

**LAND USE APPRAISAL FOR SUSTAINABLE RURAL LIVELIHOODS IN
SMALLHOLDER TEA ZONES OF KENYA- THE CASE OF KIRANGI SUB-
LOCATION, KIAMBU COUNTY.**

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DECLARATION

I, do hereby declare to the best of my knowledge that this is my own original work and has not been presented for a degree in any other University.

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ABSTRACT

Agriculture remains the most vital sector in the economy of Kenya as it contributes the most to Gross Domestic Product (GDP) of the country as well as a very important source of livelihoods to many citizens. Land is a key factor in agricultural production and thus majority of the rural households, especially in sub-Saharan Africa depend on land-related activities for their livelihoods in terms of food and employment. However, in recent past, the contribution of agricultural sector to the GDP of Kenya has been declining over the years. Rural population are facing increased levels of poverty and inability to get sustainable livelihoods in terms of income and food. This adversely affects smallholder farmers especially in densely populated areas where there is high pressure on land and uncontrolled land uses. This study sought to determine the household land size change in the study area, established the existing household land uses and respective financial returns and food sufficiency in the study area, examined the household livelihood diversification strategies and respective financial returns in the study area and proposed land use planning interventions that can ensure sustainable rural livelihoods in Kirangi Sub-location. The study adopted a descriptive survey design. Number of households made a sample frame. Stratified random sampling was employed to select households from strata drawn from each village. Strata comprised of male-headed, female-headed and child-headed households. Key informants were selected using purposive sampling. Participants of focused group discussion were selected using stratified random sampling. Strata were made up of male, female and youth. The total number of households interviewed in Kirangi Sub-location was 91. Data analysis was done using SPSS software and descriptive methods. Data presentation was through charts, tables, cross tabulation and narratives. Research findings revealed that land size has reduced tremendously from 14 acres that the parents of the respondents owned to 3.2 acres that the households currently own, with a majority of the households having 2.7 acres. Hypothesis test indicate that the change in land size is highly significant with a $t=7.80$, $P=0.000$ which is less than 0.001. However, 2 acres was found to be the minimum land size for tea farming that is sufficient to meet livelihood needs at optimal production level in the area. The study concluded that households in the area undertake varied land uses. Tea which was found to be the leading land use had a mean land size of 1.67 acres. Other cash crops apart from tea recorded a mean land size of 0.55 acres. Food crops and dairy farming had a mean of 0.3 acres. Further, the study reached a conclusion that households engage in income diversification strategies, both farming and off-farm. However, it was found out that off-farm diversification brings more income to households than on-farm diversification. Mean annual household income is 28,168 and 142,444 for on-farm and off-farm diversification respectively. The study thus proposes the following land use planning strategies; households to set the minimum land size of 2 acres, adoption of modern farming technologies, specialization of farming activities, diversification of income strategies by households and value addition of farm produce. Therefore, for further research, the study recommended that a more in-depth research should be conducted to determine sustainable ways to stop land subdivision. A study focusing on preferred human settlements for rural households was also recommended to save on space and solve the issue of scattered homesteads that occupy substantial amount of land.

DEDICATION

This work is a special dedication to my dear parents and siblings for their unwavering love, continuous support and prayers during the entire time of writing this thesis.

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ACRONYMS

ASDP - Agricultural Sector Development Program

CBOs – Community Based Organizations

CIDP - County Integrated Development Plan

CIP - Crop Intensification Program

CIDP - County Integrated Development Plan

DFID - Department For International Development

FAO - Food and Agriculture Organization

GNP - Gross Domestic Product

GDP - Gross National Produce

KNBS - Kenya National Bureau of Statistics

LDBD - Land Development Settlement Board

NGOs – Non-Governmental Organizations

NLP - Nations Land-use Policy

PPS - Planning Policy Statements

ROA - Review of Agriculture

SPP - Statement of Public Planning Policy

UNCED - United Nation Conference in Environmental Development

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CHAPTER ONE

INTRODUCTION

1.0 Introduction

Land in Kenya has been given different meaning by various people. For pastoralists and farmers, land means a property that one owns which is a source of livelihood. To them, accessing and controlling land is the major point of focus (Foeken, 2008). While land to elites means a tradable commodity in the open market that generates windfall profits through mechanisms such as market speculation, the nation and the state consider land as a sovereign unit which is a reflection of a social, cultural and political identity with its boundaries (Mwagore, 2003). Land use refers to a process of putting systematically the inputs and activities undertaken by people in a given type of land cover with an aim of producing, changing or maintaining it (FAO, 1999).

According to De Wit (2009), majority of the rural households, especially in sub-Saharan Africa depend on land to meet their livelihoods. This is in quest to meet their livelihood aspirations, both long-term and immediate. However, most countries major in Agriculture except for the developed countries whose main activity is industrialization. Gross National Product (GNP) of sub-Saharan Africa is contributed mainly by crop production, forest products use and commercialization, fishing, gathering of wild food in addition to extensive grazing of indigenous breeds. More than 44% of economically active populations are employed in agriculture

1.1 Context of Study Problem

In Kenya, Agriculture is the backbone of the economy (Alila, 2006). However, in recent past, the sector has seen a decline in its contribution to country's Gross Domestic Product (GDP) from 40% in 1963, 33% in the 1980s to 27% in 2014. However, the sector is still the most prevailing sector in the economy, accounting or 60% of the foreign exchange earnings. Agriculture contributes about 16% of the formal employment as well as providing numerous opportunities for self-employment. There is therefore an indication of a high correlation between the national economy growth and productivity of the agricultural sector (KNBS, 2015).

Cleaver and Schrieber (1994) argues that changes in land use in the farming systems of Africa is linked majorly to rapid population growth which has caused serious issues of environmental degradation. This reflects clearly on the neo-Malthusian theory which states that land degradation occurs when land use surpasses the carrying capacity of resources (Malthus, 1989). Population growth alone does not sufficiently explains the changes in land use especially in tropical farming

systems. Rather, it interacts with other factors for instance cultural norms, politics and economic environment that prevails in geographical location in question (Lambin et. al., 2001, 2003). Farming systems therefore tend to undergo intensification or extensification depending on the household resource and socio-economic factors in a given area (Crowley & Carter, 2000; Malmberg & Tegenu, 2007; Siren, 2007).

With the increased population growth due to natural increase and migration, Kenya witnesses serious land sub-division leading to continuous reduction in average land sizes. The approximate average size of farms under small scale farming in Gatundu is currently 0.36 Ha and 69.5 Ha occupied by large scale farming. On the other hand, Small land holdings are majorly occupy Gatundu South, Kikuyu, upper parts of Gatundu North, Limuru and Kiambaa constituencies. Land-subdivision has adversely threatened household livelihoods by putting so much pressure on agricultural land. The growing population combined with limited land availability in the agriculturally productive highlands has led to increasing land use (Sanyu, 2001).

Reduction in land sizes has resulted in increased pressure on agricultural land. One of the consequences of this is exploitation of marginal lands resulting in land degradation which does not sustain the livelihoods of the people. To respond to this, widespread uncontrolled changes in land use has been witnessed which in most cases has been intensification of agricultural lands. Changing land use by Intensification of agricultural production so far has not been able to yield the expected results in respect to the decreasing land/man ratio. This is simply because most of the modern farming system techniques are beyond the means of the average African farmer (De Wit, 2009).

Verheye (1997) argues that, pressure on land together with the resultant effect on agricultural production is a major concern for almost all governments in both developing countries and developed countries. In the past the countries experienced vast agricultural lands that was abundant for household livelihoods but the trends is changing fast. Globally, the land per capita has reduced from 0.39 ha in 1961 to 0.27 ha in 1990s. For Africa, the land/man ratio has decreased from 0.62 ha in 1965 to 0.26 ha in 1995. Other countries such as Malawi and Rwanda faces a frightening scenario of 0.15 ha.

1.2 The Concept of Sustainable Livelihoods

Sustainable livelihood is a form of livelihood that can withstand shocks and stress by maintaining or enhancing its potential assets in order to provide sustainable livelihood opportunities for future generation. Sustainable livelihood contributes to net benefits of other livelihoods both at the local

and global levels as well as being a key factor in the short and long run (Chambers & Conway, 1992).

The idea of sustainable livelihoods was first introduced by the Brundtland Commission on Environment and Development. The concept was developed further at the 1992 United Nations Conference on Environment and Development, which was advocating for measures to achieve sustainable livelihoods in quest to eradicate poverty. The most complicated component of livelihoods, is the array of assets from which people source their living, which encompasses the tangible assets and resources, together with intangible assets in form of claims and access. According to different organizations, DFID (1999) and FAO (2006) as well as various authors, including Chambers & Conway (1992); Krantz (2001) and Scoones (1998), sustainable livelihood is defined as: a livelihood that comprise of the possibilities, assets (in terms of social resources) and activities that are needed for living. A livelihood is said to be sustainable when it is capable of coping with and able to recover from shocks and stresses, support or boost its possibilities and assets, without threatening the natural resource base. In addition, livelihood is also deemed sustainable when it adds to net benefits of others livelihoods both locally and globally in addition to short and long term goals (Chambers & Gordon, 1992). Besides, the essential activities that are needed as a means of living include the production of crops and livestock, aquaculture, hunting and gathering, barter trade including other endeavors that generate income (including off-farm activities).

According to Morse et. al., (2009), the approach of sustainable livelihoods is one of the multiple capital approaches where sustainability is key in terms of capital availability that is; human, social, natural, physical and financial. It is also an evaluation of the vulnerability aspects which are shocks, trends and stresses in which these assets operates. This framework offers an approach used to assess how policies, organizations, institutions and cultural norms informs livelihoods, by highlighting who gets access to whatever type of asset, and demonstrating the kind of range of livelihood strategies that are available are and suitable to people (Carney, 1998).

DFID (1999) however explains sustainable livelihood to comprise three main components namely: Livelihood strategies, Livelihood resources and Institutional processes including organizational structures. It is worth noting that livelihoods vary significantly from one country to another, from rural to urban areas as well as across nations (FAO, 2006).

1.3 Contributions of Tea Farming To Livelihoods

Tea industry makes a major contribution to the agricultural sector. The industry leads in foreign exchange earnings by contributing about 5 percent of the country's GDP and 25 percent of the foreign exchange earnings (Republic of Kenya, 2017). Tea sector supports over 5 million people directly and indirectly and this makes it one of the leading source of livelihood especially to rural households in Kenya (Republic of Kenya, 2015).

Smallholder tea farming has called for labor demand. Smallholder tea farming was initially ceiled at 0.80 acres by KTDA due to limited labor provided by households. With increment of household land size up to 20 acres, this has called for increased demand for labor. However, this has given an opportunity for both permanent and part-time employment to non-growers would not be fully employed in tea zones. Additionally, KTDA's demand for personnel has boosted labor demand (Kagira et. al., 2012).

Tea farming has resulted in tremendous improvement of rural infrastructure in tea zones. Such infrastructure include roads, electricity, water supply and telecommunications which are connected to factories. Government on the other hand has been a major player in infrastructural improvement by improving rural roads in a quest to facilitate tea collection. KTDA road network is approximately 5086 kms and they are comprised of secondary roads, minor roads, special roads and unclassified roads. 83.3% fall make up the classified category and the remaining 849 kms fall under the unclassified category. Roads under special purpose are designated as "tea roads" and were constructed in the late 1960s and early 1970s financed by the World Bank. There are only 300-400 km roads in this class (Miriti, 2003).

Smallholder tea farming has contributed immensely to household income. It is a good source of regular income to rural households which earned throughout the year. Tea life cycle is at least 50 years and minimal cases of diseases. This income enable households to cater for household expenditures such as paying of school fees, hire labor, buy food and even access medical services without having to rely on credit facilities. Annual bonus given to tea farmers may be invested in other enterprises such as dairy farming and even expansion of tea farms. Tea has given farmers the opportunity for higher income. On the other hand, tea farming has enabled households to diversify their income activities (Mitei, 2011).

1.4 Importance of Maintaining Household Land Size for Tea Growing and Food Crop Production

It is very crucial to maintain household land size because it helps to protect local agricultural industry. Rich agricultural lands may be producing commodities similar to what is available in other regions. This may result in that agricultural activity being pushed out altogether. Loss of agricultural land to urban development has raised a point of concern in recent past. Thus, it is important to prevent significant loss of agricultural land. Farming together, agricultural supply together with processing industries account for significant employment opportunities and income to rural households. Economic land sizes are very essential in ensuring the continued operation of the industries. Average cost of service decrease with the increase of goods and service produced by the firms. Such increase bring benefit to the farmers. Contrary, increase in the average cost of service will result in losses creating negative externalities. Therefore, employment and income of are affected and farmers are faced with higher average costs and inability to maintain their levels of production. As a result of such externalities, land and other inputs will not move to higher uses. Market failure may exist and local community may be prompted to preserve agricultural lands without any concern for general food supply (Derr, et. al., 1997).

Maintaining household land size is very effective in maintaining local food supply. Producing food items such as vegetables, eggs and milk has been found to be very efficient near metropolitan areas. Producers of such commodities are able to have higher bids than producers of livestock and grains. This means that such commodities should be produced nearby but as the rent increases, they are pushed further away from the urban areas unless consumers are able to protect local production to an extent of paying higher prices to ensure its continued production. Food produced far away from consumers may not be available during times of emergencies such as strike in transport sector as well as times of food shortage (Corty, 1975). Continued food production translates to formation of strategies for dispersion. Dispersion plays a major role in preventing national food shortages normally caused by droughts, insect infestation, diseases, localized freeze-outs as well as natural hazards. Logically, this scenario greatly depends on the accounting stance of a particular country. It is not realistic for some localities to incur additional costs in order to benefit the national consumers. Dispersion is beneficial when it operates in national and international levels but it has limited advantage at the local level unless the local communities are assured of compensation (Mundy, 1975; Peterson & Yampolsky, 1975).

Farmlands are often described as critical when they form larger part of national production of certain commodities and also happen to face population pressure. Loss of such farmlands results to non-farm uses may result in shortages both locally and abroad if they are exported. The advantages of soil and climate normally reflect the price of that particular farmland. This enables such farmlands to withstand competition from other land uses. This is not always the case because the national interest in sustaining some agricultural products may not always be reflected in the local market (Peterson & Yampolsky, 1975).

Environmental aspect of land use preservation mainly deals with the emotional appeal. Such appeals include recreation, air and water recharge, open space, aesthetics, as well as nostalgic and bucolic emotions. These aspects are very key in determining preserving preservation and are more crucial than preserving land for economic efficiency or legal and constitutional aspects. However, agricultural economists have given a short shrift because it is difficult to quantify the emotional calculus of such aspects and the champions of these concerns don't seem to be concerned with equity nor economic efficiency. Farms are not available for recreational. On the other hand, farming does not always contribute to aesthetics. Aesthetics may not have higher bids than other land uses such as commercial or residential. In this case, aesthetics may not depend entirely on land bid rates for it to be considered. This calls for deliberate actions to protect farmlands for beauty (Alonso, 2013).

Preventing development of farmlands often promotes an organized growth and thus curb sub-urban sprawl. However, this is challenged by sprawl that that skips the restricted zones only resume. This breeds challenges such as high cost of service production as well as congested roads. Urban sprawl may extend for greater distances around the urban communities as a result of land preservation. Contrary, zoning of preservation areas may prevent realization of cumulative ownership change whereby land does not framed intensively nor being developed for long periods of time (Nickerson & Barnard, 2006).

1.5 Tea Growing in Kenya

Tea farming in Kenya has seen rapid expansion since it was introduced in 1903 from India. It has become the leading crop in the country's exports with approximately Kshs. 43 billion earnings in 2006. Tea earnings contributes 4% of the total country's gross domestic product (GDP). About a tenth of the entire Kenya's population which is approximately 3 million people are employed in the tea sector. However, the tea industry comprise of the estates which are owned mostly by the multinational companies and the smallholder farmers. In Kenya, tea growing is practiced in the highland zones, which has ideal requirements for tea growing. Such areas have well spread,

sufficient and reliable rainfall all year round. These highlands experience temperature ranging from an average of 15 to 24°C. Soils are of rich volcanic type, deep and well-drained with a pH of 4.0-5.0. The regions exhibit eminent agricultural potential suitable for growing other crops such as; maize, wheat, millet, oat, potatoes, horticultural crops, barley, sugar cane, pyrethrum, sheep rearing and dairy. Originally, these areas were occupied by equatorial rain forests and thus very vital water catchment areas for numerous rivers. These lands attracts very high population due to its high potentials to households (Jaetzold & Schmits, 1983).

Cultivation of tea is only confined to certain specific regions because they require specific climate and soil to thrive well. Tea is grown in Kenya's highlands of Central Kenya and Rift Valley regions. In Rift Valley, tea is found mainly on the on the western and eastern sides while in Central Kenya, tea farming is practiced mostly in Gatundu in Kiambu County within the altitudes of 1500 to 2700 meters above the sea level. The area receives sufficient and well distributed rainfall of between 1270-1397 mm. Tea requires annual rainfall of between 1200 to 1400mm, soil PH of about 4.5-5.8 and deep soil particularly volcanic soil (Kagira et. al., 2012 & Tea Board of Kenya (TBK), 2014). Tea growing in Kenya is practiced in 18 counties namely Nakuru, Elgeyo-Marakwet, Nandi, Kericho Bomet, Nyamira, Kisii, Kakamega, Narok, Vihiga, Kiambu, Murang'a, Trans Nzoia, Nyeri, Embu, Meru, Kirinyaga and Tharaka-Nithi (Ruben, 2017).

Tea industry makes a major contribution to the agricultural sector. The industry leads in foreign exchange earnings by contributing about 5 percent of the country's GDP and 25 percent of the foreign exchange earnings (Republic of Kenya, 2017). Tea sector supports over 5 million people directly and indirectly and this makes it one of the leading source of livelihood especially to rural households in Kenya (Republic of Kenya, 2015). Notably, Kenya is the leading exporter of black tea globally and thus accounts for 25 percent of the total world tea exports and 8 percent of total global productions (Onduru et. al., 2012).

According to Jayne and Muyanga (2012), tea industry has registered a rising trend in yields and acreage. The number of tea growers has seen a sharp rise which is attributed to subdivision of tea farms. This phenomenon is a reflection of cultural practices of land inheritance and land tenure facing the country. In addition to land fragmentation, farms in tea sector are faced by the threat of competing land uses such as diversification of agricultural activities where farmers grow tea alongside other crops. In Kenya however, smallholder farmers have relatively small land holdings with majority having less than one acre of tea farm (Republic of Kenya, 2014a).

1.6 Smallholder Tea Economy

Tea production is majorly the output of two main sectors comprising small-scale farmers and the multinational companies. Both have seen the benefits of many scientific advancements in tea production even though the yields in the estates surpasses the average yields in the small-scale. In 2006, smallholders per hectare produced 1,996kilograms against 2338 produced by the estates in 2006 (Anonymous, 2003).

The smallholder sub-sector contributes to 60% of total tea produced in Kenya therefore they are the main players in the local market which influence greatly both the local prices and prevailing amount at the auction (Mwaura et. al., 2005). The term smallholder is used to refer to farmers who own and operate tea farms of below eight hectares (Nyangito, 2001). Lamb and Muller (1982) continue to argue that 16 companies currently own the estate sub-sector and they operate 38 tea-processing factories producing 40 percent of the total amount of tea produced in Kenya. Small holder farmers are served by 54 smallholder tea factories which are run by the Kenya Tea Development Agency (KTDA). Smallholder farms amounted to 66% of the total acres under tea in Kenya by 2005 (ITC, 2005). The smallholder tea growers are approximated to be 0.4 million and are one of the largest and the most successful scheme in the world. The strong advancement and structural changes that the industry has witnessed is majorly due to substantial policies that has promoted continuous investments in the private tea estates as well the smallholder subsector under KTDA. Nationally, smallholder industry remains the leading employer in the private sector registering about 80,000 people working in the tea estates and approximately 3 million people who earns their livelihoods from the sector (Wachira, 2002).

1.7 Tea Growing in Gatundu

Kiambu County is a tea growing zone. Tea is mainly found in the areas of Limuru, Thika and Gatundu. Tea farming is practiced in both Gatundu North and Gatundu South Sub-Countries. Gatundu region is endowed with good climatic and physical conditions ideal for tea growing with altitude of between 1,500-1,800 meters, mean temperatures of 26°C, rainfall of between 1200-2000mm and deep red volcanic soils with good terrain. Tea is the major crop but farmers engage in other crops, food and cash crops. The region is composed of medium and high potential areas within the I to III agro-ecological zones where coffee, tea, pineapples and sisal are grown; they are the leading income earners as well as employment generating cash crops (Musa & Odera, 2015).

1.8 Tea in Kirangi Sub-Location

Kirangi is one of the sub-locations in Gatundu South Sub-county. Tea growing in Kirangi sub-location is majorly by smallholder market who sell their tea to Kuri Tea Factory which is managed by KTDA. The factory is a branch of Theta Tea factory. It was founded in the year 2005 and was completed in 2009. Its goal was to reduce congestion that was witnessed at Theta Factory which was overstretched by tea volumes that surpassed its capacity. In addition, it was also a form of rural industrialization aimed at promoting employment opportunities of rapidly growing rural youth. Kuri offers services to 3,245 registered farmers who take their tea to 70 tea collection and buying centers. The total size of land under tea in the area is 2743.49 hectares with a total of approximately 14,711,596 tea bushes. The factory is situated in the catchment endowed with rich red volcanic soils ideal for tea growing (Musuva et. al., 2016).

Despite tea being the leading cash crop in Kirangi Sub-location, farmers still grow other cash crops and food crops such as beans, maize, bananas, arrow roots, vegetables, avocados, macadamia and pineapples. In the last three decades, the region has experienced rapid population growth which has exerted a lot pressure on the limited land resource affecting land uses in the entire region. In addition, low incomes from tea farming no longer sustain livelihoods and farmers majorly employ crop diversification to get food and additional source of income (Ntale, 2012).

1.9 Statement of the Research Problem

Changing land use and land use patterns are the major critical issues as far as sustainable rural livelihoods in developing countries is concerned. Due to rapid rural transformation encompassing the rise of contemporary agriculture, sub-Saharan countries are faced by a myriad of setbacks. Kenya being one of the sub-Saharan counties, it is however faced by land use challenges particularly in agriculture sector. However, serious problems lie in the tea growing zones of Kenya due acute intensification of farming lands, rapid land fragmentation, land degradation and abandonment of farmland due unsustainably low returns or rural-urban migration. Cultivation of tea is faced by the challenge of competing interest on land by other land uses such as cultivation of other cash crops, food crops and dairy farming. These competing interests on land have resulted in conflicts related to land-use which have threaten the sustainability of land development and in turn the sustainability of rural households. In Kenya, the greatest challenge is the technique of managing and regulating the use of land in rural areas in respect to socio-economic development, food security and land-size that can fully sustain rural households. To establish sustainable land

use in tea zones of Kenya, it is essential to conduct land-use appraisal in order to highlight the major land use transformations that are taking place as well as their propelling factors.

According to Ogise et. al., (2008), over 90% of the smallholder tea farmers are cultivating less than one acre of tea acreage. Most of the farmers cultivate between 0.25 - 0.5 acres which is less than the required minimum estimated at 0.75 acres that is sufficient for households meet its basic needs. It has been found out that the size of farm have resultant economic impacts on agricultural production as demonstrated by the outcomes of numerous studies that have investigated on the linkages between productivity and farm size (Barret, 1996; Bhalla & Roy, 1988; Kiani, 2008; Helfand & Levine, 2004). However, it is not clear how farms of varying sizes differ in sustainability and efficiency (Republic of Kenya, 2014a).

Although the smallholder tea growing has been contributing greatly to employment and exports, high poverty levels are still prevalent in the tea growing zones. The Central Bureau of Statistics, (2009) reports instances of households living below rural poverty line (given as US\$ 0.55 daily incomes) which is an average of 50.3 % of the people who live in tea growing zones. The high poverty escalation however requires to be addressed considering the large number of smallholder tea farmers. The high levels of poverty with subsistence farmers in Kenya has been attributed to increased costs of farm inputs, witnessed high inflation, poor land tenure, poor technologies, low output prices, post-harvest losses, poor markets and aging rural population which limits physical energies required for production, an attribute of urbanization. Factors that contribute to escalating poverty levels among tea growers in Kenya are not yet discovered and thus interventions to curb the menace should be rooted on pertinent facts which are dependable and predicts the future (Batiano et. at., 2004).

However, there is need to look into the issue of land fragmentation in tea zones, protection and conservation of farmland, efficiency in land use, mitigation of negative impacts on the environment and controlling of land use changes and land use patterns which are not sustainable. Despite the rising concern over sustainable land use in Kenya, the limit of sustainable land use is still unclear (Smaling, 1993). It is worth studying to understand the major obstacles to sustainable land use which can sustainably meet household needs.

