ANALYSIS OF SOCIO-ECONOMIC FACTORS THAT AFFECT AGROFORESTRY ADOPTION AMONG SMALLHOLDERS IN TEMIYOTTA LOCATION, NAKURU COUNTY

BY

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DECLARATION

I hereby declare that this is my own original work and has not been submitted for examination at any other institution.

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DEDICATION

I dedicate this project to my Wife, Lizzy Kerubo and my children (Akeelah Josephs and Nyamweya Joseph Junior) also to my parents Mr. and Mrs. William Makori Nyagara, Sister Josepha Otwori, my siblings: Paul, Hassan, Timothy, Francis and Joan. Lastly but not least I dedicate it to Dennis Miranyi and family.

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Lastly but not least I am thankful to the Almighty God for giving me good health, sound mind, strength, blessings and an insight to pursue and complete the Master Degree. Finally to all that I may not have specifically mentioned but contributed their resources in different forms to make this research a success, Thank you.

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LIST OF ACRONYMS AND ABBREVIATIONS

AF	Agroforestry
CBO	Community Based Organization
FAO	Food Agricultural Organization
ICRAF	International Centre for Research in Agro-forestry
KNBS	Kenya National Bureau of Statistics
MDGs	Millennium Development Goals
PES	Payment for Environmental Services
SID	Society for International Development
SPSS	Statistical Package for Social Sciences
UNEP	United Nations Environmental Program

ABSTRACT

The main objective of this study was to assess the households' socio-economic factors influencing agroforestry adoption in Temiyotta location. The hypotheses for the study were; there is no significant relationship between household size and agroforestry adoption in Temiyotta location. The household head's level of education was not significantly related to agroforestry adoption in Temiyotta location; and there was no significant relationship between the household head's income and agroforestry adoption in Temiyotta location. The study variables included socio-economic factors, agroforestry practices adopted by the residents and the benefits of agroforestry. The data was got from a sample of three out of nine villages based on demographic and socio-economic factors and randomly picking the households in the identified villages to collect data from the household heads. The study used a sample size of 86 households with a proportionate distribution of households from every village. The data was collected through administration of questionnaires to the household heads. The result showed that there was a significant relationship between residents' household size and agroforestry adoption in Temiyotta location. The Chi square analysis (X^2=27.468), revealed that there was a significant relationship between the head of household's level of education and agroforestry adoption in Temiyotta location. This statistical test was significant at $p<0.05$. Furthermore, the Chi square analysis (X^2=16.347), revealed that there was a significant relationship between the household's income and agroforestry adoption in Temiyotta location at $p<0.05$ significance level. Most of the smallholders' total annual income was estimated at Kshs. 20,001 – 100,000 Kenya shillings thus had enough for agroforestry practices. The Chi square analysis (X^2=15.001), revealed that there was a significant relationship between the size of household and agroforestry adoption in Temiyotta location. This statistical test was significant at $p<0.05$. Based on the findings, the study recommends for the need of agroforestry extension services for the smallholders in the area so that they can be guided on agroforestry adoption and the appropriate trees to plant as regards the various agroforestry practices.

CHAPTER ONE
INTRODUCTION

1.1 Study Background

Agroforestry has become a sustainable land management practice looking into land degradation and deterioration of soil productiveness (FAO, 2010). According to Edinam *et al.,* (2013) in the near past there has been a growing attention in the execution and campaigning for agroforestry practices amongst smallholder farmers especially in the third world countries. He further states that, socio-economic factors like; gender, farm size, access to capital and incentives contribute to adoption of agroforestry. According to him, if farm size is large and unavailability of labour is prevalent, farmers may be willing to embrace Agroforestry (AF) practices such as woodlots, or enriched fallows.

Socio-economic factors like income, occupation, education level, farm size and household size, are linked to agroforestry adoption among smallholder farmers. According to Ong'ayo, (1993) income, occupation and education level influence tree planting in Western Kenya. On the other hand, Chitere (1985) reveals that land size has an influence on agroforestry adoption in Central Kenya. According to Ajayi *et al.,* (2003) farm size has a positive relationship with the smallholders' choice to practice agroforestry. He also notes that age has influence on adoption of agroforestry. Factors like availability of labour, innovativeness of a farmer, also influence the adoption of agroforestry (Ajayi *et al.,* 2006). According to FAO (1989) age, land size and income have a link to agroforestry adoption among farmers. For instance, in Nigeria, adopters of agroforestry are old and rich farmers with larger farm sizes. High income earners embrace and practice agroforestry more compared to their counterparts.

Traditional beliefs influence acceptance of Agroforestry practices. For instance Gichuki and Njoroge (1989) records that in Kenya, among some communities, women are not allowed to plant trees because doing so is believed to be an act of ownership over land. In some other communities, trees belong to men irrespective of who plants them. In Western Kenya there are different tree species for men and women (Kerkhof, 1992). It is not acceptable for women to plant certain tree species, because it is believed if they do so

they will become barren. Some tree species are linked with certain beliefs and therefore, cannot be planted at all by community members even if they are beneficial in any way. On the other hand tree planting decisions in some communities have to be done by the male head of the household (Ipara, 1992). According to Kiptot and Franzel, (2011) women are often in charge of management of trees and other agricultural undertakings. For instance, in Uganda, the percentage of households where females managed fodder shrubs is way above 80%. Paralleling the tree survival rates as managed by males or females in Kenya, reveal that households headed by men have higher survival rates for fodder shrubs than those headed by females (45% as compared to 31%).

Blaug (1970) argues that, education improves one's ability to capitalize on opportunities. The same is echoed by Thangata (1996) who states that educational level of household head is a key factor of agroforestry adoption. He argues that formal and informal training has the prospective to rise the rate of adoption by directly increasing awareness, on the new practice. The level of education and exposure to information influences farmers to embrace and practice agroforestry. Farmers in rural areas throughout the world in recent years have faced massive challenges including population upsurge, poverty increase and food insecurity, climate change among others. Gradually many farmers are turning to agroforestry practices as alternative means of improving their state of affairs. According to Mercer, (2004) an investigation carried out in more than 700 households in East Africa established that more than 50% of those households had adopted agroforestry with the aim to protect the environment and expand their production.

According to FAO, (2013) some countries are working hard to promote agroforestry adoption among farmers by enhancing and coordinating national activities, through the development of national information networks. In different areas around the globe different agroforestry prospects are evolving, for instance; in Niger, the introduction of friendly legal environment has prompted farmers to embrace the restoration and management of natural trees, this has led to about 5 million hectares of freshly created parkland systems.

Agroforestry systems can be carried out in different farm sizes ranging from small plots to large tracts of lands. On small plots, cereal crops can be combined with nitrogen fixing trees to enrich the soil. On large tracts of land, trees may be planted in woodlots, boundaries, and on landscape scale trees and other vegetation can be cultivated (Sileshi and Mafongoya 2006). For Agroforestry systems to be effective they have to have positive interactions among their innumerable components, leading to final products which are invaluable, also lessen the likelihood of total failure of harvests' and reliance on chemical inputs. Properly managed agro-forestry plots, have demonstrated that trees add value that surpass any loss in crop production process. Nevertheless, these results are not assured, therefore consideration on the type of agro-forestry system used and species selected is key (UNEP 2015).

According to Sileshi *et al.*, (2007) if Agroforestry is properly planned and carried out, particularly at landscape level, enormous benefits which play a part to the sustainability of residents and, on a greater magnitude, to ecosystems on which the local community rely upon for their livelihoods will be enhanced. On the other hand, the environmental and economic services perhaps could not be valued by the market, implying that development actors and farmers must take up all the production cost, though the entire nation benefits in the long run. Introducing financial assistance to farmers who practice tree cultivation in their farms can be regarded as a system of payment for environmental services, which will motivate more people to embrace agroforestry.

Cheik (2015) records that progress has been made in integrating sustainable development goals into forest sector. The integration of agroforestry into national sustainable development can help achieve sustainability. Forests and agroforestry if well embraced and managed, play a role in achieving the United Nations, Millennium Development Goals (MDGs), including other globally agreed development goals. Agroforestry makes an enormous impact on the MDGs for instance, it eliminates hunger and poverty also ensuring environmental sustainability. On the other hand agroforestry has an indirect role assisting to meet other MDGs, through their social, economic and environmental services. For instance agroforestry minimizes child mortality rate and enhances human

health through its contribution to food security, providing medicines, as well as a source of income.

1.2 Statement Problem

According to Nakuru County Integrated Development Plan, (2013) agroforestry was introduced in the year 2010 in Temiyotta location. Agroforestry rules were introduced in the same year which requires that all farmers in Temiyotta location and the larger Nakuru County increase their trees' species to 10 per cent per land hectare. The study area has experienced a decline of Kariara community forest, which has been overexploited by residents for; charcoal, firewood, timber and poles. About 543.41 Ha. (61.85%) of the community forest has been lost since 1970s (DRSRS, 2010). Efforts must be put to increase the area under tree cover, and agroforestry is one way of sustainably achieving this. This study seeks to analyse the socioeconomic factors i.e. household size, education level of the household head, income of the household head and farm size of the household, and how they influence agroforestry adoption.

Agroforestry adoption in the study area has experienced numerous challenges, for instance little access to information sources and insufficient understanding on tree/crop growing on-farms. Few studies have been carried out to examine how socio-economic factors affect agroforestry adoption among smallholders within farming communities. The available information regarding socioeconomic factors that affect agroforestry in many areas is often scanty in terms of quality and quantity. Most of the past studies on this subject often emphasized on the biophysical factors and disregarded the socio-economic factors, assuming that it is only biophysical factors that affect the advancement in agroforestry practices.

Nakuru District Strategic Plan (2005) states that; the households of Temiyotta location own an average farm size of 0.77Ha. Agroforestry improves soil fertility. Fertilizer trees like *Grevellea robusta, Sesbania sesban* grown together with food crops are known to increase the fertility of the soil and hence productivity (Ayuya *et al.,* 2012). Agroforestry is a source of income to farmers. It is a source of fodder to livestock e.g. Calliandra.

Provides fuel for household use, Nakuru District Strategic Plan (2005) states that 70% of the households buy firewood and long distances are covered daily to fetch firewood, hence a lot of time is wasted which could be used in other productive farm practices. According to Kenya National Bureau of Statistics (2013) 86% (1,723) households use fire-wood and 12.8% (257) use charcoal for cooking. This statistic shows the urgency of promoting agroforestry among the farmers so that they can cut down on the cost and time spent in fetching the commodity.

1.3 Research Questions

1. Do socio-economic factors such as; household size, education, farm size, and income, influence agroforestry adoption among the household heads of Temiyotta location?
2. Which agroforestry practices are adopted by the household heads of Temiyotta location?
3. What are the benefits of agroforestry among the household heads of Temiyotta location?

1.4 Project Objectives

1.4.1 General Objective

The main objective of this study was to assess the household heads' socio-economic factors influencing agroforestry adoption in Temiyotta location.

1.4.2 Specific Objectives

The specific objectives of the study included:

1. To assess how socio-economic factors influence agroforestry adoption in Temiyotta location.
2. To document the agroforestry practices adopted by the households in Temiyotta location.
3. To identify the benefits of agroforestry among the households of Temiyotta location.

1.5 Research Hypotheses

H_0: There is no significant relationship between the household heads' household size and agroforestry adoption in Temiyotta location

H_0: The household heads' level of education was not significantly related to agroforestry adoption in Temiyotta location

H_0: There was no significant relationship between the household heads' income and agroforestry adoption in Temiyotta location

1.6 Justification

Temiyotta location was chosen as the case study, because of poor adoption of agro forestry in the area. To achieve the Millennium Development Goals (MDGs) and Kenya's vision 2030 as a country, we need environmental sustainability. Systematic environmental degradation in any society would deter it from reaching the goal of reversing loss of environmental resources. Also, unequal access to productive resources hold back a society from achieving the goal of halving extreme poverty. Sustainable development and achievements of the MDGs are thus mutually reinforcing. They represent a two-way relationship – where achievement of the MDGs helps in achieving sustainable development and where the presence of sustainability in its various dimensions is needed for achievement of the time-bound global goals.

1.7 Scope and limitations of the Study

This study focused on the adoption of Agroforestry in Temiyotta location; For instance, the socio-economic factors that influence agroforestry adoption i.e. income, household size, farm size, and education of the household heads. On the other hand the study identified some of the agro-forestry technologies practiced in Temiyotta location. Lastly the study identified the benefits of agroforestry adoption among the residents of the study area. This study did not focus into biophysical, environmental and cultural factors that affect agroforestry adoption.

1.8 Definition of Terms

Agro forestry: It is a collective name for land-use systems and practices where woody perennials are deliberately integrated with crops and/or animals on the same land management unit.

Household: It refers to a single person or group of persons who live and eat together and share common living arrangements i.e. share expense.

Household head: It refers to the main decision-maker, or the person who owns or rents the dwelling, or the person who is the chief breadwinner.

Household income: It refers to all revenue earned by all members of a household, in cash and in kind, in exchange for employment, or in return for capital investment, or revenue gained from other sources such as social grants, pension, etc.

CHAPTER TWO
LITERATURE REVIEW

2.1 Introduction

This chapter begins by presenting literature on various studies carried out in Kenya and outside Kenya on socio-economic factors affecting agroforestry adoption. The study begins by reviewing literature done globally, then Africa and finally discussing literature on Kenya about Agroforestry adoption. The chapter also shows gaps identified in the empirical studies in various parts of the world and how the study intends to fill those gaps. These chapter as well presents the conceptual and theoretical frameworks and lastly concludes by discussing the variables under study

2.2 Socio-Economic Factors Affecting Agroforestry Adoption

2.2.1 Farm Size

Pattanayak et al., (2002) carried out a study to identify general determinants of agroforestry adoption in eastern Philippines. The study reports that; farm size is statistically correlated with adoption of agroforestry r2 = 0.66. The findings show that as the farm size increases, agroforestry adoption as well increases. The study concludes that the 'economies of scale' should offer an explanation of adoption in this scenario; that is, a farmer with more land is more likely and, or willing to experiment with a new technology.

Orisakwe and Agomuo, (2011) in his study in Imo State Nigeria, sought to examine the socio-economic factors of the residents practicing agroforestry, and the extent of adoption of agroforestry technologies in the area. In his findings, he states that 48.9% of the farmers own land sizes of 1-3 hectares, and 40% own land sizes which are below 1 hectare. The average land owned by the residents practising agroforestry was approximately 1.5 hectares. The study revealed that, land size of the respondents had a positive relationship to levels of agroforestry adoption, meaning that; as the respondents land size increase, adoption of agroforestry systems increase, and when the farm size decreases the adoption as well declines. There was a significant relationship between the farm size and adoption levels, the t-calculated value was 2.325 which is greater than the

t-tabulated value which is 1.98, this was tested at 5% level of probability. A similar study by Kabwe et al., (2009) carried out with the objectives to determine extent of adoption of agroforestry technologies and to determine factors influencing adoption of agroforestry among smallholder farmers in Zambia. His findings show that farm size is significantly associated with adoption of agroforestry. The calculated $\chi 2 = 5.787$ is greater than the critical value, $\chi 2 = 3.84$.

Geremew (2016) carried out a study in Mecha rural district, found in Amhara National Regional State in the Northwest of Ethiopia. The objective of the study was to investigate the factors that influence the agroforestry adoption decisions of the farm households and its effect on farmland productivity. The findings show that; farm size has a positive correlation with agroforestry adoption ($r2 = 0.834$). The study records that as farm size increased by one hectare, the probability of adopting agroforestry of that household would rise by 28.2% units. The study concludes that, where there is surplus farmland the household can be motivated to allocate the additional farmland for cash generating agroforestry practices. Similar findings are echoed in the study of Kassa, (2015).

Maluki et al., (2016) carried out a survey targeting smallholder households in the semi-arid Makueni County, Kenya. The objective of the survey was to ascertain the various agroforestry practices adopted and the extent of adoption. 234 respondents were interviewed. Adoption of agroforestry was positively correlated with size of landholding ($r2 = 0.507$). The bigger the land, the higher the likelihood to invest in agroforestry technologies suitable in the semi-arid areas and that the farmer can plant in parts of the land deemed suitable without restrictions. 23% of the respondents own less than 3 acres, 59% own between 3.1-6 acres and 18% own above 6.1 acres. The studies failed to recognize that farmers with a small size of land are likely to adopt agroforestry technologies to improve soil fertility, through intercropping fertilizer trees with crops. Therefore this study seeks to fill this gap, by linking improving soil fertility with agroforestry adoption among small land holders.

