ha	Hectares
KFMP	Kenya Forest Master Plan
KFMP	Kenya Forest Master Plan
KFS	Kenya Forest Service
KFWG	Kenya Forest Working Group
KM	Kilo Meters
MTS	Modified Taungya System
NAREDA	Natural Resource Management and Development Agency
No.	Number
NWFP	None Wood Forest Product
PELIS	Plantation Establishment Livelihood Scheme
PES	Payment for Environmental Services
REDD	Reduced Emission avoiding Deforestation and forest Degradation
SLA	Sustainable Livelihood Approach
SPSS	Statistical Package for Social Sciences
UNU	United Nations University

ABSTRACT

This study was intended to establish the influence of Plantation Establishment Livelihood Improvement Scheme (PELIS) on the livelihood of forest adjacent communities in Gathiuru forest Nyeri County. PELIS is a modified form of Taungya System or 'Shamba' System which for a long time has been used by the Government of Kenya to raise forest plantation where the forest adjacent communities' benefit from cultivation of food crops in the forest and the forest authority benefit from establishment of forest plantation at a low cost. The system has been receiving opposition from environmental pressure groups alleging that PELIS exploits farmers. The purpose of this study was therefore to assess the influence of PELIS on the livelihood of forest adjacent communities. The objectives of the study were: To examine how community participation in PELIS activities influence the livelihood of forest adjacent communities, to establish the extent to which PELIS benefits influence the livelihood of forest adjacent communities, to assess how community attitudes towards PELIS influence the livelihood of forest adjacent communities and to determine the influence of PELIS challenges on the welfare of forest adjacent communities. The research questions were: how does community participation in PELIS activities influence livelihood of forest adjacent communities? To what extent do PELIS benefits influence livelihood of forest adjacent communities? How does community attitudes towards PELIS influence livelihood of forest adjacent communities? How do PELIS challenges influence livelihood of forest adjacent communities? Descriptive research design was used in this study and the study population was the 1,500 registered farmers participating in PELIS. Stratified random sampling was used to draw a sample size of 150 respondents who were administered with questionnaires to collect the data. The final data was analyzed using statistical package for social scientists (SPSS). The study found out that participating in PELIS activities diversifies sources of livelihood and enhanced both social and human capitals. PELIS farmers were able to produce an average of 87 bags of potatoes per acre per year which enhanced food security and PELIS crops produced contributed 39% of the household income. Communities had a positive attitude towards PELIS. However, limited forest land for cultivation, poor forest roads and wildlife damage were some of the PELIS challenges which had negative influence to their livelihood. In conclusion the study established to some extent that PELIS had a positive influence on the livelihood of forest adjacent communities. The scheme diversifies sources of livelihood, enhances social and human capital and generates livelihood outcomes in the form of more adequate income, increased wellbeing, improved food security which enhances peoples living conditions or enable them reduce poverty levels. The study recommends the fencing of plantation areas to reduce wildlife damage, maintain forest roads regularly, harvest mature forest plantation to sustain the scheme and KFS to appreciate the PELIS farmers by providing them with some incentives.

CHAPTER ONE:

INTRODUCTION

1.1 Background of the study

Today, the livelihoods of 1.6 billion people in the world depend directly or indirectly on forests for the generation of cash and non-cash income, providing a wide range of social, economic, cultural, spiritual and environmental benefits for local communities. Globally many governments have recognized that local communities are key forest stakeholders and promoting their inclusion in the management of forests greatly contributes to improve local livelihoods and rural development as well as ensuring forest conservation (FAO, 2011).

Plantation Establishment Livelihood Improvement Scheme (PELIS) formerly known as *"Shamba"* System in Kenya or Taungya System in other countries is a system of forest plantation establishment in which forest land is allocated to forest adjacent communities, cleared and initially planted with crops. Seedlings of desirable tree species are then planted on the same plot, leading in time to harvestable timber. The word taungya is reported to have originated in Myanmar (Burma) (Nair, 1992) where Dr. Dietrich Brandis used it in 1856 to rehabilitate degraded forest areas at a low cost and forest adjacent communities benefited from cultivation of crops. The System was soon introduced to other parts of India, and later it spread throughout Asia, Africa and Latin America (Ursula, 2007).

While the Taungya System has been criticized because of its apparent colonial, exploitational origins according to Menzies (1988), an identical system was first used by the peoples of southern China in the cultivation of a subtropical conifer. More recently it has been used by small-scale farmers to produce teak (Roder et al. 1995). Literature indicate that Taungya farmers in China contributed about 56 per cent of the country's food requirements while in Thailand the indication is that Taungya farmers produce enough food to feed themselves and sale the surplus to the market (Chamshama, 1992).

Succession systems of forest management which follow the pattern of Taungya or PELIS have been used for at least three century's worldwide (Menzies, 1988). The

resilience of these systems is associated with economic and social factors which have made the cultivation of trees an adaptive strategy of land use for the forest adjacent communities. Recent modifications to the Taugya System include social and economic benefits to the participating families (Carl, 1992). Public-sector agencies dominated forest plantation development in most countries in Asia and the Pacific. This pattern has changed in many countries worldwide over the past 10 to 20 years, mainly for four reasons. First, devolution of forest management has led to greater involvement of communities and the private sector in forestry. Second, the performance (financially and biologically) of public-sector plantations – with few exceptions – has been disappointing. Third, shrinking government budgets make it impossible for most forest departments to devote as many resources to forest plantations as they have in the past. Fourth, problems related to weak governance structures are driving many countries to reconsider the role of government in administering forest resources and in directly implementing forest programmes (Gregersen, 2004).

Globally, the formulation and implementation of an adaptation strategy to climate change is of growing concern to governments. The adaptation policy framework (APF) sets out indicative activities and features of an adaptation strategy. Understanding the extent to which existing practices can support adaptation in societies and ecosystems is an important step towards the solution. Kalama, (2011) indicated that modified Taungya System takes into consideration most of the activities of an adaptation strategy. Modified Taungya System is a profitable venture and has a high potential to reduce vulnerability due to short-term food production and long-term plantation establishment.

In Sri Lanka plots of 5 acres were given out on a three year permit to landless people where they would plant this area with trees as instructed by the Forest Department and cultivated their own crops on the same area. For this they received an incentive payment of 3,500 rupees in the first year. If they maintain the plot in subsequent years and plant crops again, they received payments of 1,500 and 1,000 rupees for years two and three. The scheme provides employment in areas where unemployment is high. It is to be a cheaper means of afforestation than the block forestry direct labour system. The five acres taungya farms gave net income of between 10,000 to 12,000 rupees per year. This is without the incentive payment from the Forest Department and other income derived from labouring. When compared with the average rural wage employment of 800 rupees per

month, it was concluded that Taungya farming was more profitable than rural employment (Gilbert, 1988).

Shortage of food is one of the greatest problems facing many Africans. It is noted that two-thirds of all productive land holdings in Africa are less than two hectares. In Nigeria, farmers are faced with insufficient cultivation land and as a result, many can produce food only for the family with little left for sale. Cultivation in the forests has gone a long way to improve the socio-economic life of the rural sector of the economy and is a means of increasing food supply. Victor and Bakare (2004) in their study on rural livelihood benefits from participating in the Taungya System in Ondo State of Nigeria estimated the yields per hectare from Taungya farms at 1.2 metric tons of maize, 15 metric tons of cassava and 8 metric tons of yams and majority of the farmers were able to earn between 30,000 to 60,000 Naira. Nao (1978) estimated that Taungya Systems in Nigeria have directly provided enough food for about 700,000 people, constituting about 1 per cent of the country's food needs.

In Ghana the Taungya System was revised since 2002 with support from FAO and the World Bank to include benefit sharing of the forest products to all participants. Benefits accruing under the Modified Taungya System (MTS) are outlined as follows: Taungya farmers are entitled to 100% of the benefits from the food crops. However, benefits accruing from the sale of timber trees are shared as follows: Forestry Commission (40%), the farmers (40%), the traditional landowners (15%) and the forest-adjacent community (5%) (Tagoe, 2012). It is estimated that nearly 100,000 ha of Modified Taungya System plantations have been established across the country through the involvement of over 100,000 rural farmers.

In Tanzania, Taungya System has been suggested as being among the means of ameliorating negative land use impacts resulting from high population density while addressing the basic needs of agrarian societies. Fast growing population has been one of the major problems facing Tanzania and this has in consequence placed pressure on land in some areas. The Taungya System has been among the land use practices applied to reduce the problem especially in North Kilimanjaro region where land pressure is very high. The

Tanzanian government policy has been in favour of increased forest plantation using Taungya System to reduce labour cost and benefit the agrarian society to access forest land for food production. According to studies by Chemshama (1992) in Kilimanjaro North Plantation, Taungya System was found to be more beneficial to the peasant farmers as compared to rural wage employment.

Kenya has a total surface area of 582,646 km², and a population total of just over 40 million with a growth rate of 2.7% (2009 census). According to Mathu and Ngethe (2011) the total state forest area is estimated at 2.35 million ha (about 2.7% of Kenya's land area). It is estimated that approximately 530,000 forest adjacent households, which translate to about 2.9 million Kenyans live adjacent to the forest and their livelihood are highly dependent on the forest. This rural population is characterized by shortage of farmland and unemployment resulting to low income and high poverty levels (Obonyo, 2009).

According to the latest forest plantation inventory data, Kenya Forest Service manages about 135,869 ha of forest plantations out of this total, 41,298 ha are unstocked (Kenya Forest Service [KFS], 2011). To restock the 41,298 ha Kenya Forest Service has been using 'Shamba' System or PELIS as it is a cheaper option of plantation establishment. Forest plantation establishment through PELIS has been recommended by many stakeholders like Kenya Forest Working Group (KFWG) (Kariuki, 2006) to address forest destruction and to meet the increasing demand for timber which stands at 2.35 million cubic meters against supply of 1.8 million cubic meters (Mathu & Ng'ethe, 2011) and to improve the livelihood of forest adjacent community.

Forest plantation establishment in Kenya has been undertaken through the *Shamba* System or non-resident cultivation) since 1910 to raise the forest plantations to increase availability of wood for industrial and domestic use which would otherwise not be met by supply from natural forests (Kagombe, 2005). The system, involves planting tree seedlings in combination with food crops by peasant farmers in forestland over a period of 3–4 years in exchange for free labour for planting and tending tree seedlings (Imo, 2008). However due to lack of clear policies and guidelines the systems has been abused and stopped

several times resulting to huge planting backlogs amounting to 16,000 ha and 41,298 ha of unstocked plantations.

The new Forest Act (2005) brought in provisions to streamline the management and utilization of forest resources. Part IV of the Act recognizes community participation in forest management by allowing the formation of Community Forest Associations (CFA) to be registered under the Societies Act. Such CFAs may apply to the Director of forests for permission to participate in the conservation and management of a state forest. The Act gives community forest associations several user rights which include plantation establishment through non-resident cultivation or PELIS among others. Following the Forest Act 2005, non-resident cultivation or the 'Shamba' System was rebranded to Plantation Establishment Livelihood Scheme (PELIS) by Kenya Forest Service to capture the overall purpose of the whole programme with the overall objective of establishment of forest plantations and improvement of community livelihood (Khalumba, 2010).

Gathiuru forest is part of the larger Mt. Kenya forest ecosystem and covers an area of 14,978 ha which comprise of 2,557.7 ha of exotic forest plantation, 8,625.3 ha of indigenous forest, 2,000 ha of bamboo, 1,189.9 ha of bush land and 612.5 ha of grassland areas. The altitude varies from 1900m to 5,188 m a.s.l. Rainfall varies from 500mm to 1500mm. Rainfall is bimodal with the long rains occurring in the months of March to June and short rains in October and November. The rainfall is well distributed and reliable and has largely influenced agricultural activities in the landscape. The population of the Gathiuru forest adjacent communities is 44,678 people with 13,266 households occupying an area of 404.29 Km^2 (2009 census). The main land uses and livelihood activities for the community living adjacent to Gathiuru forest is mixed agriculture where rain fed and irrigation fed crop production and livestock production are practiced (GCFA & NAREDA, 2009).

1.2 Statement of the problem

There has been much debate worldwide concerning the ethics of Taungya or '*Shamba'* System. Although it is noted as a promising combination of farming and forestry by some, critics consider it to be an exploitation of cultivators for the purpose of reducing

costs to the Forest Departments (Foley & Barnard, 1984). It is also seen as a temporary arrangement and thus may not foster development in any real sense (Arnold, 1984). In Kenya the system has been receiving opposition from some environmental pressure groups like Green Belt Movement (Kariuki, 2006) alleging that cultivation in the forest focuses more on economic gains undermining environmental conservation. It is also alleged that cultivation interferes with water infiltration, escalates soil erosion and forest authorities exploit PELIS farmers (Khalumba, 2010).

Taugya System or '*Shamba*' System has undergone several changes over the past two decades in Kenya due to poor management and controversial policy decisions by the government. For example, the government banned the system in 1988 (KFMP 1994) in an effort to drive out squatters from the forest. It was re-introduced in 1994 as non-resident cultivation (Kirinya, 1994) with the aim of replanting clear felled plantation areas, and outlawed again in 2004 (Ogweno et al. 2005) due to cases of illegally extending into natural forests, river banks while replanting stalled. A new scheme was introduced in 2008 and renamed as Plantation Establishment Livelihood Scheme (PELIS) with the main objective of establishment of forest plantation and improvement of community livelihood through sustainable collaborative management of forests.

PELIS is an adaptive strategy of land use for reducing poverty level of forest adjacent communities. Although there is adequate information that PELIS improves tree establishment and growth in Kenya's plantation forests, there is inadequate information on its contribution to the welfare of forest adjustment communities that can be used to improve the scheme in order to reduce the poverty levels. This is as recommended by Kagombe and Gitonga (2005) that there is need for a research on the benefits of PELIS to the forest adjacent community. Ikiara (2010) also indicated that there is need for further research on benefit sharing between the Government and participating communities and this study may form the basis of benefit sharing mechanism.

1.3 Purpose of the study

The purpose of this study was to establish the influence of Plantation Establishment Livelihood Improvement Scheme on the livelihood of forest adjacent communities.