There exists the question of whether on-farm land diversification in tea growing zone brings about sustainable livelihoods to the farmers in the region. What brings this uncertainty is a review from the study by Reardon (1997) which states that smallholder tea farmers in most cases lack access to financial support, markets and training and information. Without these, they face limitations

while investing in their farms. They face constraints when it comes to making choices of how, what and when to grow. This interprets missed opportunities towards improved quality and yields. Other factors that limit them include gender inequalities, lack of income diversification, poor diet, health problems especially due to poor sanitation.

According to Smaling (1993), very little studies have been conducted on farming systems. This study therefore sought to contribute to the study basically on African farming systems and contribute to regional policy interventions. The study went ahead to appreciate the diversity of farming by households and heterogeneity of land uses. These have been given little attention in developing recommendations yet they are very essential to farmers in deciding which land use to adopt in a gainful management practices in regards to sustaining their livelihoods.

1.10 Research Questions

- i. How has household land size changed since land was consolidated in the study area?
- ii. What are the existing household land uses and respective financial returns and food sufficiency in the study area?
- iii. What are the household livelihood diversification strategies and respective financial returns in the study area?
- iv. What land use planning interventions would ensure sustainable rural livelihoods in the study area?

1.11 Research Objectives

The study sought to test the following objectives;

- i. Determine the household land size change since land was consolidated in the study area.
- ii. Establish the existing household land uses and respective financial returns and food sufficiency in the study area.
- iii. Examine the household livelihood diversification strategies and respective financial returns in the study area.
- iv. Propose land use planning interventions that would ensure sustainable rural livelihoods in the study area

1.12 Research Hypotheses

The study sought to test four hypotheses:

1.12.1 First Hypothesis

H₁: Household land size has reduced significantly since land consolidation in the study area.

H₀: Household land size has not reduced significantly since land consolidation in the study area.

1.12.2 Second Hypothesis

H₂: Household land size determines household farm production.

H₀: The household land size does not determine household farm production.

1.12.3 Third Hypothesis

H₃: Households that undertake more than one agricultural land use at the same time have higher financial returns and food sufficiency than households with only one agricultural land use at a time.

H₀: Households that undertake more than one agricultural land use at the same time do not have higher financial returns and food sufficiency than households with only one agricultural land use at a time

1.12.4 Forth Hypothesis

H₄: Households with farm and non-farm livelihood diversification strategies have significantly higher household income than those without non-farm livelihood diversification strategies.

H₀: Households with farm and non-farm livelihood diversification strategies do not have significantly higher household income than those without non-farm livelihood diversification strategies.

1.13 Geographical and Theoretical Scope

Geographically, the study covered Kirangi Sub-location in Gatundu South Sub-county, Kiambu County. Kirangi sub-location is one of the Sub-counties forming Ndarugu ward with an approximate area of 6.2 kilometer square. It has a total population of 2,502 and population density of 401 people per kilometer square according to the Kenya National Bureau of Statistics (KNBS) population census of 2019. Conceptually, it will cover aspects of change in land size and land use as well as livelihood diversification and their implications on household livelihood.

1.14 Justification of the Study

The study is justified on the premise that land use and land size change is a very serious phenomenon that has raised a lot of concern not only in Kenya but also the entire Africa especially

the Sub-Saharan region. While population growth rate is very high, pressure in on land becomes inevitable and thus land productivity becomes low. This subjects households to low income as well as shortage of food. The resultant feature of this is a poor vulnerable nation with high dependency ratio on each other as well the government for basic needs. A poor hungry nation translates to low productivity and thus low GDP for the nation. Consequently, inappropriate land uses and land size leads to encroachment on marginal and environmentally sensitive areas. This hazardous practice results in environmental degradation which has serious consequences on livability and survival of life on the earth.

It was therefore, imperative to undertake this study as a precursor to generating information necessary to plan for sustainable land size and land use as well as livelihoods among the people of Gatundu. The information will be fundamental to governmental, non-governmental and community based agencies wishing to undertake their projects in Kirangi Sub-location for sustainable planning and development.

1.15 Significance

The outcome of this study will help the community of Kirangi Sub-location and Gatundu in general. It will enlighten them on land size and land use issues and their impacts on sustainable livelihoods. It will empower them on how land diversification brings out additional income as well as shield against farming stress and environmental challenges.

The study will be a guide to government, community based organizations, and non-governmental organizations concerned with formulating policies related to land use and land size change and their impact on livelihoods.

The research will be instrumental to policy makers since they will use the outcomes as a rational basis for developing appropriate policies and strategies in maintaining a reasonable minimum land size as well as adoption of profitable and sustainable land uses to achieve sustainable rural livelihoods.

Finally, the study will also be useful to future researchers as a content of literature review that can be consulted while seeking to conduct a study in the similar area. The findings may be used as reference point for other studies.

1.16 Limitations of the Study

The major limitations that affected the process were time and financial constraints. This challenge was however solved through sampling procedures that enabled the study to only select samples of population and areas.

1.17 Definition of Terms

1.17.1 Livelihoods

A means of earning a living through capabilities, activities and social and material resources.

1.17.2 Sustainable livelihood

Sustainable livelihood is used to define a livelihood that entails the application of assets (both social and material) in addition to activities that are required to make a living. Livelihood is termed as sustainable when it is in a position to withstand and recover from shocks and stresses while maintaining its potentials without threatening natural resources.

1.17.3 Land use

Land use refers to a process of putting systematically the inputs activities undertaken by people in a given land cover type with an aim of producing, changing or maintaining it (FAO, 1999).

1.17.4 Land fragmentation

Land fragmentation is the process of dividing a large block of land into pieces that are easier to sell or develop. The small portions are however developed independently, mostly for commercial, industrial and agricultural developments (Sundqvist, 2006).

1.18 Conclusion

Chapter one of this study introduced land use and changes in land use in rural households of Kenya as they inform livelihoods of rural households. Tea growing in Kenya, smallholder tea economy, tea growing in Gatundu and tea growing in Kirangi Sub-Location were discussed. The chapter figured out the problem that the research focused on. Research questions of the study that were identified informed the study objectives and research hypotheses which became the essential variables upon which the study was established. Thus, the chapter was a fundamental guide through which relevant literature was reviewed.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This chapter is a review of previous works relevant to the study topic. It provides detailed discourse on changes in the household land size since land consolidation in the study area, existing household land uses, household livelihood diversification strategies and land use planning interventions that would ensure sustainable rural livelihoods in the study area. The chapter ends in the development of a conceptual and theoretical framework which is a statement summarizing the main guiding principles (concepts and techniques drawn from the reviewed literature, the conceptual framework provides a grounding of the main issues relevant to the phenomenon of land use.

2.1 Land Consolidation in Central Kenya

Civil turmoil that was growing in Central part of Kenya in 1952, led to the declaration of the state of emergency. This would later lead to independence but the region witnessed a great effects on land tenure. One of the strategies that were imposed at the course of the Emergency was "villagization." Ideally, the program was meant to set keep away Mau Mau warriors who were secluded in the forests away from sympathizers who supplied them with material and food items. The villagization program unveiled unexpected forms of social stratifications. Families who were living on isolated homesteads together with about 10 to 20 other individuals evicted to villages which had an average of 200 residents. By 1956, a total of 272 villages had been set up in Kiambu District, 169 in Nyeri District and 235 in Murang'a District (Thurston, 1987:85).

The emergency led to the displacement of over 100,000 people from white settlers' farms where they had occupied as squatters. In essence, they had not adapted to reserves since they were used to their squatting state for many generations. They were given plots in the villages whereby everyone was allocated a twentieth of a hectare (around 500m²). This was in an effort to resolve the issue of the squatter and landlessness among the natives of the region. Cultivation of the land was only allowed to those who had land use rights. There were those who did not have any other land except for their 500m² plot allocated at the villages. They were however supposed to work in large labour holdings where they were not supported with capital nor means of production (Sorrenson, 1987:147).

The assignment of Roger Swynnerton in around 1950 as an Assistant Director for Agriculture heightened the momentum for change. Swynnerton plan in 1953 prioritized land consolidation in agricultural developments in Kenya. However, it could have been difficult to accomplish consolidation without the Swynnerton plan (Swynnerton, undated). The move to relocate people to villages promoted consolidation since homesteads were no longer an issue. In addition, consolidation was meant to reward loyalist economically. Consolidation comprised of blocks measuring between 800 and 1600 ha, which is the size of almost a sub-location. Before consolidation, it was necessary to redeem every plot of land from temporary purchasers. The objective of this was to incorporate proportions of cash crop, grazing and arable land into every consolidated land holding. The size of existing developments and cash crops were put in record in order for the new owners to pay for the compensation for permanent developments (Wilson, 1956:146).

A report by R. J. M. Swynnerton was published in 1954 which advocated for reforms on land management in the reserves. This was done particularly to focus on the Mau Mau districts in an attempt to lower the demand for redistribution of the land held by the Europeans. The strategies that were put forward included individualization of tenure through land combination and registration, as well as the improvement of agricultural production through the provision of extension services. The report saw the support of East African Royal Commission Report in 1955 which endorsed a multi-racial strategy to the agrarian policy meant to break limits to land ownership that was faced by racial prejudice by allowing the natives to practice cash crop farming. Further, Native Land Tenure Rules was declared in 1956 in an attempt to strengthen the Minister for African Affairs to provide capital resource for the adjudication and consolidation of the native lands. The process could not be questioned once the process was completed and the title deeds issued and therefore, this was a strong barrier to block Mau Mau detainees from confronting those who were allocated land when they were absent. This process therefore rendered many people dispossessed (Syagga, 2006).

Syagga (2006) continues to add that, a Working Party on African Land tenure was appointed in 1957. The aim was to recommend ways in which reforms on land tenure could be introduced to every part of the native lands. However, the recommendations resulted in the formulation of two statutes namely; Land Control (Native Lands) Ordinance of 1960 and the Native Lands Registration Ordinance of 1959. Both were meant to keep in check all the land transactions within the areas of adjudication. The two legislations prepared way for the Land Control Act of 1967

and the Registered Land Act of 1963 that are currently operating in Kenya. Towards independence, European settlers had occupied 7,501,000 acres (3,000,400 hectares) of land which were held on freehold tenure and leases, which were demanded by Africans. The colonial government formulated a settlement plan aimed at Africanization of the highlands in addition to a clear guideline of constitutional and statutory guarantees of property rights, both aimed at safeguarding their possessions in case of power transfer.

According to Swynnerton (Undated), the constitution of Kenya adopted negotiations and agreement of Lancaster House Constitution in 1960 which advocated for the “willing-seller willing-buyer” which acts as a foundation of land ownership as well as land redistribution. A Land Development and Settlement Board (LDSB) was enacted in 1960 to boost the principle. Its mandate was to devise and administer resettlement schemes that cover all races by stabilizing land prices of farmlands owned by the Europeans. It also offered credit facilities to Africans who were interested in purchasing farmlands in the designated areas. To facilitate this, an Agricultural Settlement Fund was established. This was done through a loan/grant agreement of £7.5 million from the World Bank, the government of the United Kingdom and Colonial Development Corporation.

According to the proposal, the scheme aimed to settle 1,800 families each holding about 50 hectares, about 6,000 peasant farmers on land size of 20 hectares and a high density scheme consisting of 12,000 smallholders each holding 5 hectares. Land Freedom Army was among the first organizations to be settled. The organization was enacted in early 1960 with an objective of forcefully repossessing the White Highlands from the Europeans (Syagga, 2006).

A program by the name Yeomen conceived to the purchase of 240,000 of European land that was subdivided into 100-acre land parcels. This was to be distributed to a particular set of Africans who would cultivate the land alongside the Europeans. In 1961, the name of the program was changed to Assisted Farmers Scheme and it became an item in the negotiations for independence as the Million-Acre Settlement Scheme that would be sponsored by both the British government and the World Bank and latter submitted to the Kenyatta government. The mandate of the Million-Acre Settlement Scheme was to promote an orderly rapid transfer land from Europeans to the settlers who sought to leave after independence. The scheme was approximately 1.15 million acres comprising both small and medium-size holdings which was to be sold out to individuals who were the beneficiaries of loans from the British government. Land transfers were grounded on the willing buyer willing seller basis but the loans however could only be beneficial to those

who portrayed the financial potential to repay with cash (Leo, 1989). By the year 1968, a total of 30,000 individuals had already been settled on the scheme with 5-20 acres holdings. Ironically, amongst them was President Kenyatta with 216.5 acres holdings and Minister Jackson Angaine having 252 acres (Kamau, 2009).

2.1.1 The Concept of Land Consolidation

Vitikainen (2004) defines land consolidation as land arrangement changes that takes place in a given territory, which are effected in order to realize an integrated soil management elements in line with the needs of the individual land owners, in line with societal landscape demands, environment and investment constructions.

Land consolidation is not a new concept, and has been implemented in different a number of countries. One study has shown that it is perceived that land consolidation took place around 1060 B.C.in China as well as in the Roman Empire at about 300 B.C. In addition, land consolidation was practiced in Europe back in the Middle Ages and extended to the 19th and 20th Centuries. Today, land consolidation practices are witnessed in Netherlands, Luxembourg, Germany, France, Switzerland, Belgium, Finland, Sweden, Norway and Australia. Eastern Europe witnessed a considerable land consolidation which was a result of the socialist production system reforms which led to fragmented property rights. By 1990s, the entire Western Europe had occurred in a quarter of all cultivated lands, which exceeds agricultural land by 38 million (Vitikainen, 2004).

The Government of Rwanda saw the implementation of the policy on land use consolidation for the first time in 2008 by the Ministry of Agriculture. This was done as part of the Crop Intensification Program (CIP). The ministry initiated CIP in September 2007 aiming at increasing agricultural productivity of food crops in high potential areas in quest to increase self-sufficiency and food security of Rwanda. The promulgation of the program included diverse components such as land use consolidation which was the main pillar, proximity of extension services to farmers, inputs in terms of fertilizers and seeds, availability technologies after harvest such storage facilities and driers (Kathiresan, 2012),

2.1.2 Average Household Land Size in Kenya

According to Kenya National Bureau of Statistics (2003), approximately 28.9 percent of Kenyans nationally are landless. A higher proportion is covered by North Eastern with 73.9%, Rift Valley (26.8%) and Coast (49.4%) provinces. Nyanza, Central, Eastern and Western provinces exhibit low landless proportions of below 15%. This is in contrasts with the expectation brought about

by high population densities per square kilometer in Nyanza (350), Central (282) and Western (406) provinces, in comparison to low densities of less than 30 people per square kilometer in Eastern (30), North Eastern (8) and Coast (30) provinces. As depicted by The Labor Force Survey, the regions with high population density experiences significant emigration which exceeds 15% of the population born there. Western leads with (21.5%) followed by Central and Nyanza provinces with 18.8% and 15.1% respectively (Republic of Kenya, 2015).

Table 1: Percentage Household Land Size (Hectares) per Province

Province	Landless:0.0 ha	0.1-0.99	1.0-2.99	3.0-4.99	5.0+ ha
Kenya	28.9	32.0	27.5	6.1	5.3
Nairobi	96.2	2.4	0.7	0.3	0.4
Central	12.6	52.7	17.3	1.8	0.0
Coast	49.4	17.6	22.5	7.6	2.8
Eastern	11.5	35.0	33.6	11.1	8.8
N/Eastern	73.9	9.9	11.7	2.3	2.0
Nyanza	10.6	33.3	27.1	7.8	8.1
R.Valley	26.8	30.1	27.1	7.8	8.1
Western	7.5	45.0	37.1	5.9	4.4
Rural	13.6	38.6	33.8	7.4	6.6
Urban	89.0	6.4	3.0	0.9	0.7

Source: Republic of Kenya, (KNBS, 2003).

Households who owns less than 1.0 hectare of land are mostly found in Central part of Kenya having the highest percentage of 52.7 followed by Western (45.0%), Eastern (35.0%), Nyanza (33.3%) and Rift Valley (30.1%) provinces. Eastern Province however exhibits the highest number of households who have more than 3.0 hectares of land (19.9%) followed by Rift Valley (15.9%) and Nyanza (12.7%) provinces. Only 2.7% of Households in Central Province own more than 3.0 hectares of land. Garissa, Wajir, Kajiado, Tana River and Turkana exhibit highest proportion of landlessness in more than 70% of the districts in Kenya. Apart from Isiolo, these districts depicts population densities of below 20 people per square kilometer. Districts with high population densities such as Vihiga (975: 0%), Kisii (693: 4.6%), Kiambu (660: 48.9%), Embu (594:16.0%), Kisumu (549: 26.6%) and Butere (548: 29.7%) depicts relatively low situations of landlessness as demonstrated in the percentages. This demonstration helps to conclude that the state being landless may not necessarily relate to high population densities. However,

landlessness is probably as a result of other factors which include mode of land distribution. It is deduced that people do not think that they own land with common-hold tenure, however, it seems that Kenyans focus on owning private land. Households in many districts namely Samburu, Nyeri, Keiyo/Marakwet, Meru, Vihiga, Kirinyaga, Muranga and Kiambu have 50% of its households owning below 1.0 acre of land. Cumulatively, only five districts have 25% of the households owning more than 3 acres of land (KNBS, 2003).

Generally, Kenya depicts small land holdings. However, among the top 10 districts with 19% of the households having above 3.0 hectares (7.5 acres) of land, only Wasin Gishu and Kericho had a poverty levels of below 50%. This is in contrast with Central Province where all the districts who recorded more than 50% of households to own less than 1.0 hectares of land had a poverty incidence of less than 40 percent. Notably, despite Kiambu having a high rates of the landless and a most of the households with less than 1.0 hectares, it recorded a poverty incidence of 22% and thus is the richest district in Kenya. This has been attributed to its proximity to the city of Nairobi which offers ready and sufficient market for agricultural products as well as high number off-farm opportunities available to households since agriculture contributes only 17.4% of the household income, (Republic of Kenya, 2003).

Table 2: Land Size Distribution (Hectares) in 10 Districts

District	% who are landless	District	% owning 0.1-0.99 ha	District	% owning > 3ha
Mombasa	98.5	Vihiga	80.1	Makueni	34.7
Nairobi	96.2	Murang'a	76.1	Narok	34.4
Garissa	92.5	Meru	65.5	West Pokot	28.7
Turkana	89.7	Samburu	61.3	Uasin Gishu	27.8
Isiolo	87.7	Kirinyaga	59.6	Kericho	26.7
Wajir	81.7	Nyeri	58.2	Bomet	24.9
Kajiado	72.8	Kiambu	56.4	Lamu	24.0
Tana River	70.2	Keiyo	55.3	Homa Bay	23.8
Lamu	53.1	Embu	48.0	Machakos	19.5
Marsabit	51.5	Tharaka Nithi	45.5	Kwale	19.1

Source: Republic of Kenya (2003c) and District Development Plans, (2002-2008).

According to Syagga (2006), Kiambu has seen significant change in land size. The units of the largest lands of more than 50 acres (20 hectares) consist of 1 percent of ownership units but

controls around 40 percent of agricultural land. Other farms range between 5 to 10 acres (2-5 ha). Besides, land under large scale sector generally of good quality as depicted by gentle slopes, water, and electricity as well as served with feeder roads. Small range farms are owned by poorer settlers and are characterized by steep slopes, poor soils and have poor road network and water supplies.

The areal extent of arable land in Kiambu County is approximately 1,878.4 Km². On the other hand, non-arable land on the other hand is 649.7 Km² while land under water mass is 15.5Km². The average household land size is 0.36 hectares on smallholding and 69.5 hectares under large scale. Large land parcels occupy mostly the lower parts of Kiambu particularly the Upper highlands of Lari, Limuru, and Juja Constituencies. Small land holdings are mostly found Gatundu South, Gatundu North, Kiambaa, Kikuyu and Limuru Constituencies. Land fragmentation has resulted in small uneconomical parcels of land and therefore majority of land owners are resorting convert their agricultural lands into residential plots in a bid boost low incomes from the farms (Kiambu CIDP, 2018).

2.2 Current Household Land Uses

Agriculture is the most dominant income earner in the economy of Kenya. Despite the fact that only 15 to 17% of the total land is considered arable due to sufficient fertility and adequate rainfall, only 7 to 8 percent meets the conditions to be classified as first-class land. However, most of the land is categorized as arid or semi-arid. Suitable land use for these areas is animal husbandry especially if the carrying capacity is put into consideration in order to realize sustainable use of land resource. Cash crops dominate the first-class land as opposed to food crops (FAO, 2009). Major land uses in Kenya include: infrastructure, industrial /commercial use, agriculture, human settlements, pastoralism, fishing, forests, mining, recreational areas, wildlife, cultural sites national reserves among others distributed across the low, medium and high rainfall areas (ROA, 2012).

Originally, the inhabitants of Gatundu were hunters and gatherers before 1800. From 19th century they begun to engage in agricultural activities mainly the cultivation of beans, sweet potatoes and millet (Ochieng', 1985). They also kept animals. The Central Highlands however became self-sufficient in food requirements (ibid, 1985). In later years of the colonial period, from 1888 to 1963, cash crops found their way into the region although it was completely dominated by the white settlers. Native Kenyans were allowed only to grow domestic food crops. In early 1960s, African households started growing cash crops (Leo, 1984).

A study by Aclund (1971); Leo (1984); Maxon & Ndege (1995); Ochieng' (1985) show that from the 19th century, agriculture has been the major land use in Gatundu even though cultivated crops and land management practices have been changing over the years. The main changes however in crop cultivation are the introduction of cash crops leading to a significant decline in indigenous crops which were very important food crops. Those crops include sorghum, millet, sweet potatoes, peas and yams. Land consolidation that was conducted in 1954 under the Swynnerton plan was a major development of Agriculture in the region which brought about significant changes in land use.

Cash crops were initially preserved for the whites. However, Africans were not given the permission to cultivate cash crops in order to work in the European farms as well as to offer protection to the white settlers from facing competition (Talbot, 1992). Besides, Europeans reasoned that peasant tea production was not economical because large units of tea was required for economic processing by factories (Carlsen, 1980). Conversely, Africans got the permission to grow tea in the mid-1950s. The formulation of African agricultural policy in Kenya, published in 1954 was intensified by the Swynnerton Plan that was released the same year (Leys, 1994). The policy gave a compressive change in African agricultural sector which was termed by the government as 'a circle of subsistence or near subsistence agriculture' (Lipscomb & Cone, 1972). Therefore, Africans were then allowed to engage in cash crop and small holder tea farming (Odingo, 1971).

Most of Kiambu is generally of high agricultural potential. Agriculture is the most prevalent economic activity which contributes 17.4 per cent of the population income of the county. The sub-sector is the leading in terms of income earnings, food security, employment and general contribution to the livelihoods of the people. Most of the people in Kiambu County draws their livelihoods from the sub-sector. Approximately 304,449 people are employed in the sector directly and indirectly. Total arable land in the country is approximately 1,878.4 Km² and of this, 21,447 Ha is occupied by food crops. The remaining 35,367.41 Ha is used for cash crops. The region allows offers a wide variety for intensive agricultural activities (Kiambu CIDP, 2018).

It is worth noting that most cultivated crops are used for subsistence as well as a source of income to households. Domestic consumption includes use as household, feeding of livestock, (maize and bananas) and given-away as gifts. In some cases, the amount sold (coffee, tea and potato) is more than the amount produced. This is possibly because some farmers were also trading in the

produce by buying from other farmers and then sold later, hence increasing the quantity sold (Kiambu CIDP, 2018).

Table 3: Crop Production in Kiambu County

Crop	Production (Tons)	Values (Ksh. Million)
Dry maize	27,831	724
Beans	16,268	849
Sweet potatoes	1,368	41
Pigeon peas	558	26
Cowpea	162	7
Green gram	57	4
Sorghum	24	1
Millet	5	0
Total	46,173	1,625

Source: Review of Agriculture, (2012)

As demonstrated in table 3, Review Of Agriculture (ROA) indicates that maize was the leading produce in Kiambu county with 27,831 tons fetching 724 million shillings earnings. The least produce crop was sorghum with 5 tons of total units produced. It is worth noting that millet is produced mostly for subsistence in the region.

Gatundu South constituency is one of the most agriculturally viable region with most of the crops grown being coffee, tea, pyrethrum and temperate fruits among others. Food crops include maize, beans, bananas, Irish potatoes and a variety of vegetables. Livestock rearing is also another prominent land use in the area (Mbai, 1984). It is important to note that poultry farming has also gained prominence in the region in the recent past (FAO, 2017).

In conclusion, the existing land use data was in the colonial era and it has not been reviewed on regular basis to keep a breast with emerging issues making it outdated and inadequate. In addition, there is limited access to land use data as it made available to only a limited number of institutions that process the data with limited access by the public (NLP, 2016).

2.3 Household Livelihood Diversification Strategies

The term “livelihood” has been used to denote a way of living that sustains one’s life and provides basic needs (Khatum & Roy, 2012). Diversification of livelihoods occurs when members of a household have a series of practices and communal advances to exist and draw their wellbeing.