These studies have failed to indicate how the size of the farm influence the farmers' decision to plant/not to plant trees. Therefore this study seeks to fill this gap by, finding out the various farm factors that play a role in the farmers' decision making to adopt or not to adopt agroforestry. These study will reveal how farmers use their farm, the kind of crops grown and the size of farm occupied by each crop in question.

2.2.2 Education Level

A study by Rahim *et al.*, (2013) with an aim to examine social factors which affect farmers' adoption of agroforestry system in Azna, Iran, found out that; educational level of the respondents had a positive correlation with agroforestry adoption (r = 0.560). 73.3% of the household heads had a post primary education and 26.7% had a primary level of education and below. The higher the educational level of the household head, the higher the adoption levels of agroforestry practices. The study concludes that; education of the household head plays a crucial role in agroforestry adoption, since education enhances an understanding of new technologies hence the probability of adoption is increased.

Twahu *et al.,* (2016) carried out a study, with the objective to assess the socioeconomic factors that affect agroforestry adoption in the Eastern Agro-ecological zone of Uganda, he reported a positive correlation between education level and agroforestry adoption (r^2=0.671). He states that, farmers with a secondary level of education and above tend to embrace agroforestry more because education enhances obtaining information as well as promoting awareness on new agroforestry practices, consequently encouraging adoption. He found that, if all elements are held constant, and the farmers' education increases by one year, the possibility of farmers to adopt agroforestry rises with 1%.

A study by Oino and Mugure (2013) with the objective to assess farmer-oriented factors that influence adoption of agroforestry practices in Kenya, Nambale District, Busia County states that; there is a strong positive correlation (r^2 = 0.613) between the household head level of education and the number of trees planted on the farm. The number of trees in the household farm is related to household head level of education.

The study further reports that majority of the farmers with less than 10 trees had low level of formal education (below primary school level of education), while those with above 30 trees had higher levels of formal education, i.e., above secondary school level of education. Therefore, the study concludes that; education level of the household head influences decision to adopt agroforestry practices at the household level.

Okoba *et al.,* (2013) carried out a study in Laikipia County in Kenya, where 130 farmers were interviewed. The objective of the study was to assess farmers' perception on adoption of conservation agriculture. The level of education of the household heads was found to be 2% illiterate, 47% primary school, 44% secondary school and 8% tertiary level. The findings reveal that; the level of education of the head of the household had influence on agroforestry adoption among farmers and the results shows that farmers who are more educated are more likely to practice agroforestry and other conservation agriculture practices. Pearson correlation analysis shows that there is a positive and significant relationship between practice of agroforestry among farmers and education level $r^2 = 0.541$. The study concludes that the reason for this could be; education exposes the farmers to comprehending the advantages of agroforestry such as sustainability, hence the higher adoption rate.

A study by Okuthe *et al.,* (2013) analysing the socio cultural determinants of adoption of integrated natural resource management technologies by small scale farmers in Ndhiwa division, Kenya. A sample of 220 small scale farmers were carefully selected and interviewed. A positive correlation $r^2 = 0.494$ was reported to exist between adoption of agricultural technologies and level of education. 43% of the adopters interviewed had attained upper primary level of education and 25% had lower primary school level of education. Those with secondary level of education and above constituted 27%. Integrated natural resource management systems for example agroforestry practices demand knowledge, also necessitates for substantial administrative effort (Barret *et al*., 2002). The study notes that education is key for farmers to comprehend agricultural related technologies. A well-educated farmer can easily understand and interpret the information conveyed to them by an extension officer or from any other source. Better

educated farmers have an enhanced understanding of agroforestry related information at their disposal, also improves their involvement in agricultural related undertakings. The studies on how education of the household head affects agroforestry adoption have failed to indicate how education directly affects the adoption levels. Consequently this study seeks to fill this gap by, investigating how the farmers thought education influences them to adopt or fail to adopt agroforestry.

2.2.3 Household Size

Bzugu *et al.,* (2012) carried out a study with the objective to analyse the socio economic factors influencing the adoption of improved agricultural technologies. The study was carried out at the sahelian zone of Borno State, Nigeria. A sample size of 321 households was used for this exercise. A positive correlation is reported to exist between agroforestry and household size $r^2 = 0.5039$. Further findings from the study reveals that 32.1% of the respondents had 9-12 members per household. The study concludes that much labor used in small scale farms emanates from the household.

Madalcho and Tefera (2016) conducted a study, in which he had a sample size of 50 households. The study was carried out in Gunugo watershed at Wolayitta zone it Ethiopia, with an objective to assess the socioeconomic factors affecting tree planting in agroforestry practices. The findings reveal a positive correlation between household size and agroforestry adoption in the area ($r^2 = 0.501$). Larger households planted more trees than small households. He attributes the findings to labor availability, where he argues that larger households would have enough labor to plant trees and able to provide adequate management for the planted trees.

Ayuya *et al.,* (2012) carried out a study, with the objective to establishing the most preferred organic soil management techniques among farmers and the factors influencing the choice of these techniques. A sample size of 150 smallholder maize farmers were selected, from Bungoma County. Household size is significantly related to adoption of agroforestry technology $r^2 = 0.692$. An increase in the household size by one member, increases the likelihood of choosing agroforestry technologies by 5.57%. Large

household size positively influences adoption of labor- demanding agricultural technologies since they have the ability to relax the labor limitations necessary in the course of introduction of new technologies (Odendo *et al*., 2009). The studies above failed to clearly articulate how household size is one of the factors influencing agroforestry adoption. Therefore this study seeks to fill this gap by asking the respondents to state the roles of their household members in agroforestry. This gives a clearer picture of how various persons in the household contribute to adoption and management of agroforestry.

2.2.4 Income

Adnan *et al.,* (2014) in his study with the objective of analyzing farmers' socioeconomic characteristics and their impacts on agroforestry in Swat Pakistan. He found that there is a positive correlation of r^2=0.541 between the farmers with a higher income and agroforestry adoption. Among the surveyed farmers, 28% possess land which is below 1 acre of planted trees and they earn a monthly average income which is below 8,300 Rupees (Rs) per household. On the other hand 32% of the farmers possess 1-2 acres of land and earn Rs. 10,900. Farmers who practiced more agroforestry (more than 5 acres) earn more (> Rs. 21500 per month). Similar findings are echoed by Alavalapati *et al.,* (2008), whose objective was to assess agroforestry adoption and maintenance, self-efficacy, attitudes and socio-economic factors. A positive correlation (r^2 = 0.520) exists between the farmers' annual income and agroforestry adoption in Bahia, Brazil.

Mercer and Pattanayak (2005) carried out a comparative study on agroforestry adoption in Mexico and Philippines. The objective of the study was to examine the socioeconomic, cultural factors that affect agroforestry adoption in Campeche (mexico) and Leyte (philippines). In Campeche 176 households were interviewed and in Leyte 159 households. From the comparative study, findings show that both in Campeche and Lyete, income is positively correlated with agroforestry adoption (r^2 = 0.47 and r^2 = 0.66 respectively). The annual average income from Campeche and Lyete is US $402 and US $510 respectively. The study concludes that high income earners are likely to hire people to carry out the agroforestry management practices in their farms, hence a higher

adoption rate among high income earners. Mulatu *et al.*, (2014) carried out a study in 'Tsolo' and 'Lusikisiki' areas in Tambo district in the Eastern Cape Province of South Africa. The aim of the survey was to analyse factors that affect the implementation of agroforestry practices. The findings reveal that income has a positive correlation with agroforestry adoption in the area $r^2 = 0.749$. Thirty percent of the farmers interviewed earn a monthly income of less than South African Rand (R) 800, while 56% earn R. 801-6,400 and 14% of the respondents earn above R. 6,401. The study records that possibly high income earners have adopted agroforestry because they are able to hire labor to manage agroforestry systems in the farm.

Munyaradzi and Torquebiau (2010) in his investigation with the objective to assess agroforestry adoption by smallholder farmers in Gutu District, Zimbabwe, documents that; the ability or inability to meet the cost of pesticides, seeds and other inputs necessary for practicing new agroforestry technologies relies on household income. His findings reveals that; at least 66% of the respondents earn an average monthly income below Z$ 860 000. With such meagre incomes, a lot of households are not able to procure the inputs necessary for subsistence crop production, let alone for managing agroforestry ventures. The income of the small holders in the area is very low and unpredictable, this is the key external factor restraining the farmers' capacity to implement agroforestry. There is a strong correlation ($r^2= 0.727$) between agroforestry adoption and the income of the residents of Gutu area. Over 60% of the farmers in the area have not adopted agroforestry.

2.3 Theoretical Framework

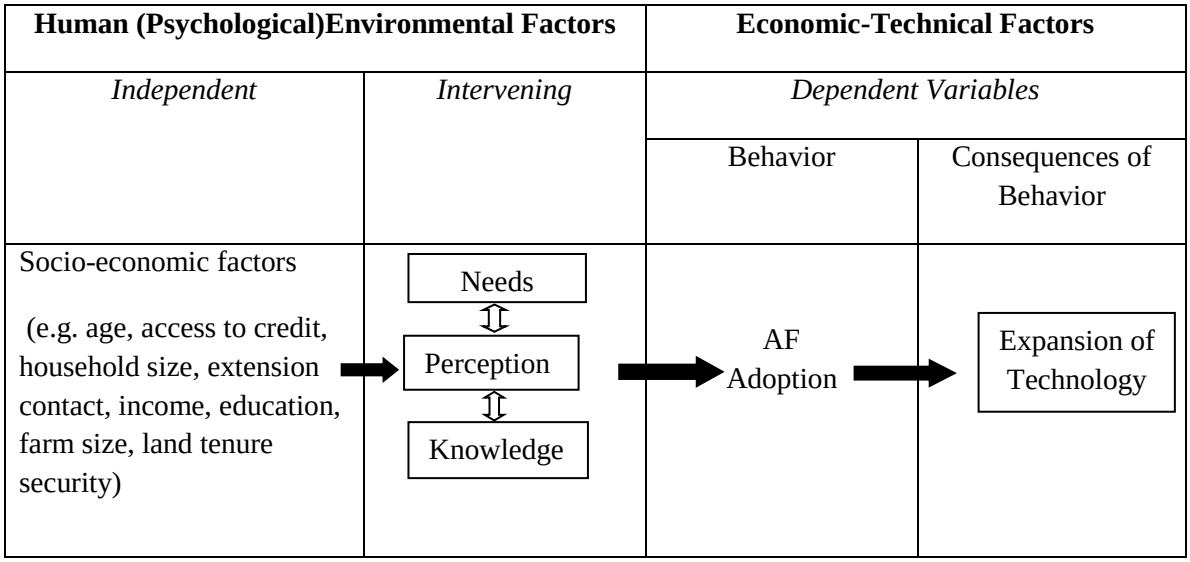
2.3.1 Adoption Behavior Model

Agroforestry adoption is a mental decision based on needs, knowledge and perception Duvel, (1994). This study adopts the adoption behaviour model which is beneficial and suitable to this study (Tolman, 1967). Based on this theory, adoption behaviour of a person relies on socioeconomic and environmental aspects, consequently the main reason of taking on a new technology is endogenous to the entirety of the interrelating aspects of his/her state of affairs.

Duvel (1994) states that adoption is influenced by many factors such as socio-economic, environmental and mental process. These factors are intervened by variables that include knowledge about agroforestry technology, needs and one's perceptions about methods to acquire these needs. It explains that adoption behaviour is dependent upon intervening variables such as individual's needs, knowledge about agroforestry technologies and individual's perception about methods used in meeting these needs in a specific environment. According to Duvel (1997) needs are regarded as adoption behaviour determinants. They are linked with forces that influence a person to act, or that bear or give direction to motion. They motivate adoption behaviour and offer it a bearing. Adoption and expansion of agroforestry practices is mainly influenced by the realized returns in meeting individual's needs. Duvel (1994) further explains that the intervening variables are the best predictors of the adoption behaviour and the effect of independent variables is demonstrated in the adoption behaviour through the intervening variables. These intervening variables are dependent on socio-economic variables such as age, level of awareness, extension contact, income, education and household size. Banana *et al.,* (2008) explains that farmers are rational beings and make decisions to adopt certain agroforestry systems based on the household and field characteristics such as gender, household size, farm size, fuel wood scarcity and income of the household.

Thangata and Alavalapati (2003) states that this model, presumes that agroforestry is environmentally practical, economically effective, and generally well-suited in the study area. The theory displays the difference between embracing and development of a new technological practice. Readiness to engage in agroforestry practices could essentially depend on the person's behaviour regarding taking risks. On the other hand, furtherance or development of a technology basically hinges on observed benefits of a fresh technology compared to an older technology in reaching his/her essentials. This model was preferred because it clearly shows the distinction between adoption and expansion of technology.

Figure 2.1: Agroforestry (AF) Adoption Behavior Model



Source: *Duvel,* (1994)

2.4 Conceptual Framework

Farmers' decision to take up agro forestry practices like home gardens, boundary tree planting, hedges, live fences, woodlots and homestead planting, would be determined by the respondent's socio-economic factors (independent variables) such as farm size, household size, highest education level attained and the annual income of the respondent. The needs of the farmers (that is, income, fodder and fuel) is the intervening variable which predicts the adoption behaviour.

The effect of land size on acceptance of agroforestry is influenced by several aspects like fixed adoption expenses, risk preferences, labour availability and tenure arrangements. Farm size has a significant effect on agroforestry adoption. Persons owning huge farms tend to embrace new agroforestry practices. Farmers with large tracts of land have prospects to carry out pilot projects, to find out the sustainability of the technology before a full implementation is carried out. Nonetheless, sometimes farmers with small size of land could adopt agroforestry, so that they can improve the soils fertility, and increase on their production.

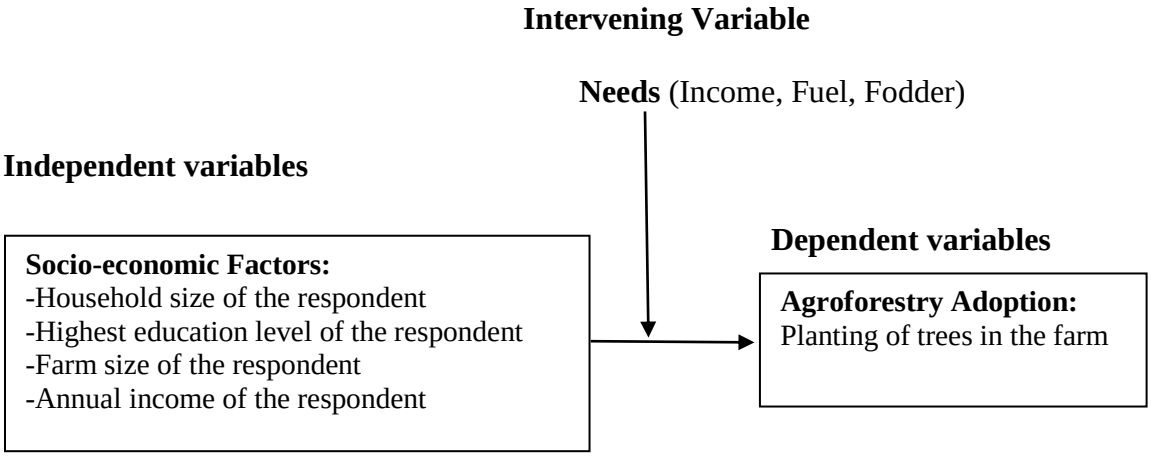
It is likely that persons who earn more money have the potential to implement agroforestry practices than those with meagre earnings. Adoption of agroforestry practices may vary among groups with different income levels, for instance small scale farmers may think the new practices are too risky hence avoid it. On the other hand the high income earners can afford to pay wages for agroforestry management in their farm as a result they chose to adopt it. In some cases high income earners may not practice the agroforestry due to other factors.

Household size might have a varying influence on adoption of agroforestry practices. Increased household size impacts on the need for additional produce for household members to consume. In the context of agroforestry, the household size has a varying effect on the implementation of a new technology. Larger households with sufficient labour source tend to embrace agroforestry practices compared with those of small households. However agroforestry adoption may as well increase in small household sizes, perhaps for the reason that agroforestry is less labour demanding.