1.4 The objectives of the study

The study sought to address the following objectives:

1. To examine how community participation in PELIS activities influences the livelihood of forest adjacent communities.
2. To establish the extent to which PELIS benefits influence the livelihood of forest adjacent communities.
3. To assess how community attitudes towards PELIS influence the livelihood of forest adjacent communities.
4. To determine the influence of PELIS challenges on livelihood of forest adjacent communities.

1.5 Research questions

The research sought to answer the following questions.

1. How does community participation in PELIS activities influence the livelihood of forest adjacent communities?
2. To what extent do PELIS benefits influence the livelihood of forest adjacent communities?
3. How do community attitudes towards PELIS influence the livelihood of forest adjacent communities?
4. How do PELIS challenges influence the livelihood of forest adjacent communities?

1.6 Significance of the study

The study may be of great importance to the Mt. Kenya Gathiuru Community Forest Association as it may act as a reference when negotiating with Kenya Forest Service for benefit sharing of plantations products proceeds. The study may be used to assist the PELIS farmers to address the challenges they are facing in order to improve the livelihood of forest adjacent community. On the other hand the study may assist Kenya Forest Service (KFS) to improve on the implementation of Plantation Establishment Livelihood Scheme by advising policy makers (based on facts) on its importance to forest adjacent

communities. The study may also add literature to the existing research material and may form a stepping stone for further research which may be of benefit to the researchers and academicians.

1.7 Basic assumptions of the study

This study assumed that the respondents were collaborative and gave correct relevant data by answering the questions correctly and truthfully. It was also assumed that the sample used was a representative of the whole population including gender. In addition the study also assumed PELIS was supportive to forest adjacent communities.

1.8 Limitation of the study

Finances and time were limiting factors to the researcher. To overcome this, sampling method was adopted instead of doing a census. Language was a barrier to the researcher and this was overcome by training competent research assistants and used in the study for language translation purpose.

1.9 Delimitation of the study

This study focused on the benefits accruing to the forest adjacent communities for participating in the implementation of Plantation Establishment Livelihood Scheme. The study was carried in Gathiuru Forest Station which has been implementing PELIS since its inception in 2008. Gathiuru Forest Station is one of the pioneer stations to implement PELIS. The study was delimited to the 1,500 members of the Mt. Kenya Gathiuru Forest Association involved in plantation establishment livelihood scheme.

1.10 Definitions of significant terms used in the study

PELIS benefits: This term refers to profits arising from sale of PELIS crops, nursery seedlings and pruning's or direct benefits derived from employment related to forest resources or indirect benefits such as climate amelioration.

Community attitude towards PELIS: Is the sum total of mans inclination, feelings, prejudice or bias, preconceived notion, ideas, fears, threats and conviction about PELIS.

Community Participation in PELIS activities: Is the involvement of forest adjacent communities in forest affaires like cultivation, nursery, community forest policing and silvicultural operations to enable them solve their own problems. Community participation is important as it motivates people to work together and own up the project/activity they are engaged in. Through community participation, community members see a genuine opportunity to better their own lives and that of the entire community. The aim of community participation in PELIS activities is to ensure sustainable management of forest plantations as well as improvement of the livelihood of forest adjacent communities.

Community Forest Association: Is a legal body formed out of the members of the forest adjacent communities and duly registered under the Societies Act who is permitted to participate in the management and conservation of state forests, local authority and provisional forest in accordance with the provision of the Forest Act.

Livelihood of forest adjacent communities: Livelihood comprises the capabilities, assets (including both material and social resources) and activities required and pursued by households and individuals for a means of living (FAO 2009). These households and individuals should be living within five kilometer radius from the boundary of the forest and they directly or indirectly relay on the forest for their welfare.

PELIS challenges: These refer to the constraints like human wildlife conflict, poor forest roads and limited forest land for cultivation the PELIS farmers encounter while implementing the scheme.

Plantation Establishment Livelihood Scheme (PELIS): Refers to modified Tuangya System or non-residence cultivation or *'Shamba'* System where forest adjacent communities through their community forest association enter into mutual agreement that defines roles and responsibilities under set rules and regulations with Kenya Forest Service to participate in forest plantation development. This is by allowing forest adjacent communities to cultivate forest land and grow food crops as the forest authority plants trees on the cultivated land for a period of 3-4 years when the trees cannot allow intercropping any more.

1.11 Organization of the study

This project report has been organized into five chapters. Chapter one contains the introduction of the study and has the background of the study where a brief of the topic has been highlighted at global, regional and locally. Also the background contains the statement of the problem, the purpose of the study, objectives of the study and research questions. Significant of the study, basic assumptions of the study, limitation, delimitation and definition of significant terms used in the study are also found in the background of the study. Chapter two of this study contains the literature review starting with a brief introduction of the chapter followed by literature review of the history of PELIS, community participation, PELIS benefits and community attitude towards PELIS. The chapter also contains the theoretical and conceptual frameworks, gaps in the literature and ends with a summary of the literature review.

Chapter three contains the research methodology starting with an introduction of the chapter followed by the research design and target population. This chapter also contains the sample size and sampling procedure and research instruments. Pilot testing, validity and reliability of the instrument are also contained in this chapter. Lastly the chapter contains data collection procedures, data analysis techniques, ethical considerations and operationalization of the variables in the conceptual framework. Data analysis, presentation and interpretation forms chapter four of the report and includes the response rate, demographic data analysis, analysis of the findings based on the study objectives. Discussions of findings, conclusion and recommendations forms chapter five of this report and includes the following subsections: introduction, summary of findings, discussion of findings based on the objectives of the study; conclusion recommendations and suggestions for further studies. The report ends with a list of references and appendices.

CHAPTER TWO:

LITERATURE REVIEW

2.1 Introduction

This chapter presents the literature review on the overview of the concept of PELIS, community participation in PELIS activities and PELIS (Taungya) benefits on livelihood of forest adjacent communities. In addition community attitudes towards PELIS on livelihood of forest adjacent communities have been reviewed. Finally this chapter has highlighted the theoretical and conceptual framework and gaps in the literature.

2.2 Concept of Plantation Establishment Livelihood Scheme

Forest plantations are variously defined in the literature and even the standardized definition adapted by FAO has significantly changed over time (Carle & Holmgren, 2003). The main shared characteristics of these definitions point to forested areas artificially established by planting or seeding. Other features are that the trees usually belong to the same species (native or introduced), have the same age structure and are regularly spaced (FAO 2006; FRA 2010).

Forest plantations are not anything new. In southwestern France, for example, there are records of man-made forests as early as year 1500, as well as evidence of trading in forest products, both wood and non-wood from maritime pine (*Pinus pinaster*) plantations. These early plantations resulted mainly from the initiative of private landlords as well as smallholders and communities, primarily for commercial purposes (i.e., the trade of wood and resin products), but also for direct household needs **(**Turnbull, 2002).

Forest plantation establishment and management is a very expensive undertaking. Globally, most governments have adopted Tuangya System of plantation development in order to cut down the costs and promote livelihood improvement. Taungya is a system of forest management in which land is cleared and initially planted with crops. Seedlings of desirable tree species are then planted on the same plot, leading in time to harvestable timber. The word taungya is reported to have originated, in Myanmar (Burma) and means hill (*Taung*) cultivation (*ya*) (Nair, 1992) and (Ursula, 2007). Originally it was the local

term for shifting cultivation, and was subsequently used to describe the afforestation method. In 1856, when Dietrich Brandis was in Burma, then part of British India, shifting cultivation was widespread and there were several court cases against the villagers for encroaching on the forest reserves. Brandis realized the detrimental effect of shifting cultivation on the management of timber resources and encouraged the practice of "regeneration of teak (*Tectona grandis*) with the assistance of Taungya," based on the well known German system of *Waldfeldbau*, which involved the cultivation of agricultural crops in forests. Two decades later the system proved so efficient that teak plantations were established at a very low cost. The villagers, who were given the right to cultivate food crops in the early stages of plantation establishment, no longer had to defend themselves in court cases on charges of forest destruction; they promoted afforestation on the cleared land by sowing teak seeds. The Taungya System was soon introduced into other parts of British India, and later it spread throughout Asia, Africa, and Latin America (Ursula, 2007).

In Kenya, the first plantation scheme was established in 1902 using mainly exotic hardwoods which were to provide fuelwood for the railway. Areas of natural forests which were heavily logged during the Second World War were subsequently converted to forest plantation, mostly of exotic softwoods. The plantation programme was expanded in the 1950s to include the planting of exotic pines in the natural glades within the closed canopy forests and on grasslands at the margins of the montane forests (Wass, 1995). Until 1987 the establishment of forest plantation was undertaken using the *'Shamba'* System or Taungya where the landless poor communities benefited from accessing productive land for crop production and the forest department was able to establish plantation successfully at a minimum cost. The form of Taungya System used by that time was known as resident cultivation where farmers were permitted to reside in the forest reserve for as long as their permit was valid. Many extended period, resulting to serious squatter problem for the forest department. In the late 1980s, as a direct effect of a drive to evict squatters, the *Shamba* Sytem was discontinued (Wass 1995). It was re-introduced in 1994 as non-resident cultivation (Kirinya 1994) with the aim of replanting clear felled plantation areas, and outlawed again in 2004 (Ogweno et al. 2005) due to cases of illegally extending into natural forests, river banks while replanting stalled. A new scheme was introduced in 2008

and renamed as Plantation Establishment Livelihood Improvement Scheme (PELIS) with the main objective of establishment of forest plantation and improvement of community livelihood through sustainable collaborative management of forest. PELIS is implemented under the new Forest Act 2005 section 47 (2) which embrace community participation in forest management (Khalumba, 2010).

2.3 Community participation in PELIS activities on livelihood of forest adjacent communities

The earth summit of 1992 identified local community participation in natural resource management as critical to the continued existence of forest landscapes globally [KEFRI], 2007). Global concerns about biological, economic, and social sustainability of forest has resulted in changes in management practices in plantations. There is increasing trend towards sustained forest management in which forests are managed as ecological systems with multiple economic benefits and environmental values, and with broad public participation in decision making. The relationship between the state and communities has been an overriding issue in the development of forestry institutions globally. In many countries, the trend is for communities to become co-managers of public forests. Meanwhile, in development co-operation both poverty and multiple rural livelihoods have received increased attention. Forest production has several characteristics that make it suitable for joint management where both parties benefit. Involving communities in management decreases the state's forest plantation establishment and monitoring costs, while communities benefit from better access to forest resources. For this to take place, however, the state forest apparatus needs to be free from undue rent-seeking (Castren, 2005).

In Mexico's Yucatan peninsula, 16,000 subsistence farmers joined together with the Government, Local Foresters and Conservationists to deal with issues of forestry and land degradation and periods of hunger is now being introduced to activities such as Taungya System which can stabilize land use and make the best use of cleared forest land (Salim, 1999). Hazelwood (1987) notes that deforestation cannot be reversed and sustained patterns of forest land use established without the active participation of the millions of small farmers and land less people who daily depend on forests and trees for survival. A

much greater emphasis on `bottom-up` approach is needed to balance prevailing `top down` policies.

Richards *et al* (2003), asserts that forest conservation through community involvement has resulted into marked improvement in forest status in South East Asia. Wiersum (1984) clarified that forestry can neither develop nor survive without the active involvement of the local community. Effective participation in conservation means involving people throughout the organization and in decision making process. The participation of local community will never materialize unless a sense of belonging is created among them through the practices of Joint Management, in which the Forest Service acts as co-partner with the local community organization to serve the larger national needs for forests and forest products. Bonyo (2009) in her study on gender integration in forest resource management found that about 58% of the community forest association members joined the community forest association to benefit from forest resource which included access to forest land for cultivation, sale of tree seedlings and firewood collection among others.

Benjamin (2010) in his study on Women in Community Forestry Organization: An empirical study in Thailand noted that women are continuously dominated with only 3 women out of 20 representatives on village forest committee and making decisions (women make up to 16% of the Village forest committees. His findings also showed that women are not well represented in forest conservation initiates despite the fact that they are the source of food security for their household. However a study by Obonyo (2009) on integrating gender on forest management conducted in Mt Kenya, Aberdares, Kakamega and Mau contrary results indicating that 49 % of the community members participating in PELIS were women. This indicated that women preferred activities that contributed to the subsistence economies of their households and those that gave them enough time to attend to household activities.

For over 100 years the Forest Department in Kenya (now KFS) was managing the state forests more or less single handedly. Communities only participated in forestry matters as forest workers on a works paid basis or as cultivators who were instrumental in the establishment of industrial plantations under the '*Shamba*' System. Access to state

forests was tightly controlled by forest guards who ensured continued forest health through exclusion and only activities approved by the then Forest department were carried out (KEFRI, 2007).

Community participation in natural resource management and conservation has been recognized in the Constitution of Kenya (2010), the Vision 2030 and the Forest Act 2005. Chapter five sections 69 article (1) (d) of the Constitution recognizes public participation in the management, protection and conservation of the environment. Article (2) stipulates that each person has a duty to cooperate with state organs and other persons to protect, conserve the environment and ensure ecological sustainable development and use of natural resources. Chapter two of the constitution section 36 gives everybody the right to form, join, or participate in activities of an association of any kind. The vision 2030 under the guiding principles makes it the duty of public authorities to promote individual and community participation in activities of society to influence decision making affecting them, while Forest Act 2005 recognize community participation in forest conservation through registering as community forest association with the register of societies. Community Forest Association membership seems to strengthen the social capital of the community members living adjacent to the forests with a goal of improving forest management while improving their livelihood. Social capital includes characteristics of social organizations such as networks, norms, and trust that enable participants to act together more effectively in order to pursue shared objectives (Tagoe, 2012).

Forest adjacent communities participate in PELIS to generate additional income and ensure economic security thus contributing to social equity and poverty alleviation (Nsiah, 2010). Single activity does not raise enough money or products for a livelihood, so multiple activities should be undertaken to build one's livelihood. In this case diversity is important, because people make a living through a complex web of activities. In reality people combine different activities in a complex portfolio of activities (Scoones 2009). Scoones continue to narrate that attention to securing of livelihoods in the long term is important. PELIS is a temporary undertaking which last for a period of about four years. The relevant questions in this respect are: What are the expectations for the future? Are there changing conditions in the future? The term sustainable livelihood implies that

livelihoods are stable, durable, resilient and robust in the face of both external shocks and internal stresses. The focus on PELIS in Kenya has often been on coping and short-term adaptation. Livelihoods analysis that identifies different future strategies or pathways provides one way of thinking about longer-term change.