Livelihood diversification has been defined by Hussein and Nelson (1999) to mean attempts that individuals make in order to raise income and minimize environmental threats.

The study however adopts the definition coined by Iiyama (2006) which describes livelihood diversification as a collection of on-farm, off-farm and non-farming activities that households undertake to earn a living. The definition has been adopted since it describes specific types of activities households can engage in. Schwarze and Zeller (2005) states that households that adopt diversified livelihoods can easily withstand the shocks, employ sustainable use of resources as well as provide opportunities for others.

Governments in almost all developing countries have been keen on the diversification of their rural economies. This is based on one premise that dependence on a few cash crops can lead to income instabilities that threatens income in rural areas. In addition, it has been established that many households who farm primarily for subsistence boost their incomes through diversification. This is done by addition of cash crops such as tea, coffee, cotton and fresh produce while they continue to produce for their own consumption. Notably, off-farm diversification activities can immensely boost and stabilize total incomes for the households. Thus, farm diversification qualifies to be a policy goal in managing risks and associated vulnerability affecting rural households, besides being a strong tool in boosting rural incomes (Kimenju & Tschirley, 2008).

Diversification is yet to adopt innovations and induced innovations. A wide range of studies on diversifications have put their focus on land, population increase and availability of labor as dependent variables. Population pressure theory has for a very long time continued to be a dominant paradigm that explains agricultural diversification (Boserup, 1981; Chayanov, 1966). Some studies have emphasized the complexity of agricultural development process since it is influenced by not only population density but also resource availability, behavioral factors as well as economic opportunities (Tiffen, Mortimore, & Gichuki, 1994). Farmers tend to diversify in line with the prevailing market conditions in quest to maximize profits. This argument agrees with the market demand theory. Lately, diversification has been propelled by emerging needs such as the urgency to protect the environment putting sustainable development into consideration. This effort may be curtailed by the aversion of the producers to risks. Low tea prices together with unsustainable income in tea zones have made many tea farmers to engage in agricultural diversification activities (Wolgin, 1975; Alam, 1975 and Anderson, 1989).

Ellis 1998 and Bryceson 2002 argue that majority of rural homes in Africa are faced with the challenge of environmental degradation as well as high levels of poverty. Researchers since 1990

have continued to explore strategies that can be employed by African households to diversify livelihoods in both on-farm (livestock and crop) and off-farm to curb the risks. According to Chambers (1997), poor people usually engage in various source of livelihoods as a way of survival as well as a strategy to cope with risks. This agrees with Sahelian people of West Africa who display a rich history of diversification (Painter et. al., 1994).

The main reason behind livelihood diversification by the households is the desire to accumulate income. This is influenced by factors such as land size, market access, income, credit access and educational levels of the households (Shen, 2004). Another reason as put forward by Davis (2006) is necessities which are driven by poverty, unemployment, unpredicted weather, size of the households and fluctuation in food prices.

According to Boserup (1965), population increase often leads to adoption of intensive farming systems which results in increased output. Continued population increase on the other hand puts pressure on natural resources resulting in high competition by households leaving diversification as the ideal survival strategy.

A study by Awudu and Ann (2001) states that land size as a degree of wealth impact greatly on household's participation on non-farm strategies. In Ethiopia, determinants of diversification differ in respect to wealth and Geography. Ownership of assets especially livestock is a major motivating factor for household to diversify off-farm activities (Demisse and Workineh, 2004). In addition, the choice of diversification is determined by the quality and quantity of labor as it enable the barriers to engagement in non-farming diversification (Demite and Negatu, 2004).

Agriculture alone is not an adequate measure of getting people out of poverty and that is why non-farming diversification comes in. Income levels as mentioned earlier influences livelihood strategies especially the type and number of options that are available to households. Latin America gives a good example of intensive economic diversification among the wealthiest people. Rich households owning big farms as well having high education levels have the ability to employ someone to work in an off-farm for better wages. In addition, they have good access to infrastructure which is very vital in the establishment of non-agricultural activities. In contrary, poor farmers are constrained to low pay as well as low productivity in farm labor due to small farms and low education levels (Chapman & Tripp, 2004).

According to Rantamaki-Lahtinen (2008), diversification into non-agricultural activities is on the increase in Norway, Finland, France and UK. In Latin America, non-farm activities constitute approximately 40 percent of rural incomes. Brazil for instance register about 39 per cent of non-

farm income for rural households. Areas depicting successful agricultural activities, such as coffee and sugar areas were found to register the highest income levels (Bryceson, 2000).

In Bukina Faso, farmers obtain about 20-25 percent of their income from non-farm activities. This indicated that participation in off-farm activities enables farmers especially who are producing near subsistence farming to earn extra income to meet their needs (Delgado, 1989). Extra income enable households to purchase essential goods and services, such as household products, farm products, pay education and even access health services (Berry, 1989a).

According to Hussein & Nelson (1998), there are two important strategies that people in rural areas can employ in order to achieve sustainable livelihoods. The two interventions that are very instrumental are agricultural intensification and migration. Essentially, migration is a very crucial factor in livelihood diversification. For instance in Ethiopia, Bangladesh and Mali, migration is a very major phenomenon that has a very strong influence in income generation strategies (McDowell & de Haan, 1997). Remittances from migration may cushion credit constrains in rural areas especially farmers who live in poor conditions (Taylor & Wyatt, 1996). According to Bigsten (1996), migration may be an indicator of rational distribution of household labor to realize maximum household utility. Different forms of migration was put forward by a study that was conducted by McDowell and de Haan (1997). According to them, the context in which each form of migration being undertaken occurs should be put into consideration. They continue to argue that, it is very crucial to put into consideration migration issues in relation to other livelihood strategies with the aim of factoring out generalizations in this process. This also applies to agricultural intensification.

Carswell (1997) describes agricultural extensification as the state in which average inputs of labor or capital input increases on a small holding, containing either cultivation only, or both grazing and cultivation with the aim of increasing the output value of a given land parcel. Agricultural intensification is greatly affected by market proximity among other factors (Reardon, 1997). Markets are advantageous to farmers because it enables them to realize non-farm income from diversified sources (Valentine, 1993). A portion of the income may be used to invest in other productive ventures of the households. Further consideration is needed on the extent to which this happens and the direction whether it is urban-rural or rural-urban. Crop-livestock integration may form part of a multi-faceted form of a strategy that enables the generation of sustainable livelihoods particularly in the process of agricultural intensification (Tiffen et. al., 1994).

It is interesting to note that the fact that in most cases, livelihood diversification strategies are specific to gender. Chen (1989) argues that both men and women undertake various diversification strategies. However, in most context, men are flexible to practice diversification opportunities that women find it hard to access due to cultural restrictions. On the other hand, the opportunities that does not bar women from accessing have low returns. For example, many women in Africa undertakes very low levels of micro-enterprises, which is household-based income generating activities with very low returns. They are not translating to the skills and capital of women but they are not sustainable in meeting livelihoods but just mere survival undertakings (Haan, 1989). Conversely, Koch Laier et. al., (1996) points out the fact that strategies that are limited to men may be undertaken by women. For example in Mali, prostitution is one form of diversification strategy that has been adopted by women the urban areas as an income generating activity (Vaa et. al, 1989). In Mali, the proportion of women engaging in non-farm employment is 16% compared to 84% by men. This depicts clearly that men have more diversification opportunities to pursue (Haggblade et. al., 1989).

In as much as livelihood diversification has been seen as a very important way of increasing income to meet sustainable livelihoods in rural areas, many researchers have pointed out negative long-term effects associated with it (Berry, 1989). With continued economic instability and fluctuating employment opportunities, increasing the number of diversifying activities does not necessarily reflect a sustainable livelihood. For instance, poor farmers who undertake off-farm activities, may just be doing so in an attempt to cope with stress, and poverty. This may only be a way to survive poverty in a risky environment other than improving their livelihoods (Davies, 1996).

The available opportunities that rural household can access for livelihood diversification are subject to so many actors. Seppala (1996) gives an example of a rural Tanzania set-up. He argues that success or failure of any type of livelihood diversification strategy depends on household's approaches to management such as timing of activities, location of activities as well as the capacity to take calculated risks.

According to Dercon and Krishnan (1996), different income strategies adapted by each household is determined by several factors that is unique to individual households. It majorly entails household characteristics and economic variables (Bigsten, 1996). Some rural homes may have limited capacity to diversify livelihood strategies due to constraining factors such as low education levels, inadequate infrastructure, long distances to markets and financial challenges. In

spite of household knowledge on the importance of income diversification, these constraints may still be so limiting that individuals may not be able to spread risks and increase income. (Reardon, 1997).

Dose (2007) indicate that diversification among the small-scale farmers in Kakamega region did not improve livelihoods of the households. In as much as she focused only on structural diversification which does not amount to all aspects of diversification, her conclusion is that diversification did not better household livelihoods due to limiting factors such as limited education, poor infrastructure and limited access to finance. However, Kenya has made significant strides in improving education and infrastructure in recent past and thus a study conducted years later could yield different results.

Further it can be deduced that whereas specialized tea farmers attempt to access food from own production, the diversified farmers attempt to increase their cash income from cash crops and possibly use the cash income to purchase food. If this was to be the case, then the specialized farmers may sell any surplus food crop harvest to the diversified farmers since the demand for food exists. This would eventually lead to improved economic welfare among food crop producers in the study area (Mwangi et. al., 2015).

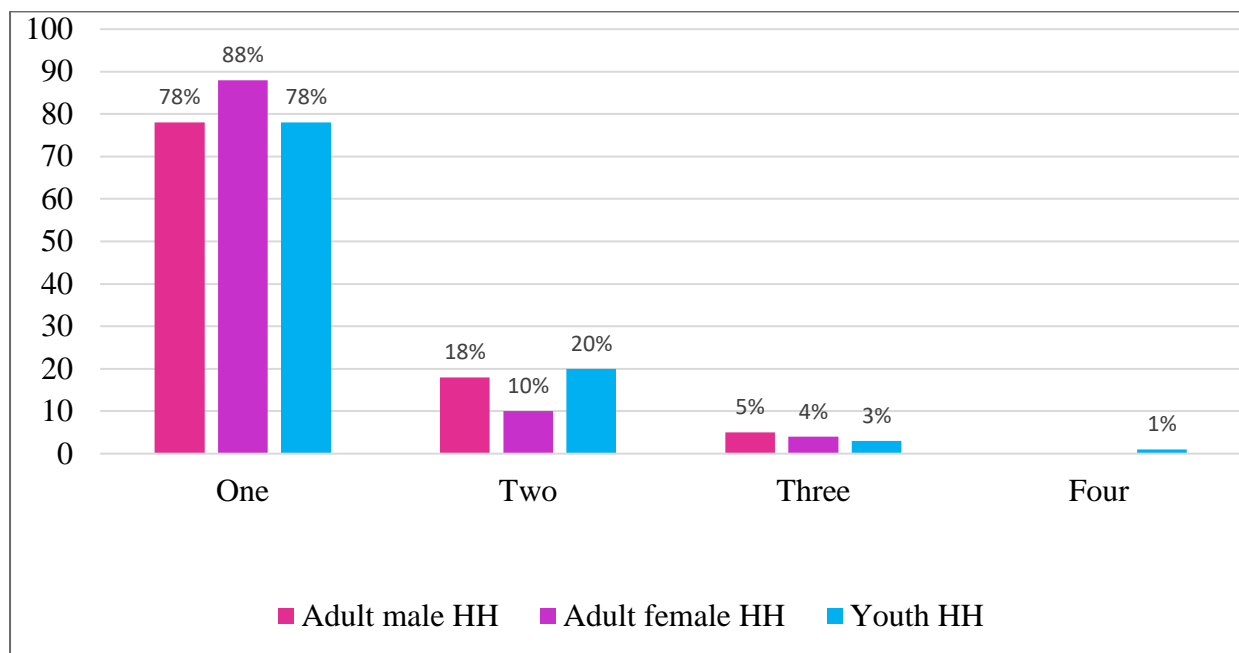
According to Falco et. al., (2010), there is a positive correlation between farm biodiversity and farm profitability in tea zone of Gatanga District. This study however will find out if this is the case with tea zone of Gatundu South sub-county. The author argues that this is an indication that households that grow varied range of crops outdo those that specialize on one crop in terms of production. This further illustrates the premise cash crops diversification brings economic benefits to households. Similarly, varying crop species reduce the effects of risks associated with production and price and thus allowing farmers to marketing their produce many times all year round (Baumgärtner & Quaas, 2008).

In Gatundu South sub-county, farmers are small scale cash crop farmers and the chief cash crops grown is tea. In recent past however, horticultural crops such as avocado, vegetables, macadamia, passion fruits and cut flowers have become important on the farms of these farmers. There is however no adequate documentation of the effect the shift of farming effort to diversified fields especially to horticulture and fruits has on the profitability of smallholder tea farming in Gatundu South. Given the small sizes of farms in the region, sustainability of these farms in the long run is pegged on improved production and profit base at the farm level. Secondly, given the role of agriculture in the economic pillar of Kenya's development plan, vision 2030, improving

productivity and profitability of the smallholder farms is crucial since they occupy 60% of area under production in the country. Farm sustainability is the ability of agriculture to endure over time and to achieve smallholder farming needs to be profitable and economically viable (Veenhuizen, 2007).

Mwangi et. al., (2015) argues that since the diversified tea farmers apply significantly more manure, labor and pesticides per hectare to their cash crops than do specialized farmers, they earn significantly higher profit from cash crop farming than the specialized farmers.

Figure 1: Number of Income Diversification by Households



Source: ASDP report, (2014)

Majority of the households have one source of income. According to the study, about 78% of the respondents in the adult male headed and youth headed households had one source of income while adult women-headed in this category were about 88%. Similarly, respondents with two sources of income were as follows; adult male headed-18%, youth headed-20%, and adult female headed- 10%. Households with three sources on incomes registered; adult male headed-5%, adult female headed-4% and youth headed- 3%. Only youth headed household had four sources of income amounting to 1% (ASDP report, 2014).

2.4 Land Use Planning Interventions

Planning in this context is a process of decision-making that is vital in the formulation of policies. Planning however is problem driven thus it depends on information and it is never a perfect

solution (Lein, 2003). Land use on the other hand is a process that involves observing various land use options and selecting categorically, and establishing a land use plan that enables the chosen option to be realized. Notably, land use planning remains the most essential mechanism in land use policy (FAO, 1999).

Land use planning entails assessing systematically land potential while considering alternatives for maximum land use and improved social conditions while incorporating participatory processes which are scale-dependent, multistakeholder and multispectral. Land-use planning is aimed at supporting decision makers and land users in selecting and practices that best meet needs of the people for posterity (FAO, 1993). There are myriad of mechanisms that can possibly be employed in order to protect and conserve land and land use. They include both the statutory and non-statutory in nature; that is policy or guideline inclined (Lamsal, Pant, Kumar & Atreya, 2015). Various options that can be combined to meet land use planning objectives include:

2.4.1 Sustainability in Land Use Planning

In the context of sustainable development, it is the mandate of land use planning to appreciate the relationship that exists among resource consumption, land use and spatial temporal environmental processes. It is the duty of panning system to focus on resource use sustainability by employing appropriate policies and design (Owens & Cowell, 2002). Land use planning is key in realizing long-term sustainability since it focuses on the integration of environmental deals and information into the planning process (Lein, 2003).

2.4.2 Subdivision for Conservation;

Subdivision should only be permitted where there is no harmful effects on the aesthetic, conservation or ecological values of the land and where withholding of these values of the land in perpetuity will be realized. This results in environmental protection that includes remnant vegetation, management of catchment lands through innovative designs in subdivision that results in consolidated cluster style development, that optimizes the long-term protection and management of land aspects subject to the prevailing individual circumstances and the quality of the proposal (Western Australian Planning Commission, 2010).

2.4.3 Local Area Planning Strategies

Land use planning tool should include both the local government and community in formulating vision for the locality and in drawing of short, medium and long term policies to envision sustainable land use and development. These can however be adopted by the town planning schemes to boosts the statutory force (Town of Bassendean Local Planning Strategy, 2008).

2.4.4 Zoning under the Local Town Planning Scheme

Zoning of land within a local planning scheme is a basic way of controlling land use and is a significant consideration in the assessment of subdivision, development and rezoning applications. This mechanism protects private ownership. However, with this mechanism, development control provisions as well as new land use and can be incorporated into the areas with greater need for heightened controls to achieve conservation and landscape objectives (Ironbark Environment, 2008).

2.4.5 Public Participation

Participation leads to suitable planning because it incorporates democracy and justice whereby people are invited as part of decision makers in matters that affect their lives. Thus, inclusive participation is essential for a sustainable community (Owens & Cowell, 2002). According to Selman (1996), public participation boosts validity of the planning process, as it results in the achievement of decisions which are better-informed. When the public is involved in planning, new ideas, different opinions and worldwide views are introduced to dispute the official conceptions of sustainable development and existing strategies for sustainable development (Owens & Cowell, 2002).

2.4.6 Land Exchange

Existing public land which is facing lower conservation measures as well as threatened landscape values can be taken and exchanged for land that is owned privately and which exhibits high conservation measures and landscape values. Land exchange mechanism is an attractive venture attractive for public agencies especially those focusing on the amount of land registered under public ownership or those facing constrained funding sources (Fairfax, 2005).

2.4.7 Food Security

This strategy supports livelihood plans focusing on rural households. It implies that apart from crop production, there are other options that are available. One major option that is very essential is diversification of income source by households. This includes carrying out of farm activities which are not practiced by traditional rural dwellers for example eco-tourism (FAO, 1999).

2.5 Policy Framework

This section reviews policy guidelines that have been operating in Kenya to control land uses. The policy framework provide wide guidelines and principles in land use management.

2.5.1 National Land Use Policy

National land use policy informs intentions, programs and operations of the public authority controlling land use in an agreeable way. It is grounded in the desire to regulate and control land activities in the most sensible and ethical way preventing land use conflicts. At present, Kenya does not have a codified and comprehensive national land use policy but rather land utilization laws which have been inconsistent including the Land Planning Act, chapter 303. All sectors affected by land use including Agriculture lament on the existence of National Land Use Policy. At present, land use management is guided by many laws including; The Land Control Act, chapter 302 and Physical Planning Act, chapter 286. However, formulation of land use policy is underway in Kenya and therefore the existing land use policies do not sufficiently promote sustainable development which translates to poor land use management.

2.5.2 National Land Policy

Since independence, Kenya has not had a clearly codified National Land Use Policy until 2009 when National Land Use Policy was formulated (Kenya, 2009). The delay gave a chance to many incompatible land uses which resulted in a complex management and administrative system. Since colonial times, Kenya has been struggling with land issues and which subsequent regimes failed to adequately resolve. This has been the reason of many social, environmental and political issues and subsequent deterioration of quality land, squatter settlement, landlessness, disinheritance issues, and abandonment of Agricultural lands and lack of security of tenure (Muendo, 2004). The mandate of the National Land Use Policy is to steer the country towards attaining an equitable and sustainable land and resolve land issues completely.

The policy recognizes land uses in rural areas which in recent past has been of great concern to Kenyans. One of the serious issues that needs to be resolved by these policies is the emergence of land use conflicts due to competing land uses, uncontrolled land sub-division especially in potentially rich agricultural lands of smallholding, low productivity, diminishing land quality due to poor land use activities, indiscriminate land use and land purchase, lack of alternative land uses and lack of planning that allows diversification to curb high population growth. All these require mitigation by applying appropriate policies. However, urban agriculture has not been able to benefit from proper policy regulation. This is backed up by the fact that Kenya is yet to formulate and effect effective land use and management planning and this has led the country to experience unsustainable land use and environmental deterioration (Muendo, 2004).

2.5.3 The Kenya Vision 2030

This is Kenya's blue print that covers the period of 2008-2030 (Kenya, 2008). Its aim is to make Kenya prosperous and economically competitive with sustainable livelihoods by 2030. Vision 2030 has put agriculture into consideration as one major sector to deliver 10 percent annual economic growth rate. Under agriculture, Kenya aims at improving livestock and crop productivity by introducing new land policies and utilization of medium and high potential agricultural lands and formulating Agriculture Land Use Master Plan. However, sustainable agricultural land use is a vital in achieving this goal in order to achieve protection of low, medium, and high agricultural lands.

2.6 Legal Framework

Kenya has formulated several laws to guide land use in both urban and rural areas. This document however shall highlight laws that relevant to rural land use. The legal framework controls and regulate land use differently.

2.6.1 The Constitution of Kenya, (Kenya, 2010)

Since its promulgation in 27th August, 2010, the constitution has form a very strong basis of land laws in Kenya. Chapter six section 60(1) highlights the principles of land use management. It includes efficient, equitable, sustainable and productive control of the land resource, as well as use and access of land. It has gone further to clearly highlight the ways of implementing the principles through National Land Policy. In addition, the section provides for the enactment of national land commission whose mandate is to provide oversight duties on land use planning countrywide. It is also tasked with the responsibility of conducting research on land use as well as the consumption of natural resources and finally draw recommendations to relevant authorities.

Article 60 section 1 highlights issues on land use and it states that "land shall be held, used and managed in a manner that is equitable access to land; security of land rights, sustainable and productive management of land resources, transparent and cost effective administration of land and sound conservation and protection of ecologically sensitive areas"

Article 66 section 1 covers the duty of the sovereign state to use and control any land or any vested interest over any land concerning public order, public safety, public health, public morality and public land use planning. This however is under the National Land Commission whose mandate is monitoring and oversight responsibilities (Kenya, 2010).

2.6.2 The County Government Act 2012, Laws of Kenya

The act highlights the mandate of the county government. Part X1 highlights on the county planning. Therefore it states that the objectives at the county level includes development of a well-balanced system of settlements; productive use of scarce resources- land, water, for economic, social and ecological functions; development of rural and urban areas as an integrated system, sub-counties and wards or planning purposes. Section 2 of the act emphasizes on the kind of plans that should be formulated for the purposes of development in each county. They include county sectorial plans, county integrated development plans, cities and urban areas plan as highlighted under the Urban Areas and Cities Act.

2.6.3 The Physical Planning Act, Chapter 286, Laws of Kenya

This act emphasizes on the documentation of plans unique to each spatial level. It also highlights the procedures and contents of each plans. Section 16(1) covers the drafting of a regional physical development plan "...in reference to any government land, trust land or private land within the area of authority of a county council for the purposes of improving the land and providing or the proper physical developments of such lands." Section 16(2) continues to add that ... "a regional physical development plan may provide for planning, preplanning or reconstructing the whole or part of the area comprised in the plan, controlling the order, nature and directions of developments in such an area."

A plan is usually prepared to act as a guide during developments. Conversely a plan can be directed to benefit of the general public in provisions such as in sub-section 3 which states the purpose of a local physical plan is prepared, given as "...guiding and coordinating the development of infrastructural facilities and services for an area referred to in section (1) and or the specific control of the use and development of land or for the provision of any land in such areas for public purposes." Section 36 gives a discourse relating to land use that may result in detrimental effects on the environment such as excavations that results in land use.

2.6.4 The Land Act 2012, Laws of Kenya

This act was formed with an aim of consolidation and rationalization of many sects of laws used to govern and the management and land administration in Kenya. Regarding land use management and planning, part II of the act ideally reiterates on the management of public land. The organization responsible for formulating planning regulation and approval of plans is the National Land Commission. In section 17, the formulation of development plans by a management body is highlighted. The main aims of plan preparation are stated in section 2.

Section 19 finally covers making of rules and regulations for conserving land resources sustainably.

2.6.5 National Land Commission Act 2012, Laws of Kenya

The main objective of this act is land management according to land policy and also article 10 of the national constitution. Its mandate is also to link NLC to county government and other relevant institutions which deals with land and other land related matters. Part h of Section 5 gives the commission powers in regards to monitoring and oversight duties concerning land use planning.

2.6.6 Land Control Act, Chapter 302, Laws of Kenya

Boards dealing with land control activities are vested with powers to refuse or grant permissions related to agricultural land for example lease mortgage, sale, disposal and partition. Before granting or denying a permission on land dealings, the boards should put the following factors into consideration: the effect on economic development of the land in question as a result of acceptance or refusal; they should consider the fact that the consent should be declined when the owner of the land in disposal is likely to cultivate the farm accordingly, or develop it proportionately or is not likely to use the land in a profitable manner and for the intended purpose due to the nature of the land or is having adequate agricultural land. In regards to land sub-division into two or more fragments, the lands controls board should deny permission in cases where the subdivision is likely to results in reduced the land productivity or where the players seeking to purchase the land are aliens.

2.7 Land Use Theories and Models

A number of theories explaining the dynamics in land use have established a theoretical base upon which the study was conducted. The theories include Von Thunen's crop theory, Ricardo's "comparative advantage", Economic Rent, Land use theory. Von Thunen's Rural Land Use Model was also considered by the study.