Education level of the farmer has an influence on the adoption of agroforestry practices in the farm level. Farmers with high education are likely to develop a positive attitude towards agroforestry. Farmers with higher education are better at understanding the problems and they have more capacity to access, process and use relevant information about new practices or technology in their farming. Farmers who are more educated can certainly acquire the relevant knowledge regarding agroforestry for instance, on disadvantages of new practices, consequently they may reduce, avoid or tend to delay on adopting the practices.

2.4 Conceptual Framework

Figure 2.2: Conceptual Framework



Source: *Modified from Duvel, 1994.*

CHAPTER THREE

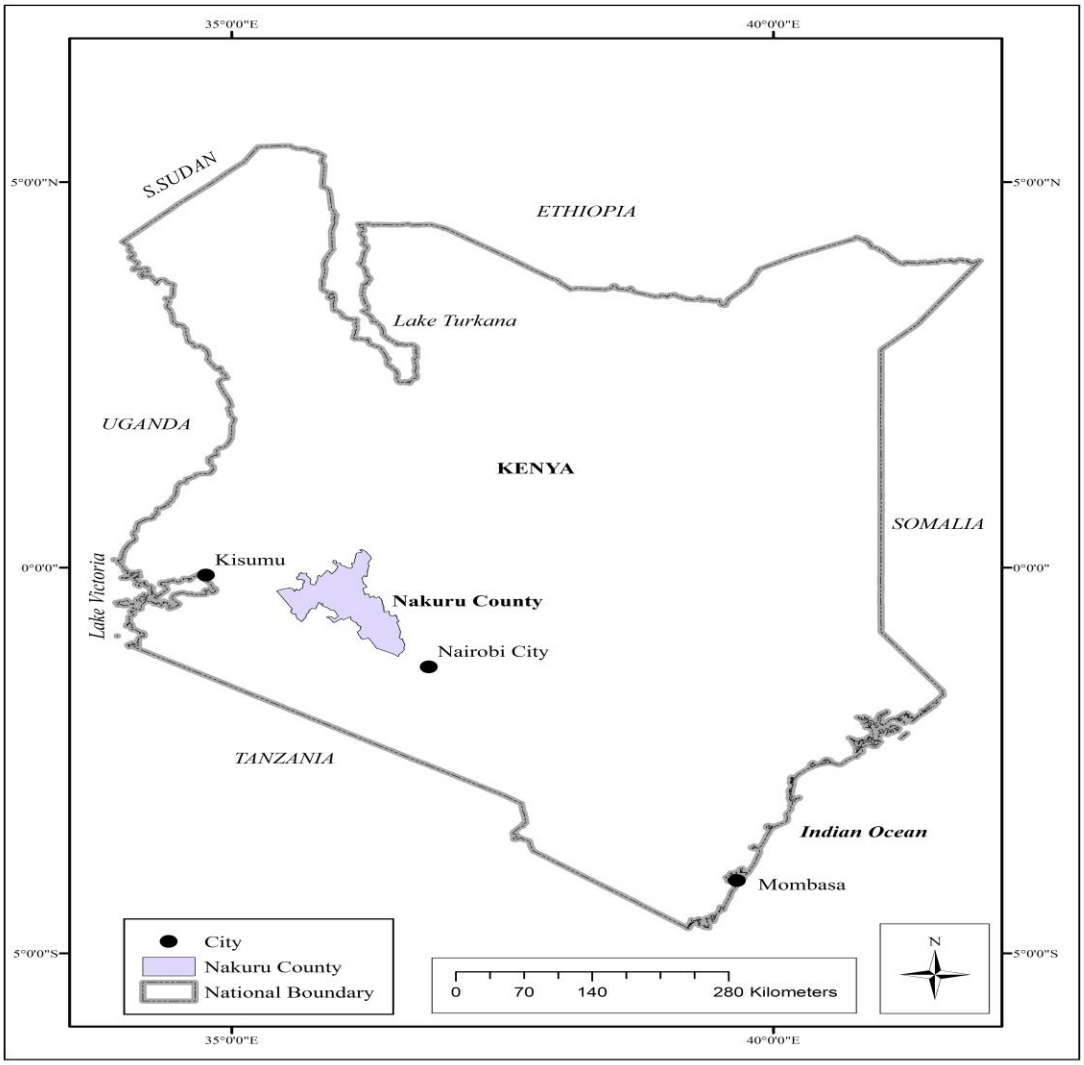
STUDY AREA AND RESEARCH METHODOLOGY

3.1 Study Area

3.1.1 Introduction

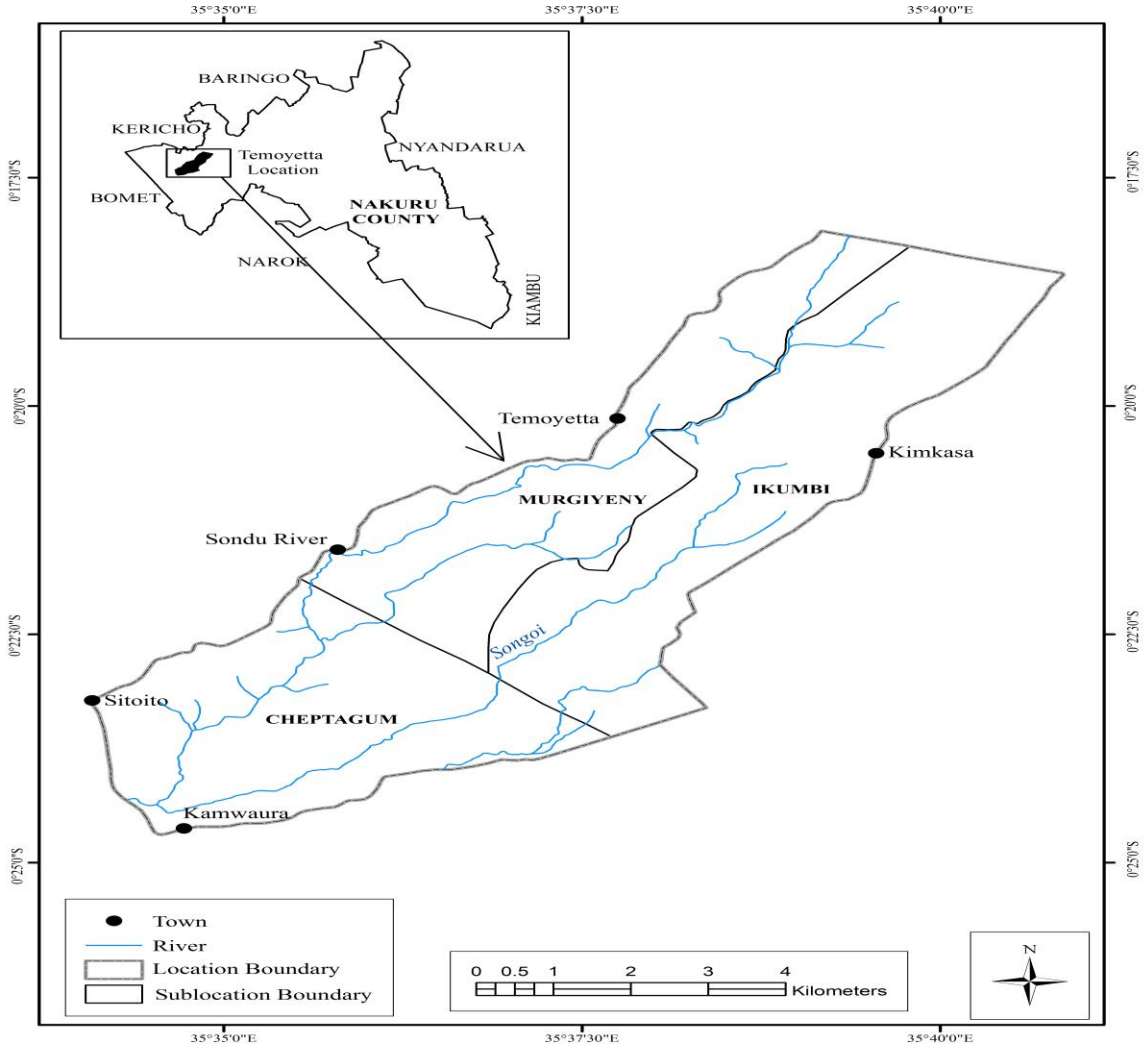
The study was carried out in Temiyotta location, in Kuresoi North Constituency, Nakuru County in Rift valley Province, Kenya. As illustrated in Figures 3.1 and 3.2 respectively.

Figure 3.1: Map Highlighting Nakuru County in Kenya



Source: *Survey of Kenya, (2011).*

Figure 3.2: Map Highlighting Temiyotta Location in Nakuru County



Source: *Survey of Kenya, (2011).*

3.1.2 Location of Temiyotta

Temiyotta location lies in Nakuru County. Nakuru County lies within the Great Rift Valley and borders eight other counties namely, Kericho, and Bomet to the West, Baringo and Laikipia to the North, Nyandarua to the East, Narok to the Southwest and Kajiado and Kiambu to the South (Figure 3.2). The County covers an area of 7,495.1 km^2 and is located between longitudes 35º 28º and 35º 36º and latitudes 0º 13º and 1º 10º South (Nakuru County Integrated Development Plan, (2013). Temiyotta location lies

within longitudes; 35^{o} 34^{o} E to 35^{o} 41^{o} E, and latitudes 0^{o} 18^{o} S to 0^{o} 25^{o} 0^{o} S. It covers a total area of 5900.88 hectares.

3.2 Physiography and Natural Conditions

3.2.1 Geomorphologic Features

The major geomorphologic features in the location include of the hills, rolling land and plains. From field-measurements, the top soils in the plains are of clay loam (CL) to loam (L) in texture, with friable consistence and weak to moderate sub-angular blocky structure. The subsoil texture ranges from silty clay loam (SCL) to clay loam (CL) and clay (C), with pH values ranging from 5.6 to 6.4, making them slightly to moderately acidic in nature (China, 1993).

3.2.2 Climate

Temiyotta location lies at 2,400 m above sea level. The rainfall pattern in the location is bimodal in distribution, peaking in April and August, and ranges from 1000 to 2000 mm. The rain days range from 120 to 200 per year. This rainfall pattern supports healthy forest vegetation. The temperatures range from 16°C to 22°C with July being the coldest month. The potential evapotranspiration is 1400 to 1800 mm per annum (Nakuru District Strategic Plan, 2005). Forests where agroforestry is included are essential for maintaining the rain patterns, therefore it is of essence that farmers adopt agroforestry.

3.3 Demographic Characteristics of the Location

3.3.1 Population Distribution

The population of the area has been on the upward trend since 1979 to 2009, this is because of the new migrants and natural increase. Many new people come to buy land after the ethnic conflicts because at this time the land is sold at cheaper rates. In the year 2009 there was a slight decrease of the population simply because of the 2007/2008 violent ethnic conflicts whereby other people have not returned to their destroyed homes. On the other hand the numbers of households and population density/ persons per square kilometer have ever since increased within the location (table 3.1).

Table 3.1: Population by Administrative Location Unit

Census	Total population	Number of households	Square kilometers	Density/ persons per Km^2	Inter-censual growth rate
1979	3,415	627	187	77	2.1%
1989	4,589	1,473	167	137	2.4%
1999	9,792	1,992	19.7	179	3.6%
2009	9,174	2,004	19.1	161	2.7%

Source: *Census (2009).*

3.3.2 Education in the Location

According to Nakuru District Strategic Plan (2005) Temiyotta location and the larger Nakuru County experience a 38% drop out of females and males out of primary schools. On the other hand in secondary schools the males drop out levels increases to 49.1% and that of females rises to 54.8%. More boys are enrolled in schools than girls. Most of the drop outs are likely to engage in farming activities, and therefore may not be able to read and write and therefore may not be able to access literature related to agroforestry to enlighten themselves on its advantages. On the other hand farmers with higher education have more capacity to access, process and use relevant information about new practices or technology in their farming.

3.3.3 Income in the Location

Ayieni (2013) states that most of the residents of Temiyotta location earn less than Kshs.100 a day. He further explains that poverty in the area is high due to unemployment, landlessness, insecurity, lack of basic services such as health, education and lack of credit facilities. He notes that land crashes have played a major role in the current state of poverty in the location and its environs by creating tension, insecurity, forced migration and destruction of life and property and wastage of time. Many low income earners are prone to undermine agroforestry since it is a long term investment, and their immediate needs is food which they have to work for on a daily basis.

3.4 Land Use in the Location

3.4.1 Agriculture

The most common livestock kept by residents of Temiyotta location are dairy and beef cattle, goats, poultry and sheep, with milk, meat, hide and skin, wool and mutton as their main products. The main crops grown in the area include: maize, beans, peas and Irish Potatoes. Many residents cultivate Irish potatoes for commercial reasons (KARI, 2007). Nakuru District Strategic Plan (2005) states that; the households of Temiyotta location own an average farm size of 0.77Ha. Since the farm is small most of them purely rely on subsistence agriculture, and therefore not likely to adopt agroforestry.

3.4.2 Vegetation Cover

The Vegetation in the location varies largely from grasslands with scattered trees in the plains, to shrub land and forests in the hilly uplands. In the hilly areas, bamboo forests are largely predominant. The vegetation around the rivers is mainly indigenous trees and dense bush and shrubs. Previously, the area was largely covered by rich evergreen forests, extending from the hills, and woodland in the plains (Mutangah, *et al.,* 1993). The location has witnessed land use changes consequent of the up-surging human population and their associated activities. The former large scale farms have been subdivided and allocated to small scale farmers. For instance, the large scale farms, which produced wheat and dairy products on commercial basis, have been converted into small arable and grazing plots through the land fragmentation process (DRSRS, 2010).

RESEARCH METHODOLOGY

3.5 Introduction

This section describes in detail the strategy that was used by the researcher in conducting the research. It includes the following; research design, sampling and sampling procedures, and description of research instruments, data collection and data analysis procedures.

3.6 Study Design

Survey research design was used for this study, which involved sampling three out of nine villages based on demographic and socio-economic factors and randomly picking the households in the identified villages to collect data from the household heads, who make decisions for the household, whereby the decision to plant or not to plant trees is inclusive. The questions asked in the questionnaires were based on the study variables (that is; annual income, household size, farm size, and education level) to lead to responses that were analyzed to measure the study objectives and test the hypotheses.

3.7 Data Types and Sources

Primary and secondary data were used with an intention of meeting the research objectives. Household information (Primary data) was obtained through the use of the structured questionnaires administered to the heads of households, interview guides for key informants and focus group discussions were used. Secondary data was obtained from books, journals, articles, academic thesis and projects.

3.8 Target Population and Sampling Frame

The target population in this study is small scale farmers from Temiyotta location. The location, which is the study area, is made of 3 sub locations and 9 villages with a total of 2,004 households and a population of 9,174 people Census (2009), from which household heads were interviewed. Table 3.2 shows the sub locations and villages within the location, also it shows how the population and households are distributed. The number of households and population has been categorized according to villages.

Table 3.2: Population Distribution in the Location

Sub location	Village	No. of households	Population
Ikumbi	Chemaner	168	638
	Kamwaura	301	1,485
	Sitoito	243	1,234
Cheptagum	Banana	228	989
	Tebere	198	605
	Lelaitich	238	1,232
Murginye	Mtimoja	209	1,108
	Arimi	154	798
	Chepkenoiywo	265	1085
Total:3 Sub locations	**9 Villages**	**2,004**	**9,174**

Source: *Census (2009).*

3.9 Sampling Procedure and Sample selection

Temiyotta location was purposively sampled and selected from other locations in Nakuru County because the researcher has prior knowledge concerning the administrative and location of the study area better than other locations. Stratified sampling was used to place the respondents (household heads) into their respective geographical areas, i.e. villages. The villages in Temiyotta location were listed according to their respective sub locations as shown in table 3.2. A sample of three villages was randomly picked, one village from each sub location. This was done by writing the names of the villages according to their sub location on separate small pieces of paper which were folded then put in a hat, and then one was picked from each sub location. The three randomly drawn villages were; Sitoito (243 households), Tebere (198 households) and Arimi (154 households) which have a total of 595 households (target population). In this study, a sample size of 86 household heads was obtained (14% of the total households). This size was got by the following formula, recommended by Nassiuma (2000).

$$n = (NCv^2) / (Cv^2 + (N - 1) e^2)$$

Where; n = the desired sample size,

N = Target population (595)

Cv = Coefficient of variation (take 0.5)

e = Tolerance at desired level of confidence (0.05) at 95% confidence level.

$$n = (595x0.5^2) \div (0.5^2 + (595-1)\ 0.05^2)$$

$$n = 86$$

The study used a sample size of 86 households with a proportionate distribution of households from every village as shown in Table 3.2 below;

Table 3.3: Sample Size and Sampling of the Households

Sub Location	**Selected Villages**	**No. of Households**	**Selected no. of Households (n)**	**Response Rate**
Ikumbi	Sitoito	243	41	47.7%
Cheptagum	Tebere	198	28	32.6%
Murginye	Arimi	154	17	19.7%
Total		**595**	**86**	**100%**

Source: *Fieldwork (2017).*

Once the strata was established and the sample size from each stratum (village) determined, the researcher sourced a list from the sub chief's offices of the respective villages from which the household heads were picked using systematic sampling. A sampling interval (K = 7) was established by dividing the target population (595 households) by the sample size (86). A sampling starting point was established by folding N papers as per the sample size in every stratum (village) then one was randomly picked. The subsequent households to be interviewed were obtained by adding the sampling interval (K=7) to the household that has been interviewed (Kothari, 2004). The household heads selected for the study were derived from the lists that were obtained at the Sub chiefs offices of the respective villages showing the number and names of the household heads.