2.4 PELIS benefits on livelihood of forest adjacent communities

Literature indicates that different countries have used incentives to ensure that people who participate in tree planting on public land do benefit from their efforts. In Asia tree planting was practiced as early as 1100 BC in China where a Forest Service was established by the Emperor to be responsible for preserving natural forest and reforesting denuded lands. People were encouraged to plant trees which were important for food and timber. In the Sung Dynasty (420AD to 589 AD) direct planting of tree seeds for reforestation was widely practiced and public land reforested by farmers become the property of the farmer (FAO, 1947).

The Spaniards recognized the medicinal value of the bark of Cinchona trees during their colonization of Peru and Bolivia and by 1640 Cinchona bark was being used in Europe to manufacture quinine for combating malaria. Overexploitation of natural forest resulted to shortage of quinine and in 1850 steps were taken to cultivate Cinchona in other parts of the world. Plantations of Cinchona were established in India, Indonesia and Zaire through the Taungya System where farmers befitted from the food crop they cultivated and also from employment for establishing the Cinchona plantations (Turnbull, 2002).

When forest adjacent communities co-manage forest resources with the forest authorities, they expect tangible benefits from the arrangement through benefit sharing. Different countries have started rolling out benefit sharing arrangement. A god example is the Governments of Ghana who revised Taungya System with support from FAO and the World Bank. In the proposed system, farmers would essentially be owners of forest plantation products, with the Forestry Commission, landowners and forest-adjacent communities as shareholders. Previously, the Forestry Commission was the owner of plantations established using the Taungya System, and only landowners, not farmers, received benefits from the tree crops. Under the new arrangement, all participants in the

modified Taungya System, including farmers, would be eligible for a share of the benefits accruing from the plantation based on their contribution. Farmers would carry out most of the labour, including pruning, maintenance and tending while the Forestry Commission would contribute technical expertise, training for farmers to carry out their functions efficiently, equipment and tools, and would be responsible for stock inventory and auctioning or marketing of products. The landowner (i.e. traditional authority) would contribute land and the forest-adjacent community would provide support services in the form of protection of the investment from fire and encroachment (Agyeman *et al*. 2003). Benefits accruing under the Modified Taungya System (MTS) are outlined as follows: Farmers are entitled to 100% of the benefits from the food crops. However, benefits accruing from the sale of timber trees are shared as follows: Forestry Commission (40%), the farmers (40%), the traditional landowners (15%) and the forest-adjacent community (5%) (Tagoe, 2012). It is estimated that nearly 100,000 ha of Modified Taungya System plantations have been established across the country through the involvement of over 100,000 rural farmers since the launch of the MTS in 2002 (Abugre, et al 2010). This case of Ghana shows that good benefit sharing arrangement results to successful plantation establishment. In Nigeria, Mende (2003) indicated that Taungya System has gradually enhanced the socio economic livelihood of the rural community by boosting income earnings potential, human welfare, food and nutritional security as well as provision of fuel wood, fodder for animal consumption and employment.

The Tanzanian government policy has been in favour of increased forest plantation using taungya system to reduce labour cost and benefit the agrarian society to access forest land for food production. A study by Chamshama (1992) on sustainability of Taungya System at North Kilimanjaro forest plantation aimed at examining of costs and revenue resulting from the practice and also the impact of the system has on trees survival and food crops yields yielded the following results: during early stages of plantation development intercropping of young trees with food crops is beneficial in terms of tree survival, food crop production, financial incomes to the peasant farmers and reduction of forest plantation establishment cost. Famers were allocated an average of 2.2 ha of land and the yields were 45 bags/ha of maize and 20 bags of beans/ha valued at Tshs 90,000 and Tshs 100,000 respectively. Chamshama (1992) continue to indicate that the financial returns that accrue

to the farmer through sale of food under Taungya is substantial to play a role in reducing the often exaggerated doubts that the Taungya System exploits the peasant farmers. This income is even higher than income per labour-day under the pure reforestation system as the revenue accruing from sale of crops translates to Tshs 508 per day while income per labour-day is about Tsh 100.

In Kenya PELIS has been supported by arguments that it enhances food security by allowing farmers adjoining the forest to grow food crops such as beans, maize, cabbages, and potatoes. In the West Mount Kenya forest blocks of Kabaru, Chehe and Hombe, most of the farming communities and squatters have depended on the systems to earn their livelihoods. Indeed, crops grown from these blocks have supplied food stuffs to the various local markets in a very sustainable manner. Hence, the system has been able to support many families with food requirements and also provide enough supplies for the local market thus generating enough income to meet other social economic needs of these rural households. Kariuki, (2006) indicated that, one forest plots under potatoes, could fetch 30-40 bags in an acre in a three months period. In a good season where a bags goes for 800-1000 shillings, the forest farmers accrue gross income of 24,000-40,000 Kenya shillings.

A study by Itubo, (2011) on power dynamics within community forest indicated that forest adjacent communities in Gathiuru forest benefited more from utilizing land for PELIS and grazing rights and not directly from forest timber products. The financial benefits to the KFS in the PELIS system come in the form of savings accrued from site clearing, staking, planting and tending over a three year period. Khalumba (2010) indicated that the cost of establishment of forest plantation per hectare under PELIS is Kshs 99,224 while under the conventional system (without PELIS) is kshs 123,736 resulting to a cost saving of Kshs 24,512 per hectare. The forest adjacent communities are also entitled to other forest goods and services like grazing, firewood collection, water abstraction, collection of herbs, honey and enjoy the environmental services (Ndwiga, 2010).

There is need to find ways of generating income between canopy closure and timber harvesting. Several options have been suggested by Insiado (2012) which when implemented would ensure sustainability of livelihood to farmers involved in PELIS. Through mutually agreement with Kenya Forest Service, the PELIS farmers can benefit

from pruning's, thinning's, non-timber products and (payment for environmental services) especially the carbon credit (KFS, 2012). Carbon payments and payments for environmental services from forestry and conservation actions are possible means of financing local community forestry initiatives (Seton, 2012). Natural forests and, to a more limited extent, forest plantations provide environmental services. According to the Millennium Ecosystem Assessment, there are four major categories of environmental services which are: the supporting services (e.g. soil formation and nutrient cycling), the provisioning services (supply of goods), the regulating environmental services (e.g. climate and food regulation), and the cultural services (e.g. the aesthetic, educational and spiritual services).

In order to conserve natural ecosystems a financial market mechanism was created called payments for environmental services (PES). The basic idea is that those who provide environmental services by conserving natural ecosystems should be financially compensated.

According to Wunder (2005), payments for environmental services are voluntary transaction where a well-defined environmental service is being bought by a service buyer from a service provider. The idea behind PES is that forest owners, private plantation developers or communities are paid for the environmental service that their natural forest or forest plantation provide.

There is a lot of attention for PES for forest conservation as a means to mitigate climate change through the reduction of carbon emissions from deforestation (estimated at 20% of total global greenhouse gas emissions). In the case of plantation development, private developers and communities would be paid for carbon sequestration by selling carbon credits based on the number of planted trees. In addition to the future timber benefits, plantation development can thus be stimulated by additional benefits from the trade in carbon credits. Carbon credits represent a unit of a certain amount of carbon dioxide reduced or removed from the atmosphere into biomass (Asare, 2010). For example every planted mature tree sequestrates a certain amount of carbon which equals a certain economic value. On the basis of this principle, forest plantation development could be

involved in PES schemes, as is the case in Costa Rica where the government pays plantation developers for environmental services provided (Pagiola, 2008).

2.5 Community attitude towards PELIS on livelihood of forest adjacent communities

Many researchers indicate that the poorer people are more dependent on natural resources. Therefore household socio-economic characteristics may play a role in resource use decision making. Understanding factors influencing community participation in forest management programs such as PELIS may be critical to forest managers and decision makers. Factors motivating their participation in decisions and activities for preservation of state forests or protected areas may be likewise important. A better understanding of community members' motivation for participation in PELIS is fundamental to the development and implementation of management strategies that are both sustainable in the long term and sensitive to the local need. Participation of rural community members in management of protected forests may vary according to socioeconomic and demographic backgrounds of the individual farmers. Individual community member's characteristics may influence decision making on whether or not to participate in PELIS (Musyoka et al, 2013).

Results of a study by Kobbail (2012) on attitude of community on forestry programs in Southern Sudan showed that almost all the respondents have a particularly favourable perception of the community forestry programmes implemented and they perceive the best type of management for running these forests which is to be owned and managed by them for livelihood improvement. They participated in different programme activities and willing to further participation in tree planting activities. Women have possessed positive attitudes towards community forestry although they were not fully involved in community forestry Practices.

Understanding the attitude of stakeholders towards Taungya System is important for the conservation of forests. In a study by Michael (2011) to examine attitudes of primary stakeholders towards Taungya Sytem in Ghana, in Subri Forest Reserve, the results revealed that primary stakeholders have positive attitudes towards Taungya System and this was not dependent on the location of the community. Their attitude towards

Taungya System is influenced by their perception of forest values and economic benefits they derive from the forest.

There has been much debate worldwide concerning the ethics of Taungya. Although it is noted as a promising combination of farming and forestry by some, critics consider it to be an exploitation of cultivators for the purpose of reducing costs to the Forest Departments (Foley & Barnard, 1984). It is also seen as a temporary arrangement and thus may not foster development in any real sense (Arnold, 1984). Several authors, including Mergen (1978) and Nao (1978), have contended that the Taungya farmer is exploited by participating in the establishment of plantations without being adequately rewarded. King (1968) went further, to suggest a sharing of the savings in the cost of establishing the forest plantation between the farmer and the Forest Department. The thinking is that if there are other job opportunities in the rural areas, the farmer may prefer them. However, 99 per cent of farmers in South-West Nigeria reported that they gained from participating in Taungya (Kio & Bada, 1981 cited in UNU, 1983). The indication is that even if farmers are being exploited they are not aware of it and they are quite willing to participate.

When forest adjacent communities are not satisfied with the implementation of PELIS and are not reaping benefits from it, the end results can be disastrous. For example in the 1930s the Government of Ghana launched a plantation development programme using the Taungya System, devised in Myanmar, in which farmers are given parcels of degraded forest reserves to produce food crops and to help establish and maintain timber trees. The intention was to produce a mature crop of commercial timber in a relatively short time, while also addressing the shortage of farmland in communities bordering forest reserves (Agyeman, et al, 2003). Under this system, Ghanaian farmers had no rights to benefits accruing from the planted trees (Milton, 1994) and no decision making role in any aspect of forest management (Birikorang, 2001). As a result, farmers tended to neglect the tree crops since they would not directly benefit when it is matured. Farmers also realized that if the tree canopy closed, they would be asked to stop farming to enable the establishment of the tree crop which they would not benefit. As a result, most farmers' deliberately killed the tree crop so that they would not be asked to stop farming on that

piece of land resulting to suspension of the system by the Government (Abugre, et al 2010). However, in spite of the problems, forest-adjacent communities still viewed the Taungya System as potential and the most beneficial forest tenure systems, and they requested its reintroduction, albeit with changes. Ledger (2009) on her study on consequences of the introduction of the modified Taungya System in Ghana's high forest zone for the livelihoods of forest-fringe communities reported that MTS was perceived on the whole as a positive system that is having a positive impact on people's livelihoods; enabling a better access to food and increasing ability to pay for education and housing.

A study by Maug (2007) on the socio economic situation of plantation villagers in Myanmar found that forest area allocated for farming may be too small to produce enough food for household consumption and sale thus unable to meet the wellbeing of the villagers. This contributed to communities have a negative attitude towards Taungya System as their needs were not addressed fully.

2.6 Theoretical framework

This study fits well within the Sustainable Livelihood Approach (SLA) advanced by Department for International Development (DFID) in 1999. The approach shows how poor people in rural areas build their livelihood and goes beyond a purely economic approach to poverty. Sustainable approach establishes the relationship between identified livelihood assets or building blocks of capital, mediating institutional arrangement or actors and defined livelihood outcomes. In sustainable livelihood framework, the assets that are recognized are natural capital e.g. land, water, wildlife, biodiversity and environmental resources. Physical capital which comprises access to basic infrastructure such as adequate water and sanitation, affordable energy, transport, communication and equipment for means of production that support livelihood. Human capital which comprises health, knowledge, skills, information and ability to labour that together enable people to pursue different livelihood strategies and achieve their livelihood objectives. Social capital which include the relationship of trust, membership of groups, networks, access to wider institution and other social resources upon which people draw in pursuit of their livelihood targets. Financial capital comprise financial resources available such as regular remittances, savings, supplies and other financial resources used to achieve

livelihood objectives. Therefore access to required assets generates livelihood outcomes in the form of more adequate income, increased wellbeing reduced vulnerability, improved food security, more sustainable use of natural resource base which enhance peoples living conditions or enable them reduce poverty level (Tagoe, 2012).

Plantation Establishment Livelihood Scheme can have an influence on the forest adjacent communities' livelihood by increasing family income as well as food from farming activities. The PELIS receives inputs from and delivers outputs to forest adjacent communities as well as to Kenya Forest Service. Inputs from adjacent forest community are labour, skills knowledge (human capital) while the outputs generated from PELIS to forest adjacent communities are financial capital, specific skills (human capital), faming land (natural capital) and possibly wood (physical capital). As a result, PELIS has an influence on the livelihood of forest adjacent communities. The main inputs from Kenya Forest Service are financial capital, knowledge and organizational skills and seedlings. The outputs from PELIS to Kenya Forest Service are trees and timber when trees are harvested. So the inputs and outputs have both direct and indirect influence on forest adjacent communities and Kenya Forest Service. Governance arrangement determines how the relationship between Kenya Forest Service and forest adjacent communities take shape. This includes the policies, regulations and institutions related to Plantation Establishment and Livelihood Improvement Scheme.

2.7 Conceptual framework

This study examined the relationship between independent variables that is: community participation in PELIS activities, PELIS benefits, community attitude towards PELIS and PELIS challenges and the dependent variable which was livelihood of forest adjacent communities. Government policies legislations and institutions were considered as moderating variables while the weather conditions and political stability were treated as intervening variables. Figure 1 shows the conceptual framework.