2.7.1 Von Thunen's Crop Theory

To clearly elaborate this theory, Von Thunen's own words are quoted. "... Imagine a very large town, at the center of a fertile plain which is crossed by no navigable river or canal. Throughout the plain the soil is capable of cultivation and of the same fertility. Far from the town, the plain turns into an uncultivated wilderness which cuts off all communications between this State and the outside world. There are no other towns on the plain. The central town must therefore supply the rural areas with all manufactured products, and in turn it will obtain all its provisions from the

surrounding countryside. The mines that provide the State with salt and metals are near the central town.”

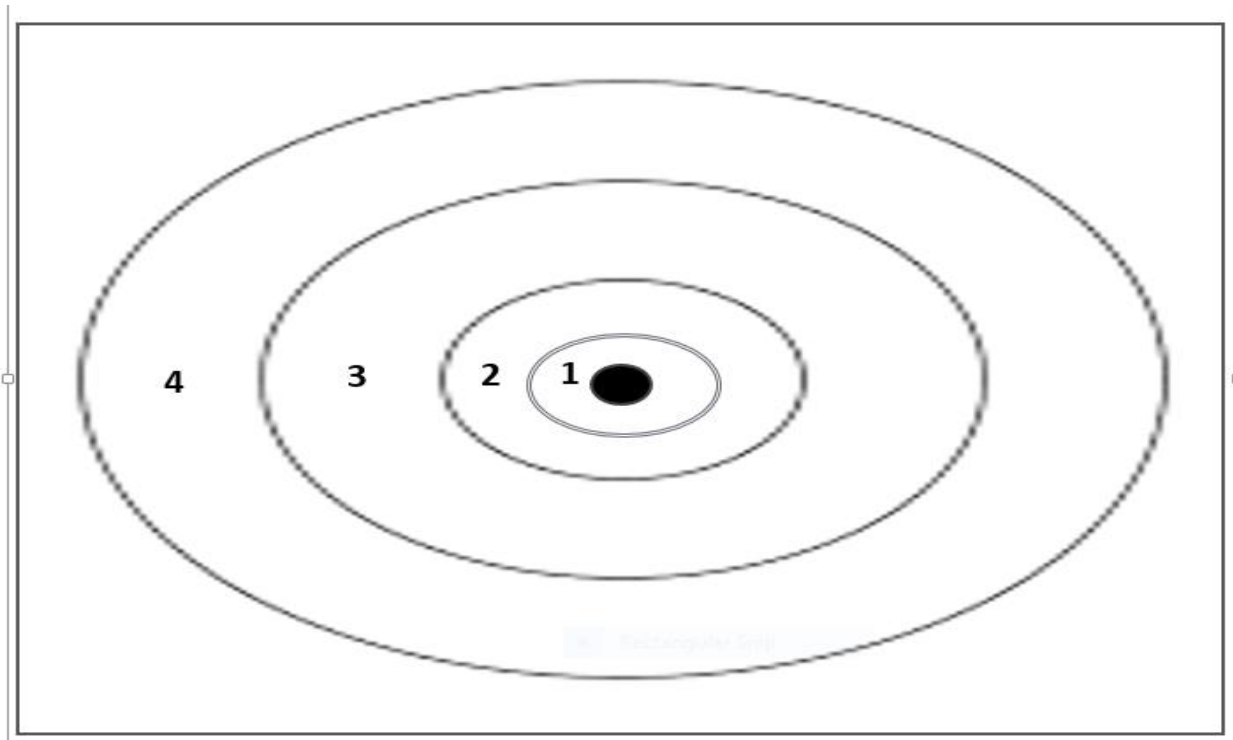
The structure of Von Thunen’s model is based on the premise that the location of urban places to greater extent determines land rent as well as spatial location of agricultural crops. The city’s impact on economic rent is determined by; first the prices and the demand for agricultural produce; and secondly the costs incurred during transportation and distance taken from each farm to the city and this varies from one crop to the other. Moreover, land rent is affected by yields per crop and crop production costs and in relation to each unit of land. Thus, the spatial arrangement of crops around a given city will constitute crop rings because land rents differ from one crop to another. Although this theory was developed entirely by Von Thunen, it has been adopted by many writers for instance Sir James Stuart (Scott, 1976).

2.7.2 Von Thunen’s Rural Land Use Model

Von Thunen coined a detailed description of how land rent informs land use. As presented in figure 2, the small black dot in the center represents a city. Number 1 stands for dairy farming and market gardening. While number 2 denotes forest for fuel, number 3 represents grains and crop field and wilderness is represented by number 4 where Agriculture is not profitable.

Bannister (1977) gives a detailed description of each of the rings in Von Thunen’s model. The first ring surrounding the urban community is set apart entirely for market gardening as well as the production of fresh milk. The rationale behind this is that garden produce such as vegetables and milk products are highly perishable and should reach the market immediately. It is important to note that Von Thünen came up with this model when refrigerators had not been invented. Therefore, farmers producing perishable crops would bid more than those producing less perishable produce so as to farm land that is closest to the market making the land close to the city to have a higher economic rent.

Figure 2: Von Thunen model of land use



Source: "Von Thünen circles city" by Erin Silversmith (7th edition), 2003

The second ring according to Von Thünen would be distinguished for forest production and harvest of forest products. The reason behind this is the fact that people in the early 19th century used wood for heating, cooking as well as building. As wood is bulky and heavy, it brings about transportation challenges. This need is not as pressing as for perishable crops and thus Von Thünen thought that wood farmers would outbid other producers for the second ring of land around the market center except producers of milk and market gardening.

Von Thünen believed that the third ring would be consecrated for crop rotation farming systems. Rye was very important cash grain crop during his time. The third ring would bring about differences in the intensity of cultivation. Since land rent reduced with distance from the city, farmers at the other edges of the ring would find lower rents would offset the increased transportation cost. In addition, since farmers at the outer edges would pay less rent, they would put lower inputs before reaching the point of decreasing marginal returns than those paying higher rent in order to be closer to the market. Thus, they would not practice intensive farming as those farming land closer to the urban center.

The fourth ring according to the reasoning of Von Thünen would be set apart for livestock ranching. Animals could walk into the market unlike perishable or bulky products. Moreover,

animal products for instance hide, wool and horn, did not pose challenges of transportation or perishability.

Bannister therefore reached a conclusion that Von Thünen's model demonstrates the fact that wilderness enclosed the outer edges of Von Thünen's detached state. He argued that the lands would in the end direct rent value according to the population increase of the state.

2.7.3 Land Use Theory

According to Wood et. al., (2000), destruction of habitats and loss of biodiversity results from a combination of myriad of driving forces both direct and indirect. Direct forces comprise those related to natural resource exploitation at local level. It includes land use change of a given niche by replacing natural vegetation with cultivation; changes in crop types, encroachment by agriculture on grazing fields and expansion of settlements on natural vegetation. While preparing land for agriculture, vegetation is cleared which may greatly reduce vegetal cover and in turn change or result in a complete loss of primary vegetation.

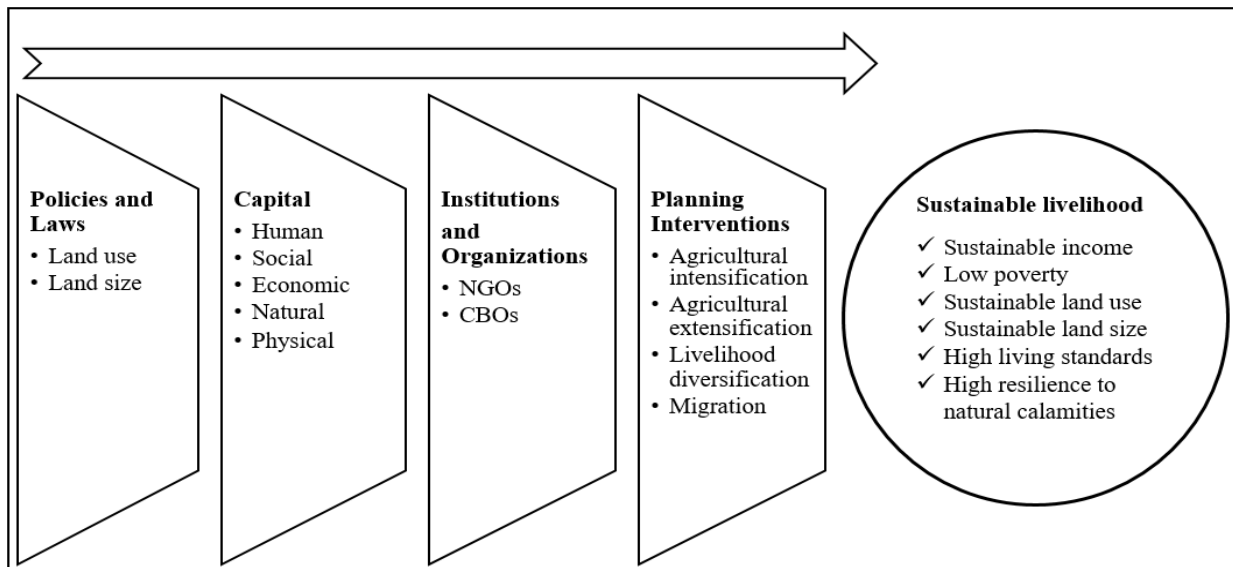
Wood et. al., (2000) continue to argue that the reasons behind the changing patterns of resource use include the cultural norms that dictates the local communities' perception on forest biodiversity, macroeconomic policies and structure, changes in forest management and responsibilities, adopted and existing land use laws and regulations, macroeconomic policies and structure and population change. The resultant effect is either an improved natural resource use and management or negative effects such as environmental degradation and loss of biodiversity. It is worth noting that human population greatly affects land use through processes such as recreation, production and consumption activities. Thus in order to meet the food security and protect the environment, various technologies are introduced and promoted especially in smallholders farming systems in order to satisfy high food demand for population.

2.8 The Conceptual Framework

The following conceptual framework is derived from literature review. It focuses on how various variables such as land size, land use planning and policies work in relation to each other to achieve sustainable livelihood.

To achieve sustainable livelihood, resources are very essential. They range from tangible to intangible, human to physical and even social assets. They are conceptualized as different productive sources from which livelihood are constructed. Four types of capital are identified including; natural, economic, human and social capital.

Figure 3: Conceptual Framework



Source: Author, 2019

Policy and legal framework on the other hand are very crucial since they are roadmaps guiding people towards sustainable livelihoods. Land use and land size are essentially very critical factors in sustainable rural livelihood. However, for a nation to realize proper land use and reasonable land size, it should be grounded on strong policies and guided by very strong laws.

Institutions are considered as either formal or informal. They are often equivocal, and are usually power laden. Institutions tend to intervene on access to livelihood resources both directly and indirectly. This affects the strategies and the scope employed to achieve sustainable livelihoods.

Planning interventions helps to enlighten and empower rural households in various strategies that can be employed to realize sustainable livelihoods. Literature has expounded on such diversification to include on-farm, and off-farm and non-farm diversification. On-farm diversification happens when farmer plant a variety of crops on the same piece of land. This help the farmer to spread risks and shield from uncertainties in farming for instance unstable prices, unpredictable market conditions and even environmental challenges such as drought and disease infestations. On the other hand, non-farming enables the farmer to undertake activities outside farming such as employment and business opportunities. This helps the farmer to have multiple streams of income to meet household needs. This is favorable to farmers who have small agricultural lands. Further to note this mode of diversification is not farm-dependent and thus it is free from challenges related to farming. Off-farm diversification occurs when a farmers engage in other activities outside own parcel of land in which they live in.

The aforementioned factors work hand in hand in the realization of sustainable livelihood. With adequate capital resource, good policy and legal framework, backed up by effective institutions and adequate planning, the society shall witness sustainable rural developments with sustainable household income, low poverty index, sustainability in land use, sustainable land size, high living standards and high resilience of communities to natural calamities.

2.9 Overall information Gap

According to literature review, it is evident that average land size has changes considerably since land reform in 1954 by the Swynnerton plan which sought to consolidate land that was facing a serious challenge of land fragmentation. In Gatundu South, land was facing sub-division such that it was no longer supporting subsistence production leave alone commercial farming. However, the region is currently facing the same phenomenon as land is sub-divided mainly due to inheritance reasons. Therefore, the existing small parcels of land does not meet household needs and this warrants a study. However, the exiting literature does not point out which minimum land size can sustainably meet household needs.

It is clear the tea farmers generally have embraced livelihood diversification due to low prices and climatic factors affecting tea sector as well as a means of obtaining food. Literature indicates that livelihood diversification increase household income and shield farmers from stress since they don't need to only depend on farming which is prone to fluctuating prices and environmental challenges. In addition to that, it has been found out that farming systems that diversify crops tend to perform better, than those that concentrate on only one product. In as much as livelihood diversification has been seen as a very important way of increasing income to meet sustainable livelihoods in rural areas, many researchers have pointed out that increasing the number of diversifying activities does not necessarily reflect a sustainable livelihood. For instance, poor farmers who undertake off-farm activities, may just be doing so in an attempt to cope with stress, and poverty. In addition, livelihood diversification may not be beneficial especially when constrained by factors such as such as poor infrastructure, financial challenges and low education levels that is dependent on.

Agriculture alone does not adequately save households from poverty and that is why non-farming diversification comes. However, it exists disagreement that crop diversification reduce cash crop productivity and thus this this study was imperative.

Land use planning is policy dependent as it seeks to manage, coordinate and regulate the use of land in order to achieve sustainable livelihoods. For it to be effective, land use polices and

legislation should be grounded in strong policies. Despite the existence of many policies, land use planning is still a very big challenge in the realization of sustainable livelihoods.

CHAPTER THREE

RESEARCH METHODOLOGY

3.0 Introduction

This chapter describes the research methodology that the study adopted. It defines the target population of the study, data collection instruments, the sampling technique that was used, and data analysis procedures. Thus, the chapter is thus organized in the following subsections; research design, target population, sample size and sampling plan, data collection methods, pilot testing, research ethics and data analysis techniques.

3.1 Research Design

Qualitative research design was adopted as it enables the researcher to build an understanding of the research topic as well as comprehend the research problem. The main strategy used was mainly the descriptive case study, which adopts an interpretive approach to data, making it possible to study the land use and land size problem to smallholder tea farming households and bring objective meaning into the study. It has been considered the most preferred research design since it is not interested with individual characteristics rather it provides information about the general population (Kothari, 2009).

3.2 Target Population

The target population is a universal collection of individuals, objects or events either real or hypothetical which is focused by the study so as draw conclusions (Mugenda & Mugenda, 2003). The target population for the study comprised of all the households, community leaders, opinion leaders, religious leaders, political leaders, administrators and professionals in Kirangi sub-location. The table below shows the structure of the target population. However, sampling was done to pick a representative from each category of the target population.

Table 4: Target Population

Kirangi Sub-location	Male	Female	Total	Households	Area in sq. Km	Density
	1,255	1,247	2,502	791	6.2	401

Source: KNBS, 2019

2019 population census statistics indicates Kirangi Sub-Location has a total population of 2,502, with 791 households and a population density of 791 people per square kilometer.

3.3 Sampling Plan and Sample Size

A sample is a small group selected from a larger population for measurement. A good sample size ranges between 10 to 30% of the population so as to give a good representation of the target population and thus for a good analysis, 30% rule is recommended. Sampling is essential because it solve time and resources limitations (Mugenda, 2003). The method of sampling chosen for this study was Stratified random sampling since it gives a good representative sample. This involves the division of a population into smaller groups known as strata. Strata was comprised of male-headed, female-headed and child-headed. 10 households from each village in the sub-location was randomly selected from each strata.

3.4 Data Collection Methods

Both qualitative and quantitative data was collected. The methods for data collection were; documents review, observation, interviews, photography, and instrument administration. The researcher administered household questionnaires with the aim of collecting data from the selected respondents in Kirangi Sub-location. The purpose was to administer appropriate tools and instruments so as to measure different land use and land sizes change and coping strategies by the households.

3.4.1 Observation

This was done by the researcher by formulating observation check list on all data needs to ensure that all observable data was captured. Observation was used during transect survey to physically view existing land use, land size, vegetative land cover, human activities and people's socio-economic lifestyle among others.

3.4.2 Document Review

The researcher reviewed existing literature on the relationships between household land size, land use changes, land fragmentation and livelihood diversification with livelihood sustainability. In addition, land use and land size data was obtained from analysis of data since land was consolidated in 1956 by the Swynnerton plan. Further, demographic census reports and maps on physiographic features such as rainfall, temperature, soil types and dominant crop of the Kirangi Sub-location was reviewed. The study also examined past studies on household income diversification strategies.

3.4.3 Interviews

The researcher conducted both household and key informant interviews as well as focused group discussions. With the aid of a well-formulated questionnaire of both open ended and closed questions, data on land sizes, land use change, land subdivision, livelihood, and fragmentation were collected. The samples interviewed were drawn from a randomly selected members of households, religious leaders, administrators, professionals and possibly political leaders.

3.4.4 Photography

Data were captured based on photograph checklist. Photographs are very essential since it helps to visualize and give more explanations on the collected data. In addition it acts as evidence of the situation in actual ground set up as well as making comparisons with existing photographs possible.

3.4.5 Instrument Administration

With the use of the appropriate tools and instruments, the actual measurements of the household land size and land allocations for different land uses was undertaken. This acted as validation of data gathered via the interview method. The instruments were designed to clearly capture the issues in the field. The instruments had the ability to capture specific data to test hypotheses statistically.

3.5 Pilot Testing

A pilot study was conducted on one of the villages of Kirangi sub-location. Household questionnaire was administered so as to establish potential challenging areas and to clarify how the respondents interpret the questions. Review was then made on the questionnaire based on the outcomes of the pilot study.

3.6 Ethical Considerations

This study involved people and thus ethics were put into considerations. Before the study commenced, pertinent permission was asked from the respondents. Informants were given all explanations pertaining to this study in terms of its objectives, scope, as well as the intended use of the gathered information. This was upheld throughout the entire study and even later during the report writing and publication of the findings. Respondents were duly notified that they have rights to retreat at any stage of the study. They were also clearly informed about the means of accessing the research findings (Kothari, 2004).

3.6.1 Informed Consent

Participants were duly communicated about the study and their permission concerning the purpose of the study was sought. The informed consent included; the rights of the respondents to retreat during the process as well as the expected duration of the research (Wallen, 2000).

3.6.2 Voluntary Participation

Participants were informed about their freedom to volunteer in giving the required information. No mandatory participation was imposed on any respondent.

3.6.3 Confidentiality

Pertinent measures were put in place to ensure that no information was revealed outside their consent. They were however explained to that the gathered information during the study would be treated with utmost confidence and study findings were for the purpose of the study only.

3.6.4 Privacy

Privacy of each respondent was respected by not encroaching into their private space and time.

3.6.5 Anonymity

Mugenda and Mugenda (2003) states that anonymity is achieved only if the identity of the respondents is subject to ethical considerations. To safeguard this, the respondents were granted due respect by ensuring that their identity was concealed. Respondents were picked randomly without any bias so that the findings were not associated with any individual.

3.7 Data Presentation Plans

Classification and tabulation was applied in analyzing quantitative data. This was helpful in getting measures of central tendencies, dispersions, trends and making graphical presentations. Completed questionnaires were checked accordingly to ensure completeness and consistency. A predetermined coding scheme was used to code the collected data. For qualitative data, analysis and comparison of the different opinions were done to ensure that accurate data were encoded into the findings of this study. Quantitative data were analyzed using Scientific Package for Social Sciences (SPSS), use of percentages, frequency counts and graphs to describe distributions, per-charts to show differences in frequencies and bar charts to display nominal or ordinal data. The data were then presented using descriptive case and use of diagrams such as pie charts, graphs, tables et cetera that were found to be appropriate for each set of data.

3.8 Chapter summary

This chapter has highlighted the methodology that the study adopted. Thus, it has accurately discussed the target population, the sample and research design, data collection techniques and the methods used in data analysis.

CHAPTER FOUR

BACKGROUND OF THE STUDY AREA

4.0 Introduction

This chapter is an outline on the background and the existing situation of Kirangi Sub-location; both physical and the social environment. It presents physiographic factors, the historical aspects of the site, land use patterns, settlement patterns as well as the administrative aspects of the sub-location.

4.1 Location and Size

This is a summary of geographical location of the study area in respect to national, regional and local context

4.1.1 National Context

The study was conducted in Kiambu County which is one of the 47 counties in the Republic of Kenya. Kiambu is located in central part of Kenya, covering a total area of 2,539 Km² with forest covering 476.3 Km² according to the Kenya Population and Housing Census data 2019. The county borders Machakos to the East, Murang'a to the North and North East, Nyandarua to the North West, Nakuru to the West and Nairobi and Kajiado Counties to the South as shown in figure 4. Kiambu county lies between Longitude 36° 31' and 37° 15' East, latitudes 0° 25' and 10° 20' South of the Equator.

Figure 4: Map of Kenya Showing Location of Kiambu County

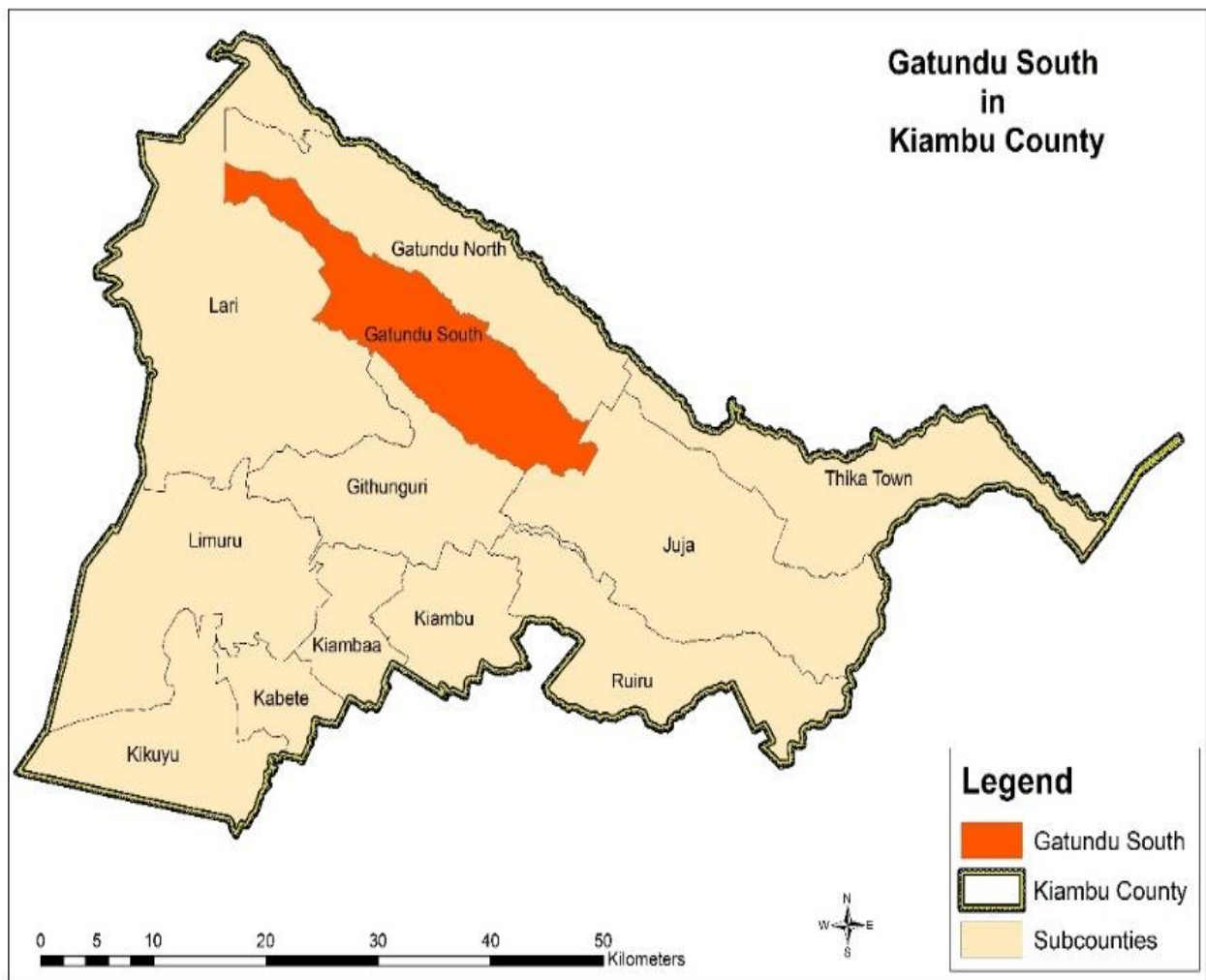


Source: Kenya GIS data)

4.1.2 Regional Context

Gatundu south is one of the constituencies in Kiambu namely; Gatundu South, Gatundu North, Juja, Thika, Githunguri, Kiambu, Kiambaa, Kikuyu, Kabete, Limuru and Lari Constituencies. Gatundu south is also an electoral constituency in Kiambu County.