The focus group discussions and the key informant interviews were also conducted. The number of key informants' who were interviewed are four. They are; A Community Based Organization (CBO) leader, local area administration Chief, a Rural forest officer from the area and a women leader. The 4 key informants mentioned above were purposively identified and interviewed based on the fact that they are knowledgeable on

social economic and agroforestry issues which affect Temiyotta location. They were asked to discuss on the challenges they encounter while promoting agroforestry and also to explain the kind of support they give to the farmers. Three focus group discussions were as well conducted, one from each village named on table 3.3 above. The composition of the focus group discussions purely comprised of; a group of men, a group of women and that of youth. They gave information on the challenges farmers undergo as far as agroforestry adoption is concerned.

3.10 Data Collection Instruments

Primary data for this study was collected through administration of questionnaires to the Household heads. The questionnaire comprised of queries linked to the variables of the study as shown in the study objectives. These variables are: respondents' annual income, the household size, education level of the household head, respondents' farm size (independent variables) and agroforestry adoption (dependent variable). On the other hand the researcher used observations on the respondents' farms, this helps to support data collected through questionnaires. The questions were structured to collect data on the socio-economic factors that affect agroforestry, identify the agroforestry technologies practiced in the area, and as well assess the level of awareness on agroforestry within the location.

A Camera was used to capture some important features relevant to the objectives of the study as at the time of the field survey such as; agroforestry technologies practiced by the respondents. The questionnaire for focus group discussions was structured in such a way that it captured on key issues with regard to agroforestry adoption in Temiyotta location. Such as; the influence of socio-economic factors on agroforestry adoption. The key informant interview guides were designed in a manner that information relevant to the study was obtained, such as; agroforestry awareness efforts by extension officers, Community Based Organizations (CBOs), Non-Governmental Organizations (NGOs). Secondary data was generated from the following sources; books, journals, articles, academic thesis and projects to back-up primary sources.

3.11 Data Processing and Analyzes

Questionnaires were designed in such a way that vital statistics on the responses was sought, and it included variables such as; the annual income of the respondents, their household sizes, their education level, respondents contact with extension services, farm size of the respondents (Independent variables), and agroforestry adoption (Dependent variable). Descriptive and inferential statistical techniques were used to analyze data. Descriptive statistics of percentages and frequency tables were calculated for each variable in relation to agroforestry adoption in Temiyotta location. The Data was then further analyzed using chi square statistics. The Chi square technique was used to test the association between the dependent variable and the independent variables. The Chi square analysis used the formulae of observed and expected values (shown below) to work out the chi value (χ^2).

$$\chi^2 = \sum_{i=1}^{n} \frac{(O_i - E_i)^2}{E_i}$$

Where; O_i is an observed frequency

E_i is the expected frequency

χ^2 = Calculated Chi square value

$\sum$ = Summation

The significant test in all cases was at α 0.05. If the computed χ^2 value exceeds the critical value in the table for α 0.05 probability level, the null hypothesis of equal distribution will be rejected. On the other hand if the computed χ^2 statistic falls below the critical value in the table for α 0.05, the null hypothesis of equal distribution fails to be rejected.

CHAPTER FOUR
RESULTS AND DISCUSSION

4.1 Introduction

This chapter covers data analysis, presentation and interpretation of the results. The information has been presented in form of narration with aid of tables and numerical figures for clarification. Chi-square was used to determine statistical significance between the study variables. The chapter also gives conclusion of the study, recommendations and ends with a summary.

4.2 Questionnaire Response Rate

The questionnaire response rate was 100% which means that all the 86 respondents answered the 86 questionnaires. The 100% response rate was because the questionnaires were administered by trained research assistants through interviews in Temiyotta location, Nakuru County.

4.3 Social and Economic Characteristic

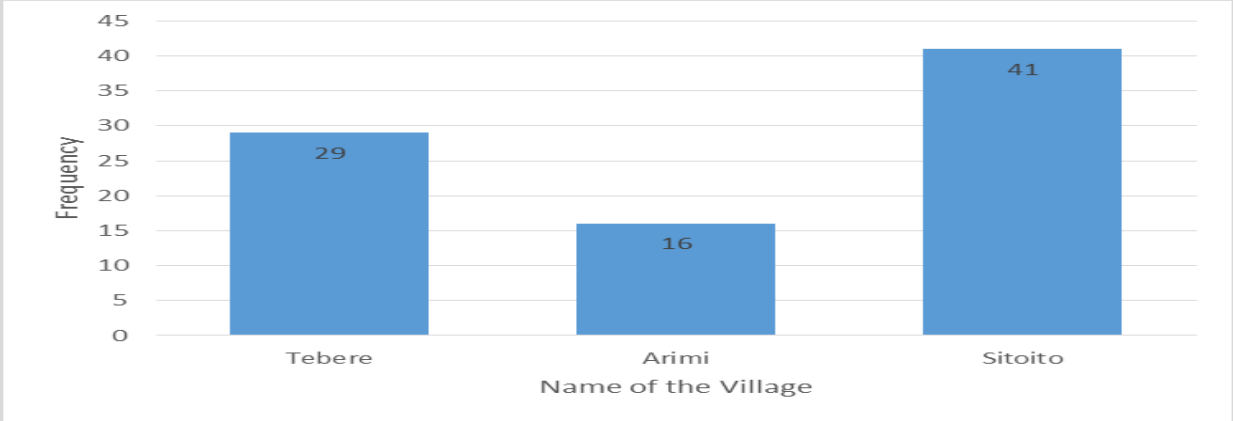
Three villages were covered. The findings are indicated in the Table 4.1 and figure 4.1.

Table 4.1: Name of the Village

Name of the Village	Frequency	Percent (%)
Tebere	29	33.7
Arimi	16	18.6
Sitoito	41	47.7
Total	**86**	**100**

Source: *Fieldwork (2017).*

Figure 4.1: Name of the Village



Source: *Fieldwork (2017).*

From figure 4.1, 41 respondents were from Sitoito village, 29 respondents were from Tebere village while 16 respondents were from Arimi village. Most of the smallholder farmers interviewed were mainly from Sitoito village.

4.4 Information on Head of Household

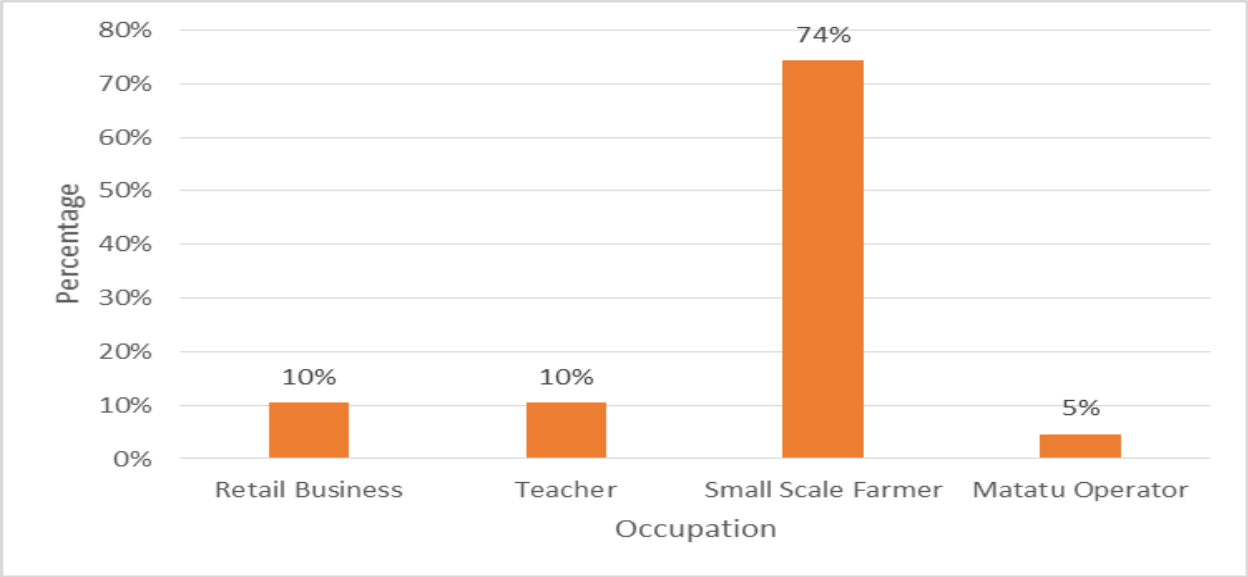
The respondents were also requested to indicate their occupation. The results are indicated in Table 4.2 and figure 4.2.

Table 4.2: Occupation

Occupation	Frequency	Percent (%)
Retail Business	9	10
Teacher	9	10
Small Scale Farmer	64	74
Matatu Operator	4	5
Total	**86**	**100**

Source: *Fieldwork (2017).*

Figure 4.2: Occupation of the Respondents



Source: *Fieldwork (2017).*

From the findings, majority of the respondents (64) (74%) indicated they are small scale farmers as their occupation. Teachers and retail business owners were 20% (10% each). Teachers can easily access information or have knowledge on agroforestry and therefore can influence the adoption of agroforestry in Temiyotta location. Small scale farmers are more likely to adopt agroforestry than any other occupation since they practice farming.

4.5 Farm Size

4.5.1 Relationship between Size of Farm and Agroforestry

The respondents were asked to state the size of their farm in acres. The findings are indicated in the Table 4.3 below.

Table 4.3: Relationship between Size of Farm and Agroforestry

	Planting Trees		
Size of Farm (Acres)	**Yes**	**No**	**Total**
0.5-2	10	14	24
3-4	27	3	30
5-7	19	3	22
8-10	9	1	10
Total	**65**	**21**	**86**

Source: *Fieldwork (2017).*

According to the findings, 27 household heads who plant tree have 3-4 acres of land while 19 household heads have 5-7 acres of land. This shows that most of the farmers who were more likely to adopt agroforestry had a bigger acreage of land planting more trees. From the findings, respondents' farm size is related to adoption rate of agroforestry, those with larger farm sizes are more likely to adopt agroforestry than those with small farm size. This is in tandem with Orisakwe and Agomuo (2011) examining the socioeconomic factors of the respondents practicing agroforestry reveals that, farm size of the respondents had a positive relationship to levels of agroforestry adoption. He reports that an increase in respondents' farm size leads to an increase in adoption of agroforestry. A similar study by Kabwe *et al.,* (2009) reports a significant association between the farm size and adoption of agroforestry. According to (Geremew, 2016) an increase of farm size by one hectare, increases the probability of adopting agroforestry. Where there is surplus farmland the household can be interested to allot the additional farmland for cash generating agroforestry practices.

4.5.2 Land Usage

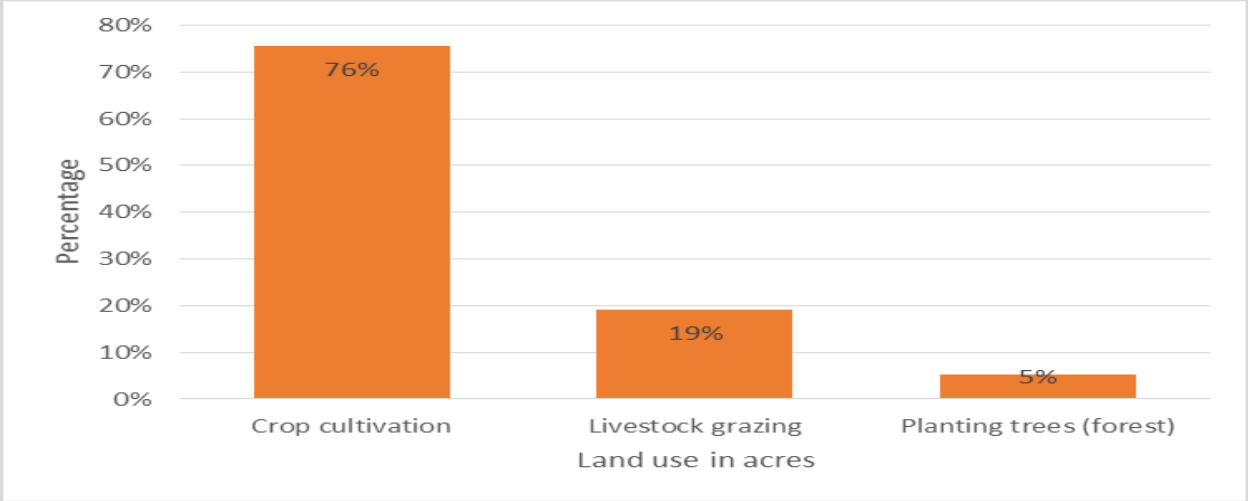
The respondents were requested to indicate what they use the land for. Table 4.4 and figure 4.3 show the findings.

Table 4.4: Land Use Activity

Land Use activity	Estimated land size (Acres)	Percent (%)
Crop cultivation	161.5	76%
Livestock grazing	41	19%
Planting trees (forest)	11	5%
Total	**213.5**	**100%**

Source: *Fieldwork (2017).*

Figure 4.3: Land Use Activity



Source: *Fieldwork (2017).*

The findings indicate that 161.5 acres were used for crop cultivation while the remaining 52 acres were used for Livestock grazing and tree plantation (forest). This means that majority of the farmers' plant crops leaving a small portion of land to plant trees.

4.5.3 Main Type of Crop Cultivated

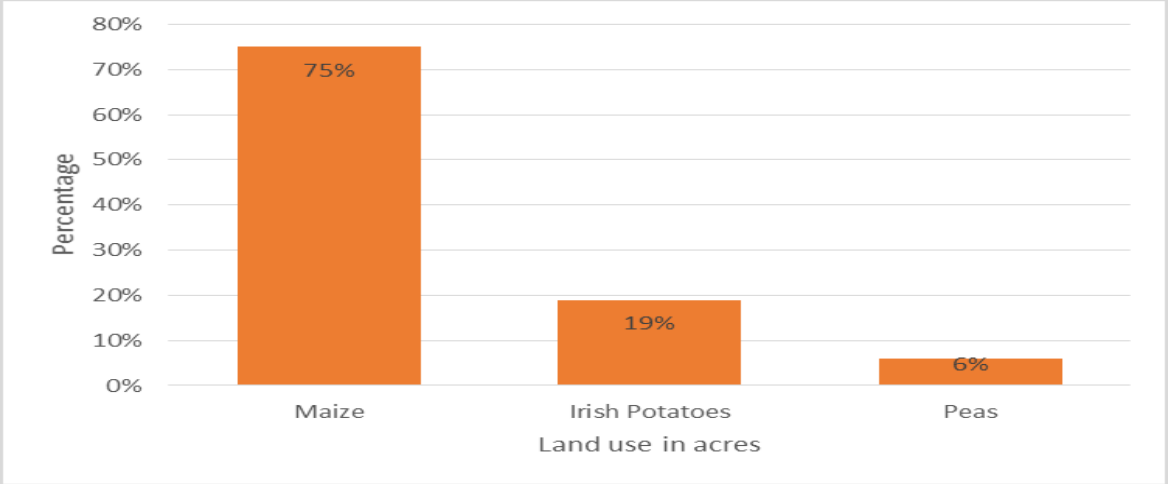
The study sought to determine the main type of crop cultivated by the respondents practicing crop cultivation. Table 4.5 and figure 4.4 illustrate the findings.