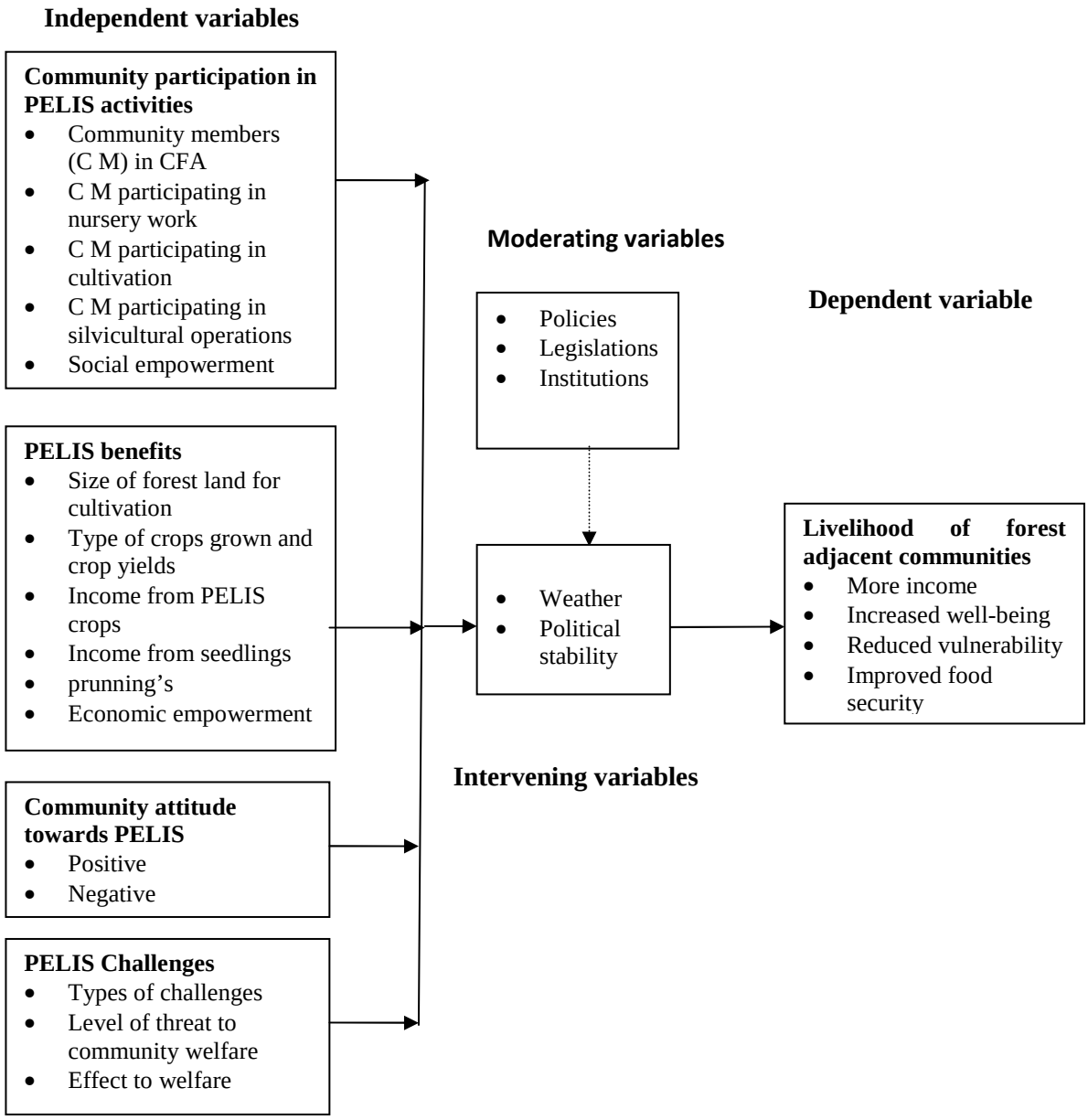

Figure1: Conceptual framework

From the conceptual framework, livelihood of forest adjacent communities depends on community participation in PELIS activities, PELIS benefits, community attitude towards PELIS and PELIS challenges. This relationship is moderated by government legislation and the institutions while weather conditions and political stability intervene on this relationship.

2.8 Gaps in the literature

From the literature it is observed that there is very little documentation of benefits accruing from plantation establishment livelihood improvement scheme to forest adjacent

communities. Literature available is on how PELIS is useful in ensuring high survival rate of planted seedlings at a reduced cost to the forest authorities.

2.9 Summary of the literature review

In this study, Literature Review has been done with the main purpose of exploring the influence of Plantation Establishment Improvement Livelihood Scheme on livelihood of forest adjacent communities, a case of Gathiuru Forest Station in Nyeri County.

Literature on community participation in PELIS activities on livelihood of forest adjacent communities established that forest adjacent communities are key stakeholders in forest management. They participate in PELIS activities to diversify their livelihood sources which ensure economic security thus contributing to social equity and poverty reduction. Most of the studies reviewed indicated that deferent Governments have used incentives such as land for cultivation, money or ownership of planted trees to encourage people to participate in tree planting and also reduce cost of plantation establishment.

On PELIS benefits literature from the global and regional perspectives indicated that forest adjacent communities were able to access forest land for cultivation earning financial income and food crops. Literature indicates that participating community members were able to meet their basic needs and pay school fees for their children. However, literature on local perspective had gaps on information on PELIS benefits accruing to forest adjacent communities thus need for the study.

Community attitude towards PELIS and its influence on livelihood of forest adjacent communities was also reviewed. Studies shows that forest adjacent communities had positive attitude towards PELIS and they were willing to participate in programmes where they are going to benefit. The attitude towards PELIS is influenced by their perception of the values and economic benefits they derive from the forest.

CHAPTER THREE:

RESEARCH METHODOLOGY

3.1 Introduction

This section presents the methods used to achieve the objectives of the study. It discusses the research design adopted in the study, the target population, the sample size and sampling procedures; research instrument used indicating how it was piloted. Validity and reliability of data collection instrument has also been discussed in this section. Finally, data collection procedures, data analysis techniques, ethical issues and operational definitions of variables are outlined in this section.

3.2 Research design

The study was carried out using descriptive research design because it is appropriate for collecting information about people's attitude, opinion, habits or any of the variety of social issues (Kombo & Tromp, 2006). This design is the best for this study mainly because the researcher was interested in answering the question "what is" the influence of PELIS on the livelihood of forest adjacent communities. This design is also the best in describing characteristics of a large population (Orodho, 2009). The questionnaire had both closed and open ended questions for data collection. Open ended questions gave the researcher the ability to look at whatever is being studied in so many various aspects and could provide a bigger overview.

3.3 Target population

Population refers to an entire group of individuals or events having common observable characteristics (Mugenda and Mugenda, 1999). Target population refers to all the members of a real or hypothetical set of people, objects by observing some of them and extending the results to the entire population or set of events (Orodho, 2009).The study focused on the 1,500 registered members of Mt. Kenya Gathiuru Community Forest Association participating in Plantation Establishment Livelihood Improvement Scheme (PELIS).

3.4 Sampling size and Sampling procedures

This section describes the sample size and the sampling procedure.

3.4.1 Sample size

A sample is a subject of a target population to which the research intends to generalize the findings. According to Saleemi (2009), a sampling frame is a list of all items of a population, a directory or index of cases where a sample can be drawn. The sample size for this study was 150 respondents.

3.4.2 Sampling procedure

The sample size for this study was obtained from a sampling frame of 1,500 registered members of Mt. Kenya Gathiuru Community Forest Association participating in PELIS. The study adopted Grbich's (2007) recommendation of picking a sample size of 10 % to 30 % for a study population of over 1,000 respondents. Therefore the sample size of this study was 10% of 1,500 which was 150 respondents

In order for all forest adjacent communities to be represented and to avoid bias, stratified random sampling was used in this study. This gave all the individuals in the defined population an equal chance of being selected as a member of the sample (Saleemi, 2009). The registered members of PELIS were grouped (stratified) as per sub-location from where they reside followed by simply random sampling using random numbers to pick the respondents. Random numbers were generated by use of Stat Trek's random number generator that uses a statistical algorithm to produce random numbers (http://stattrek.com/statistics/random-numbergenerator.aspx). The eight sub-locations adjacent to Gathiuru forest station formed the strata where samples were drawn proportionally as shown in Table 3.1.

Table 0.1: Sampling size

Location	Sub-location	Population representation as per the PELIS register	Sample size (10% of study population)
Gakawa	Kahurura	320	32
	Equator	60	6
	Kaaga	220	22
Githima	Gathiuru	220	22
	Bagoret	40	4
	Githima	40	4
Kiamathanga	Gikamba	320	32
	Kabendera	280	28
	Total	**1,500**	**150**

3.5 Research instruments

The study employed the use of a questionnaire as a research instrument. The questionnaires were used because they are convenient to use when handling a large group of respondents. The instrument consisted of both open and closed questions (Scott, 2006). The questions were grouped according to various variables to be studied.

The first section of the instrument covered questions on the demographic information of the respondents. Data pertaining to gender, age, marital status, main occupation, education level and size of the household were collected. Section two of the instrument focused on the first objective of the study which was to examine how community participation in PELIS activities influences the livelihood of forest adjacent communities while the third section focused on the second objective of the study which was to establish the extent to which PELIS benefits influence the livelihood of forest adjacent communities. Section four focused on objective three which was to assess how community attitudes towards PELIS influence the livelihood of forest adjacent communities while the fifth section sought to gather information on objective four, which was to determine how PELIS challenges influence the livelihood of forest adjacent communities. The instrument was administered by trained enumerators.

3.5.1 Pilot testing

The instrument was pre-tested in order to ensure that it yields the required information for the study. This was done by picking five respondents at Gathiuru Forest

Station, interviewing them and analyzing the test data to ensure the right information was captured. After the pre-test, the questionnaire was revised to make it fully appropriate to collect the required data.

3.5.2 Validity of the instrument

Validity is the accuracy and meaningfulness of inferences which are based on the research results. It can also be seen as the degree to which results obtained from the analysis of the data actually represent the phenomena under study. Validity means how accurately the data obtained in the study represents the variable of the study (Mugenda & Mugenda 1999). Validity test of data collection instrument enables to ascertain that one is measuring the correct concept and not something else. In order to insure validity of the research instrument the following was undertaken: The instruments were pretested for content validity in order to ensure that they yielded the required information during the survey by picking 5 respondents from Gathiuru forest. The results of pilot study were discussed with respondents and enumerators for correction of ambiguous and wrongly structured questions. This enabled the researcher to develop instruments that would yield valid, relevant and reliable data. The content of the instrument were designed in such a way that the questions in the instrument related to the objectives and variables in the conceptual framework of the study.

3.5.3 Reliability of the instrument

Reliability refers to the consistency of scores or answers from one administration of an instrument to another and from one set of items to another (Bishop, 2007) and the closer the value is to + 1.00, the stronger the congruence measure (Mugenda & Mugenda, 1999). Two common tests are test-retest and split half reliability. In this study Split-Halves Method was used to test reliability of the instrument. This method is more practical in that it does not require two administrations of the same or an alternative form test. In the split-halves method, the total number of items were divided into halves by placing odd numbers and even numbers into their subtests, and a correlation taken between the two halves which gave a split-half correlation of +0.67. This correlation only estimates the reliability of each half of the test. It was necessary then to use a statistical correction to estimate the

reliability of the whole test. By using Spearman-Brown prophecy formula (Pxx" = 2Pxx'/1+Pxx' where Pxx" is the reliability coefficient for the whole test and Pxx' is the split-half correlation) a reliability coefficient of +0.8 was established. Knapp (1985) indicated that a questionnaire with a correlation coefficient above +0.65 is reliable and can be used in a study implying that the instrument for this study was reliable.

3.6 Data collection procedures

Upon approval of the research proposal, the researcher obtained a research permit from the government to allow him collect the data. The forester Gathiuru Forest Station was contacted to guide the researcher on how to reach the respondents. The officer introduced the researcher to the community so that the researcher can explain about the study before data collection commenced. This was followed by identifying two enumerators and two language translators and training them. The training took one day followed by another day for pre-testing the instrument. After pre-testing various issues arising were incorporated into the instrument. Sampling was done based on the register available in the foresters' office and the data collection exercise started. The entire data collection exercise took five days. After the data collection, editing was done to avoid obvious errors and inconsistencies. At the end of each day, the researcher held brief meetings with the enumerators to review the day's experiences and also check the completeness and consistence of the data collected. At the same time all the questionnaires administered in a particular day were collected at the end of the day to avoid cases of alteration of the data collected.

3.7 Data analysis techniques

The data collected was both qualitative and quantitative in nature comprising of numeric and non-numeric types. Before analysis, the data was prepared by checking for accuracy and entering the data into a computer. The raw data was appropriately coded in readiness for analysis in order to organize it and provide a means to introduce the interpretations into quantitative methods. It involved reading the data and demarcating the segments within it. Each segment was labeled with "code" – a word or short phrase that suggests how the associated data segments inform the research objectives. Descriptive

statistics such as frequencies, percentages, mode, means and standard deviations were used to analyze the data. Statistical Package for Social Scientist (SPSS), Excel and Word computer packages were used in analyzing the data.

3.8 Ethical considerations

The Researcher carried out the study with utmost professionalism and sincerity in mind. Prior to administering the questionnaires to respondents, their consent were sought to partake the study at will. The Researcher made sure that the information availed in the process of data collection is specifically used for the purpose of the research work. To ensure confidentiality, respondents' names were not captured on the questionnaire instead questionnaires were given numerical codes. High level of integrity and honesty was upheld in the entire course of the study. The outcomes of the study were presented without manipulations thus the study gave credible findings and conclusion.