Figure 5: Map of Gatundu County showing Gatundu South Sub-county

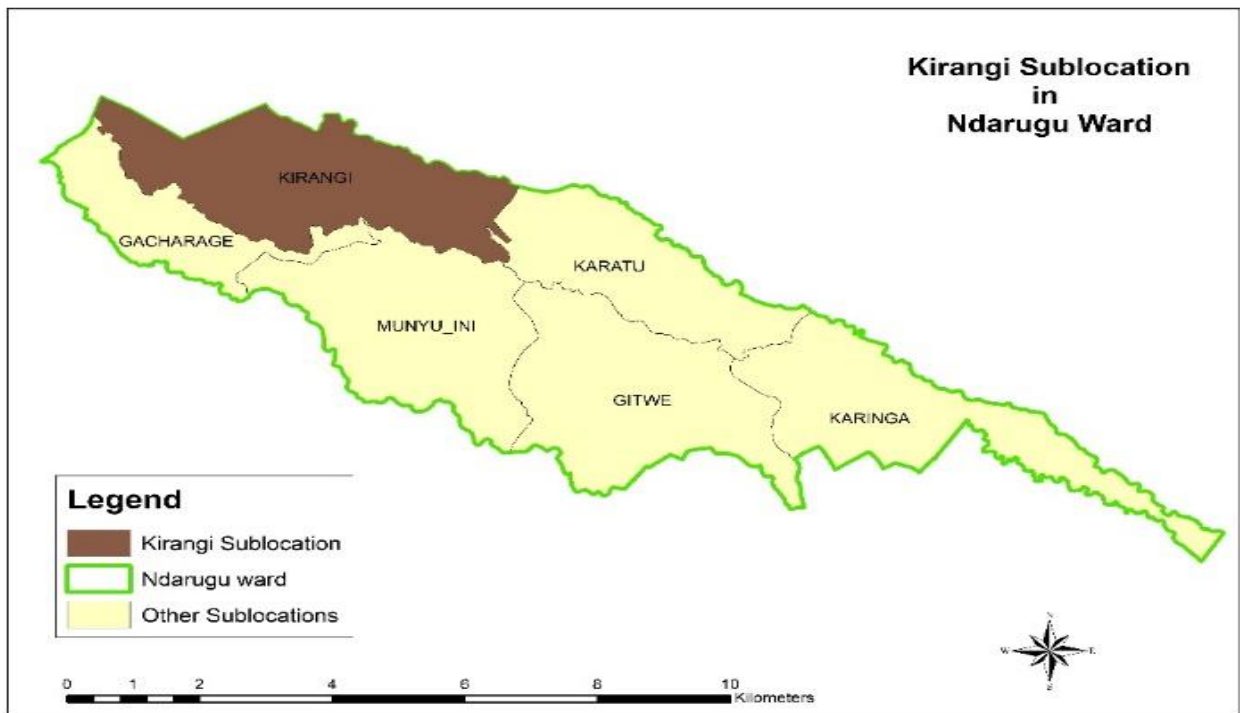


Source: Kenya GIS data

4.1.3 Local Context

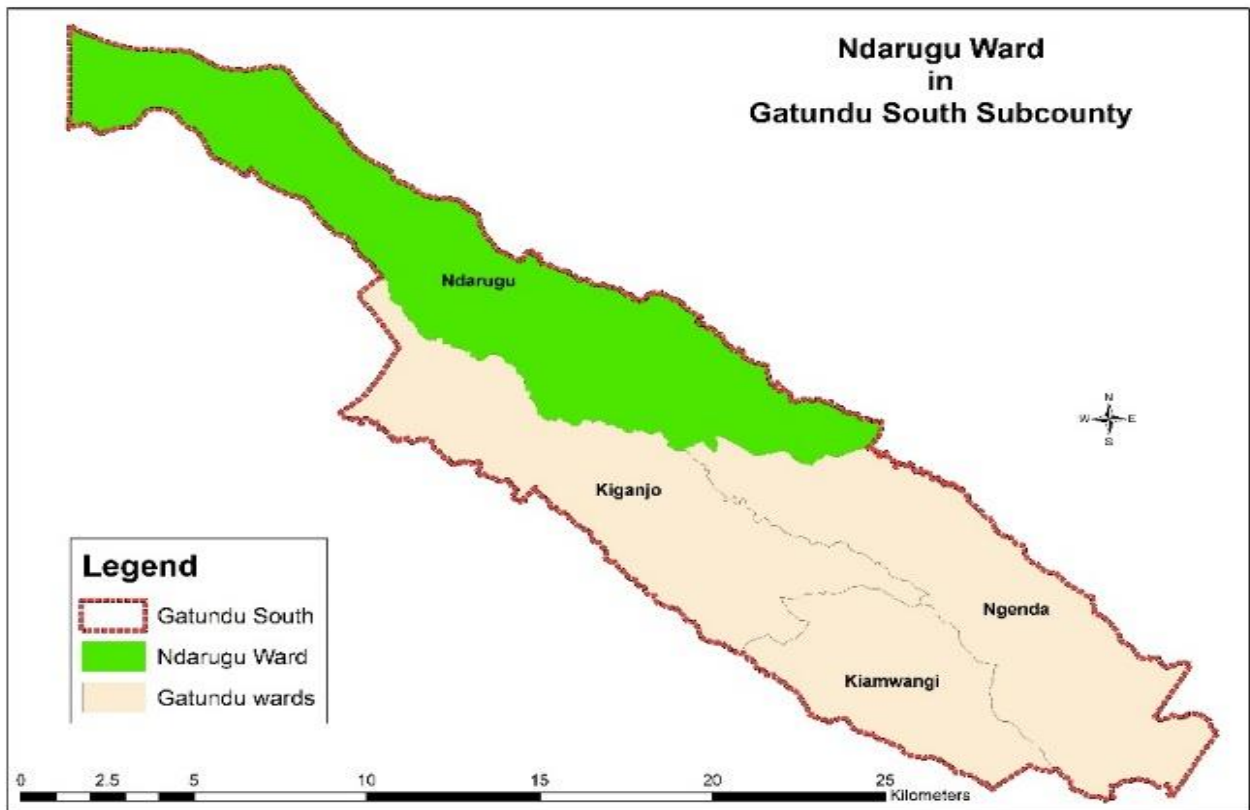
Kirangi Sub-location is one of the sub- location forming Ndarugo location in Gatundu South Sub-county. Other sub-locations include; Gacharage, Karatu, Munyu-ini, Gitwe and Karinga sub-locations. On the other hand, Ndarugo ward is also one of the wards in Gatundu South constituency. Others include; Kiganjo, Ngende and Kiamwangi wards.

Figure 6: Map of Ndarugu Ward Kirangi Sub-location



Source: Kenya GIS data

Figure 7: Map showing Ndarugu ward



Source: Kenya GIS data

4.2 Physiographic Factors

This section covers the physical patterns of Kirangi sub-location. It highlights on the natural environment and features such as topography, geology, climate, hydrology biological environment and edaphic factors.

4.2.1 Topography

Major topographical zones in Kiambu County are Upper Midland, Lower Midland, Upper Highland and Lower Highland zone. The lower highland zone is a stretch covering Limuru, Kabete and some parts of Gatundu South, Gatundu North and Githunguri constituencies. The region generally is endowed with plateaus, high-elevation plains and hills. Altitude ranges between 1,500 to 1,800 meters above sea level. Major agricultural activities in the region are tea and dairy. Other activities farming activities include, horticultural crops, maize and sheep.

4.2.2 Geology and Soil Type

The rocks of the Gatundu Sub-county is made up of Pyroclast with little components of basalts of Pliocene to Lower Pleistocene Age. Rock outcrops are witnessed majorly at river beds and deep incised valleys.

Generally, Gatundu South soils are: plateau soils, high level upland soils and volcanic footbridges soils. These soils vary in their levels of fertility with high-level uplands being very fertile as they are from volcanic rocks. It is ideal for livestock keeping and it also supports cash crops and food crops farming. However, crops that are cultivated in this region include coffee, horticultural products, tea, pyrethrum, maize, vegetables, beans, potatoes and peas.

Kirangi Sub-location is endowed with typical tropic red soils (Latosols), found mostly in high altitudes. They exhibit high clay content, thin layer of fertile humus and distinguish aggregate structure. It is because of these characteristics that they are resistant to soil erosion. These soils are fertile volcanic red soil ideal for tea growing qualifying Kirangi as a tea growing zone.

4.2.3 Hydrology

Both surface and ground water resources in the region are discussed. It includes rivers, drainage basins, dams and wells.

4.2.3.1 Surface Water Resource

Gatundu South is located on the slopes of Aberdare Forest Ecosystem which is one of the major water catchments in Kenya. Having lied in the wind ward side of the escapements, the region is

endowed with many river tributaries flowing towards east of Aberdare-Athi drainage system. These rivers include the Ndarugu, Rwabura, Karimenu and Thiririka.

4.2.3.2 Ground Water Resources

Due to the proximity of the region to Aberdare Forest Ecosystem, there exist abundant river water systems draining the catchment into Athi Catchment. Therefore, the ground water sources have not been extensively exploited. Shallow wells are the most prevalent category of ground water sources within the area providing an alternative source to supplement piped water which is not usually reliable during dry season. They are found within homesteads in areas where the water table is high. Tiririka dam is the major supply of piped water to homesteads in Kirangi sub-location.

4.2.4 Biological Environment

This comprise of the living organisms both plants and animals. Kirangi Sub-location is endowed with myriad of species of plants and animals.

4.2.4.1 Vegetation and Flora

Kirangi biodiversity is a result of high influence of by the Aberdare Forest Ecosystem especially the indigenous plant species. Human activities however have displaced the exotic breeds that in recent past because of their economic values to the local communities. Such plant species include cash crops such as pineapple and tea which is the major cash crop in the area. Other crops include food crops such as avocado, banana, maize, sugarcane, beans, vegetables, arrowroots, yams and cassava (mainly in the river flood plains). Trees include Cypress ssp., Eucalyptus spp., Graveria ssp., Caussurina spp. and wattle trees species which are exotic. Other plant features include ferns, grass species and nappier grass.

4.2.4.2 Fauna

Human settlements and ever expanding agricultural activities have greatly affected both aquatic and terrestrial habitats in the area. The area does not have terrestrial wildlife conservancy because of agricultural activities that has been going on for a very long time. This has pushed the animals into the Aberdare Forest. However, limited animals are still found in the area like moles, rodents, squirrels and different bird species. Aquatic species that still exist in the river basin include fresh water fishes and frogs in the rivers. Livestock keeping is prevalent in the area and it constitutes sheep, dairy cows, goats and house pets (cats and dogs).

4.2.5 Climatic Conditions

Aberdares Forest Ecosystem highly influence the climate of Gatundu South Sub-county. The area experiences mist and bi-modal type of rainfall throughout the year. The long rains fall between mid-March to May followed by a cold season usually with drizzles and frost during June to August and the short rains between mid-october to November. The average amount of rainfall experienced in the area range from 1000mm on the Northern Western slopes of Aberdare Escarpments as high as 3000mm in the South Eastern all year round. The upper catchment area lies within the Kikuyu Forest Escarpment and it consists of the humid zone. It is the source of Thiririka and Rwabura Rivers in addition to numerous tributaries flowing into Ndarugu River and other neighboring rivers. Sub-humid zone is the characteristic of the middle sub-catchment area which constitute agricultural lands where small-scale agricultural activities are practiced specifically dairy farming, tea farming and woodlots.

Kirangi sub-location lies at an altitude of 2,100 meters above the sea level on the slopes of Aberdare Ranges. The temperatures vary from a minimum of 13 degrees to a maximum of 28 degrees Celsius with a relative humidity of between 70 -90 degrees. The average relative humidity is between 54 percent in dry months to 300 in wet months of between March to August (Musuva, 2016).

Geographical location and altitude of the area in relation to the equator and the Aberdares ranges greatly influence the prevailing climate condition. Of more effect is the Intercontinental convergence zone (I.T.C.Z), a low pressure cell, where the south easterly and the north easterly trade winds converge. However, the climate is cooler than the general tropical continental climate or highland subtropical climate.

4.3 Population and Demographic Characteristics

Nairobi has witnessed one of the highest population growth rates, typical of any African city, with a growth rate of 4.1% per annum. Nairobi has grown to be the largest city in East Africa despite being the youngest city in the region, having been founded in 1899. Currently, Nairobi's population is estimated reach 5 million by 2025 (2009, population census).The high rates of population increase in the city is attributed to two factors; one being the high influx of immigrants from other regions especially from rural areas in search of job opportunities and better serves. The second factor is due to natural increase due to birth rates. High population in Nairobi has resulted in urban sprawl into the peri-urban areas of Nairobi. Kiambu County is one of the areas witnessing effects of urban sprawl.

Gatundu Sub-county is found in Kiambu County. According the 2019 census report from the Ministry of Planning and National Development, Kiambu County had a population of 2,417,735 with 1,187,146 males and 1,230,454 females. It covers an area of 2,539 square kilometer with a population density of 952.

2019 population census statistics indicates Gatundu South constituency has a population of 122,103, with 35,609 households and a population density of 631 people per square kilometer. It has 795, 241 households with household size of 3 people. Kirangi Sub-location registered a total population of 2,502 with a population density of 401 people per square kilometer. The area has a total of 791 households. This is according to data shown in table 5.

Table 5: Population Distribution and Density

Adminis- trative units	Male	Female	Total population	Land in Area square Km	Population density	No. of households	Household size
Kiambu County	1,187,146	1,230,454	2,417,735	2,539	952	795,241	3.0
Gatundu south sub-county	60,384	61,714	122,103	194	631	35,609	3.4
Ndarugu ward	11,168	11,625	22,793	49.2	463	6,461	-
Kirangi Sub- location	1,255	1,247	2,502	6.2	401	791	-

Source: Kenya Population and Housing Census, (2019)

4.4 Social Set Up

This discusses the immediate social setting in which people live in a society. Both settlement patterns and land use patterns are discussed.

4.5 Settlement Patterns

Generally, Gatundu Sub County is densely populated. Population distribution in the area has been influenced greatly by factors such as food availability, proximity to Nairobi City and

infrastructure. However, market centers and surrounding areas depict high population density. Specifically, the settlement patterns within Kirangi Sub-location is comprised mainly of low, medium and high income residents. Population varies from one rural town to another. Rural areas register lower population compared to the urban centers.

4.6 Land Use Patterns

Various land uses exist in Kirangi Sub-location. Majority of them entails farming, residential (high, medium and low income residences together with informal settlements), commercial, and institutional (schools, hospitals, hostels). Urban areas experiences minor industrial developments. However, major industries found in the towns are mainly milk processing plants. Land prices are influenced by location and its proximity to the urban centers, tertiary institutions and all weather road network. It is worth noting that land fertility has been blamed for relatively high cost of land in the region (Kiambu CIDP, 2018).

4.7 Chapter Summary

The chapter is a discussion of the situational analysis of Kirangi Sub-location. It has highlighted on the physical location of the study area, the physical environment, the prevailing social set-up, land use patterns, the demographics and finally the settlement patterns.

CHAPTER FIVE

RESEARCH FINDINGS

5.1 Introduction

This chapter mainly reports the data analysis and research findings in relation to research objectives upon which the study was grounded. However, the objectives include: to determine the household land size change in the study area; to establish the existing household land uses and respective financial returns and food sufficiency in the study area; to examine the household livelihood diversification strategies and respective financial returns in the study area; and finally to determine the land use planning interventions that would ensure sustainable rural livelihoods in the study area. To achieve the aforementioned objectives, the study saw an administration of 91 household questionnaires to household heads randomly selected from 13 villages of Kirangi Sub-location. In addition, interviews were conducted with key informants as well as focused group discussions.

5.2 Research Preliminaries

5.2.1 Response Rate

Mugenda and Mugenda (2013) states that an adequate response for analysis and reporting is a response rate of above 70%. In regards to this, the response rate of this study was excellent since 100% response rate was recorded. 91 detailed questionnaires were administered to households in quest to appraise land use for sustainable rural livelihoods in Kirangi Sub-location. All the questionnaires were duly filled in a manner that met the objectives of the study.

5.2.2 Respondents Characteristics

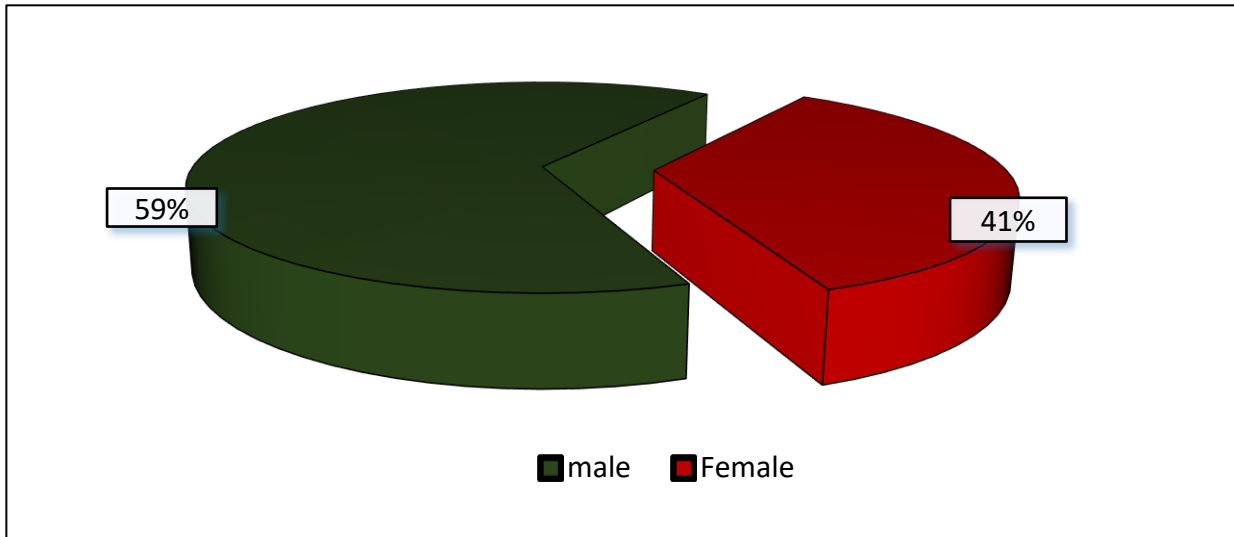
The key aspects of households include age, gender, marital status, socio-economic activities, household size and household land size. Understanding these variables is very essential since it influence household dynamics such as household livelihoods in terms of productivity through household economic activities. Land size trends and land fragmentation aspects are informed by household characteristics thus worth looking into.

5.2.3 Gender of the Respondents

Gender is a very important aspect as far as land and livelihood dynamics are concerned. Essentially, this parameter affects land inheritance since females are married off and in most cases do not come back to demand for land. Analysis of the research findings according to figure 8

indicates that out of 91 household respondents that were interviewed, 54 were men against 46 women. This constitute 59% and 41% respectively.

Figure 8: Gender of the Respondents

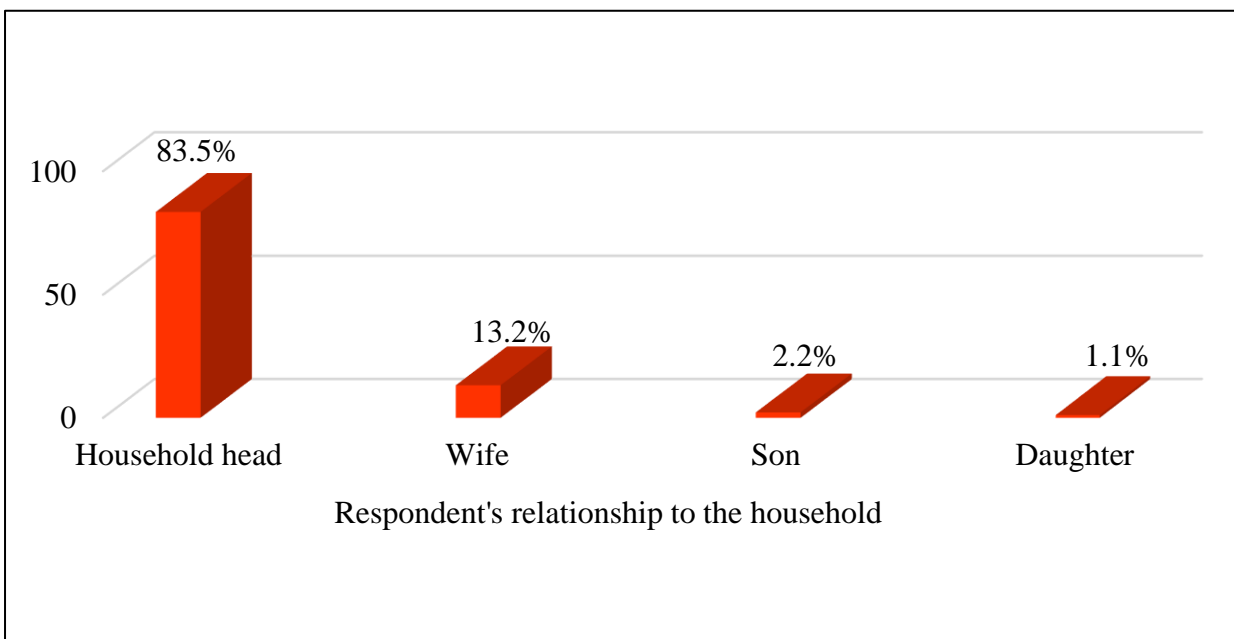


Source: Field data, 2019

5.2.4 Respondent's Relationship to the Household

Respondents were classified into; Household head, wife, son, daughter, son-in-law, daughter-in-law, grand child and other relative.

Figure 9: Relationship of the Respondents to the Household



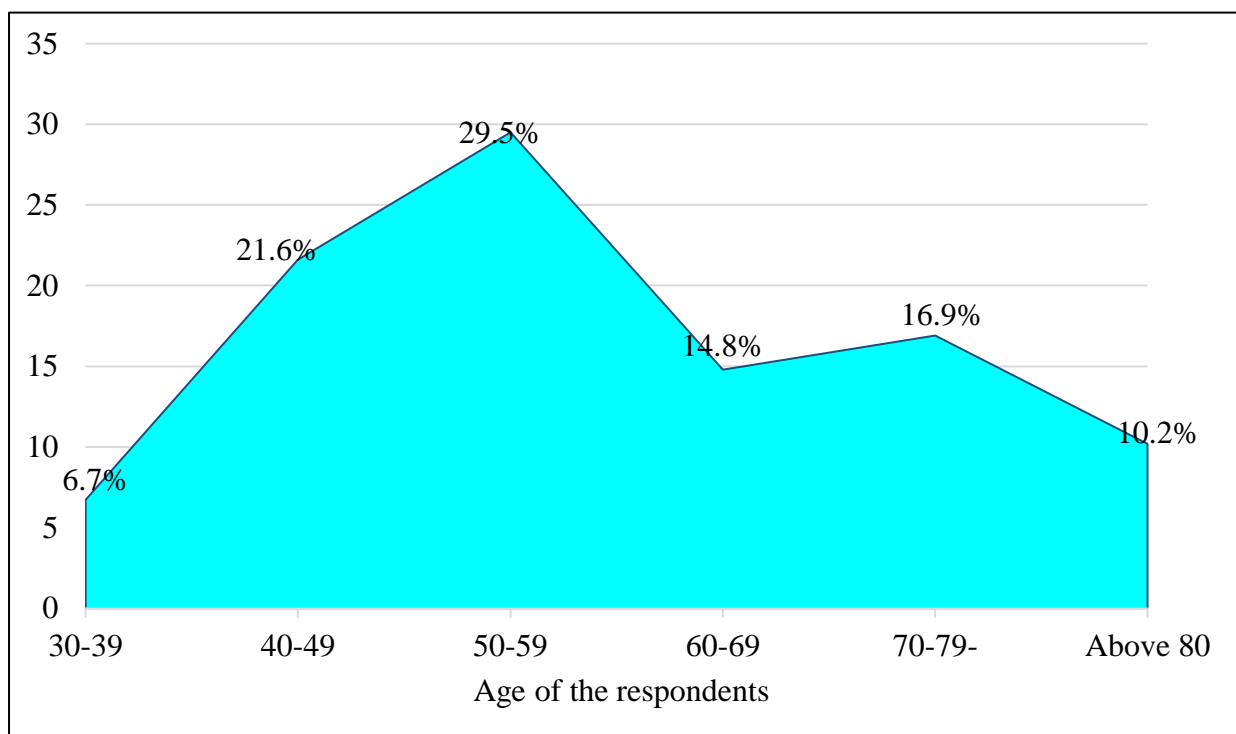
Source: Field data, 2019

It was imperative to consider the respondent’s relationship to the household since members with close relationship to the household have more correct information concerning the household unlike other distant relatives. Out of the 91 households that were interviewed, 76 respondents were household head which amounts to 83.5%. Wives on the other hand were 12 which is equivalent to 13.2%. While 1 respondent was a son, 2 of them were daughters which constitute 2.2% and 1.1% respectively as shown in figure 9. High number of household head respondents indicates a high regards by households to household heads in matters of household leadership and household information.