Table 4.5: Main Type of Crop Cultivated

Land Use activity	Estimated land size (acres)	Percent (%)
Maize	121.125	75%
Irish Potatoes	30.685	19%
Peas	9.69	6%
Total	**161.5**	**100%**

Source: *Fieldwork (2017).*

Figure 4.4: Main Type of Crop Cultivated



Source: *Fieldwork (2017).*

As reflected in table 4.5 and figure 4.4, 121.125 acres (75%) of the total land size of the respondents are used for maize production, while 19% was used to plant Irish potatoes. Therefore, it can be indicated that maize was the main type of crop cultivated, out of the 121.125 acres of land owned by the respondents who were likely to adopt agroforestry.

4.5.4 Influence of Farm Size on Decision Making

The respondents were requested to state whether the size of farm influenced their decision to plant/not to plant trees. The findings are presented in table 4.6.

Table 4.6: Influence of Farm Size on Decision Making

Influence of Farm Size on Decision Making	Frequency	Percent (%)
Yes	79	91.9
No	7	8.1
Total	**86**	**100**

Source: *Fieldwork (2017).*

According to the findings, 79 (91.9%) respondents revealed that the size of farm had an influence on their decision to plant/not to plant trees while 7 (8.1%) indicated that the size of farm did not influence their decision to plant or not to plant trees. As such, this implies that the size of farm had an influence on their decision to plant or not to plant trees.

How the size of the farm influence the farmers' decision to plant or not to plant trees. The findings are illustrated in Table 4.7 below.

Table 4.7: Mode of Influence

Mode of Influence	Agreement	Frequency	Percent (%)
Farm too small to accommodate trees	Agree	22	25.6
	Disagree	61	70.9
Farm too big and trees are naturally growing	Agree	5	5.8
	Disagree	79	91.9
Utilized for cereals production and grazing	Disagree	84	97.7
	Agree	2	2.3
Trees interfere with mechanized farming	Agree		
	Disagree	82	95.3
Farm small hence trees supplement income	Agree	55	64
	Disagree	29	33.7
Total		**86**	**100**

Source: *Fieldwork (2017).*

The findings illustrated on table 4.7 show that majority of the respondents 55 (64%) revealed that their farm is small hence trees supplement income and therefore influence decision to plant or not to plant trees, while 29 (33.7%) indicated that small farm hence trees supplement income did not influence decision to plant or not to plant trees. However, most of the respondents 84 (97.7%) indicated utilization for cereals production and grazing as the other reason that did not influence decision to plant or not to plant trees. Furthermore, majority of the respondents 82 (95.3%) indicated that trees interfere with mechanized farming did not influence decision to plant or not to plant trees while 2 (2.3%) indicated that it influenced decision to plant or not to plant trees. Majority of the respondents also indicated that farm is large and trees are naturally growing and farm being small to accommodate trees did not influence decision to plant or not to plant trees as represented by 79 (91.9%) and 61 (70.9%) respectively. These findings imply that most agroforestry farmers in Temiyotta location in Nakuru County recognize small farm hence trees supplement income as the factor that influence decision to plant trees.

4.6 Education Level

4.6.1 Educational Level of the Household Head

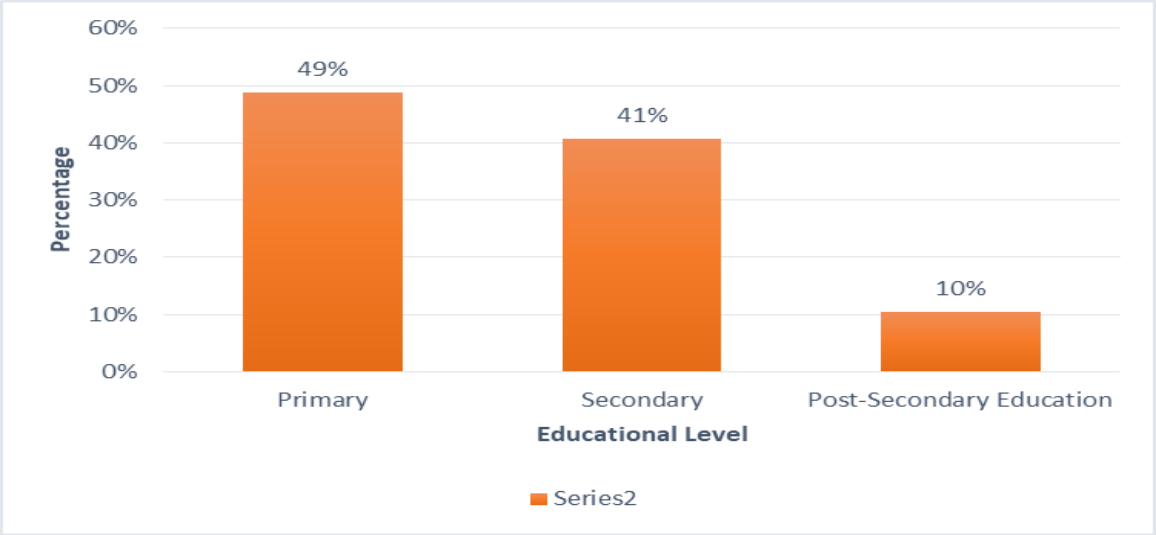
The respondents were asked to indicate their educational level. The results are indicated in Table 4.8 and figure 4.5.

Table 4.8: Educational Level of the Household Head

Educational Level of the Household Head	Frequency	Percent (%)
Primary	42	48.8
Secondary	35	40.7
Post-Secondary Education	9	10.4
Total	**86**	**100**

Source: *Fieldwork (2017).*

Figure 4.5: Educational Level of the Household Head



Source: *Fieldwork (2017).*

According to the findings, 42 (49%) respondents had primary level of education, 35 (41%) had secondary level of education, 9 (10%) had achieved post-secondary level of education. This implies that most respondents had obtained primary level education as their highest education level.

4.6.2 Establishing the Relationship between Household Head's Level of Education and Agroforestry Adoption

Household head's level of education was measured by asking respondents whether they planted trees or not. Since all the cells had values more than five, chi square test was used to analyze the data. Data for these variables was put in a table as shown in the Table 4.9 below.

Table 4.9: Educational Level of the Household Head and Agroforestry Adoption

Years Spent in School		Freq. (%)		Freq. (%)	Planting of Trees	Frequency	Percent (%)
1-9	Yes	24 (27.9%)	No	9 (10.5%)	Yes	65	75.6
Above 10	Yes	44 (51.2%)	No	9 (10.5%)	No	21	24.4
Total		**86**		**100**	**Total**	**86**	**100**

Source: *Fieldwork (2017)*

Table 4.10: Contingency table for the Head of Household's Level of Education and Agroforestry Adoption

Number of years and agroforestry adoption Cross tabulation				
		planting trees		Total
Years spent in school		Yes	No	
0-9	Observed Outcome	24	9	33
	Expected Outcome	26.2	6.8	33
Above 10	Observed Outcome	44	9	53
	Expected Outcome	41.9	11.1	53
Total	Observed Outcome	68	18	86
	Expected Outcome	68	18	86

X^2=27.468 d=15 $p=0.05$ Critical value=4.073

Source: *Fieldwork (2017).*

H_0: The residents' level of education was not significantly related to agroforestry adoption in Temiyotta location.

The Chi square analysis for this variable {X^2=27.468}, revealed that there was a significant relationship between the head of household's level of education and agroforestry adoption in Temiyotta location. This means that the more educated household head, is likely to adopt agroforestry than those with low level of education. The null hypothesis that there was no significant relationship between the household heads' level of education and agroforestry adoption was rejected. This statistical test was significant at $p<0.05$, meaning that the relationship observed was not likely to have been contributed by chance of random sample.

The study findings agree with those of Rahim *et al.,* (2013) whose study examined social factors, which affect farmers' adoption of agroforestry system in Azna. The study reveals that, the higher the educational level of the household head, the higher the adoption levels of agroforestry practices. This is alluded to the fact that, education enhances an understanding of new technologies hence the probability of adoption is increased. Okuthe *et al.,* (2013) analysing the socio cultural determinants of adoption of integrated natural resource management technologies by small scale farmers in Ndhiwa division, agrees that there is a strong relationship between education level of the household head and the agroforestry adoption levels. He explains that, a well-educated farmer can easily understand and interpret the information conveyed to them by an extension officer or from any other source.

The study also asked the respondents to give the reason as to how they thought formal education had been useful in their tree-planting activities. From the study findings, most of the respondents (28) indicated that they were able to access necessary education services in regard to the importance of agroforestry. They attained knowledge on planting trees especially in spacing and management skills and knowledge about various species of trees used in agroforestry. Additionally, most of the respondents (10) also indicated that formal education, management skills and means and sources of information and technology were significant in tree-planting activities. However, some of the respondents indicated that they cannot access information and had not planted trees.

4.6.3 Total Annual Income

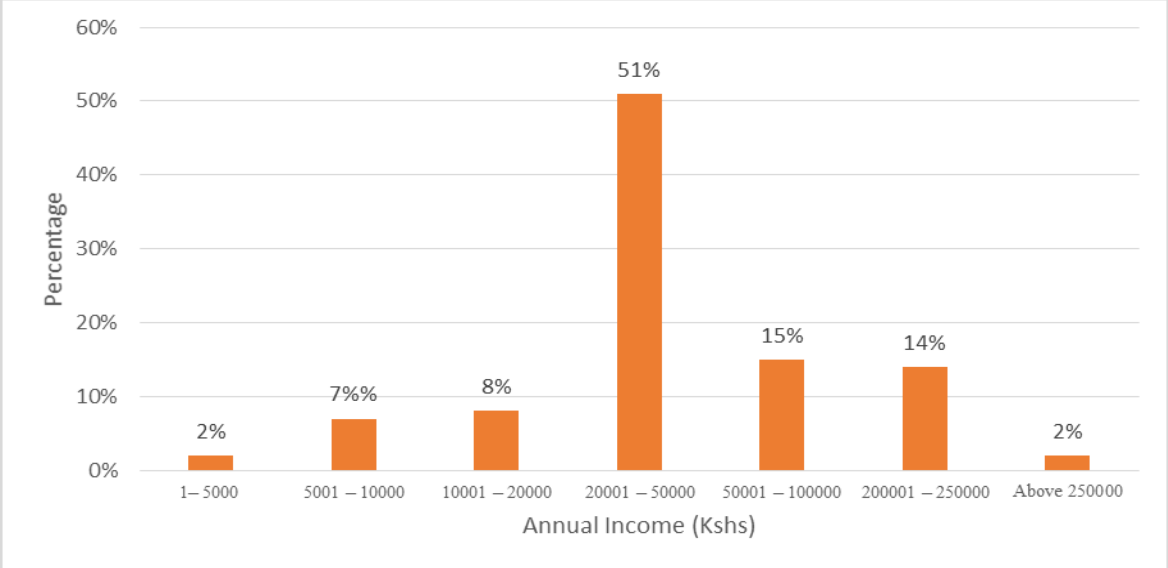
The results of the total annual income of the respondents in Kenya shillings are alluded in Table 4.11 and figure 4.6.

Table 4.11: Total Annual Income

Total Annual Income (Kshs)	Frequency	Percent (%)
1– 5000	2	2.3
5001 – 10000	6	7.0
10001 – 20000	7	8.1
20001 – 50000	44	51.2
50001 – 100000	13	15.1
200001 – 250000	12	14.0
Above 250000	2	2.3
Total	**86**	**100**

Source: *Fieldwork (2017).*

Figure 4.6: Total Annual Income



Source: *Fieldwork (2017).*

As Table 4.11 and figure 4.6 revealed 44 (51.2%) respondents indicated 20,001 – 50,000 Kenya shillings as their total annual income, 13 (15.1%) indicated 50,001 – 100,000 shillings as their total annual income, 12 (14%) revealed 200,001 – 250,000 shillings as their total annual income and 6 (7%) revealed 5,001 – 10,000 shillings as their total annual income. Furthermore, 2 (2.3%) indicated 0 – 5,000 and above 250,000 shillings as

their total annual income. This implies that most smallholders' total annual income was estimated at 20,001 – 50,000 shillings. This means that most respondents are high income earners and therefore can be able to source labor for a fee to manage their agroforestry practices, also to purchase required seeds and seedlings. This is in tandem with the study of Mercer and Pattanayak (2005) who carried out a comparative study on agroforestry adoption in Mexico and Philippines. The objective of the study was to examine the socioeconomic, cultural factors that affect agroforestry adoption in Campeche and Leyte. The study found a positive correlation between income levels of the household head and agroforestry adoption. High income earners are likely to hire people to carry out the agroforestry management practices in their farms, hence a higher adoption rate among high income earners. Also Mulatu *et al.,* (2014) carrying out a study in Tambo district in the Eastern Cape Province, analysing factors that affect the implementation of agroforestry practices agrees that income has a positive correlation with agroforestry adoption.

4.6.4 Establishing Relationship between Household Income and Agroforestry Adoption

Household head's income and agroforestry adoption were measured by asking respondents whether they planted trees or not, and to state their income. Since all the cells had values more than five, chi square test was used to analyze data. Data for these variables were put in table 4.12 as shown below.

Table 4.12: Agroforestry Adoption and Annual Income

	Planting of Trees		
Annual Income	**Yes**	**No**	**Total**
1 – 5000	2	0	2
5001 – 10000	3	3	6
10001 – 20000	4	3	7
20001 – 50000	32	9	42
50001 – 100000	21	5	25
200001 – 250000	2	1	2
Above 250000	1	0	2
Total	**65**	**21**	**86**

Source: *Fieldwork (2017).*

From the findings, 32 households who plant trees have an income of 20,001 – 50,000 while 21 households have an income of 50,001 – 100,000. This shows that majority of the households (53) who practice agroforestry have an annual income of 20,001 – 100,000 and had adopted agroforestry.

Table 4.13: Contingency table for the Residents' Income and Agroforestry Adoption

Residents' Income and Agroforestry Adoption Cross tabulation				
	Planting trees			Total
Total annual income		Yes	No	
0 – 100,000	Observed Outcome	41	15	56
	Expected Outcome	44	12	56
Above 100,000	Observed Outcome	25	5	30
	Expected Outcome	24	6	30
Total	Observed Outcome	68	18	86
	Expected Outcome	68	18	86

X^2=16.347 d=5 $p=0.05$ Critical value=6.869

Source: *Fieldwork (2017).*

H_0: The household's income was not significantly related to agroforestry adoption in Temiyotta location. The Chi square analysis for this variable $\{X^2=16.347\}$, revealed that there was a significant relationship between the household's income and agroforestry adoption in Temiyotta location. This means that the more the household heads earn, the more they are likely to adopt agroforestry than those with low income levels. The null hypothesis that household's income was not significantly related to agroforestry adoption was rejected. This statistical test was significant at $p<0.05$, meaning that the relationship observed was not likely to have been contributed by chance of random sample.

4.7 Household Size

4.7.1 Respondent's Household Size

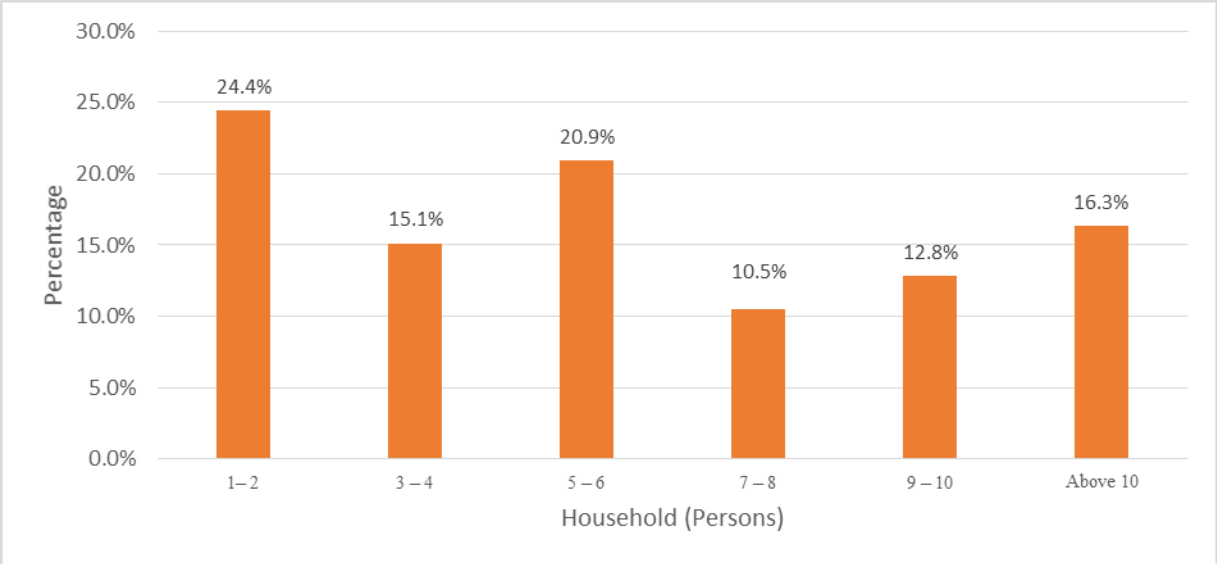
The study asked the respondents to state the size of their household and the findings are indicated in table 4.14 and figure 4.7 below.