3.9 Operationalisation of the Variables in the Conceptual Framework

Table 0.2: Operationalization of variable

Objectives	Independent variable	Dependent variables	Indicators	Measurements	Scale	Data collection methods	Data analysis
To examine how community participation in PELIS activities influence the livelihood of forest adjacent communities	Community participation in PELIS activities	Livelihood of forest adjacent community	• Community members (CM) in CFA	• No. of members	• Nominal	Questionnaire	Descriptive analysis using SPSS
			• CM involved in nursery work	• No. of members	• Nominal		
			• CM involved in cultivation	• No. of members	• Nominal		
			• CM in community policing	• No. of members • Incentives	• Nominal		
			• CM in silvicutural operations	• No. of members	• Nominal		
			• Social empowerment	• No. empowered	• Nominal		
				• No. acquired skills	• Nominal		
To establish the extent to which PELIS benefits influence the livelihood of Forest adjacent communities.	PELIS benefits	Livelihood of forest adjacent community	• Forest land for cultivation	• Acres	• Nominal	Questionnaire	Descriptive analysis using SPSS
			• Type of crop /yields	• No. of crops/ tones	• Nominal		
			• Income from PELIS crops	• Income levels	• Ratio		
			• Income from seedlings	• Income levels	• Ratio		
			• Income from pruning's	• Income levels	• Ratio		
			• Economic empowerment	• No. empowered	• Nominal		
To assess how community attitudes towards PELIS influence the livelihood of forest adjacent communities.	Community attitude towards PELIS	Livelihood of forest adjacent community	• Positive	• Perception/Opinions	• Likert,	Questionnaire	Descriptive analysis using SPSS
			• Negative	• Perception/Opinions	• Likert		
To determine the influence of PELIS challenges on the livelihood of forest adjacent communities.	PELIS Challenges	Livelihood of forest adjacent community	• Types of challenge	• No. of challenges	• Nominal	Questionnaire	Qualitative analysis using SPSS
			• Magnitude of threat to welfare	• Threat levels	• Nominal		

CHAPTER FOUR:

DATA ANALYSIS, PRESENTATION AND INTERPRETATION

4.1 Introduction

This chapter presents the research findings beginning with response rate and demographic information of the respondents. The other sub-sections were presented based on the study objectives which are: influence of community participation in PELIS activities on the livelihood of forest adjacent communities, influence of PELIS benefits on the livelihood of forest adjacent communities, influence of community attitudes towards PELIS on the livelihood of forest adjacent communities and influence of PELIS challenges on the livelihood of forest adjacent communities.

4.2 Questionnaire return rate

The data was collected from a sample size of 150 forest adjacent communities participating in PELIS activities in Gathiuru forest in Nyeri County. The main respondents were randomly sampled from among community forest association members in the eight locations adjacent to the forest. For the purposes of answering research questions, the researcher assisted by well trained research assistants administered all the questionnaires in person to the respondents. The response is as shown in Table 4.1.

Table 4.1: Response rate

	Response		None response	
Sublocations	**Frequency**	**Percent**	**Frequency**	**Percentage**
Gikamba	31	20.7	1	0.7
Kaaga	22	14.7	0	0.0
Githima	4	2.6	0	0.0
Bagoret	4	2.6	0	0.0
Kahurura	30	20.0	2	1.3
Kabendera	28	18.7	0	0.0
Equator	6	4.0	0	0.0
Gathiuru	21	14.0	1	0.7
Total	**146**	**97.3**	**4**	**2.7**

Out of the 150 respondent sampled for data collection, 146 could be reached by the researcher and the research assistants. Those who were not reached were away from the research area during data collection. The response rate was therefore 97.3% which was very adequate for analysis, recommendations and conclusions. According to Frankel and Wallen, (2004) a response rate of over 95% in any study was deemed to be adequate. For the purpose of analysis the sample size for this study was therefore taken as 146 respondents.

4.3 Demographic information

In this section, the study sought to find demographic information on the respondent's gender, age, marital status, and level of education, household size and main occupation. This information forms the foundation of any study (Gall et al, 2003).

4.3.1. Gender of respondents

Gender was one of the demographic characteristics that the researcher was concerned with in order to fully understand its influence on the livelihood of forest adjacent communities. The respondents were asked to indicate their gender and they responded as shown in Table 4.2

Table 4.2: Gender of respondents

Gender	Frequency	Percent
Male	91	62.3
Female	55	37.7
Total	**146**	**100.0**

According to this study 62.3% of the respondents were male where as 37.7% were females. This implies that women were adequately represented in the study.

4.3.2. Respondents age

Age was another demographic characteristic that was the researcher was concerned with in order to understand its influence the livelihood of forest adjacent communities. To

determine how age influenced livelihood, respondents were asked to indicate their age in complete years. The ages of the respondents were captured in Table 4.3.

Table 4.3: Age of respondents

Age	Frequency	Percent
24-29	6	4.1
30-35	26	17.8
36-41	36	24.7
42-47	46	31.5
48-53	18	12.3
53 and above	14	9.6
Total	**146**	**100.0**

Majority of the respondents (31.5%) fell within the age class of 42-47 years. However, slightly more than a quarter of the respondents (46.6%) were less than 41 years of age and those of 48 years and above were the minority at 21.9%. This means that the respondents were within the active age of the working class and are heavily relied upon by their families for livelihood.

4.3.3. Respondent marital status

Marital status was another demographic variable the researcher was interested on as it has a bearing on the livelihood of forest adjacent communities. Respondents were requested to state their marital status and the responses were presented in Table 4.4.

Table 4.4: Marital status

Marital status	Frequency	Percent
Married	128	87.7
Divorced	10	6.8
Widows	2	1.4
Widowers	1	.7
Single	5	3.4
Total	**146**	**100.0**

From table 4.4, majority of the respondents indicated that they are married at 87.7% while divorced were 6.8% and widows and widowers were 1.4% and 0.7% respectively. Those who were single were only 3.4%. This means the majority of respondents were bread winners and dependants who toiled to ensure their household livelihood was enhanced in order to meet family requirements.

4.3.4. Respondent level of education

Education level was also one of variables the researcher was concerned with in order to fully understand its influence on the livelihood of forest adjacent communities as it has a bearing on human capital. The respondents were requested to indicate their level of education and the responses were presented in Table 4.5.

Table 4.5: Level of Education

Level of Education	Frequency	Percent
None	11	7.5
Primary	79	54.1
Secondary	48	32.9
Tertiary	8	5.5
Total	**146**	**100.0**

The majority of the respondent (54.1%) had primary school education while 32.9% and 5.5% had secondary education and tertiary education respectively. Those who had no formal education were 7.5%. This means that the forest adjacent communities were equipped with basic elementary education to adopt best farming practices which will influence their livelihood.

4.3.5. Respondent household size

Household size is one of the factors which are likely to influence the livelihood of forest adjacent communities. The researcher was interested on knowing the respondents household size and the results were presented in Table 4.6.

Table 4.6: Size of the Household

House hold size	Frequency	Percent
1	4	2.7
1-3	41	28.1
4-6	87	59.6
7-9	13	8.9
>10	1	0.7
Total	**146**	**100.0**

The most common household size is between 4-6 people at 59.6% followed by 1-3 persons at 28%. Those with only one member were 2.7% while those with 7-9 and over 10 household members were 8.9% and 0.7% respectively. In the rural set up, large number of people in a household is an asset for the purpose of providing labour for farm activities thus building on human capital.

4.3.6. Respondents main occupation

Main occupation was another variable the researcher was concerned with in order to understand its influence on the livelihood of forest adjacent communities since. The respondents were requested to indicate their occupation and the responses were presented in Table 4.7.

Table 4.7: Occupation of Respondents

Main occupation	Frequency	Percent
Farming	127	87
Business	16	11
Employed	3	2
Others	0	0
Total	**146**	**100.0**

The majority of the respondents were farmers at 87% while 11% were involved in business and 2% were employed. This implies that the respondents' welfare was dependent on farming activities both own-farms and in PELIS plots in the forest reserve.

4.4 Community participation in PELIS activities

This section of the study sought information to examine how community participation in PELIS activities influences the livelihood of forest adjacent communities. The study focused on social capital, diversification of sources of livelihood and human capital (experience, skills and knowledge gained in participating in PELIS activities).

4.4.1. Status of membership in the Mt. Kenya Gathiuru CFA

Membership in the CFA was one of the variables the researcher was concerned with in order to understand its influence on livelihood of forest adjacent communities. The question of whether the farmers participate in groups was important in terms of looking into the potential of social capital. Their responses were captured in Table 4.8.

Table 4.8: Membership of Response

Are you a member of the Mt. Kenya Gathiuru Community Forest Association?	Frequency	Percent
Yes	146	100
No	0	0
Total	**146**	**100.0**

All the respondents (100%) were registered members of Mt. Kenya Gathiuru Community Forest Association. This implies that participating in PELIS activities strengthens the social capital of the members of community forest association.

4.4.2. Reasons for joining the CFA

The respondents were requested to give reasons why they joined community forest association and the responses were presented in Table 4.9.

Table 4.9: Reasons for joining CFA

Reasons for joining CFA	Frequency	Percent
To reap benefits from the forests	7	4.8
To take part in conservation of forest and to reap benefits	139	95.2
I don't know	0	0
Others	0	0
Total	**146**	**100.0**

Majority of the respondents indicated that they joined the community forest association to take part in conservation and reap benefits from the forest at 95.2% while only 4.8% indicated that they joined the CFA to reap benefits. This implies that forest adjacent community view forests as an asset from which they can derive their livelihood if allowed to participate in its conservation activities.

4.4.3. Frequency of meeting

Frequency of meetings was one of the community participation variables the researcher was concerned with in order to understand its influence on the livelihood of forest adjacent community in terms of social networking. The responses were as indicated in Table 4.10.

Table 4.10: Frequency of meetings

Frequency of meetings	Frequency	Percent
Monthly	98	67.1
Quarterly	45	30.8
Once in a year	3	2.1
Total	**146**	**100.0**

Majority of the respondents indicated that they meet monthly at 67.1% while 30.8% and 2.1% meet quarterly and once in a year respectively. This implies that there was social networking in action which is one of the characteristics of social capital.

4.4.4. Enhancing social network, social support and trust

In order to examine how community participation in PELIS activities has enhanced social capital which is one of the building blocks of livelihood, the respondents were requested to indicate in a scale 1-5 whether they agree or disagree that PELIS has enhanced social network, social support and trust. Results were presented in Table 4.11.

Table 4.11: Social network

Extent of agreement that participating in PELIS activities has enhanced social networking, support and trust	Frequency	Percent
Definitely agree	139	95.2
Tend to agree	7	4.8
I don't know	0	0
Tend to disagree	0	0
Definitely disagree	0	0
Total	**146**	**100.0**

The respondents indicated that they definitely agree that participating in PELIS activities has enhanced social networking at 95% and tend to agree at 4.8%. None disagreed with the statement. This means, through community participating in PELIS activities the forest adjacent communities were living close to each other and had multiple family ties. These are important for networking on marketing of their farm produce and other social activities thus building on social capital.

4.4.5. PELIS activities undertaken by respondents

Nursery work, community forest policing, Cultivation work, Silvicultural operation work and Casual employment were some of the variables the researcher was concerned with in order to understand their influence on the livelihood of forest adjacent communities. Respondents were requested to indicate the activities they participate in and the responses were presented in Table 4.12.

Table 4.12: Activities undertaken by the respondents

Activities of respondents participate in	Frequency	Percentage
Nursery work	133	87.5
Community forest policing	52	34.2
Cultivation work	141	92.8
Silvicultural operation work	34	22.4
Casual employment	1	0.7

Cultivation work in the forest is the most undertaken activity by the respondents at a rating of 92.8% followed by nursery work at a response rate of 87.5%, community forest policing comes third at a rating of 34.2% and silvicultural operations came fourth at a response rate of 22.4%. Casual employment was the list at a response rate of 0.7%. This indicated that the respondents were participating in more than one activity thus diversifying their livelihood incomes.

4.4.6. Diversification of livelihood sources

In order to fully understand how community participation in PELIS activities diversifies sources of livelihood of forest adjacent communities, the respondents were requested to indicate in a scale 1-5 whether they agree or disagree with the statement that participating in PELIS activities diversifies the sources of livelihood and the responses were as indicated in Table 4.4

Table 4.13: Extent of diversification of livelihood source

Extent of agreement that participating in PELIS activities has diversified livelihood sources	Frequency	Percent
Definitely agree	126	86.3
Tend to agree	14	9.6
I don't know	6	4.1
Tend to disagree	0	0
Definitely disagree	0	0
Total	**146**	**100.0**

Majority of the respondents definitely agreed that participating in PELIS activities diversified livelihood sources at 86% and 10% tended to agree while those who did not know were 4.1%. No one tended to disagree with the statement. This implies that participating in PELIS activities diversified livelihood sources thus positively influencing the livelihood of forest adjacent communities.

4.4.7. Number of years the respondents have been involved in PELIS activities

In order to determine the experience gained as a result of participating in PELIS activities, the respondents were requested to state the number of years they have been involved in PELIS activities and responses were as indicated in Table 4.14.

Table 4.14: Number of years participating in PELIS activities

No. of years participating in PELIS activities	Frequency	Percent
1-2	56	38.3
3-4	78	53.4
5-6	12	8.3
Total	**146**	**100.0**

Majority of the respondents had 3-4 years working experience in PELIS activities at 53.4% while 38.3% had between 1-2 years experience and 8.3% had 5-6years experience. This implies that the forest adjacent communities through participating in PELIS activities had gained work experience which is relevant for livelihood improvement.

4.4.8. Acquisition of knowledge and skills

Social empowerment through participation in PELIS activities was one of the variables the researchers was concerned with in order to fully understand its influence on the livelihood of forest adjacent communities considering human capital development. In order to examine how participating in PELIS activities has enhanced human capital, the respondents were requested to indicate in a scale of 1-5 whether they agree or disagree that they have acquired knowledge and skills in forest management and the response was as indicated in Table 4.15.

Table 4.15: Knowledge and skills acquired

Level of agreement	Frequency	Percent
Definitely agree	141	96.6
Tend to agree	5	3.4
I don't know	0	0
Tend to disagree	0	0
Definitely disagree	0	0
Total	**146**	**100.0**

The majority of the respondents definitely agreed that they have acquired knowledge and skills in forest management at 96.6% while 3.4% tend to agree that they gained knowledge and skills. This implies that through participating in PELIS activities forest adjacent communities have socially been empowered.

4.5 PELIS benefits

This section of the study sought information to establish the extent to which PELIS benefits influence the livelihood of forest adjacent communities.

4.5.1. Respondent source of income

Source of income was one of the variables the researcher was concerned with in order to fully understand its influence on the livelihood of forest adjacent communities. The study sought to establish the respondent's economic activities by asking them to indicate their sources of income and the responses were indicated in Table 4.16.