5.2.5 Age of the Respondents

Age is a very important variable in this study since the age of a household head influence land use, land size as well as land productivity. This is because as individuals grow, they accumulate wealth that enables them to purchase land as well skills that are very crucial in land production and livelihood activities. However, the age of the respondents were as follows;

Figure 10: Age of the Respondents



Source: Field data, 2019

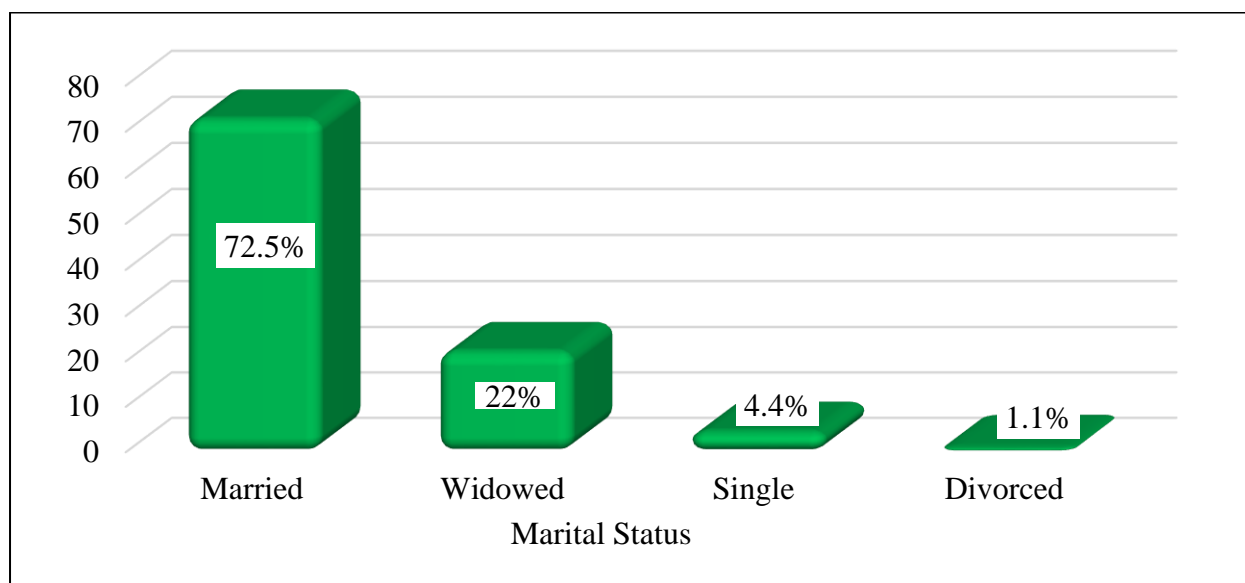
According to findings as reported in figure 10, majority of the respondents that were interviewed were within the age category of 50 to 59 which constitute 29.5%. The second highest number of respondents were in the age category of 40 to 49 which amounts to 21.6% followed by age

category of 70-79 which represents 16.9%. Age bracket of the respondents above 80 years amounted to 10.2% while the least percentage of 6.7% comprise the age bracket of 30 to 39 years.

5.2.6 Marital Status

Marital status of a household head is a very crucial aspect that affects household land use and land size as well as household's livelihood activities. Respondents were categorized into; married, single, widowed and divorced. According to the findings of the research as indicated in figure 11. Out of the 91 respondents, 66 were married which constitutes 72.5% of the total respondents. In addition, 20 were widowed which constitute 22%. While 4 of the respondents indicated to be single, 1 was divorced which corresponds to 4.4% and 1.1% respectively. A high proportion of the respondents were married which implies that both spouses have the responsibility of contributing of the household's livelihood and wellbeing. However, death of a spouse is mainly attributed to old age.

Figure 11: Marital Status of the Respondents



Source: Field data, 2019

5.3 Demographic Characteristics of Households

It was very essential to study household demographic as it informs the possible number of heirs to inherit parents land. This in turn informs land subdivision since it gives the possible portions that the land will be subdivided into.

5.3.1 Household Size

Household population is a very key factor affecting land size especially in terms of the number of heirs and land inheritance. This is likely to result in land fragmentation and corresponding

reduction in land size. However, according to the study as shown in table 6, the mean household size is 5 with a median and standard deviation of 4.

Table 6: Household Size

Mean	5
Median	4
Mode	4
Standard deviation	2.249
Variance	5.057

Source: Field data, 2019

Of the 91 households, 7 had one member while only 1 household recorded the highest number of 12 members. This depicts small household size in the region which is attributed to age of the respondents whose children have moved out and they no longer live with them.

5.3.2 Number of Sons and Daughters

The research went further to establish the number of sons and daughters in the household. The study found out that all sons are entitled to land inheritance and households that do not have sons subdivide land to the daughters. The findings indicate that the household's number of sons had a mean, median and mode of 2 as indicated in table 7. Households that did not have a son are 3 while the highest number of sons recorded is 5.

Table 7: Households' Number of Sons

Mean	2
Median	2
Mode	2
Standard deviation	1.273
Variance	1.621

Source: Field data, 2019

As illustrated in table 8, daughters' statistics recorded a mean and a median of 2 and mode of 1 respectively. Households that recorded no daughter are 8 while the maximum number of daughters that were recorded is 7.

Table 8: Households' number of Daughters

Mean	2
Median	2
Mode	1
Standard deviation	1.674
Variance	2.803

Source: Field data, 2019

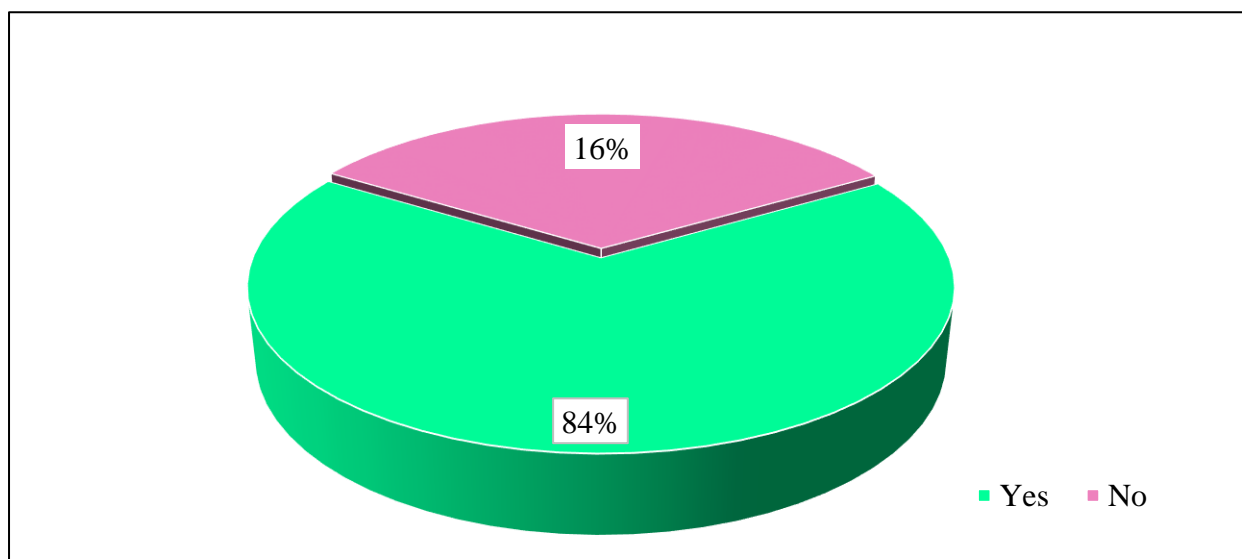
5.4 Migration Trends

Migration trends were looked into with a quest of determining the people who have lived in Gatundu since birth and those who relocated at the course of their lives. Understanding migration trends is very essential since it shed light on the pull factors that attracts population to Gatundu. It also elaborate the reasons behind emigration; the push factors in Gatundu. Migration is a form of livelihood diversification strategy that households employ in order to safeguard livelihood sustainability.

5.4.1 Immigration

The findings in figure 12 indicate that out of 91 respondents that were interviewed, 84% of the respondents have lived in in Gatundu since birth against 16% who relocated and settle in Gatundu. These corresponds to 76 and 15 respondents respectively

Figure 12: Immigration Trends of Household Members



Source: Field data, 2019

5.4.1.1 Reasons for Relocating to Gatundu

Respondents reported to have relocated to Gatundu due to the following reasons;

Table 9: Reasons for Relocating to Gatundu

Get married	55.5%
Inherit land	11.1%
End of employment	11.1%
Farm	5.6%
Purchase land	5.6%
To do farming	5.6%
To do business	5.6%

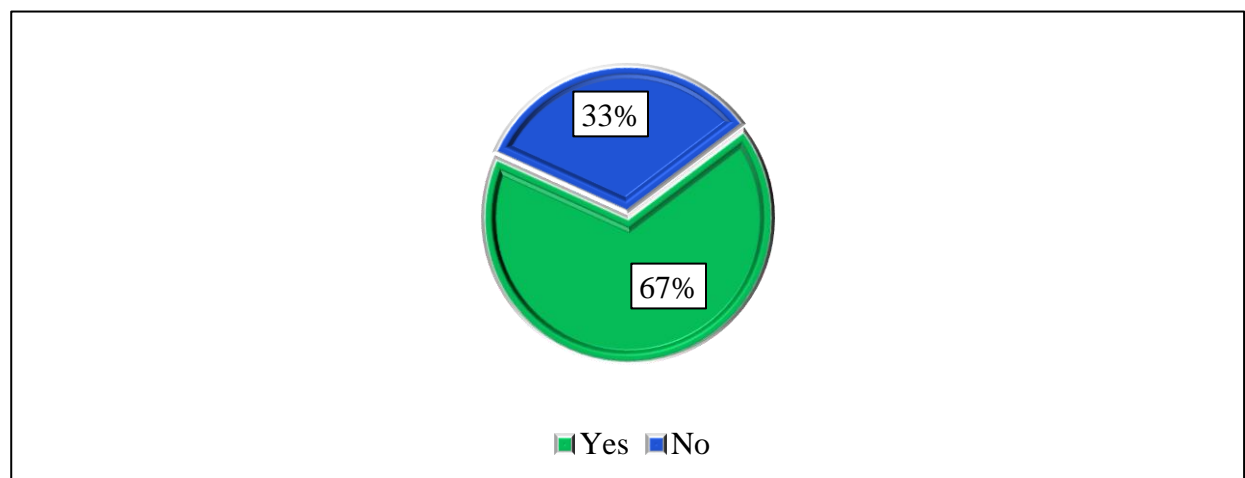
Source: Field data, 2019

According to analysis in table 9, the main reason for relocation was marriage which was reported by 55% of the respondents. This reason was mainly given by female respondents who got married in Gatundu. 11.1% of the respondents relocated to Gatundu mainly to inherit their parents' land which depicts land subdivision as heirs inherit parents' land. 11.1% relocated due to end of a contract or employment. Others went to Gatundu to buy land, do farming and transact business. Each of these had 5.6% of the responses.

5.4.2 Emigration

Emigration trends was also establish in order to understand the proportion of people who have moved permanently out of Gatundu. This has an effect on household size and land size.

Figure 13: Emigration Trends by Households



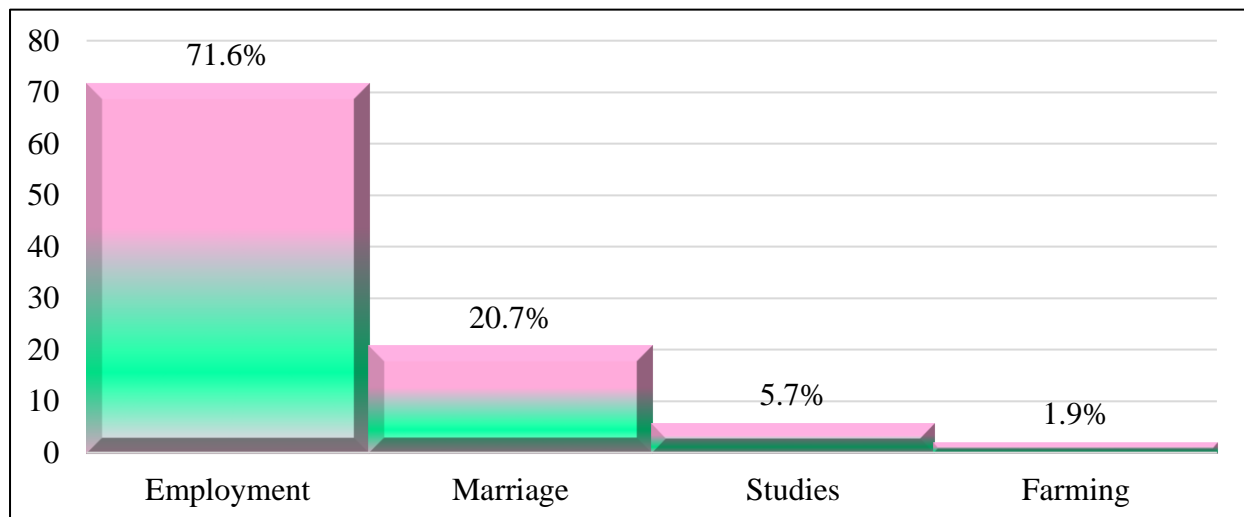
Source: Field data, 2019

However, of 91 respondents, 67% indicated that their household members have relocated to settle permanently in areas outside Gatundu, while 33% of the respondents indicated that they don't have any household member who has settled elsewhere permanently. These proportions corresponds to 61 and 39 respondents respectively as indicated in figure 13.

5.4.2.1 Reasons for Emigration

The reason why most people have moved out of Gatundu according to the study as shown in figure 14 is to look for employment as reported by 71.6% of the households. This is attributed to proximity of Gatundu to towns such as Thika, Kiambu and Nairobi where people relocate to look for employment opportunities. 20.7% indicated that their household members moved out of Gatundu to get married. While 5.7% reported that they migrate to look for education, the least proportion of 1.9% reported that household members moved out to conduct farming. Majority of these are those who purchased land elsewhere. However, respondents indicated that their family members relocate back to Gatundu after retirement. In addition, family members who have settled elsewhere still demand family land for inheritance which leads to land fragmentation and reduced land size.

Figure 14: Reasons for Emigration



Source: Field data, 2019

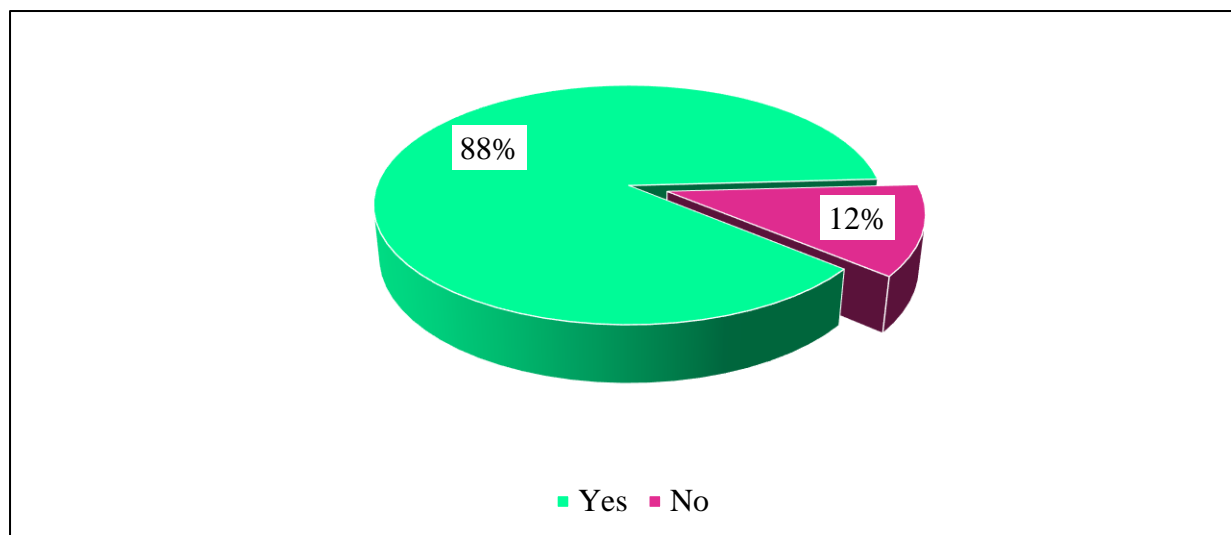
5.5 Household Land Characteristics

The study sought to establish the land parameters such as land size, land size change, land ownership and the number of pieces of land that the households in Kirangi sub-location own. This was essential because these factors establish issues affecting land such as inheritance, fragmentation, changing land size, and landlessness.

5.5.1 Land Ownership

Figure 15 demonstrates the state of land ownership by households in Kirangi Sub-location.

Figure 15: Land ownership by household



Source: Field data, 2019

While 80 out of 91 respondents that were interviewed indicated that they own land, only 12 of them do not own land. These constitute 88% and 12% respectively. The statistics is an indication that majority of the people in Kirangi Sub-location own land and thus they give a very high consideration to land ownership. This is a reflection of land inheritance which is a prevailing measure of land acquisition.

5.5.2 Pieces of Land Owned by Households

Understanding the number of pieces of land owned by households is an indication of the extent of land fragmentation in Kirangi sub-location. According to the findings in table 10, the average number of pieces of land owned by the households is 1 and majority of the households had 1 piece of land. The highest number of pieces of land 5, which was owned by only 1 household.

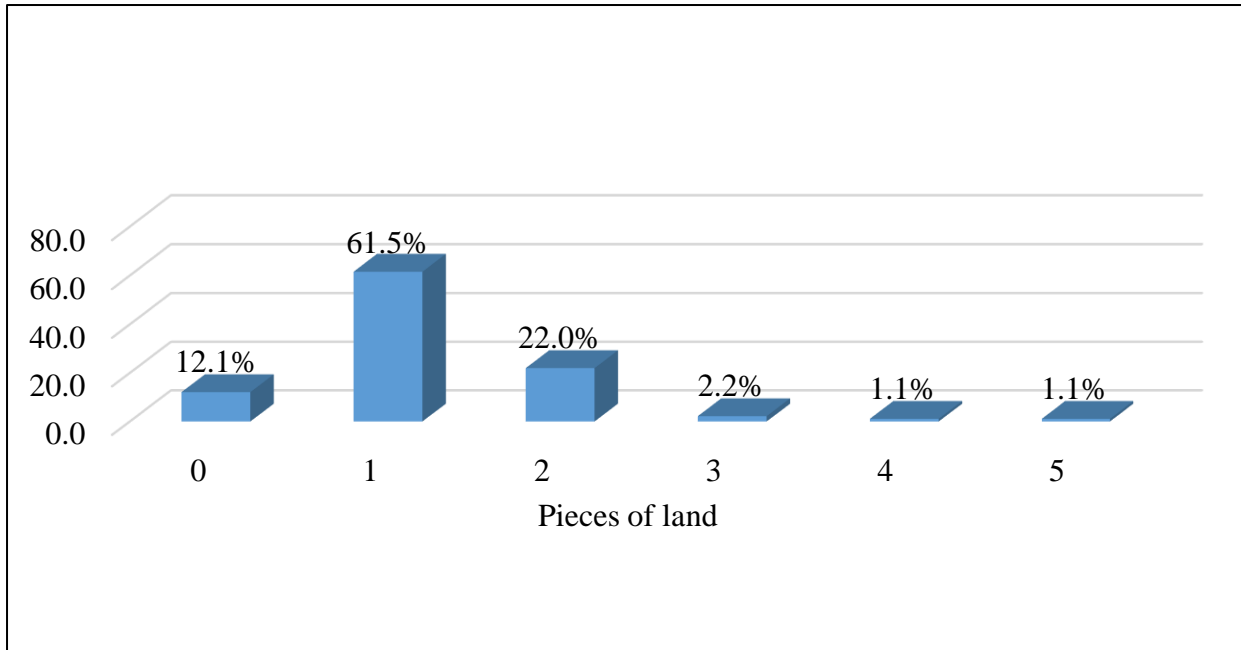
Table 10: Households' Pieces of Land

Mean	1.21
Median	1.00
Mode	1
Standard Deviation	0.789
Variance	0.623
Range	5

Source: Field data, 2019

Figure 16 further elaborates that 61.5% of the respondents had 1 piece of land and 22% had 2 pieces of land.

Figure 16: Household Pieces of Owned Land



Source: Field data, 2019

The proportion of the respondents that were landless were 12.1%. This reflects the state of landlessness in Kirangi Sub-location. Notably, majority of the respondents that indicated to be landless are those who have not received land inheritance from their parents. Respondents with 4 and 5 pieces of land were 1.1% each one of them. The reason why households in Kirangi Sub-location have few pieces of land can be explained by the fact that most of the households inherited land from their parents and majority of them have not purchased extra pieces of land.

5.5.3 Household Land Size

The study established household land size in order to determine whether the size sufficiently meets the household needs regarding food production and income requirements. The study however found out that the average land size in Kirangi Sub-location is 3.2 acres with a median of 2.5 and a mode of 2.7. The maximum land size in Kirangi Sub-location is 14 acres which is owned by 1 household, in relation to 5 households who did not own any land. Table 11 highlights the findings of the study.

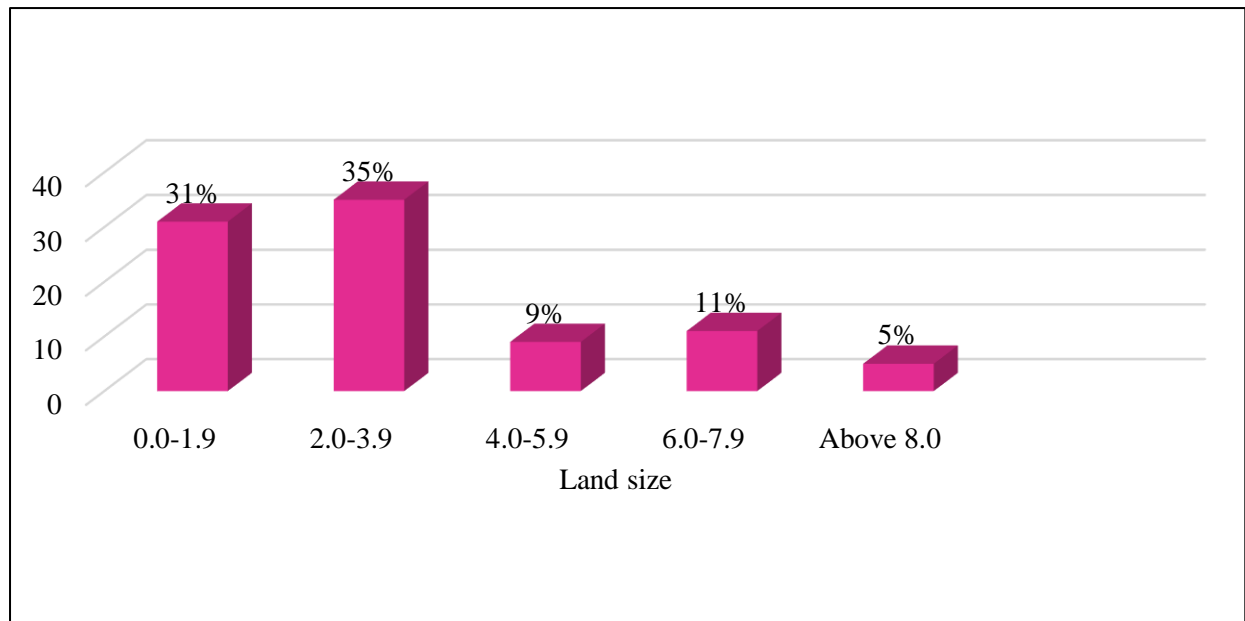
Table 11: Household Land Size

Mean	3.2
Median	2.5000
Mode	2.73324
Standard Deviation	14.00
Variance	7.471
Range	14

Source: Field data, 2019

Further, figure 17 Classifies findings into categories. However, it depicts that majority of the households which constitutes 35% own between 2 to 3.9 acres of land. While 31% of the respondents had an average land size of between 0 to 1.9 acres of land, 11% had between 6 to 7.9 acres of land. However, the least percentage of respondents which constitutes 5% own above 8.0 acres of land.

Figure 17: Household Land Size by Categories



Source: Field data, 2019

Cumulatively, 66% of people own land between 0 to 3.9 acres, 75% own land below 6 acres while 86% of the households had land less than 8 acres as shown in table 12. This study however concludes that majority of the households in Kirangi Sub-location own small sizes of land. 31 households out of the 91 households that were interviewed own less than 2 acres of land while 66 households own less than 4 acres of land.