Table 4.14: Household Size

Household Size	Frequency	Percent (%)
1 – 2	21	24.4
3 – 4	13	15.1
5 – 6	18	20.9
7 – 8	9	10.5
9 – 10	11	12.8
Above 10	14	16.3
Total	**86**	**100**

Source: *Fieldwork (2017).*

Figure 4.7: Household Size



Source: *Fieldwork (2017).*

The analysis in the table 4.14 and figure 4.7 indicate that the greatest percentages of respondents at 21 (24.4%) had 1-2 persons as the size of their household, 18 (20.9%) had 5-6 persons as the size of their household, 14 (16.3%) had more than 10 persons as the size of their household, 13 (15.1%) had 3-4 persons as the size of their household, 11 (12.8%) had 9-10 persons as the size of their household while 9 (10.5%) had 7-8 persons as the size of their household. The findings show that, the mean size of households comprised of 1-2 individuals. Household sizes tend to influence adoption of agroforestry due to the fact that it provides more labour to manage agroforestry practices. The study findings are in tandem with those of Ayuya *et al.,* (2012) who carried out a study, with the objective to establish the most preferred organic soil management techniques among farmers and the factors influencing the choice of these techniques. He found out that, large household size positively influences adoption of labor- demanding agricultural technologies like, agroforestry since they have the ability to relax the labor limitations necessary in the course of introduction of new technologies. Another study by Bzugu *et al.*, (2012) agrees that, much labor used in small scale farms emanates from the household, and therefore the larger the household the more labour available to carry out agricultural practises like agroforestry.

4.7.2 Effect of Household Size on Agroforestry Adoption

The study sought to find out if household size had an effect on tree planting options. The responses are as follows.

Table 4.15: Effect of Household Size on Adoption of Agroforestry

Effect of Household Size on Adoption of Agroforestry	Frequency	Percent (%)
Yes	46	53.5
No	40	46.5
Total	**86**	**100**

Source: *Fieldwork (2017).*

According to the findings, 46 (53.5%) of the respondents indicated that household size affected their tree planting options while 40 (46.5%) of the respondents indicated that household size did not affect their tree planting options. Therefore, household size affect tree planting options among most smallholder farmers in many ways that include; household size provides labor, planting and management, as indicated by the respondents, thus increases chances of adopting agroforestry.

4.7.3 Establishing Relationship between Household Size and Agroforestry Adoption

Household size was measured by asking respondents whether they planted trees or not. Since all the cells had values more than five, chi square test was used to analyze data. Data for these variables were put in a contingency table as shown below in Table 4.19.

Table 4.16: Household Size

	Tree Plantation		Total
Household Size	**Yes**	**No**	
1 – 2	4	2	6
3 – 4	13	3	16
5 – 6	23	2	25
7 – 8	21	6	27
9 – 10	4	3	7
Above 10	0	5	5
Total	**65**	**21**	**86**

Source: *Fieldwork (2017).*

Table 4.17: Contingency table for the size of Household and Agroforestry Adoption

Contingency table for the size of Household and Agroforestry Adoption				
Size of Household		Planting trees		Total
		Yes	No	
1– 4	Observed Outcome	22	11	33
	Expected Outcome	26.1	6.9	48
Above 5	Observed Outcome	46	7	52
	Expected Outcome	42	11	48
Total	Observed Outcome	68	18	86
	Expected Outcome	68	18	86

X^2=15.001 d=3 $p=0.05$ Critical value=12.924

Source: *Fieldwork (2017).*

H_0: The size of household was not significantly related to agroforestry adoption in Temiyotta location.

The Chi square analysis for this variable {X^2=15.001}, revealed that there was a significant relationship between the size of household and agroforestry adoption in Temiyotta location. This means that the larger the household size, the more likely they are to adopt agroforestry than those with small household size. The null hypothesis that the size of household was not significantly related to agroforestry adoption was rejected.

This statistical test was significant at $p<0.05$, meaning that the relationship observed was not likely to have been contributed by chance of random sample. Household labour is a chief element of labour for small scale farmers. This is essentially for the reason that the subsistence farm households are resources poor and they may have to rely on family labour for agricultural undertakings which in most circumstances are labour demanding. Madalcho *et al.,* (2016) argues that larger households would have enough labor to practice agroforestry and are able to provide adequate management for the agroforestry practices, than smaller households.

4.8 Types of Agroforestry Practiced

4.8.1 Source of Smallholders' Tree Seedlings

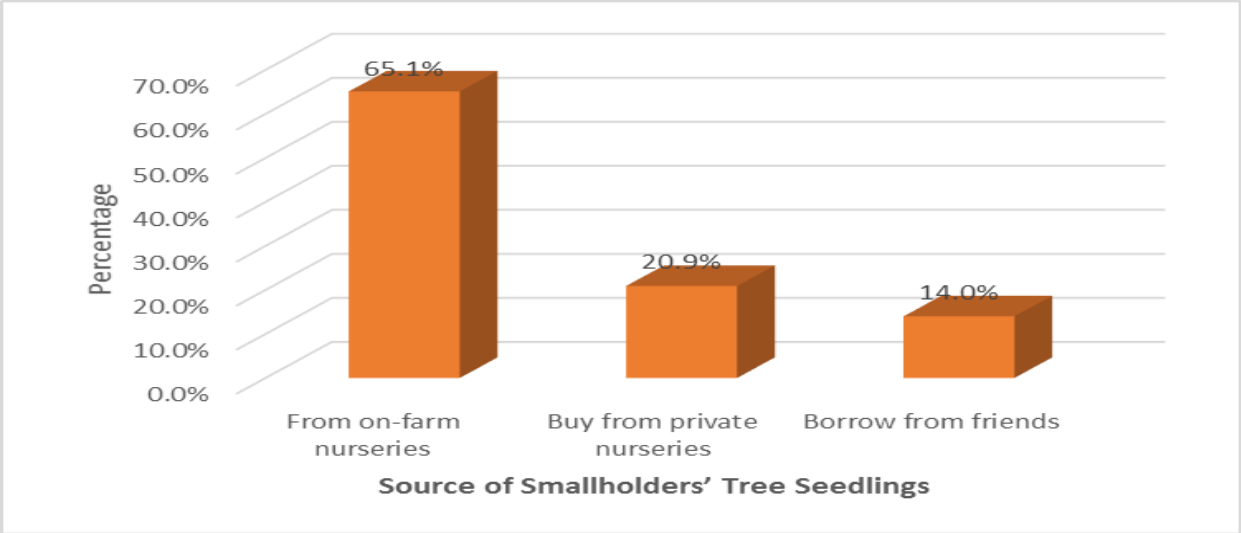
The respondents were requested to state the source of their seedlings .Their responses are shown in the table 4.18 and figure 4.8.

Table 4.18: Source of Smallholders' Tree Seedlings

Source of Smallholders' Tree Seedlings	Frequency	Percent (%)
From on-farm nurseries	40	62%
Buy from private nurseries	18	28%
Borrow from friends	7	11%
Total	**65**	**100%**

Source: *Fieldwork (2017).*

Figure 4.8: Source of Smallholders' Tree Seedlings



Source: *Fieldwork (2017).*

From the study findings, 56 (65.1%) of respondents indicated the source of their tree seedlings as on-farm nurseries, 18 (20.9%) indicated the source of their tree seedlings as buying from private nurseries while 12 (14%) indicated borrowing from friends as the source of their tree seedlings. These indications pointed out that the source of their tree seedlings as on-farm nurseries.

4.8.2 Nature of Planting Trees

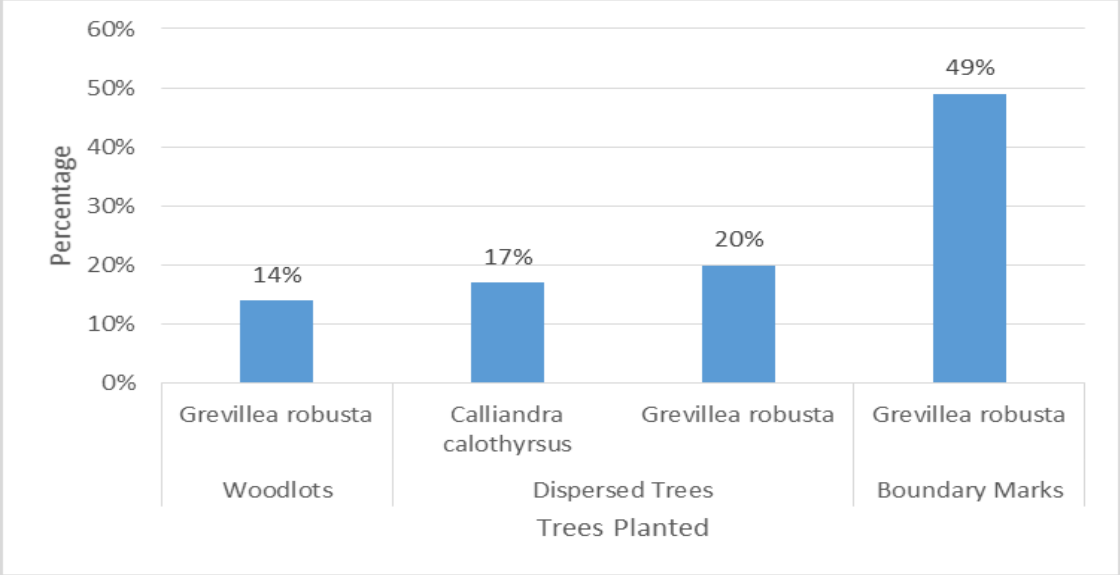
The researcher asked the respondents to indicate the nature of planting trees on their farm. The responses are indicated in Table 4.19 and figure 4.9.

Table 4.19: Nature of Planting Trees in the Farm

Location of Trees in the Farm	Tree Species	Frequency	Percent (%)
Woodlots	*Grevillea robusta*	9	14%
Dispersed Trees	*Calliandra calothyrsus*	11	17%
	Grevillea robusta	13	20%
Boundary Marks	*Grevillea robusta*	32	49%
Total		**65**	**100%**

Source: *Fieldwork (2017).*

Figure 4.9: Nature of Planting Trees in the Farm



Source: *Fieldwork (2017).*

As reflected in table and figure above, most of the respondents (49%) indicated *Grevillea robusta* as the type of tree planted as boundary marks while 20% planted the same tree (*Grevillea robusta*) as dispersed tree in the farm. This shows that *Grevillea robusta* is adopted as agroforestry tree more than other species.

Plate 4.1: *Grevillea robusta* Planted as a Woodlot in Ikumbi Sub-location

Figure 4.14: Nature of Planting Trees in the Farm

Source: *Fieldwork (2017).*

Plate 4.2: *Calliandra calothyrsus* *Dispersed* in the Farm-in Murginye Sub location

Source: *Fieldwork (2017).*

Plate 4.3: *Grevillea robusta* as Boundary marks and dispersed trees in the Homestead in Cheptagum Sub-location

Source: *Fieldwork (2017).*

4.9 Benefits of Planted Trees

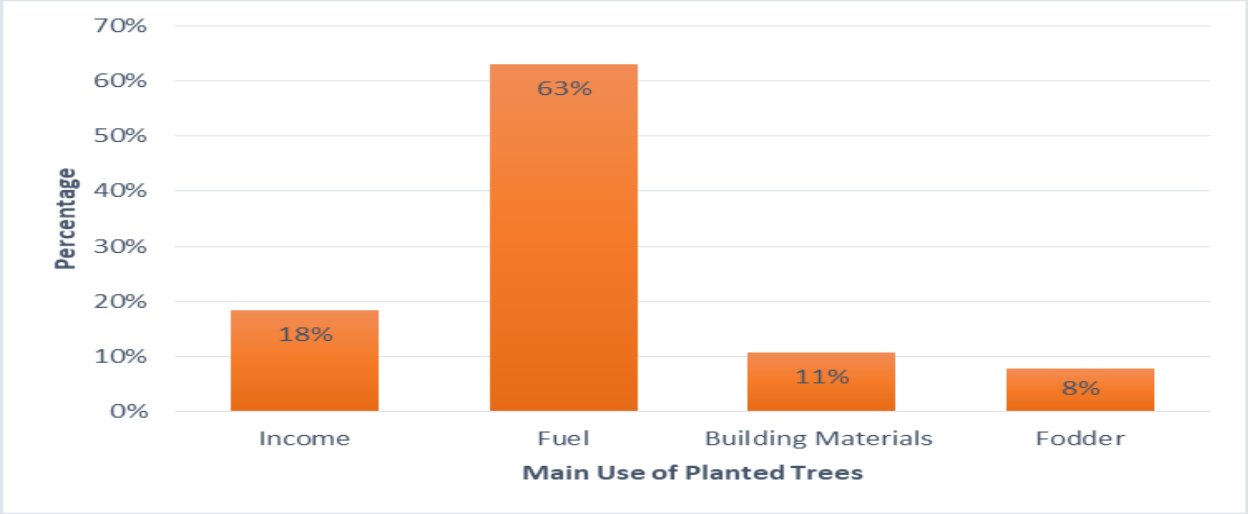
The researcher asked the respondents the main use of trees they had planted. The findings are indicated in Table 4.20 and figure 4.10.

Table 4.20: Main Use of Planted Trees

Main Use of Planted Trees	Frequency	Percent (%)
Income	12	18%
Fuel	41	63%
Building Materials	7	11%
Fodder	5	8%
Total	**65**	**100%**

Source: *Fieldwork (2017).*

Figure 4.10: Main Use of Planted Trees



Source: *Fieldwork (2017).*

Majority of the respondents (63%) indicated fuel as the main use of trees they had planted while 18% indicated income as the main use of trees. The findings as indicated by the respondents shows that the main use of trees they had planted was for fuel and therefore they are likely to adopt agroforestry to use the trees later for fuel.

4.10 Discussion of the Findings

The study found a significant relationship between residents' household size and agroforestry adoption in Temiyotta location. This is in agreement with Madalcho and Tefera (2016) who indicated that farmer's socio-economic characteristics namely;

residents' household size, educational level, membership to farmers' association and accessibility to extension services had a significant positive influence on the adoption of agroforestry.

Ayuya *et al.*, (2012) also concurs with the findings of the study by indicating that household size is significantly related to adoption of agroforestry technology. Large household size positively influences adoption of labor-demanding agricultural technologies since they have the ability to relax the labor limitations necessary in the course of introduction of new technologies. Social sustainability is achieved if the quality of life of those who live and work on the farm as well as the surrounding communities is seen to improve. Agrochemicals that are likely to injure them should be minimized or eradicated. Further, they should access yields at affordable prices (Odendo *et al*., 2009).

The study also found that the residents' level of education was significantly related to agroforestry adoption in Temiyotta location. Okuthe *et al.,* (2013) concur with the view that there is a relationship between the level of education and the practice of agroforestry. They indicate that the decisions on the soil fertility management and agroforestry practice are made within the context of the whole farm and the totality of the resources available to the farmer, which includes the entire land holding and the different fields comprising it. The scholar views the farmer as a rational individual whose land use decisions are based on level of education as well other human and material resources. Okoba *et al.,* (2013) note that when level of education increase farmers may become more interested in high yielding systems such as alley cropping. Alley cropping is a form of agroforestry where crops are grown between rows of trees.

He further states that a change in production system comes also as a need for change in knowledge, management skills, and extension services. For farmers, introduction of a new species means that they have to learn how to take care of it. In other cases effective integration of local knowledge and perspectives into agroforestry are necessary for such projects. Twahu *et al.,* (2016) says that education and training are needed in many

cases to help communities value and manage forest resources. The importance of education and training is a constant factor in all the work on forest quality. Such education can work in two directions because experts often have much to learn from local communities. Education opportunities may include bringing different groups together or informal teaching alongside more traditional approaches to extension and training. They feel that informal or formal training sessions for groups would be a good model for dissemination of agroforestry services.