Table 4.16: Source of income

Is your source of income from…..	On farm crops and livestock		PELIS crops		Petty business		Employment		Remittances	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
Yes	85	58.2	136	93.2	16	11.0	3	2.1	1	0.7
No	61	41.8	10	6.8	130	89.0	143	97.9	145	99.3
Total	**146**	**100.0**	**146**	**100.0**	**146**	**100.0**	**146**	**100.0**	**146**	**100.0**

The majority of the respondents indicated that their main source of income was from PELIS crops 93.2% while 58.2% indicated that their source of income is from on farm crops and livestock. Those involved in petty business were 11% while those employed were 2.1%. Only 0.7% respondent indicated the source of income as remittances. This implies that the respondents depend on farming as their main source of income.

4.5.2. Size of respondents forest land for cultivation

Size of forest land for cultivation was one of the variable the researcher was concerned with in order to understand its influence on the livelihood of forest adjacent communities. For comparison purposes, the study sought to find out whether the respondents have their own land outside the forest reserve and if yes how many acres was the land. The results were indicated in Tables 4.17 and 4.18 respectively.

Table 4.17: Ownership of land outside forest reserve

Do you have your own land for farming outside the forest?	Frequency	Percent
Yes	109	74.7
No	37	25.3
Total	**146**	**100.0**

The responses indicate that 74.7% own land outside the forest reserve while 25.3% indicated that they do not own land outside the forest.

Table 4.18: comparison of size of own land and size of land cultivated in the forest

Size of land owned outside the forest reserve (acres)	Frequency	Percent	Size of land cultivated in the forest (acres)	Frequency	Percent
<1	63	43.2	0 - 0.5	117	80.1
1.1-3	67	45.9	1- 1.5	26	17.8
3.1-6	16	11.0	2 -2.5	3	2.1
Total	**146**	**100.0**	**Total**	**146**	**100.0**

The respondents indicated that 43.2% owns less than an acre of land, 45.9% own 1.1-3 acres and 11% own 3.1-6 acres of land. On the other hand majority of the respondents

indicated that they cultivate 0.5 acres of land in the forest at 80% while 17.8% of the respondents indicated that they cultivated 1-1.5 acres and 2.1% indicated that they cultivated 2-2.5 acres. These findings indicate that forest adjacent communities are predominantly small farm holders a consequence of shortage of land for agriculture. Those that were landless relied on the forestry for regular supply of farmland under Plantation Establishment Livelihood Improvement Scheme.

4.5.3. Types Crops grown in own farms and PELIS plots

Types of crops grown was one of the variables the researcher was interested on in order to appreciate its influence on the livelihood of forest adjacent communities. The study sought to find out the types of crops grown both on own farms and in the allocated PELIS plots and responses were recorded in Table 4.19.

Table 4.19: Type of crops grown

Type of crop	Own farm		PELIS plots	
	Frequency	Percentage	Frequency	Percentage
Potatoes	97	66.4	129	88.4
Maize	106	72.6	3	2.1
Beans	99	67.8	19	13.0
Pease	11	7.5	4	2.7
vegetables	39	26.7	17	11.6

Maize was the major crop in own farm at 72.6% followed by beans at 67.8% and potatoes at 66.4%. Vegetables and Pease were the list cultivated at 26.7% and 7.5%. However, in the PELIS plots potatoes were major crop grown at 88.4% followed by beans and vegetable at 13% and 11.6% respectively. Pease were the list grown at 2.7%. This implies that maize is predominantly grown on farms outside the forest reserve and potatoes are predominantly grown in PELIS plots since wildlife damage dictates the type of crop to be grown in the PELIS plots.

4.5.4. Type of livestock kept

The respondents were asked to indicate the type of livestock they keep on their farms since they influence their livelihood and the responses were as indicated in Tables 4.20.

Table 4.20: Types of livestock kept

Type of livestock	Frequency	Percentage
Cattle	93	63.7
Sheep	73	50.0
Goats	30	20.5
Chicken	93	63.7
Rabbits	62	42.5

Cattle and chicken were the majority of livestock kept by the farmers at 63.7% while sheep, goats and rabbits were kept by 50%, 20.5% and 42.5% of the respondents respectively. From crops and livestock information it could be noted that people try to diversify their production in order to earn substantial income for improvement of their livelihood.

4.5.5. Quantity of crops harvested per year from PELIS plots

Quantity of crops harvested from PELIS plots was one of the variables the researcher was concerned with in order to fully understand their influence on the livelihood of forest adjacent communities. The study sought to establish the amount of the main crops harvested from the PELIS crops in a year and responses indicated that potatoes were the major crop cultivated in the PELIS plots and the quantity harvested in the last 12 months were indicated in Table 4.21.

Table 4.21: Quantity of potatoes harvested

Quantity of potatoes harvested (in 110 kg bags) in the last 12 months	Frequency	Percent
0-20	1	0.7
21-40	62	41.8
41-60	68	46.6
61-80	14	9.5
81-100	2	1.4
Total	**146**	**100.0**

The majority 46.6% indicated that they harvested between 41-60 bags per year, while 41.8% indicated a harvest of between 21-40 bags. 9.5% of respondents indicated that they

produced between 61-80 bags while 1.4% harvested between 81-100bags per year. Further analysis indicated that average production was 44 bags of potatoes per year. Since the average size cultivated in the forest was 0.5 acres, then the quantity of potatoes produced per acre per year was 87 bags. This implied that PELIS plots produced substantial amount of food crops to improve the livelihood of forest adjacent communities.

4.5.6. Income from PELIS crops

Income from PELIS crops was one of the PELIS benefit variables the researcher was concerned with in order fully understand its influence on the livelihood of forestry adjacent communities. For comparison purposes, the study sought to find out the level of net income of the respondent accruing from all sources, their own farms outside the forest reserves and those from PELIS plots and responses were shown in Table 4.22.

Table 4.22: Comparison of net annual incomes

Total net income per year from all sources			**Net annual Income from own farm crops and livestock**		**Net annual Income from of PELIS crops**	
Amount (Ksh)	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**
0-49,999	4	2.7	37	25.3	21	14.4
50,000-99,999	6	4.1	11	7.5	100	68.5
100,000-149,999	22	15.1	68	46.6	16	11.0
150,000-199,999	42	28.8	10	6.8	6	4.1
200,000-249,999	27	18.5	15	10.3	1	0.7
250,000-299,999	19	13.0	3	2.1	2	1.4
over 300,000	26	17.8	2	1.4	0	0
Total	**146**	**100.0**	**146**	**100.0**	**146**	**100.0**

From the net income from all sources, the majority (28.8%) of the respondents indicated they earned between Ksh 150,000-199,999 while net income from own farm, the majority (68%) indicated that they earned between Ksh 100,000-149,999 and from PELIS crops the majority (68.5%) indicated to have earned between Ksh50,000-99,999. The net average income from all sources was Ksh 208,219, and that from own-farm crops was Ksh 115,411 while from PELIS crops were Ksh 81,164. Further analysis indicates that sale of PELIS

crops contribute 39% of the household incomes. This implies that sale of PELIS crops contributed substantially to the livelihood of forest adjacent communities.

4.5.7. Income from seedlings and pruning's

Income from seedlings and pruning's were some of the variables under PELIS benefits the researcher was concerned with in order to fully understand their influence on the livelihood of forest adjacent communities. The study sought to find out the income respondents accrued from participating in tree nursery work and silvicultural operations and results were indicated in Table 4.23.

Table 4.23: Annual income from sale of seedlings and pruning's

	Annual income from sale of Seedlings		**Annual income from sale of Pruning's (withies or fittos)**	
Amount Ksh	Frequency	Percent	Frequency	Percent
0	70	47.9	103	70.5
1-10,000	63	43.1	30	20.5
10,000-20,000	10	48.7	12	8.2
20,001-30,000	2	1.4	1	0.7
30,001-40,000	1	0.7	1	0.7
Total	**146**	**100.0**	**146**	**100.0**

From Table 4.23, the results from the respondents indicated that 47.9% and 70.5% had not accrued any income from the sale of seedlings and pruning's respectively for the last one year. The majority (48%) of the respondents indicated that they earned between Kshs 10,001- 20,000 from the sale of seedlings while 20.5% indicated to have earned between Kshs 1-10,000 from sale of pruning's. On further analysis, the average income from sale of seedlings was Kshs 4,041 per year and silvicultural operations were Kshs 2,568 which contributed 2% and 1.2% of the total household income respectively. Apart from financial gains from sale of pruning's and seedlings, the community benefited from other none timber forest products like fuel wood, grazing and climatic amelioration.

4.5.8. Food security

Food security was one of the PELIS befits variables the researcher was concerned with in order to fully understand its influence on the livelihood of forest adjacent communities. The respondents were asked to indicate whether they were self food reliant throughout the year and the responses were as indicated in Table 4.24.

Table 4.24: Self sufficient in food

No.of months	Frequency	Percent
1-3	10	6.8
4-6	6	4.1
7-9	15	10.3
10- 12	115	78.8
Total	**146**	**100.0**

The majority (78.8%) of the respondents indicated that they were food self reliant throughout the year followed by 10.3% who indicated they are self food reliant for 7-9 months and 6.8% indicate they are self reliant for food for 1-3 months. The 4.1% indicated that they are food self reliant for 4-6 months. This implies that PELIS enhances food security of forest adjacent communities.

4.5.9. Economic empowerment

Economic empowerment was one of the PELIS benefit variables the researcher was concerned with in order to fully understand its contribution to the livelihood of forest adjacent communities. The study sought to find out how respondents have invested the gains accrued from PELIS and the responses were indicated in Table 4.25.

Table 4.25: Investment from PELIS gains

Have you invested PELIS gains in...?	Starting business		Buying a car		Building a house		Buying a plot		Paying school fees		Purchasing a motorbike	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
Yes	24	16.4	3	2	48	32.9	29	19.9	107	73.3	16	11
No	122	83.6	143	98	98	67.1	117	80.1	39	26.7	130	89
Total	**146**	**100**	**146**	**100**	**146**	**100**	**146**	**100**	**146**	**100**	**146**	**100**

The majority (73.3%) of the respondents indicated that they have been able to pay school fees for their children followed by 32.9% who indicated that they built a house and 19.9% who bought a plot while 16.4% of the respondents indicated that they started a small business and 11% indicated that they purchased motorbikes and 2% bought cars. This implies that forest adjacent communities were economically empowered. Information obtained from income from PELIS and investments undertaken clearly implies that PELIS benefits have a positive influence on the livelihood of forest adjacent communities.

4.6 Community attitude towards PELIS

This section of the study sought information to assess how community attitudes towards PELIS influence the livelihood of forest adjacent communities in regard to nine major statements put at five point likert scale : strongly disagree (1); disagree (2); uncertain (3); agree (4) and strongly agree (5). A mean score was used for analysis as presented in Table 4.26

Table 4.26: Attitude of communities towards PELIS

	N	Minimum	Maximum	Sum	Mean	Std. Deviation
1. PELIS is the best method of establishing forest plantations.	146	4	5	626	4.29	.454
2. PELIS has improved food security of forest adjacent communities	146	4	5	630	4.32	.466
3. Participating in PELIS is more paying than rural wage employment	146	3	5	680	4.66	.492
4. PELIS has positive influence on the livelihood of forest adjacent communities	146	4	5	680	4.66	.492
5. PELIS has improved the living standard of forest adjacent communities since its inception.	146	3	5	635	4.35	.518
6. KFS does not exploit forest adjacent communities participating in PELIS activities	146	2	5	616	4.22	.432
7. Forest adjacent communities are satisfied with PELIS as a source of livelihood.	146	3	5	626	4.29	.454
8. There is drastic improvement of the status of forest plantation establishment in Gathiuru forest since the introduction of PELIS	146	3	5	727	4.99	.519
9. PELIS is a colonial system of enslaving forest adjacent communities to work in forest plantations	146	1	3	228	1.56	.325

Items (1) and (2) were agreed with a mean scores of 4.29 and 4.32, that PELIS is the best method of establishing forest plantations and PELIS has improved food security of forest adjacent communities respectively. Item (3) and (4) were strongly agreed with mean scores of 4.66 and 4.66 that, participating in PELIS activities is more paying than rural daily wage employment and PELIS has a positive influence on the livelihood of forest adjacent communities respectively. Items (5), (6) and (7) were agreed with a mean score of 4.35, 4.22 and 4.29 that, PELIS has improved the living standard of forest adjacent

community since inception; Kenya forest service does not exploit PELIS farmers since there is mutual benefit between KFS and PELIS farmers and Forest adjacent communities are satisfied with PELIS as a source of livelihood income. Item (8) was strongly agreed with a mean score of 4.99 that; there is drastic improvement of the status of forest plantation establishment in Gathiuru forest since the introduction of PELIS and Item (9) was disagreed at a mean score of 1.56 that PELIS is a colonial system of enslaving forest adjacent communities to work in forest plantations. The overall mean score was recorded as 4.5 which implied that forest adjacent communities had a positive attitude towards PELIS. Forest adjacent communities were faithful and committed to the rules guiding the operation of the system. Positive community attitude toward PELIS motivates them to devote their energies and resources in PELIS in order to improve their livelihood.

4.7 PELIS challenges

This section of the study sought information to determine the influence of PELIS challenges on livelihood of forest adjacent communities by focusing on types of PELIS challenges, level of threat to livelihood, effects of PELIS challenges to livelihood and suggestions to encounter the challenges.

4.7.1. Types PELIS challenges

Types of PELIS challenges was one of the variables the researcher was concerned with in order to fully understand their influence on the livelihood of forest adjacent communities. Respondents were asked to indicate the types of PELIS challenges they face and the responses were presented in Table 4.27.

Table 4.27: Types of PELIS challenges

PELIS challenges	Frequency	Percentage
Poor forest roads	120	82.2
Lack of market	77	52.7
Limited forest land for cultivation	127	87.0
Limited benefits compared to costs	57	39.0
Wildlife damage	99	67.8
Distance of PELIS plots from the village	59	40.4

From Table 4.27 the majority (87%) of the respondents indicated limited forest land for cultivation as a challenge followed by poor forest roads at 82.2% and wildlife damage at 67.8%. Lack of market and limited benefits were rated list at 52.7% and 39% respectively. The minimum amount of land one can be allocated in the forest through balloting was 0.5 acres and farmers were allowed to intercrop with trees for a period of three years when the canopy closure cannot allow growth of crops. PELIS farmers were worried because there was no harvesting of mature trees to pave way for new forest plantation establishment.