Table 12: Land Size with Cumulative Percentage

Land Size	Percentage	Cumulative percentage
0.0-1.9	31	31
2.0-3.9	35	66
4.0-5.9	9	75
6.0-7.9	11	86
Above 8.0	5	91

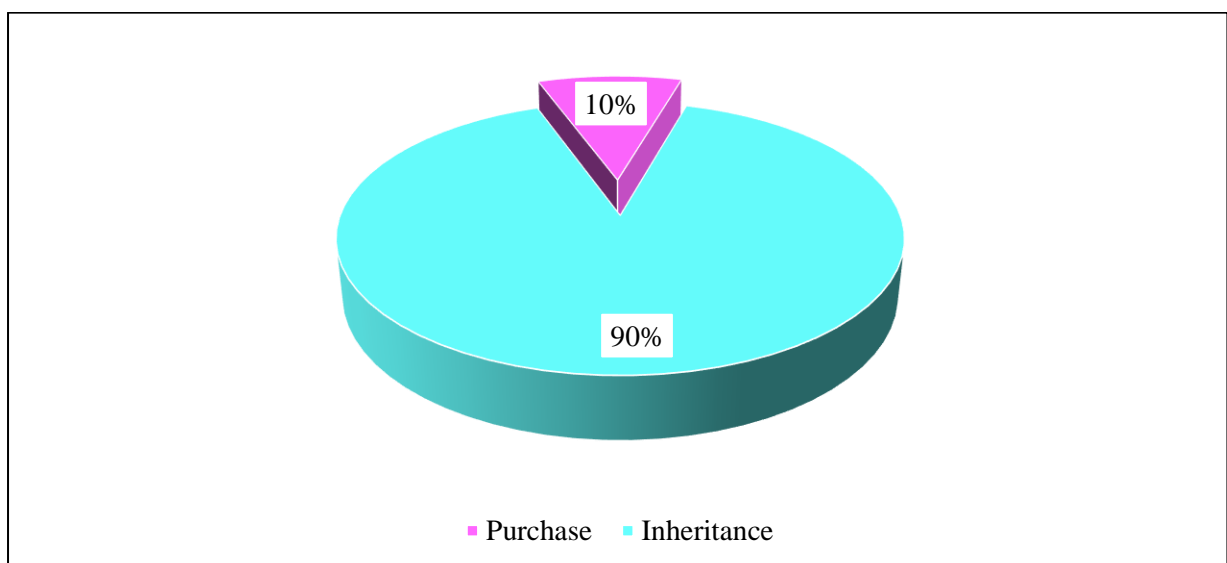
Source: Field data, 2019

This is in agreement with a study by Syagga (2006) that there are small land holdings in Gatundu with an average land size of 2-3 acres. The small household land size is attributed to the issue of land inheritance since majority of the households subdivide land to their heirs as demonstrated by the findings in figure 18 (mode of land acquisition). It depicts that households acquire land through inheritance.

5.5.4 Mode of Land Acquisition

Understanding how households acquire land is very essential since land inheritance is linked to reducing land size and land subdivision as household subdivide land for heirs to inherit. According to findings in figure 18, 90% of the respondents inherited land from their parents. Only 10% of the households purchased the land they own. This is an indication that land inheritance is still a major phenomenon in Kirangi Sub-location.

Figure 18: Mode of land acquisition

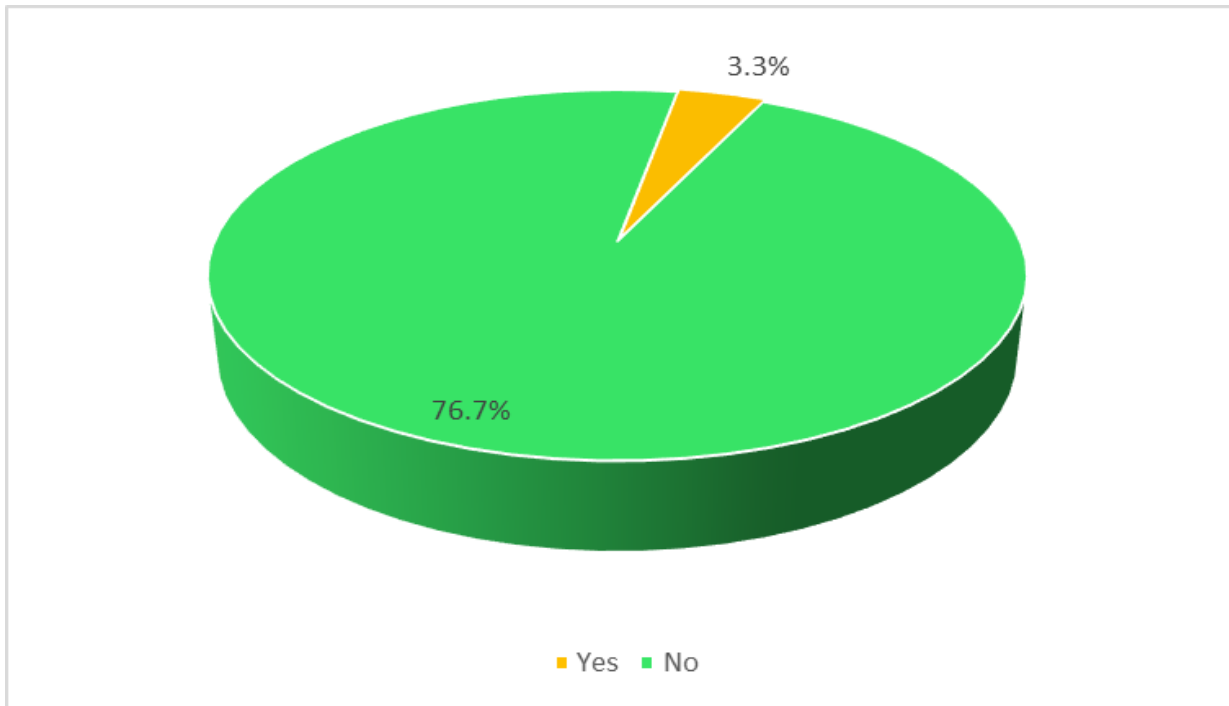


Source: Field data, 2019

5.5.5 Land Renting by Households

Of the 91 household respondents, 88 respondents indicated that they are renting land with only 3 who does not rents land. This constitutes 96.7% and 3.30% of the total respondents respectively as shown in figure 19.

Figure 19: Land Renting by Households



Source: Field data, 2019

The finding that majority of the households do not rent land is explained by the findings in figure 15 which indicates that 88% of the households own land and does not need to rent. The maximum number of acres that households rent is 1 acre and the mean land size that households rent is 0.1 acres as shown in table 13.

Table 13: Land Renting by Households

Mean	0.1
Median	0.000
Standard Deviation	0.10
Range	1
Maximum	1

Source: Field data, 2019

5.5.6 Land Ownership and Inheritance

To understand land size change, the study established average household land size that was owned by the parents of the respondents, average size of land that the respondents inherited, land size that respondents own as well as average land size that the households are likely to give to their heirs.

5.6 Household Land Size of Respondents' Parents

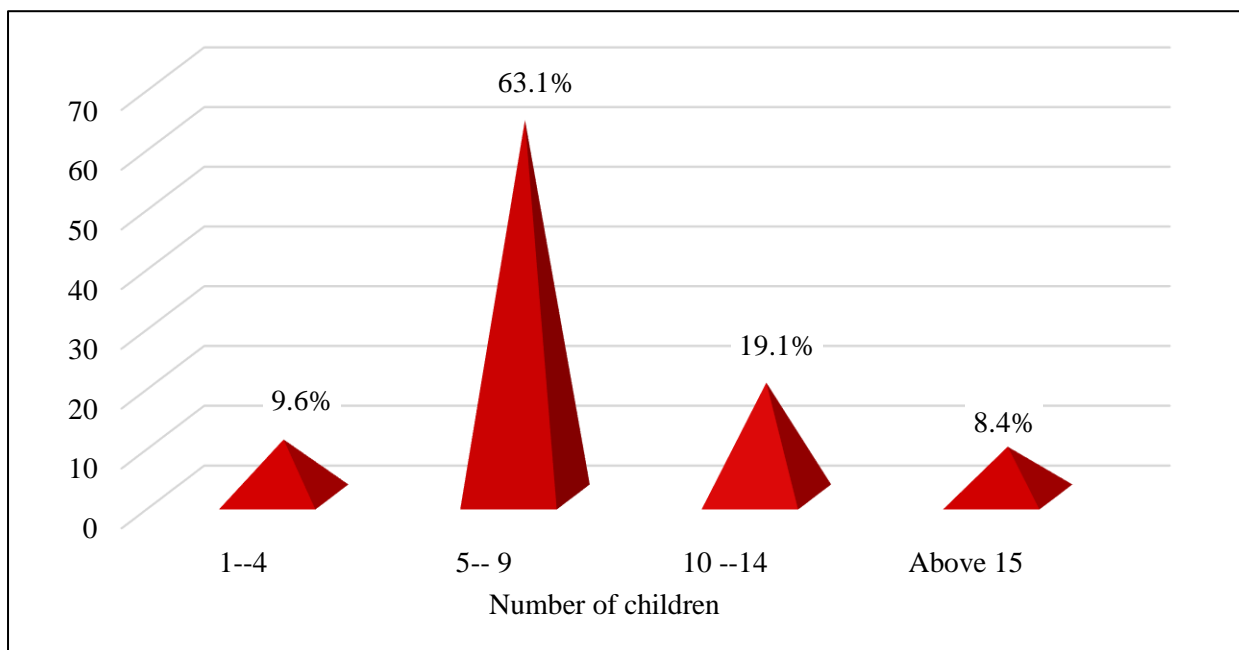
Looking at land characteristics of the parents enables the study to track how land has changed from the time of their parents to the time of respondents.

5.6.1 Households Size of the Respondents' Parents

To understand land characteristics of the respondents' parents, it is very essential to understand household characteristics since it is a very crucial factor as far as land issues are concerned. Household size is a factor in land size change in respect to land inheritance.

The analysis of the findings according to figure 20 depicts that 9.6% of the respondents indicated that their parents had between 1 to 4 children, 63.1% had between 5 to 9 children. While 19.1% indicated household of between 10 to 14, 8.4% had more than 15 children. Majority of the households (63.1%) had average household size of between 5 to 9 children which indicates that household land was subdivided into many pieces.

Figure 20: Grouped Data for Parents' Household Size



Source: Field data, 2019

Table 14 further elaborates that the average number of children in the respondents' parents household is 9, with the highest number being 34.

Table 14: Household Size of the Respondents' Parents

Mean	9
Median	8
Mode	8
Standard Deviation	5.194
Variance	26.983
Range	33
Maximum	34

Source: Field data, 2019

5.6.1.1 Number of Sons

The number of parents' sons explains the portion to which parents land was subdivided during the time of inheritance. Some parents divided land equally among all the sons while others gave bigger share to some of their heirs especially the first born. Statistics show that respondents' parents had a mean of 5 sons, median and mode of 4 and 5 respectively as indicated in table 15

Table 15: Number of Sons

Mean	5
Median	4
Mode	5
Standard Deviation	2.595
Variance	6.734
Range	16

Source: Field data 2019

5.6.1.2 Number of Daughters

Traditionally, Female were believed to be married off and thus they are not entitled to inherit land from their parents. However, households who do not have male children subdivide land equally among female children. Conversely, this belief did not hold in all the households. Table 16 shows the number of daughters in parents' households. Statistic recorded a mean of 4, median and mode of 1 and 3 respectively.

Table 16: Number of Daughters

Mean	4
Median	1.75
Mode	3
Standard Deviation	3.305
Variance	10.926
Range	17

Source: Field data 2019

5.6.2 Land Size Owned by Respondents' Parents

Understanding the size of the land that the parents of the respondents owned enables the study to formulate the trend of the land size change by making a comparison with the current land size of the respondents. The findings as indicated in table 17 demonstrate that the average size of land that the parents of the respondents possessed was 14.8, with a mode of 7 compared to the respondents' average land size of 3.2 and a mode of 2.7.

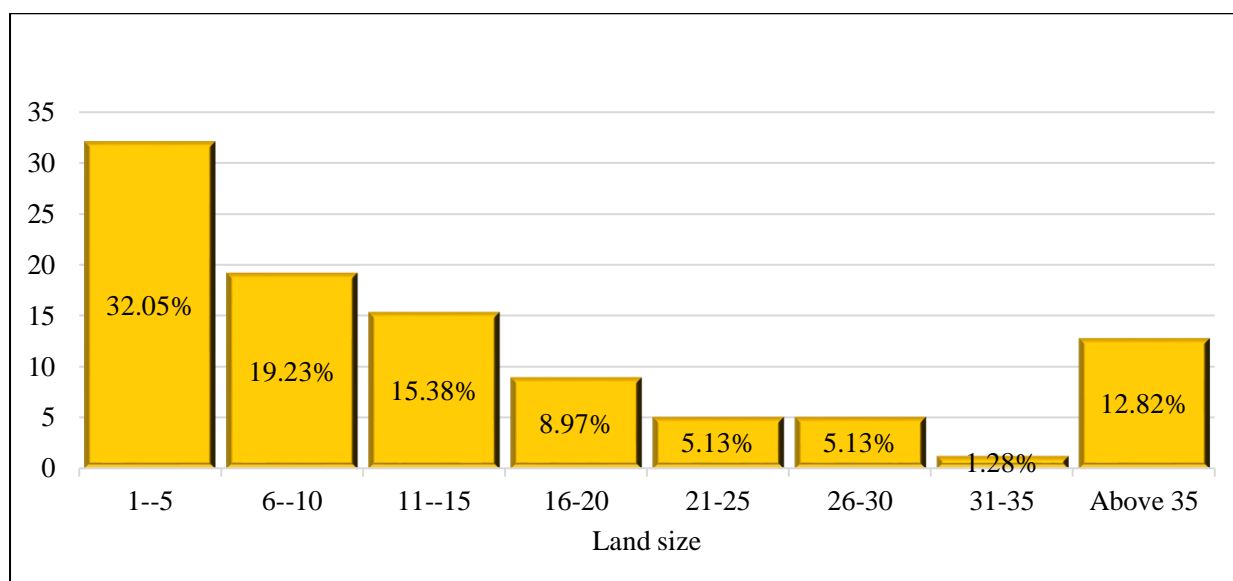
Table 17: Land Size of the Respondents' Parents

Mean	14.8
Median	10
Mode	7
Standard Deviation	13.7
Variance	187.6
Range	53
Maximum	54

Source: Field data, 2019

Figure 21 expounds further that majority of the households (32.05%) had between 1 to 5 acres of land. In comparison to respondents land size in figure 17 whereby majority of the respondents constituting 35% had land size of between 2.0 to 3.9 acres of land. This is an indication of reducing land size.

Figure 21: Grouped Land Size of the Respondents' Parents



Source: Field data, 2019

5.6.3 Land Size Inherited by the Respondents

This demonstrates land size that was inherited by the respondents, both male and female respondents.

5.6.3.1 Land Size that was inherited by Sons

According to table 18, the average land size that the male respondents inherited from their parents is 2.5 acres with a mode of 1.75 and a mode of 1.

Table 18: Land Size Inherited by Sons

Mean	2.5385
Median	1.75
Mode	1
Standard Deviation	2.68164
Variance	7.191
Range	15

Source: Field data, 2019

5.6.3.2 Land Size Inherited by Daughters

Female respondents who inherited land from the parents had a mean of 0.79 acres with a median of 0 and a mode of 0 according to findings in table 19. This is an indication that females in most cases were not considered as heirs and thus in most households they did not inherit parents' land.

Table 19: Size of land inherited by daughters

Mean	0.795
Median	0
Mode	0
Standard Deviation	1.4897
Variance	2.219
Range	8

Source: Field data, 2019

5.6.4 Land Size Likely to be inherited by Respondents' Children

Determining the size of land that the children of the respondents are likely to inherit demonstrates how land subdivision progresses with time that leads to reduction in land size. This variable however is very essential since it affects land size since it is a major factor in land subdivision.

5.6.4.1 Land size to be inherited by Sons

Table 20 indicates that the average size of land that the respondents' male children will inherit is 1 acre with a median of 0.5 acres.

Table 20: Land Size Likely to be inherited by Sons

Mean	1.0498
Median	0.5
Mode	0
Standard Deviation	1.81757
Variance	3.304
Range	12

Source: Field data, 2019

5.6.4.2 Land Size Likely to be inherited by Daughters

Table 21 shows the results of analysis to determine the size of land that the respondents' daughters are likely to inherit. Currently, the constitution of Kenya gives female heirs entitlement to their parents property equally with the males unlike in the past where they were not entitled to land inheritance. The study found out that the average size of land that daughters are likely to inherit is 0.7 acres.

Table 21: Land Size to be inherited by the Daughters

Mean	0.7
Median	0.25
Mode	0
Standard Deviation	1.03521
Variance	1.072
Range	4

Source: Field data, 2019

5.7 Land Size Change

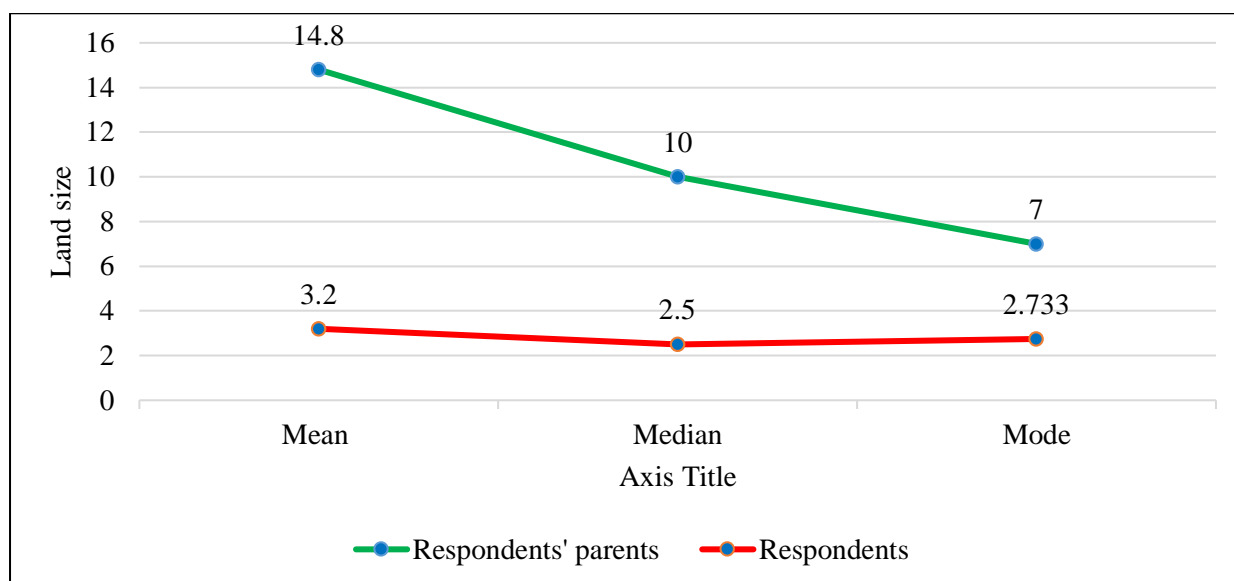
Essentially, the study sought to establish how land has been changing in recent past in Kirangi Sub-location. Land size trend gives a real scenario of how land changes as households subdivide land for inheritance. This is a very crucial phenomenon since it is an indicator of a future scenario concerning land size. Changes in land size translates to changes in land use and land cover. To demonstrate this, the first comparison was made between the land size that was owned by the respondents' parents and the size of land that is currently owned by respondents.

5.7.1 Parents' Land Size versus Respondents' Land Size

This comparison was done with an aim of determining how the land has changed from the time of respondents' parents to present. Respondents were asked about the size of land that their parents owned and was then compared with land size that the respondents currently own. According to the findings of the study as indicated in figure 22, there is a significant reduction in land size.

Statistics indicate that, the parents had an average land size of 14.8 acres with a median of 10 and a mode of 7. This is in contrast with size of land currently owned by respondents with a mean of 3.2, median of 2.5 and a mode of 2.7 acres. Households attributed this change to land inheritance as selling of land was not so significant in the study area.

Figure 22: Mean Land Size of Parents and the Respondents



Source: Field data, 2019

5.7.1.1 Percentage Change in Average Land Size from Parents to Respondents

Percentage change in land size can be calculated by comparing means as demonstrated below.

Table 22: Percentage Change in Average Land Size

Parents average land size	14.8 acres
Respondents' average land size	3.2 acres
Land size change	11.6 acres
Percentage land size change	78.38%

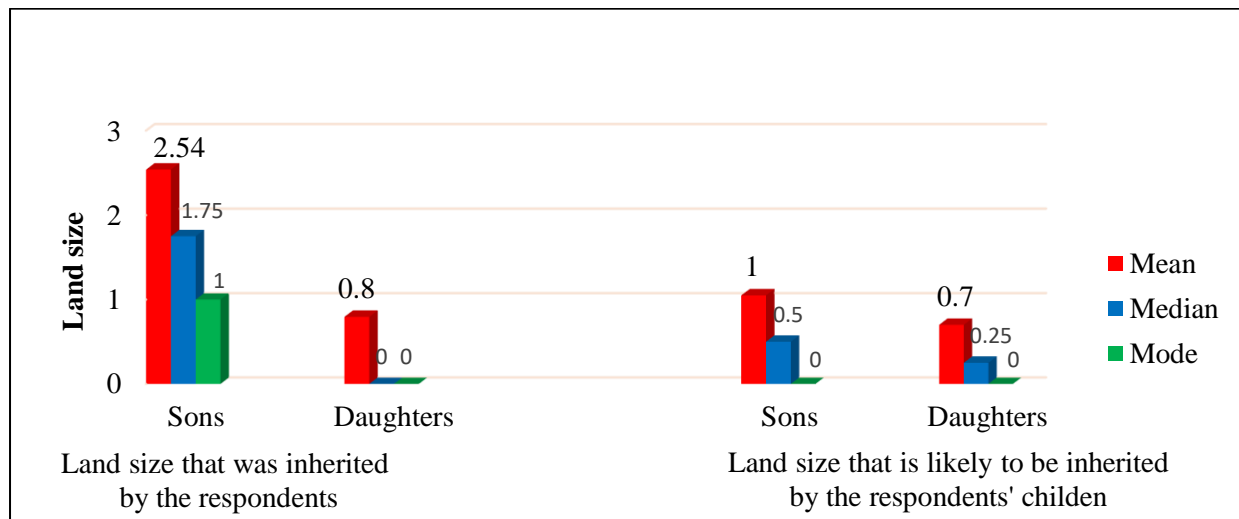
Source: Field data, 2019

From table 22, land has changed by 78.38% from the parents to the respondents. This is a very big change in land size given the fact that respondents indicated to have an intension of inheriting the already reduced land to their children. This eventually will lead to reduction in land size tremendously from parents to grandparents.

5.7.2 Land Size Inherited by Respondents versus Land Size Likely to be inherited by Respondents' Children

The second comparison is looking into land size that the respondents inherited from their parents in relation to land size that the children of the respondents are likely to inherit.

Figure 23: Land Size Inherited by the Respondents versus Land Size Likely to be inherited by Respondents' Children by Gender



Source: Field data, 2019

The comparison in the figure 23 however shows a decrease in the size of land that the respondents inherited from their parents to the size of land that the respondents are likely to give to their children. Respondents' inherited land has a mean of 2.5 for sons and 0.8 for daughters compared to the respondent's children mean of 1 for sons and 0.7 for daughters. The median on the other hand is 1.75 for respondents' sons and 0 for daughters while respondent's children has a median of 0.5 for sons and 0.25 for daughters. Mode for respondents was 1 for sons and 0 for daughters against respondents' children who recorded a mode of 0 for both sons and daughters.

5.7.3 Change in Average Land Size from the Respondents to their Children

The study sought to examine how household average land size is likely to change from the respondents to their children (after subdivision). This was done by comparing the means of respondents' average land size with the average land size that their children are likely to have. According to the analysis in table 23, the study projects a percent average land size change of 59% and 11% for sons and daughters respectively.

Table 23: Percentage Change in Average Land Size

	Sons	Daughters
Respondent's average land size	2.53	0.79
Respondents' children average land size	1.04	0.7
Change in average land size	1.49	0.9
Percentage change in average land size	59%	11%

Source: Field data, 2019

5.7.4 Land Size Change from Grandparents to Grandchildren

Further, the study compared land size that was owned by the respondents' parents with the size of land that the respondents' children are likely to inherit. That study summarizes this scenario as average land size change from grandparents to grandchildren. Therefore, the average land size change is summarized in table 24.