Furthermore, there was a significant relationship between the residents' income and agroforestry adoption in Temiyotta location. This is in agreement with Adnan *et al.*, (2014) who states that many farmers would take up credit for the agroforestry projects. However, Kenya National Bureau of Statistics (2013) indicate that it is expensive to obtain credit. Fees, costs and documentation requirements also serve to limit financial access Munyaradzi and Torquebiau (2010). Hence, unless one has other sources of income, he probably, would not be in a position to access credit facilities. This is especially so if he does not have land titles or other assets to secure finance or an engagement in other income generating activities. Hence this would have negative implications on community based agro-forestry project in that the individual would be more interested in securing other financial assets to improve his net worth. This has an impact on their participation on community based projects, as a less empowered man would not readily participate in these projects. At an individual level, there's a positive link between financial deepening and growth Adnan *et al.*, (2014). Since men have limited access to credit, they face the option of engaging in self-help projects rather than community based projects to improve their net worth or otherwise seek alternative funding from other sources. While this may happen in some cases, most men have to meet their culturally defined obligations to their immediate family first.

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter contains the summary of the findings; the discussions of the findings which are based on each of the stated objectives, conclusion and recommendations based on the findings of the study. The chapter also highlights the suggestions for further studies.

5.2 Summary of Findings

According to the study, most of the smallholder farmers were mainly from Sitoito village. The study found that majority of the farmers were aged between 35-39 years. The study further found that small scale farmers in Temiyotta location, Nakuru County were more likely to adopt agroforestry than any other occupation. It found that most smallholder farmers have 4-7 members as their household size. Household sizes tend to influence adoption of agroforestry due to the fact that it provides more people who are involved in these communities based initiatives, laying strategies to enhance participation of more households in agro-forestry.

It was discovered that most respondents owned between 3-7 acres of land and were more likely to adopt agroforestry. Farm size of farmers is positively related to adoption rate of agroforestry practices implying that as the farmers' farm sizes increase they adopt more of agroforestry practices, and when the farm size decreases the adoption as well declines. The study also found that majority of the farmers planted crops leaving a small portion of land to plant trees. The study further found that maize was the main type of crop cultivated 121 acres of land by the respondents who were likely to adopt agroforestry. Additionally, the study found that the size of farm had an influence on their decision to plant/not to plant trees since agroforestry farmers in Temiyotta location in Nakuru County recognize small farm hence trees supplement income as the factor that influence decision to plant trees.

The study found that most respondents had obtained primary level education as their highest education level. Most of the respondents were able to access necessary education services on the importance of tree farming and agroforestry, attained knowledge for planting trees especially in spacing and management skills and knowledge about various species of trees and management skills. The study found that most smallholders' total annual income was estimated at Kshs. 20001 – 50000. Furthermore, the study found that the more income of the household head, the more likely to adopt agroforestry than those with low income levels.

In regard to household size, the study found that the mean size of households was between 1-2 individuals. The study found that household size affect tree planting options among most smallholder farmers in many ways that include; household size provides labor, planting and management, as indicated by the respondents, thus increases chances of adopting agroforestry. It further found that the larger the household size, the more likely to adopt agroforestry than those with small household size.

The study found that the source of farmers' tree seedlings was on-farm nurseries. The study found that extension approach sensitizes community groups and schools on need for agroforestry especially establishment of household woodlots; growing of fruits for family and surplus for market; growing of fodder tress for improved animal husbandry and returns and growing of indigenous trees for conservation of water catchment areas. In relation to type of agroforestry trees planted, the study found Grevillea as the likely tree to be adopted as agroforestry tree by households. Finally, the study found out that the main use of trees they had planted was for fuel and therefore they are likely to adopt agroforestry to use the trees later for fuel.

5.3 Conclusion

From the study, adoption of agroforestry have a positive influence on the environment because of the many benefits derived. The study established that most respondents owned between 3-7 acres of land. The study also concluded farm size of farmers is positively related to adoption rate of agroforestry practices implying that as the farmers' farm sizes

increase they adopt more agroforestry practices, and when the farm size decreases the adoption as well declines. The study also concluded that the size of farm had an influence on their decision to plant/not to plant trees. Most agroforestry farmers in Temiyotta location in Nakuru County recognize that they own small farm hence trees supplement income as the factor that influence decision to plant/not to plant trees. The study concluded that most respondents had obtained primary level of education as their highest education level. Most of the respondents were able to access necessary information on the importance of agroforestry, attained knowledge for planting trees especially in spacing and management skills and knowledge about various species of trees and management skills.

It was established that the size of households was between 4-7 individuals. It further concluded that household size affect tree planting options among most smallholder farmers in many ways that include enough source of labor and management. The study further concluded that household labour is a chief element of labour for small scale farmers. This is essentially for the reason that the subsistence farm households are capitals poor and they may have to rely on family labour for agricultural undertakings which in most circumstances are labour demanding. This is because labour availability, where he argues that larger households would have enough labour to plant trees and able to provide adequate management for the planted trees.

On matters concerning type of agroforestry practiced, the study established that *Grevillea robusta* and *Calliandra calothyrsus* are the tree species planted by agroforestry farmers in the area. The study further concludes that *Grevillea robusta* was the likely tree to be adopted as agroforestry tree by most households. Finally, the study revealed that the main use of trees they had planted was for fuel and therefore they are likely to adopt agroforestry to use the trees later for fuel.

5.4 Recommendations

There is a great need for agroforestry extension services for the smallholder farmers in the area so that they can be guided on agroforestry adoption. Also the farmers need to be

educated on the appropriate trees to plant as regards the various agroforestry tree species. The government and other stakeholders should promote tree farming in the area so as to prevent deforestation and land degradation in search of firewood and timber from the community and government forests. The government should give incentives to encourage people to plant trees for own consumption and at the same time to restore the degraded environment.The community has inadequate knowledge on all the agroforestry adoption practices discussed. Therefore, the government and NGOs working in the area should look into capacity building of the communities on agroforestry adoption. This will help to empower the communities in conserving the environment which has been degraded through deforestation.

5.5 Suggestions for further Research

The study suggests that more studies on agroforestry to be carried out in Temiyotta location, Nakuru County on the right kind of species for different agroforestry adoption practices in the different ecological zones. This should be combined with an extensive study on the level of knowledge by the different farmers regarding the different practices.

REFERENCES

Adnan J., Haider A. & Danish M. G. (2014). *Factors upsetting agroforestry system in Swat, Pakistan.* International Journal of Agroforestry and Silviculture, Vol. 1 (8), pp. 086-092.

Ajayi, O. C., Franzel, S., Kuntashula, E., & Kwesiga, F. (2003). *Adoption of improved fallow technology for soil fertility management in Zambia: Empirical studies and emerging issues.* Agroforestry Systems, 59(3), 317-326.

Ajayi, O. C., Massi, C., Katanga, R., & Kabwe, G. (2006). *Typology and characteristics of farmers planting improved fallows in southern Africa.* Zambian Journal of Agricultural Sciences, 8(2), 1-5.

Alao, J. S., and Shuaibu, R. B. (2013). *Agroforestry practices and concepts in sustainable land use systems in Nigeria.* Journal of Horticulture and Forestry, Vol. 5(10), pp. 156-159.

Alavalapati J., Meghan M. M. & Mickie E. S. (2008). *Agroforestry adoption and maintenance: self-efficacy, attitudes and socio-economic factors.* Agroforest Syst. 73:99–108. *Applications* 6: 107-115.

Ayieni A. J., (2013) *Empowering Kuresoi North Constituency, 'Build People, Build a Nation'. An Initiative by Pulse Care Systems.* Narshi Hse 1st Floor Moktar Daddah Street, Nairobi.

Ayuya O. I., Waluse S. K & Gido O. E. (2012). *Multinomial Logit Analysis of Small-Scale Farmers' Choice of Organic Soil Management Practices in Bungoma County, Kenya.* Current Research Journal of Social Sciences 4(4): pp 314-322.

Banana, A., Nabanoga, G. & Ntakimanye, A. (2008). *Rotational woodlot technology in Kigorobya Sub-county of Hoima District, Western Uganda.* Ethnobotany Research & Applications 6: 107-115.

Barret, C.B., Place F. & Aboud, A.A. (2002). *Natural Resource Management in African Agriculture: Understanding and Improving Current Practices.* CABI Publishers, Oxford.

Blaug, M. (1970). *Introduction to the Economics of Education.* Harmondsworth: Penguin, Bonnard P. Within gender differences in tree management: Is gender distinction a reliable concept? Agroforestry Systems 25: 71–93.

Bzugu, P.M., Mustapha, S.B. & Adeogun, F.A. (2012). *Socio Economic Factors Influencing Adoption of Improved Gum Arabic Seedlings Among Farmers in the Sahelian Zone of Borno State, Nigeria*. International Journal of Innovative Research & Development, Vol 1(9) pp. 237-252.

Census, (2009). *The 2009 Kenya population and housing*, Volume 1A. Nairobi.

Cheikh M. (2015). *Agroforestry can form an effective, efficient and fair pathway to achieve food security and agricultural sustainability in Africa.* World Agroforestry Centre-Nairobi, Kenya.

China, S.S. (1993). *Land Use Planning using GIS.* Unpublished PhD thesis, University of Southampton.

Chitere, P.A. (1985). *Agroforestry Plots for Rural Kenya Project.* Socio-Economic Survey Report. Mazingira Institute, Nairobi, Kenya.

Cooper, P. J. M., Leakey, R. R. B., Rao, M. R., and Reynolds, L. (1996). *Agroforestry and the mitigation of land degradation in the humid and sub-humid tropics of Africa.* Experimental Agriculture, 32: 235-290.

DRSRS (Department of Resource Surveys and Remote Sensing) (2010) Nairobi Kenya.

Duvel G. H, (1997). *An Interdisciplinary Model for Behaviour Analysis and Intervention in Agricultural Extension and Rural Development.* Journal of International Agricultural and Extension. South African Institute for Agricultural Extension. Vol. 4 pp. 55-65.

Duvel, G.H., (1994). *A model for Adoption Behavior: Analysis in Situation Surveys.* J. Extension. Systems. Vol. 10, No. 1 pp 1–32.

Edinam K. G., Hassan B. A., & Mawutor K. G. (2013) *Analysis of Socio-Economic Conditions Influencing Adoption of Agroforestry Practices*. International Journal of Agriculture and Forestry 2013, 3(4): 178-184.

FAO. (2013). *Advancing Agroforestry on the Policy Agenda: A guide for decision-makers,* by G.Buttoud, in collaboration with O. Ajayi, G. Detlefsen, F. Place & E. Torquebiau. Agroforestry Working Paper no. 1. Food and Agriculture Organization of the United Nations. FAO, Rome. Pp. 37.

FAO/REOSA. (2010). *Farming for the future in Southern Africa: An introduction to conservation agriculture.* (FAO Regional Emergency Office for Southern Africa) REOSA Technical Brief No. 1.

Food and Agriculture Organization of the United Nations. (1989). *Forestry and Food Security,* FAO Forestry Paper No. 90 FAO. Rome, Italy.

Franzel, S., Cooper, J., and Denning, G. (2001). *Scaling up the benefits of agroforestry research: lessons learned and research challenges.* Development in Practice, 11(4)524-534.

Garrity, D. P. (2006). *Science-Based Agroforestry and the Millennium Development Goals.* In: D. P. Garrity, A. Okono, M. Grayson and S. Parrott (Eds). World Agroforestry into the Future. Nairobi, Kenya: World Agroforestry Centre, ICRAF.

Geremew W. K., (2016). *Agroforestry and land productivity: Evidence from rural Ethiopia.* Kassie, Cogent Food & Agriculture, research article (2016), 2: 1259140.

Gichuki, J.J. & Njoroge, S.N.J. (1989). *Socio-economic Aspects in Agro forestry.* Permanent Presidential Commission on Soil Conservation and Afforestation, Nairobi, Kenya.

International Centre for Research in Agro forestry. (1992). *A Selection of Useful Trees and Shrubs for Kenya.* ICRAF, Nairobi, Kenya.

Ipara, H.I. (1992). *Socio-economic Factors Affecting the Participation of women in Agroforestry Activities in Sabatia Division in Vihiga, Kenya.* M. phil, Thesis (Unpublished) Moi University, Eldoret, Kenya.

Kabwe G., Bigsby H. & Cullen R. (2009). *Factors influencing adoption of agroforestry among smallholder farmers in Zambia*. Paper presented at the 2009 NZARES Conference Tahuna Conference Centre – Nelson, New Zealand. August 27-28, 2009.

Kassa, G. (2015). *Profitability analysis and determinants of fruit tree based agroforestry system in Wondo district, Ethiopia.* African Journal of Agricultural Research, (10) pp.1273–1280.

Kenya Agricultural Research Institute (KARI)-National Potato Research Centre, Tigoni FOODNET Potato Processing Project Title: Linking ware potato growers with processors of French-fries in Nakuru District. Kenya, 2007.

Kenya National Bureau of Statistics (KNBS) and Society for International Development (SID) (2013) *Exploring Kenya's Inequality, Pulling Apart or Pooling Together-Nakuru County.* Ascent Limited, Nairobi Kenya.

Kerkhof, P. (1992). *Agroforestry in Africa: A survey of project experience,* Ipara Publication.

Kiptot E. & Franzel S. (2011). *Gender and agroforestry in Africa: are women participating?* ICRAF Occasional Paper No. 13. Nairobi: World Agroforestry Centre.

Kothari, C. R. (2004). *Research Methodology: Methods and Techniques*. New Age International, 2004, New Delhi. 401pp.

Kwesiga, F., Akinnifesi, F.K., Mafongoya, P.L, McDermott, M.H. & Agumya, A. (2003) *Agroforestry research and development in southern Africa during the 1990s: review and challenges ahead.* Agroforestry systems 59 (3), 173-186.

Kwesiga, F., Akinnifesi, F.K., Mafongoya, P.L, McDermott, M.H. and Agumya, A. (2003) *Agroforestry research and development in southern Africa during the 1990s: review and challenges ahead.* Agroforestry systems 59 (3), 173-186.

Madalcho A. B. & Tefera M. T. (2016). *Management of Traditional Agroforestry Practices in Gununo Watershed in Wolaita Zone, Ethiopia.* Forest Res 5: 163.

Makaya, P. R. (2000). *Fodder Banks – Chikwaka Dairy Farmers (Zimbabwe) Give Feedback.* Living With Trees in Southern Africa, 4, 17-19.

Maluki J. M., Kimiti J. M., Nguluu S. and Musyoki J. K. (2016). *Adoption levels of agroforestry tree types and practices by smallholders in the semi-arid areas of Kenya: A case of Makueni County.* Journal of Agricultural Extension and Rural Development. Vol.8 (9), pp. 187-196.

Mercer D. E. & Pattanayak K. S (2005). *Agroforestry Adoption by Smallholders*. USDA Forest Service and Research Triangle Institute. Sills and Abt (eds.), Forests in a Market Economy. Kluwer Academic publishers, Netherlands, pp 283-299.

Mercer, D. (2004). *Adoption of agro forestry innovations in the tropics:* a review. Agroforestry Systems, 61, 311-328.

Morris, C.T. & I. Adelman. (1988). *Comparative patterns of economic development 1850-1914.* John Hopkins University Press, Baltimore, MD.

Mulatu F. Z., Mammo M. & Zeleke W. (2014) *Determinants of agroforestry technology adoption in Eastern Cape Province, South Africa.* Development Studies Research, 1:1, 382-394.

Munyaradzi C. and Torquebiau E. (2010). *Barriers and coping mechanisms relating to agroforestry adoption by smallholder farmers in Zimbabwe.* Centre for Environmental Studies, University of Pretoria, South Africa.

Nakuru County Integrated Development Plan, (2013). *First County Integrated Development Plan (2013-2017).* Republic of Kenya Nakuru County.

Nakuru District Strategic Plan 2005-2010 (2005). *Nakuru District Strategic Plan 2005-2010 for Implementation of the National Population Policy for Sustainable Development.* Ministry of Planning and National Development Nairobi-Kenya.

Nassiuma D. K., (2000), *Survey Sampling: Theory and Methods.* Nairobi: University of Nairobi Press.

Neupane, R. P., and Thapa, G. B. (2001). *Impact of Agroforestry Intervention on Soil Fertility and Farm Income under the Subsistence Farming System of the Middle Hills, Nepal.* Agriculture, Ecosystems & Environment, 84(2): 157-167.