4.7.2. Level of threat of PELIS challenges to community livelihood

Level of threat of PELIS challenges was one of the variables the researcher was concerned in order to understand its influence on the livelihood of forest adjacent communities. The respondents were asked to rate the PELIS challenges in order of magnitude of threat to the livelihood of forest adjacent communities and the responses were indicated in Table 4.28.

Table 4.28: Types of PELIS challenges and level of threat

	Level of threat to community livelihood							
	No threat		Minor threat		Major threat		Total	
Type of challenges	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**
Poor forest roads	5	3.4	27	18.5	114	78.1	146	100
Lack of market for PELIS crops	12	8.2	75	51.4	59	40.4	146	100
Limited forest land for cultivation	15	10.3	37	25.3	94	64.4	146	100
Limited benefits compared to costs	38	26.0	94	64.4	14	9.6	146	100
Wildlife damage to crops	23	15.8	52	35.6	70	47.9	146	100
Distance of PELIS plot from home village	59	40.4	71	48.6	16	11.0	146	100

Poor forest roads was rated to be a major threat to community livelihood at 78% followed by limited forest land for cultivation at 64.4% and wildlife damage at 47.9%. Lack of market was also rated as one of the major threats at 40.4% while limited benefits compared to costs was a minor threat at 64.4%. Distance of PELIS plots to the villages was a minor threat at 48.6% to community livelihood implying that majority of the respondents came from within a radius of 5km from the forest.

4.7.3. Effect of PELIS challenges on livelihood of the respondents

Effect of PELIS challenges on the livelihood of forest adjacent communities was one of the variables the researcher was concerned with. The study sought to examine the effect of PELIS challenges on the welfare of the respondents and the results were indicated in Table 4.29.

Table 4.29: Effects of PELIS challenges to livelihoods

How do the challenges you encounter affect your livelihood?	**Frequency**	**Percent**
Reduce profit margins	131	89.7
No effect	2	1.4
Make losses	1	0.7
Kill morale	12	8.2
Total	**146**	**100.0**

Majority of the respondents (89.7%) indicated that the challenges do reduce the profit margins and 8.2% indicated that they kill their morale. This implies that PELIS challenges had a negative influence on the livelihood of forest adjacent communities.

4.7.4. Suggestions to the challenges

The respondents were asked to indicate three 3 major challenges and suggest what should be done in order to improve PELIS so that it can accrue more benefits to the forest adjacent communities. The responses were indicated in Table 4.30.

Table 4.30: Suggested solutions to PELIS challenges

Type of challenge	Suggested solution	Freq	Percent
Poor forest roads	Put marrum/Maintain them	114	78.1
Marketing of PELIS crops	Regulate/control market/packaging of 110kg bags	44	30.1
Limited forest land for cultivation	Harvest mature forest plantation to pave way for establishment new plantation	60	41.1
Wildlife damage	Put electric fence around the forest plantation areas	68	46.6

Majority (78.1%) of the respondents suggested that forest roads should be marrumed or maintained regularly to allow easy transportation of PELIS crops. On marketing 30.1% of the respondents suggested that the markets should be regulated and packaging should be limited to 110kg bag while on limited forest land for cultivation, 41.1% suggested that mature plantation should be harvested to pave way for establishment of new young forest plantation. On wildlife damage 46.6% of the respondents suggested of putting up electric fence around the forest plantations areas. This implies that implementation of suggestions made will have a positive influence of the livelihood of the forest adjacent communities.

CHAPTER FIVE:

SUMMARY OF FINDINGS, DISCUSSIONS, CONCLUSSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter presents summary of the findings, discussion, conclusion and recommendations.

5.2 Summary of findings

This section deals with summary of the findings from the data analysis in line with the objectives and the research questions.

5.2.1 Community participation in PELIS activities on livelihood of forest adjacent communities

The findings on how community participation in PELIS activities influence the livelihood of forest adjacent communities indicated that women being the source of food security at the household were adequately represented at 37.7% against men at 62.3%. The majority (95.2%) of forest adjacent communities indicated that they joined community forest association to participate in forest conservation and reap benefits. The findings indicated that the respondents participated in more than two activities as results showed that 92.8% were involved in cultivation, 85.5% in tree nursery work and 34.5% in silvicultural work. The majority (95.2%) of the respondents indicated that social network was enhanced by participating in PELIS activities, while 86% definitely agreed that participating in PELIS diversified their livelihood sources and 96.7% had acquired skills and knowledge in forest management. This implies that participating in PELIS activities diversifies the sources of livelihood and enhances both social and human capitals which are some of the building blocks of livelihoods.

5.2.2 PELIS benefits on livelihood of forest adjacent communities

The findings on the extent to which PELIS benefits influence the livelihood of forest adjacent communities indicated that majority (80.1%) of the respondent cultivate 0.5 acres of land in the forest and PELIS crops contributed an average of about 87 bags of potatoes per acre per year and financially it contributed 39% of the total household income

in a year. Nurseries and silvicultural operations contributed 2% and 1.2% respectively. On food security the majority (78.8%) of the respondents indicated that they were food self reliant throughout the year while on economic empowerment the majority (73.3%) indicated that they were able to pay school fees for their children. This implies that economically PELIS has a positive influence on the livelihood of forest adjacent communities.

5.2.3 Community attitude towards PELIS on livelihood of forest adjacent communities

Study on community attitude towards PELIS was carried out and majority of respondents were in favour of PELIS as the best method of forest plantation with a mean score of 4.6. Majority suggested that participating in PELIS is more paying than rural wage employment with mean score of 4.66 and majority agreed that KFS does not exploit PELIS farmers with a mean score of 4.6. Majority disagreed that PELIS is a colonial system of enslaving forest adjacent communities to work in the forest was disagreed at mean score of 1.56. In general the overall mean score was 4.5 implying that forest adjacent communities had positive attitude towards PELIS.

5.2.4 PELIS challenges on the livelihood of forest adjacent communities

The findings on how PELIS challenges influence the livelihood of forest adjacent communities indicated that the majority (87%) of the respondents indicated limited forest land was a challenge followed by poor forest roads at 82.2% and wildlife damage at 67.8%. The study further found out that 89.7% of the respondents indicated that PELIS challenges reduced their profit margins. This implies that PELIS challenges had a negative influence on the livelihood of forest adjacent community.

5.3 Discussions of findings

This section provides discussion of the findings of the study based on the four research objectives and research questions of the study.

5.3.1 Community participation in PELIS activities on livelihood of forest adjacent communities

The first objective of the study was to examine how community participation in PELIS activities influences the livelihood of forest adjacent communities. The results indicated that the majorities (62.3%) of the respondents were males and 37.7% were females indicating that the women were adequately represented in PELIS activities. The study findings disagrees with a study undertaken by Benjamin (2010) on Women in Community Forestry Organization: An empirical study in Thailand in which he found out that women were not well represented in forest conservation initiatives despite the fact that they were source of food security in their household. However, it concurs with a study by Obonyo (2009) on integrating gender on forest management which found that 49% of the community members participating in PELIS were women. This indicated that women preferred activities that contributed to the subsistence economies of their households and those that gave them enough time to attend to household activities.

The study found out that the majority of the respondent (98.4%) fell within age class of between 24-53 years which is within the active age of the working class and are heavily relied upon by their families for livelihood. Majority of the participants (87%) were married and 59.6% had a household size of 4-6 persons meaning they were sole bread winners of the family. The results showed that majority (54.1%) of the respondent had primary education, 32.9% had secondary education and those who had tertiary education were 5.5%. Those who had no education were 7.5%. Those with higher level of education tend to migrate to urban centers for white collar jobs. The results indicated that all (100%) community members participating in PELIS activities were registered members of Mt. Kenya Community Forest Association meaning that they were in compliance with the Forest Act 2005 which requires that for community members to participate in any activity in a Government forest they must be members of a registered group. Further to this, the majority (95.2%) of respondents indicated that they joined the CFA to take part in conservation of forest and to reap benefits. This was in agreement with Obonyo (2009) in her study on gender integration in forest resource management conducted in Mt Kenya, Aberdares, Kakamega and Mau who found that majority (58%) of the community forest association members joined the community forest association to benefit from forest

resource which included access to forest land for cultivation, sale of tree seedlings and firewood collection among others. The findings were also in agreement with what Salim (1999) found in his study in Mexico's Yucatan peninsula, where 16,000 subsistence farmers joined together with the Government, Local Foresters and Conservationists to deal with issues of forestry and land degradation and periods of hunger were introduced to activities such as Taungya System which can stabilize land use and make the best use of cleared forest land for livelihood improvement.

The study results indicated that the majority of the respondents (95.2%) were in agreement that participating in PELIS activities had enhanced social network, social support and trust. The respondent had come together to form community based organizations and they indicated that 67.5% meet monthly to discuss issues affecting their livelihood and participate in fund raising. Social networking has been used by the forest adjacent community to have a collective bargaining power in selling their farm and PELIS crops in order to win out middle men and were now packaging the potatoes in 110kg standard bags instead of having extended bags sometimes weighing up to 160kg. This means that participating in PELIS activities has enhanced social capital which is one of the building blocks of livelihood. This was in agreement with Tagoe (2012) that Community Forest Association membership seems to strengthen the social capital of the community members living adjacent to the forests with a goal of improving forest management while improving their livelihood. Social capital includes characteristics of social organizations such as networks, norms, and trust that enable participants to act together more effectively in order to pursue shared objectives.

The study found out that the respondent had diversified PELIS related activities which they undertook to enhance their livelihood. Majority (92.8%) were involved in cultivation while 87.5% were involved in tree nursery work and 34% were involved in silvicultural operations. The respondents were participating in more than two activities both in the forest and on their farms in order to maximize on livelihood enhancement. The majority (86%) of the respondents definitely agreed that participating in PELIS activities diversified the livelihood sources of forest adjacent communities. This was in agreement with Scoone's (2009) that single activity does not raise enough money or products for a

livelihood, so multiple activities should be undertaken to build one's livelihood. In this case diversity was important, because people make a living through a complex web of activities.

Human capital is one of the building blocks of livelihood of communities living adjacent to the forest. This study results indicated that over 61% of the respondents had over three years working experience in PELIS activities and 96.6% agreed to have acquired knowledge and skills in forest management. The knowledge and skills acquired has been utilized by the respondent to establish their own tree nurseries on their farms for income generation and the community forest association can be contracted by Kenya Forest Service or other stakeholders to carry out some of the forest silvicultural operation under the supervision of the forester.

5.3.2 PELIS benefits on the livelihood of forest adjacent communities

The second objective of the study was to establish the extent to which PELIS benefits influence the welfare of forest adjacent communities. Plantation Establishment Livelihood Improvement Scheme has been used by forest adjacent communities to earn a living from cultivation of food crops, sale of tree seedlings and prunings from silvicultural operations. The study found out that the majority of the respondents were farmers and their main source of income was from sale of PELIS crops at 98.2% and on-farm crops and livestock at 58.2%. Majority (74.7%) of the respondents indicated that they own land outside the forest reserve for farming. However, the size of land owned by the respondents outside the forest reserve were small as 89.1% of the respondents indicated that they had less than 3 acres. This was in agreement with the findings of Victor and Bakare (2004) on their study on rural livelihood benefits from participating in Taungya Agroforestry System in Ondo state of Nigria where they noted that two thirds of all productive land holdings in Africa are less than two hectares. This means that the farmers were faced with insufficient cultivation land to produce enough food for the family and for sale as a result they depend on land in the forest for additional income. Most of the respondents (80.1%) were allocated a minimum size of 0.5 acres of land in the forest reserve.

The study found out that maize was rated (72.6%) as the mojar crop grown on own-farms while potatoes were mostly (88.2%) grown in PELIS plots mainly for commercial purposes. Apart from the crops the respondents also keep livestock like cattle, chicken, sheep, goats and rabbits. Chicken and cattle dominated at 63.7% of the livestock kept by the respondents. The study found out that the majority of PELIS farmers (46.6%) produced between 40-60 bags of potatoes per year on their 0.5 acres PELIS plots. On average, production per acre was 87 bags per year. This was slightly higher than what Kariuki (2006) found in Kabaru forest that a one acre of forest plot under potatoes could fetch 30-40 bags in a three months period translating to 60-80 bags per year since there are two harvests in a year.

Comparison of the net annual incomes from all sources, own-farm crops and livestock and PELIS crops showed that the average annual income from all sources was Ksh 208,219, and that from on-farm crops and livestock was Ksh 115,411 while from PELIS crops were Ksh 81,164. This implies that sale of PELIS crops contributed 39% of the household incomes. This agrees with Chamshama (1992) that the financial returns that accrues to the farmer through sale of food under Taungya is substantial to play a role in reducing the often exaggerated doubts that the Taungya System exploits the peasant farmers. The study further found out that the respondents earned income from sale of seedlings amounting to an average of Ksh 4,041 and pruning's amounting to Kshs 2,568 per year which contributed 2% and 1.2% of the total household income respectively. The majority of the respondents (78.8%) indicated that they were food self reliant throughout the year and 73.3% indicated that they have been able to pay school fees for their children in school while 48% indicated that they built a house through the gains from the Plantation Establishment Livelihood Improvement Scheme. This study was in agreement with Ledger (2009) on her study on consequences of the introduction of the modified Taungya system in Ghana's high forest zone for the livelihoods of forest-fringe communities which reported that Modified Taungya System was perceived on the whole as a positive system that was having a positive impact on people's livelihoods; enabling a better access to food and increasing ability to pay for education and housing. The study also agrees with Nasiah (2010) that forest adjacent communities participate in PELIS activities to generate

additional income and ensure economic security thus contributing to social equity and poverty alleviation.