Neupane, R. P., Sharma, K. R., and Thapa, G. B. (2002). *Adoption of Agroforestry in the Hills of Nepal: A Logistic Regression Analysis.* Agricultural Systems, 72(3):177-196.

Odendo, M., Obare, G. and Salasya, B. (2009). *Factors responsible for differences in uptake of integrated soil fertility management practices amongst smallholders in western Kenya.* African Journal for Agricultural Research, 4(11): pp. 1303-1311.

Oino P. & Mugure A. (2013). *Farmer-Oriented Factors that Influence Adoption of Agroforestry Practices in Kenya:* Experiences from Nambale District, Busia County.International Journal of Science and Research (IJSR), India Online ISSN: 2319-7064, Vol. 2, pp 450-456.

Okoba B., Waweru G. & Wim C. (2013). *Farmers' perception of conservation agriculture in Laikipia East District in Kenya.* Joint proceedings of the 27th Soil Science Society of East Africa and the 6th African Soil Science Society. Nairobi Kenya.

Okuthe I. K., Kioli F. & Abuom P. (2013). *Socio Cultural Determinants of the Adoption of Integrated Natural Resource Management Technologies by Small Scale Farmers in Ndhiwa Division, Kenya.* Current Research Journal of Social Sciences 5(6): pp 203-218.

Ong'ayo, M. (1993). *Manual for Training Field Extension Workers: Extension Methods.* Moto Mwaka, KWAP and ETC. Nairobi, Kenya.

Orisakwe L. & Agomuo F., O. (2011): *"Adoption of Improved Agroforestry Technologies among Contact Farmers in Imo State, Nigeria"* Asian Journal of Agriculture and Rural Development, 2(1), pp. 1-9.

Pattanayak S. K., Mercer D. E., Erin O. S., Jui-Chen Y. & Kirsten C. (2002). *Taking Stock of Agroforestry Adoption Studies.* Working Paper 02_04. RTI International's.

Rahim M., Zeynab B., Javad S. & Kamran A. (2013). *Factors Affecting Agroforestry Acceptance Level by Framers in Lorestan, Iran.* Journal of Agriculture Science Developments, 2(10), pp 102-105.

Sileshi G., Akinnifesi F.K, Ajayi O.C, Chakeredza S., Kaonga M. & Matakala P.W. (2007). *Contributions of agroforestry to ecosystem service in the Miombo eco-region of eastern and southern Africa*. African Journal of Environmental Science and Technology, 1(4), pp 068-080.

Sileshi, G. & Mafongoya, P.L. (2006). *Long-term effects of legume-improved fallows on soil invertebrate and maize yield in eastern Zambia.* Journal of Applied Soil Ecology, M Vol.33 (1):49-60.

Survey of Kenya (2011).

Tengnas B. (1994). *Agroforestry extension manual for Kenya.* Nairobi: International Centre for Research in Agroforestry.

Thangata P. H & Alavalapati J R R, (1996) *Adoption of Agroforestry Practices in Malawi: A Case Study of Gliricidia Sepium and Maize*. School of Forest Resources and Conservation, University of Florida, Gainesville.

Thangata, P. H. & Alavalapati J.R.R. (1996). *Resource poor farmers' perception of agro-forestry practices:* A case study of Malawi. Unpublished Master's Thesis, University of Edinburgh, Scotland, UK.

Thangata, P. H., & Alavalapati, J. R. R. (2003). *Agroforestry adoption in southern Malawi: the case of mixed intercropping of Gliricidia sepium and maize.* Agricultural Systems, 78(1), 57-71.

Tolman, E. C. (1967). *A psychological model.* In: T. Parsons and E.A. Shils. Toward a general theory of action. Cambridge. Harvard Univ. Press.

Twaha, A. B., Mayanja C., Kiiza B., Nakileza B., Matsiko F., Nyende P., Bacwayo E. K., Tumushabe A. and Kassim S. (2016) *Enhancing Adoption of Agroforestry in the Eastern Agro-Ecological Zone of Uganda.* International Journal of Ecological Science and Environmental Engineering. Vol. 3, No. 1, pp. 20-31.

UNEP. (2015). *Green Economy Sector Study on Agriculture in Kenya.* 34 p.

APPENDICES

APPENDIX I: QUESTIONNAIRE

CONFIDENTIAL

ANALYSIS OF SOCIO-ECONOMIC FACTORS THAT AFFECT AGROFORESTRY ADOPTION AMONG SMALLHOLDERS IN TEMIYOTTA LOCATION, NAKURU COUNTY

1. (a) Name of the Village

	Area	**tick (√)**
1	Tebere	
2	Arimi	
3	Sitoito	

(b) Information on Head of Household

Name of Respondent	Age	Gender (Male/ Female)	Marital Status	If married/ Widowed/ Separated how many children do you have?
	Education level	Occupation	How long you have stayed here	Household size

(c) Household Information – to be answered by household head

INTERVIEWER: List all the people who live in the household and get the required information.

Persons first name	Relationship to the Head of Household	How long have you lived in the current home/Area	Gender (Male/ Female)	Age	Education	Occupation

2. (i) What size of farm do you own?.....Acres

(ii)What do you use the land for?

Land use activity	**Tick (√)**	**Estimate land size**
Crop cultivation		
Livestock grazing		
Planting trees (forest)		

(iii) If you practice crop cultivation, what main type of crop do you cultivate?

	Type of crop	Tick (√)	Acres each crop occupies
1	Maize		
2	Irish Potatoes		
3	Peas		
4	Pyrethrum		
5	Cabbages		
6	Others		

(iv) If you practice Livestock farming, what animas do you rear?

	Type of Animal	Number of Animals
1	**Cows**	
2	**Sheep**	
3	**Goats**	
4	**Donkeys**	

(v) Does size of farm influence your decision to plant/not to plant trees?

(1) No….. (2) Yes…..

If yes how?	**Tick Appropriately**
Farm too small to accommodate trees,	(…..)
Farm too big and trees are naturally growing,	(…..)
Utilized for cereals production and grazing	(…..)
Trees interfere with mechanized farming	(…..)
Farm small hence trees supplement income	(…..)

Others, specify, ……

3. (i)Educational level of the household head

	Educational level	Year completed	Years spent in school
1	None		
2	Primary – Indicate class		
3	Secondary – Indicate form		
4	Technical		
5	University		
6	Other		

(ii) Has this been useful in your tree-planting activities (1) Yes…. (2) No….
If yes, how? …….
……..
If no, why? ……..

4 (a) what is your occupation?.....

(b) What are your other sources of income, and what's the income from each source?

	Other sources of Income	**Income from each source (Kshs.)**
1	**Farming**	
2	**Peasantry**	
3	**Logging**	
4	**Charcoal burning business**	
5	**Own a retail kiosk**	
6	**Other**	

(c)What is your monthly income? Kshs.....

(d)What is your total annual income? Kshs……

5. (i) what is the size of your Household?.....

(ii) Does your household size affect your tree planting options: (1) No…. (2) Yes…..

(iii)If yes, how?……

6. Extension Services:

(i) (a) Do you get visited by an extension officer? (1) Yes…. (2) No….

(b) If yes,

How often are you visited by an extension staff at your farm?

(1) Once a week (2) Twice a month (3) Once a month

(4) Once after 3 months (5) Once a year (6) Not at all

(ii) Do you visit extension officers/offices? (1) Yes…. (2) No….

How often do you visit the extension officers/offices?

(1) Once a week (2) Twice a month (3) Once a month

(4) Once after 3 months (5) Once a year (6) Not at all

(iii) (a)Do extension officers provide seedlings (1) No…. (2) Yes….

(b) If no, what is the source of your tree seedlings?

(1) From on-farm nurseries (2) Buy from private nurseries

(3) Borrow from friends (4) Others, specify ……

(c) How often do you plant trees?

(1) Monthly (2) Quarterly (3) Semi-annually

(4) Annually (5) Not at all

7. Types of Agroforestry Practiced

(a) **Do you plant trees** (1) Yes….. (2). No…..

(b) If yes, what kind of trees and how many?

	Types of Trees	**Amount Planted**
1		
2		
3		

(c) What is the total number of trees on your farm?.....

(d) What is the main use of trees you have planted?

1. Income
2. Fuel
3. Building materials
4. Fruits
5. Fodder
6. Shade
7. Fertilizer trees
8. Other (specify)……..

(8) What is the location of trees on your farm?

	Location of Trees in the Farm	Tick Appropriately	Tree Species
1	Woodlots		
2	Windbreak/Shelterbelts		
3	Alley Cropping		
4	Home gardens		
5	Dispersed Trees (Homesteads)		
6	Boundary Marks		
7	Live Fencing		
8	Fodder Banks		

APPENDIX II: KEY INFORMANT INTERVIEW GUIDE

1. You are a Forest/Agricultural Extension Officer, how does your extension work influence Agroforestry technologies in this Area?

……

……

……

……

2. What resistance do you encounter when trying to promote Agroforestry extension?

……

……

……

3. How often do you meet farmers in groups or individuals?.....

4. What incentives do you give to farmers to promote Agro forestry production?

……

……

……

APPENDIX III: FOCUS GROUP DISCUSSIONS

1. How often are you visited by extension officers during your barazas?

……

2. Are you satisfied, there is enough trees in your area? (1) Yes (2) No

If No, what is the cause of low attention to on-farm tree production?

……...……

……

……

……

……

3. What do you think the government should do to encourage Agro forestry production in your area?

……..……

……..……

……

……

……

APPENDIX IV: RESEARCH CLEARANCE PERMIT

THIS IS TO CERTIFY THAT:
MR. NYAMWEYA JOSEPH MAKORI
of UNIVERSITY OF NAIROBI, 44365-100 NAIROBI,has been permitted to conduct research in *Nakuru County*

on the topic: *ANALYSIS OF SOCIAL ECONOMIC FACTORS THAT AFFECT AGROFORESTRY ADOPTION AMONG SMALLHOLDERS IN TEMIYOTTA LOCATION NAKURU COUNTY*

for the period ending:
30th October,2018

Permit No : NACOSTI/P/17/56220/19679
Date Of Issue : 31st October,2017
Fee Recieved :Ksh 1000

.....
Applicant's Signature

.....
Director General
National Commission for Science, Technology & Innovation

CONDITIONS

1. The License is valid for the proposed research, research site specified period.
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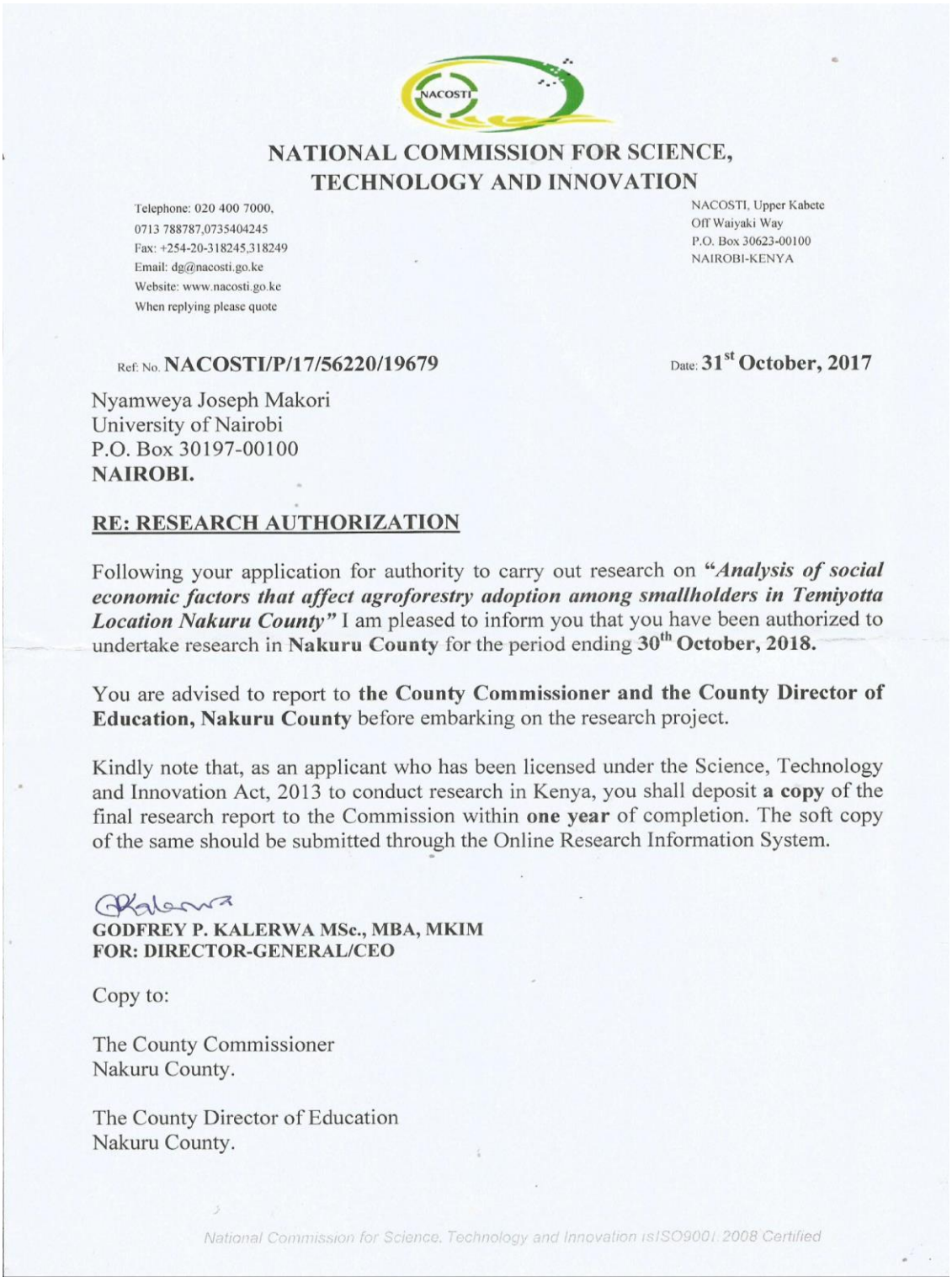
APPENDIX V: RESEARCH AUTHORIZATION



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Date: **31st October, 2017**

Nyamweya Joseph Makori
University of Nairobi
P.O. Box 30197-00100
NAIROBI.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on ***"Analysis of social economic factors that affect agroforestry adoption among smallholders in Temiyotta Location Nakuru County"*** I am pleased to inform you that you have been authorized to undertake research in **Nakuru County** for the period ending **30th October, 2018.**

You are advised to report to **the County Commissioner and the County Director of Education, Nakuru County** before embarking on the research project.

Kindly note that, as an applicant who has been licensed under the Science, Technology and Innovation Act, 2013 to conduct research in Kenya, you shall deposit **a copy** of the final research report to the Commission within **one year** of completion. The soft copy of the same should be submitted through the Online Research Information System.

GODFREY P. KALERWA MSc., MBA, MKIM
FOR: DIRECTOR-GENERAL/CEO

Copy to:

The County Commissioner
Nakuru County.

The County Director of Education
Nakuru County.

National Commission for Science, Technology and Innovation is ISO9001: 2008 Certified

Declaration Form for Students

UNIVERSITY OF NAIROBI

Declaration of Originality Form

This form must be completed and signed for all works submitted to the University for examination.

Name of Student:	NYAMWEYA JOSEPH MAKORI
Registration No:	C50/63078/2010
College:	COLLEGE OF HUMANITIES AND SOCIAL SCIENCES
Faculty/School/Institute:	ARTS
Department:	GEOGRAPHY AND ENVIRONMENTAL STUDIES
Course Name:	M.A ENVIRONMENTAL PLANNING AND MANAGEMENT
Title of the work:	ANALYSIS OF SOCIO-ECONOMIC FACTORS THAT AFFECT AGROFORESTRY ADOPTION AMONG SMALL-HOLDERS IN TEMIYOTTA LOCATION, NAKURU COUNTY.

DECLARATION

1. I understand what Plagiarism is and I am aware of the University's policy in this regard.
2. I declare that this PROJECT (Thesis , project, essay, assignment, paper, report etc) is my original work and has not been submitted elsewhere for examination, award of a degree or publication. Where other people's work, or my own work has been used, this has properly been acknowledged and referenced in accordance with the University of Nairobi's requirements.
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ANALYSIS OF SOCIO-ECONOMIC FACTORS THAT AFFECT AGROFORESTRY ADOPTION AMONG SMALLHOLDERS IN TEMIYOTTA LOCATION, NAKURU COUNTY

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