5.3.3 Community attitudes towards PELIS on the livelihood of forest adjacent communities

The third objective was to assess how community attitudes towards PELIS influence the livelihood of forest adjacent communities. Study results on community attitude towards PELIS indicated that most of the respondents were in favour for PELIS. Majority agreed that a PELIS is the best method of establishing forest plantations at a mean score of 4.29 and has improved food security of forest adjacent communities at a mean score of 4.32. Participating in PELIS activities was more paying than rural daily wage employment and PELIS has a positive influence on the livelihood of forest adjacent communities were strongly agreed at a mean score of 4.66. This is in agreement with the finding of a study by Chemshama (1992) that income from Taungya System was higher than income per labour-day under pure reforestation system as the revenue accruing from sale of crops translated to Tshs 508 per day while income per labour-day was Tshs 100. PELIS has improved the living standard of forest adjacent communities since its inception was agreed at a mean score of 4.35 while KFS does not exploit forest adjacent communities participating in PELIS activities were agreed at a mean score of 4.22. This disagrees with the debate of several authors, including Mergen (1978) and Nao (1978) and environmental pressure groups like the Green Belt Movement allegations (Khalumba, 2010) that the Taungya farmer is exploited by participating in the establishment of plantations without being adequately rewarded. However, this study is in agreement with Kio and Bandas (1981) study in South West Nigeria where 99% of the farmers reported that they gained from Taugya System. Forest adjacent communities are satisfied with PELIS as a source of livelihood was agreed at mean score of 4.29 while drastic improvement of the status of forest plantation establishment in Gathiuru forest since the introduction of PELIS was strongly agreed at a mean score of 4.99. These findings disagrees with Green Belt Movement allegations documented by Kariuki (2006) that cultivation in the forest focuses more on economic gains undermining environmental conservation.

The overall mean score for the study result on community attitude was 4.5 implying that forest adjacent communities had positive attitude towards Plantation Establishment Livelihood Improvement Scheme. The study confirms a study by Kobbail (2012) on attitude of community on forestry programs in Southern Sudan which showed that almost all the respondents have a particularly favourable perception of the community forestry programmes implemented and they perceive the best type of management for running these forests for livelihood improvement. This is also in agreement with a study by Michael (2011) which examined attitudes of primary stakeholders towards Taungya System in Ghana, in Subri Forest Reserve, whose results revealed that primary stakeholders have positive attitudes towards Taungya System and this was not dependent on the location of the community. Their attitude towards Taunya System is influenced by their perception of forest values and economic benefits they derive from the forest. This study is also in agreement with Ledger (2009) on her study on consequences of the introduction of the modified Taungya system in Ghana's high forest zone for the livelihoods of forest-fringe communities which reported that Modified Taungya System was perceived on the whole as a positive system that was having a positive impact on people's livelihoods; enabling a better access to food and increasing ability to pay for education and housing.

5.3.4 PELIS challenges on the livelihood of forest adjacent communities

The fourth objective was to determine the influence of PELIS challenges on livelihood of forest adjacent communities. The study found out that the majority (87%) of the respondents indicated limited forest land as a challenge followed by poor forest roads at 82.2% and wildlife damage at 67.8%. Majority of the forest adjacent communities were allocated a minimum of 0.5 acres through balloting due to limited forest land available for PELIS while the demand was high. This posed a challenge to farmers who wanted to maximize their livelihood through PELIS. This study results agrees with a study by Maug (2007) on the socio economic situation of plantation villagers in Myanmar which indicated that area allocated for farming may be too small to produce enough food for household consumption and sale thus unable to meet their wellbeing.

The study also found out that poor forest road was rated to be a major threat to community livelihood at 78% followed by limited forest land for cultivation at 64.4% and wildlife damage at 47.9%. This was contrary to the findings by Hill (2000) who indicated that previous work with farmers living around the southern edge of the Budongo Forest Reserve, Uganda, confirmed that many of them considered wildlife to be a major threat to their livelihood. Majority of the respondents (89.7%) indicated that the PELIS challenges reduced their profit margins. This implies that PELIS challenges had a negative influence to the livelihood of forest adjacent communities. Majority (78.1%) of the respondents suggested that forest roads should be upgraded to all weather roads or maintained regularly to allow easy transportation of PELIS crops to the market and 46.6% suggested that plantation area should be fenced off. Majority (41.1%) suggested that those mature plantations which have reached economic age should be harvested to pave way for establishment of young ones. This will ensure sustainability of the Plantations Establishment Livelihood Improvement Scheme.

5.4 Conclusions

From the findings, the study concludes that Plantation Establishment Livelihood Improvement Scheme diversifies livelihood sources of forest adjacent communities by participating in various activities and has enhanced their social network, knowledge and skills. Forest adjacent communities had a positive attitude towards PELIS an indication that they do benefit from the scheme. Despite the challenges of poor forest roads, limited forest land for cultivation and wildlife damage; the study has established to some extent that plantation establishment livelihood improvement scheme positively influence the welfare of forest adjacent communities. The scheme generates livelihood outcomes in the form of more adequate income; increased wellbeing and improved food security which enhances people's living standards or enable them reduce poverty levels.

5.5 Recommendations

Based on the findings, the study recommends the following:

1. Wildlife especially the elephants destroys crops and young plantations. Therefore the study recommends KFS to put electrical fence around the plantation area to avoid wildlife damage.

2. Poor forest roads posed a challenge to the implementation of PELIS especially when it comes to harvesting and marketing of the crops. The study recommends that KFS should maintain forest roads regularly or upgrade them to all weather roads to enhance transportation of food crops.

3. Forest area earmarked for PELIS was limiting as farmers were allocated a minimum of 0.5 acres. Since there are over mature plantation, the study recommends the harvesting of these forest plantations to pave way for establishment of new plantation in order to ensure sustainability of the forest resource.

4. Potatoes were the major crops grown by PELIS farmers. However, the study found out that the potatoes were being sold to middle men using extended bags which sometime could weigh 160kg thus making farmers loose. The study recommends to the Government to regulate the packaging and marketing of potatoes to 110kg bags.

5. Farmers were playing a very important role in clearing forest area ready for planting, doing the planting of trees and in maintaining the trees planted for a period of three years. It is recommended that the forest authorities provide incentives to these farmers. Such incentives can be in the form of cash advance (payment for environmental services or carbon credit) and supply of farm inputs like fertilizer and fungicides. Further to this, since the forest adjacent communities have acquired knowledge, skills and experience, KFS should contract them to manage some of the operations such as seedling production.

5.6 Suggestions for further studies

This study proposes areas of further study as follows:

1. A study on factors influencing forest adjacent communities to Participate in Plantation Establishment Livelihood Improvement Scheme.

2. A study to examine whether there are more opportunities available under PELIS is necessary for the forest adjacent communities to benefit more from plantation development; for example the carbon credit and payment for environmental services.
3. A study on how forest adjacent communities will build their livelihood after the canopy closure is necessary.
4. A comparative analysis of livelihood of forest adjacent communities between PELIS participants and non- PELIS participants.
5. Cost benefits analysis between the forest adjacent communities participating in PELIS and the Kenya Forest Service.

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APPENDICES

Appendix I: Letter of transmittal on data collection

Nicodemus Mwachugha Mwatika

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NAIROBI.

Dear respondent,

REF: LETTER OF TRANSMITAL ON DATA COLLECTION.

I am a Masters student of the University of Nairobi- Nairobi Extra Mural Centre undertaking Master of Art degree in Project Planning and Management. My registration number is L50/69442/2011. I am conducting a study on the influence of plantation establishment livelihood improvement scheme on the welfare of forest adjacent communities in Gathiuru Forest Station, Nyeri County.

I am interested in your opinions and suggestions. Although I understand that your schedule is busy, I am hoping that you will take the little time required to respond to the questions contained in the questionnaire. I want you to know that your responses will be of great value to the completion of this study.

Please note that all the information provided will be treated with a lot of confidentiality and will only be used for the purposes of this study.

Yours sincerely,

Nicodemus Mwachugha Mwatika

Appendix II: Questionnaire for a study on the influence of PELIS on livelihood of Gathiuru forest adjacent communities.

Name of Location _____ sub-location _____ questionnaire no. _____

Section 1: Bio-data

Please tick/ fill the appropriate answer where applicable

1. Gender: (a) Male [ ] (b) Female [ ]
2. What is your age? _____
3. What is your marital status?
   (a) Married [ ] (b) Divorced [ ] (c) Widow [ ] (d) Widower [ ] (e) Single [ ]
4. What is your main occupation?
   (a) Farming [ ] (b) Business [ ] (c) Employed [ ] (d) Others (specify)_____
5. What is the highest level of education have you attained?
   (a) None [ ] (b) Primary [ ] (c) Secondary [ ] (d) Tertiary [ ]
6. What is the size of your household?
   (a) 1-3 [ ] (b) 4-6 [ ] (c) 7-9 [ ] (d) more than 10 [ ]

Section 2: Participation in PELIS activities

7. Are you a member of the Mt. Kenya Gathiuru Community Forest Association?
   a) Yes [ ] b) No [ ]
8. What is the name of your user group? _____
9. How many times do you meet in a year?
   (a) Monthly [ ] (b) quarterly [ ] (c) twice in a year [ ] (d) once in a year [ ]
10. Why did you join the CFA?
    (a)To take part in conservation of the forest [ ] (b) to reap benefits from the forests [ ]
    (c) Both (a) and (b) [ ] (d) I don't know [ ] (e) other (specify)……
11. Which of the following activities do you participate in?
    (a) Nursery work [ ] (b) Community forest policing [ ] (c) cultivation [ ]
    (d) Silvicultural operations [ ] (e) Casual employment in tree planting and tending [ ]
12. How many years have you been participating in the above activities
    _____
13. To what extent do you agree or disagree that participating in PELIS activities has enhanced the social network, social support and trust among forest adjacent communities.
    (a) Definitely agree [ ] (b) Tend to agree [ ] (c) I don't know [ ]
    (d)Tend to disagree [ ] (e) Definitely disagree

14. To what extent do you agree or disagree that through participating in PELIS activities you have acquired knowledge and skills in forest management.

    (a)Definitely agree [ ] (b) Tend to agree [ ] (c) I don't know [ ]
    (d)Tend to disagree [ ] (e) Definitely disagree

Section 4: PELIS benefits

15. What is your main source of income?
    (a)On farm crops [ ] (b) PELIS crops [ ] (c) Petty business [ ] (d) Employment [ ]
    (e) Remittances [ ] (f) Others (Specify)_____
16. What is your total income **per year** from all sources including income from PELIS?
    Kshs _____
17. Do you have your **own land** outside the forest reserve for farming?
    (a) Yes [ ] (b) No [ ]
18. What is the size of your land in Acres do you own for farming?
    a) 0 acre b) 1 – 3 acres c) 3 – 6 acres d) 6 – 10 acres e) over 10 acres
19. Among the crops and livestock production on your farm, how much income have you realized during the **past 12 months? _____ kshs**
20. How many acres of land are you cultivating in the forest?
    (a) 0 - 0.5 [ ] (b) 1- 1.5 [ ] (c) 2 -2.5 [ ] (d) 3- 3.5[ ] (e) more than 4 [ ]
21. Which crops do you grow in the allocated forest land?
    a) Potatoes [ ] b) Maize [ ] c) beans [ ] d) Pease [ ] e) Vegetables [ ] (f) Others-(specify) ____
22. Among the crops grown please provide information in the table below on the area cultivated, quantity harvested, unit price and cost of production for the last **12 months**.

Type of crop	**Area cultivated in acres**	**Unit**	**Unit price**	**Quantity harvested**	**Cost of production**	**Net income**
Potatoes		Bags				
Beans		Kg				
Maize		Kg				
Pease		Kg				
Vegetables		Kg				
Total						

23. If you participate in the activities tabulated below, how much net income have you realized/earned from the sale of the products in the **last 12 months?**

Activity	Products whether sold or consumed at home	Amount of money realized/earned
24. Nursery work	Seedlings	
25. Silvicultural operations	Prunings (withies or fitos)	

26. How many months are you self sufficient with food in a year?
(a) 1-3 [ ] (b) 4-6 [ ] (c) 7-9 [ ] (d) 10- 12 [ ] (e) Over 12 months

27. How have you invested the gains obtained from PELIS?
(a) Started small business [ ] (b) Payment of school fees [ ] (c) Bought a plot [ ]
(d) Built a house [ ] (e) Bought a car [ ] (f) Others (specify) _____

Section 5: Community Attitudes towards PELIS

Fill in the table by ticking the number that matches your answer

Statements	**1** strongly disagree	**2** disagree	**3** uncertain	**4** agree	**5** strongly agree
28. PELIS is the best method of establishing forest plantations.					
29. PELIS has improved food security of forest adjacent communities					
30. Participating in PELIS is more paying than rural wage employment					
31. PELIS has positive influence on the livelihood of forest adjacent communities					
32. PELIS has improved the living standard of forest adjacent communities since its inception.					
33. KFS does not exploit forest adjacent communities participating in PELIS activities					
34. Forest adjacent communities are satisfied with PELIS as a source of livelihood.					
35. There is drastic improvement of the status of forest plantation establishment in Gathiuru forest since the introduction of PELIS					
36. PELIS is a colonial system of enslaving forest adjacent communities to work in forest plantations					

Section 6: PELIS Challenges

37. What challenges do you face while trying to enhance your livelihood through PELIS?
    (a) Poor forest roads [ ]
    (b) Lack of market for PELIS crops [ ]
    (c) Limited forest land for cultivation [ ]
    (d) Limited benefits compared to costs [ ]
    (e) Wild life damage to crops [ ]
    (f) Distance of PELIS plots from the villages [ ]
    (g) Others (specify) _____

38. Rate the challenges you face in order of magnitude of threat to your livelihood by ticking on the appropriate threat against the challenge.

Type of challenges	Level of threat to community livelihood		
	No threat	**Minor threat**	**Major threat**
Poor forest roads			
Lack of market for PELIS crops			
Limited forest land for cultivation			
Limited benefits compared to costs			
Wildlife damage to crops			
Distance of your PELIS plot from your village home			
Others (*Specify*) (1)			

39. How do the challenges you encounter affect your livelihood?
    (a) Reduce profit margins [ ] (b) No effect [ ] (c) Make losses [ ] (e) Kill morale

40. For three 3 major challenges, suggest what should be done in order to improve PELIS so that it can accrue more benefits to the forest adjacent communities.

No	Type of challenge	Suggested solution
1		
2		
3		

THANK YOU VERY MUCH FOR YOUR TIME AND CONTIBUTION!!!