Table 24: Percentage Land Size from Grandparents to Grandchildren,

	Land size in acres	
	Sons	Daughters
Grand parents' average land size	14.8	
Children's land average land size	1.04	0.7
Land size change	13.76	14.1
Percentage average land size change	93%	95%

Source: Field data, 2019

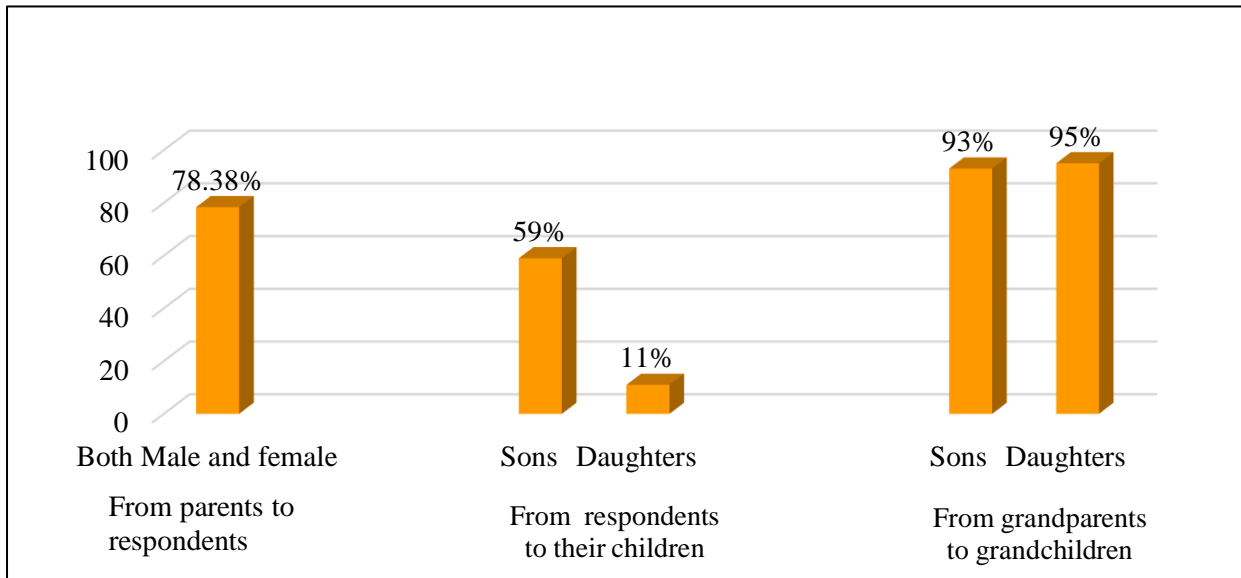
This analysis demonstrates that there is tremendous reduction in percentage land size from grandparents to grandchildren. However, percentage land size change according to sons is 93% while daughters registered land size change of 95%.

5.7.5 Summary of Percentage Change in Average Land Size

In a nutshell, the study sought to establish land size change by looking into the following three categories: Respondents parents' average land size in relation to the current mean land size owned

by the respondents, respondents' average land size compared to land size that the respondents' children are likely to inherit and finally land size of grandparents and grandchildren.

Figure 24: Summary of Percentage Change in Land Size



Source: Field data, 2019

Figure 24 demonstrates that land size change from parents to respondents is 78.3% for both male and female. Land size change from respondents to their children is 59% for male and 11% for female. Finally, the land size change from grandparents to grandchildren is 93% for male and 95% for female. Reducing land size in Kirangi sub-location is mainly attributed to high population growth rates and the tradition of land inheritance. Land inheritance in most cases leads to land fragmentation. This happens since parents desire to provide each of several heirs with land for inheritance. This is a very strong tradition since majority of the respondents said that it is their duty to leave land inheritance to their children. Fragmentation has gone on increasing through the activity of succession from one generation to another as parents continue to bequeath land to their children.

High population has led to scarcity of land since each person is striving to own a land. However, extreme scarcity of land has also lead to land fragmentation as farmers strive to acquire additional land. When population pressure on land is high, often due to lack of other off-farm activities upon which the population can earn a living, fragmentation results.

5.8 Land Subdivision

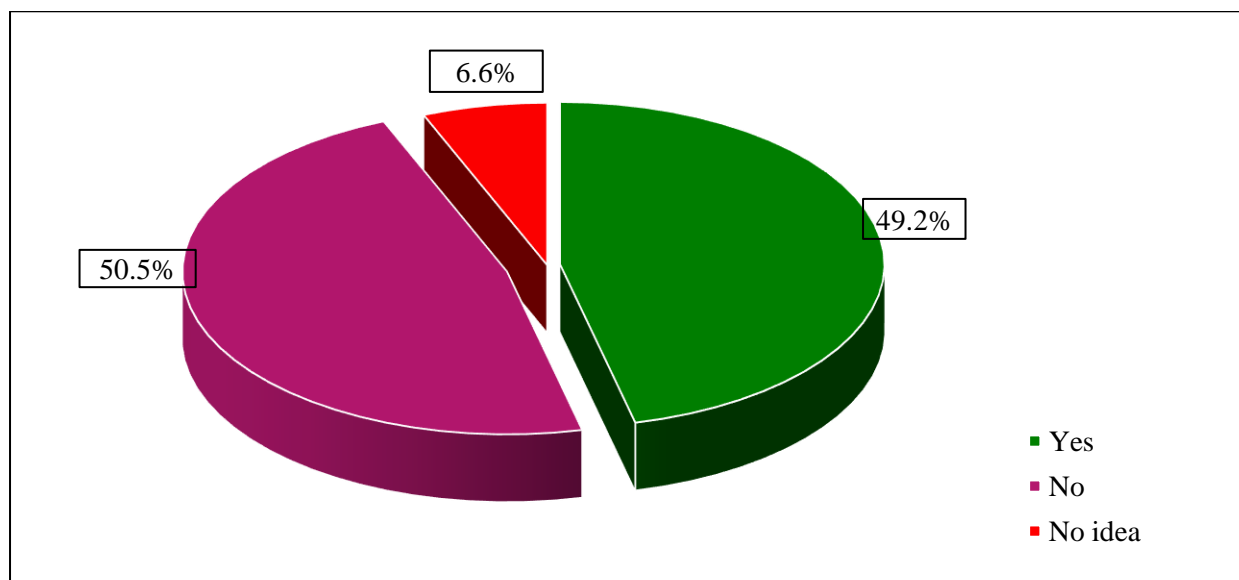
The study sought to determine the state of land subdivision in Kirangi Sub-location. First, it was imperative to determine the peoples' understanding of the issue of land subdivision. It was also

essential to find out the respondents' opinion concerning the challenges associated with land subdivision and reducing land size on agricultural productivity. The study went further to determine the respondents' opinion on measures to be employed to curb the challenges of land fragmentation.

5.8.1 Households' Opinions on Land Subdivision among Heirs

According to focused group discussions, respondents indicated that land subdivision should be allowed to continue since heirs have their right to inherit land. They continued to add that, land subdivision should not be controlled since it is an act that will be controlled by the forces of nature. When land subdivision is left to progress, it will reach a dead end and it will stop naturally when the land will be too small to be subdivided. One respondent seconded that calamities such as floods or diseases will help to keep population pressure on check.

Figure 25: Opinion on whether land subdivision should continue



Source: Field data, 2019

Analysis of household data in figure 25 depicts that, 50.5% of the respondents supported the opinion that Kenya should stop land subdivision because land is getting too small to accommodate fragmentation. On the other hand, 42.9% argued that land subdivision in Kenya should continue since children are entitled to land inheritance. However, 6.6% did not have any idea whether land fragmentation should be put to an end or not. This is attributed to the sensitivity surrounding land issue and thus shyness of the respondents in giving related information.

5.8.2 Effect of Land Subdivision on Agricultural Production

The study aspired to determine whether households in Kirangi Sub-location have witnessed apparent effects of land subdivision on land use.

Table 25: Effects of land subdivision on agricultural activities

Effects of land subdivision	Percentage
Reduced land production	69.0%
No idea	15.4%
Increased productivity	4.8%
Uneconomical to till small land parcel	4.8%
Reduced agricultural land	2.4%
No effect on production	1.2%
Difficulty in getting tea collection number with less than 750 bushes	1.2%
Crops intensification	1.2%

Source: Field data, 2019

Analysis of findings according to table 25 indicates that 69% of the respondents concluded that land subdivision has led to reduced land production which does not meet household food and financial needs. 15.5 % of the respondents did not have any idea that land subdivision affects agricultural production; this is attributed to lack of information concerning the relationship between land size and agricultural production. A proportion of 4.8% indicated that land subdivision makes agriculture uneconomical. This is because farmers will be forced to increase farm inputs to boost productivity which is costly. It was also reported that land subdivision has led to reduced size of agricultural land as indicated by 2.4% of the respondents. This threatens losing registration at tea factories since the factories do not allow registration of tea farmers with less than 750 tea bushes. This point was supported by 1.2% responses.

However, it is worth noting that 4.8% of the respondents believe that reducing land size increase agricultural productivity of the land. This is because as land size decreases, farmers employ intensive farming methods that boost land productivity. Farther to note, 1.2% of the respondents indicated that reducing land size has led to crop intensification as farmers shift to crops that occupy small sizes of land such as fruits and vegetable.

5.8.3 Solutions to Curb Land Subdivision

The study went further to identify ways of solving the problem of land fragmentation. Focused group discussion was held to determine ways of ending land subdivision. However, participants strongly demanded that the government should provide lands for them. The state of emergency which led to emergence of villages made the inhabitants of Central Kenya to lose their land to the colonial government. During their fight in the Mau Mau, they were promised land by the then ruling government and up to now they have not been given any land. It is their wish that the government provides land to their children which have been left with very little land to inherit. They continued to argue that the children belong to the government and so the government should provide land for them. In addition to that, they are very old and unable to look additional for land for their children and so they depend on the government. Household data was also collected to seek views from households on ways to curb land subdivision. However, opinions were as follows;

Table 26: Suggested Solutions to Land Subdivision

Suggested Solutions	Percentage
Impossible to stop land subdivision	47.4%
Government to set policy on minimum land size	14.1%
Urban settlement	11.0%
Households to till the land as a whole	10.1%
Cash crop farming to earn household income to purchase extra land	7.7%
Clustered settlements	7.7%
Educate the population on the adverse effects of land subdivision	5.5%
Economic growth to reduce poverty levels	2.2%
Purchase land for children	2.2%
Implement good examples from other countries	1.1%
Intensive farming methods e.g. greenhouses	1.1%

Source: Field data, 2019

According to field data tabulated in table 26, majority of the population which amounts to 37.4% strongly believed that it is hard to stop land subdivision. They felt that it is a natural process since each generation brings about heirs that demand land for inheritance and therefore nothing can be done. However, 14.1% of the respondents advocated for government policy that sets a minimum land size. The idea that households should settle in urban areas and leave the land for farming

was brought forward by 11% of the respondents. 10.1% argued that the government should focus on economic growth so as to reduce poverty levels in rural areas and high dependency on land. Households should concentrate on cash crop farming that earn income to purchase additional land for the households. This is according to 7.7% of the respondents. The same proportion of respondents indicated that households should concentrate settlements on one part of the land so as to release the entire land parcel for farming. Other suggestion include; educate the population on the adverse effects of land subdivision (5.5%), economic growth to reduce poverty levels (2.2%), parents to purchase land for children instead of subdividing family land (2.2%), picking of good examples from other countries and implement (1.1%) and practice of intensive farming methods that do not require large parcels of land e.g. greenhouses (1.1%).

5.8.5 Suggested Solutions to Reducing Land Size

From data analysis on land size change, it was evident that household land size has reduced tremendously from a mean of 14.8 acres that the parents of the respondents owned to an average land size of 3.2 acres that the respondents currently own. Therefore, respondents were asked to give their opinions on how this problem can be solved.

Table 27: Suggested Solution to Reducing Land Size

Suggested solutions	Frequency	Percent
No idea	41	45.1%
Stop land subdivision	10	10.1%
Collective/joint development of land	9	9.9%
Consensus within the family	8	8.8%
Policy on minimum land size	6	6.6%
Intensive farming	3	3.3%
Government to introduce clustered settlements	3	3.3%
Create awareness / public education	3	3.3%
Curb rural poverty	2	2.2%
Buy more land	1	2.2%
Government to provide alternative land to children	2	2.2%
Cash crop farming to earn money to buy more land	1	1.1%
Government to create avenues of generating income	1	1.1%

Source: Field data, 2019

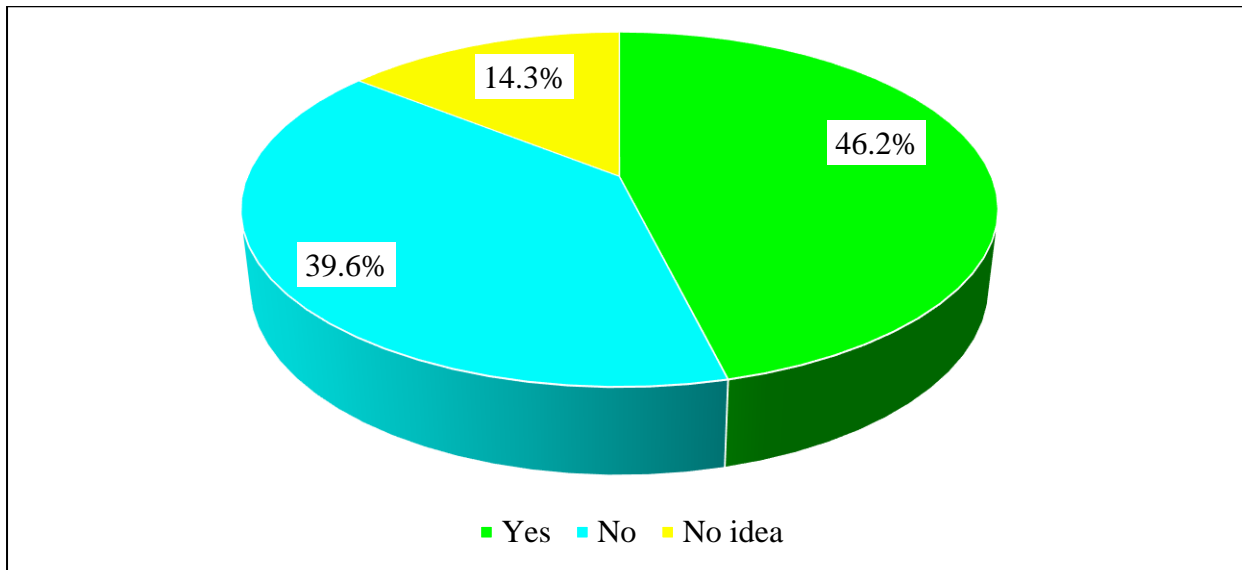
As indicated by the findings in table 27, majority of the respondents (45.1%) had no idea on what can be done to solve the challenge of reducing land size. According to them, land is bound to reduce since there is no additional farm to accommodate intergenerational land inheritance; and at the same time children are entitled to land inheritance. However, the highest score of the responses who suggested solutions was 10.1% which argued that households should stop land subdivision because subdividing land results in reducing land size. 9.9% of the respondents advocated for collective developments on land that will prevent land subdivision. Individual households can have a consensus on how they should shield their land from subdivision as suggested by 8.8% of the respondents. Here, households claim responsibility of protecting land from diminishing. Other suggestions include; formulation of policies on minimum land size, (6.6%), collective/joint development of land (9.9%), intensive farming (3.3%), government to introduce clustered settlements (3.3%), create awareness / public education (3.3%), curb rural poverty (2.2%), government to provide alternative land to children (2.2%), buy more land (2.2%), cash crop farming to earn money to buy more land (1.1%) and government to create avenues of generating income (1.1%)

5.8.5 Households' Take on Urban Settlement

Settlements occupy space on land which could otherwise be used for agricultural production. However, one way of releasing agricultural land is when households choose to settle in urban areas and leave space for agricultural production. In regards to this, the study sought to establish respondents' opinion on whether households should move to urban centers instead of constructing houses on agricultural land.

Figure 26 indicates that 46.2% of the respondents advocated for households to relocate to urban areas. This is an indication that the respondents have felt the impact of reducing agricultural land on household livelihood thus this argument that relocation to urban areas shall release land for agricultural production. 39.6% of the respondents opposed the idea of households living in urban areas. This is related to the fact that majority of the respondents were elderly people who felt that urban life is not suitable to them. They also argued that relocating to urban areas will make them go for long distances to the farms. However, some respondents who did not give any opinion were not sure whether relocating households to urban areas will bring a solution to reducing agricultural land. This constituted 14.3% of the respondents.

Figure 26: Respondents' Opinions on Urban Settlement

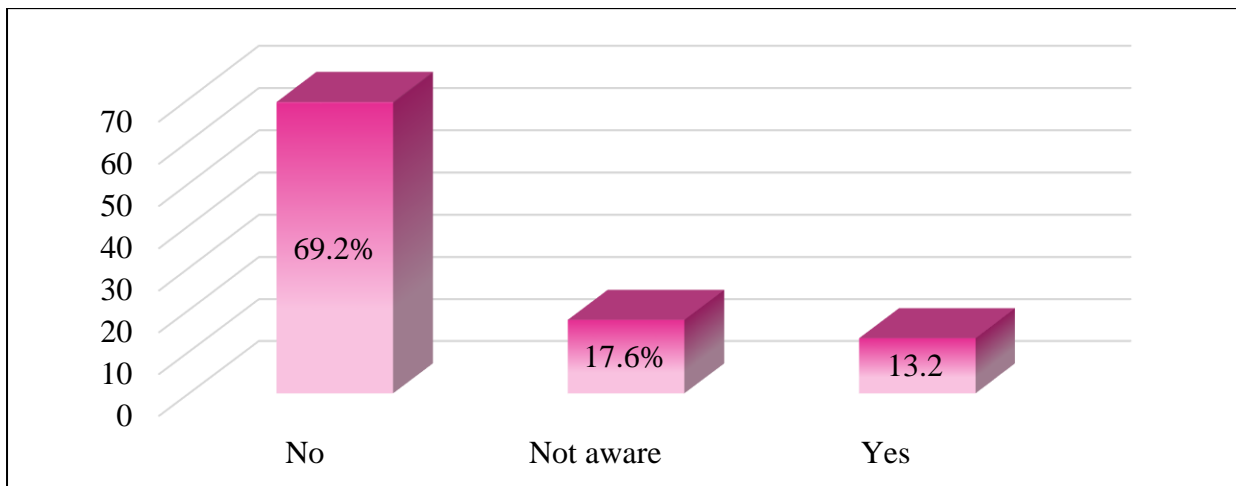


Source: Field data, 2019

5.8.6 Disputes Facing Land Subdivision

With reducing household land size, households tend to experience disputes during land subdivision and succession. The study however sought to establish if that was the case with households in Kirangi sub-location.

Figure 27: Disputes Surrounding Land Subdivision



Source: Field data, 2019

Data in figure 27 shows that 69.2% of the households did not experience disputes during land subdivision. They attributed this to the fact that parents subdivided land to their children while they are still alive. On the other hand, 17.6% indicated that they were not aware if there were any disputes during land subdivision. This can be explained by the fact that some respondents were

afraid of revealing family disputes. However, the households that experienced disputes during land subdivision were 13.2%. The reason for this is because some heirs want bigger share than the others. In addition, disputes in most cases occur when their parents pass on before subdividing land to their heirs.

5.8.7 Causes of Land Related Family Disputes

Majority of the respondents who experienced land disputes indicated that the conflicts were caused by the following factors.

Table 28: Causes of Land Related Family Disputes.

Causes of disputes	Percentage
Greed	56.4%
Land boundary	25.6%
Lack of will concerning family land	7.7%
Lack of family consensus on how to subdivide land	7.7%
Land inheritance by daughters	2.6%

Source: Field data, 2019

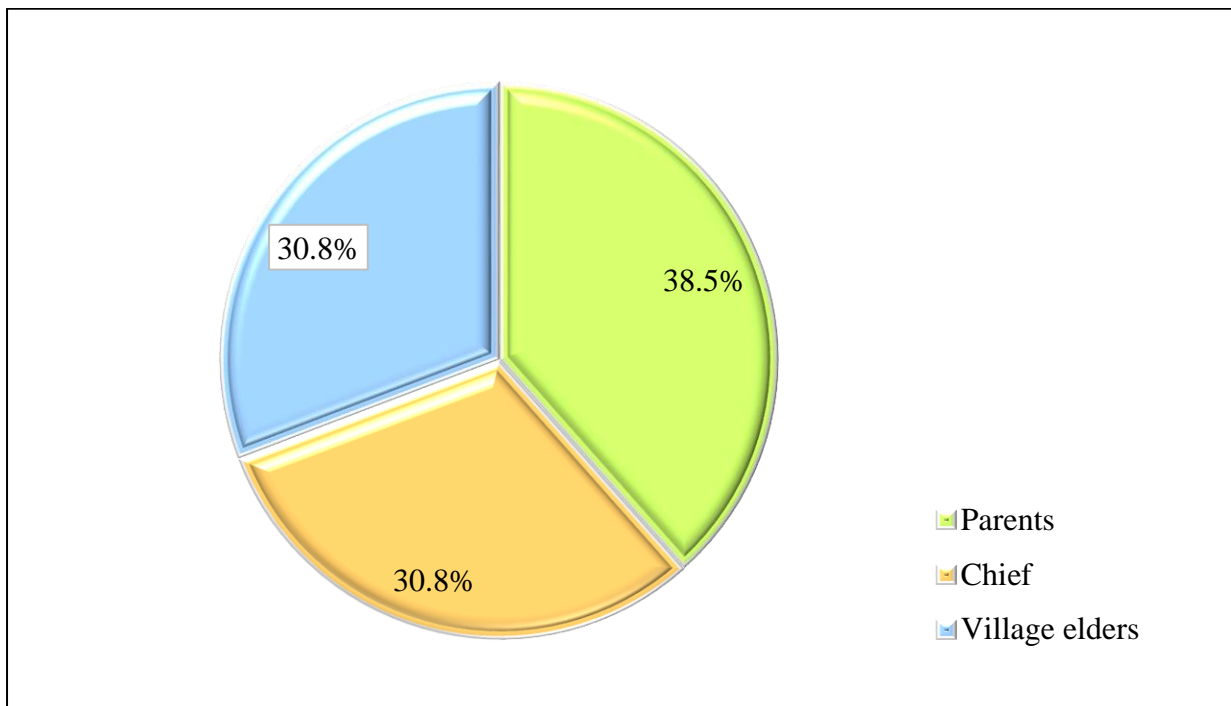
According to table 28, the major cause of land related family disputes is greed and demand for varied land shares which was reported by 28.2% of the respondents each. In some cases parents may give unequal land shares to the heirs which leads to animosity. In addition, some heirs may demand for bigger shares than others. 25.6% of the respondents indicated that the conflicts were caused by land boundaries which may not be clearly demarcated during land subdivision. Parents may grow old without writing a will concerning land which leads to conflicts when they die; a reason given by 7.7% of the respondents. The same proportion also reported that failure by family members to consult and reach a consensus on land inheritance results in family conflicts. A small proportion of respondents amounting to 2.6% indicated that family conflicts related to land was caused by sons who do not allow daughters to inherit parents' land.

Data from focused group discussion strongly pointed out that reducing land size has led to rise in family conflicts as heirs fight to inherit land. Some heirs wants a bigger share than the others or they may fight the land share with major cash cops. Conflicts have also risen between the parents and the children since some parents may feel that it is not yet the right time to subdivide the land to the children but at the same time the children feel that it is their right to be given the inheritance.

5.8.8 Mechanisms of Resolving Land Related Disputes

Further, the study sought to establish mechanisms that households employ to resolve the disputes. This indicates the severity of family conflicts related to land. The findings are reported in the figure 28. According the analysis, 38.5% of the respondents pointed out that family land related conflicts are solved by the parents. This is because in most cases parents are the household heads. On the other hand, when disputes escalates beyond family ability, village elders are called upon. Complicated cases are reported to the area chief and assistant chief. Both of these responses were reported by 30.8% of the respondents. The fact that majority of the respondents indicated that disputes are solved by the parents imply that most of the family land related disputes in Kirangi sub-location are not severe.

Figure 28: Mechanisms for Resolving Family Land Disputes



Source: Field data, 2019

5.8.9 Impacts of Family Disputes on Land Use

Family land disputes which are not resolved may have detrimental impacts on land use. Therefore, the study went further to identify how land disputes have affected land use in Kirangi Sub-location.

Table 29: Impact of Family Disputes of Land Use

Land is not being used	53.1%
No planting of permanent crops	31.2%
No application of modern farming methods	6.2%
Land is used normally	6.2%
Heirs are not entitled to inherit the land	3.1%

Source: Field data 2019

According to data analysis in table 29, 53.1% of the respondents indicated that due to family land related disputes, the land is not being used for any agricultural activity. 31.2% pointed out that they have not been able to plant permanent crops on the land. Application of modern farming methods have not been possible in the lands surrounded by disputes as indicated 6.2% of the respondents. In addition, heirs have not been able to get permanent and clear entitlement to the land as reported by 3.1% of the respondents. However, 6.2% of the responses showed that land disputes have not affected land activities and that households continue to use the land normally. This analysis shows that family land related disputes affect farming activities as most of the lands surrounded by disputes are not being utilized.

5.8.10 Opinions on How to Reduce Land Related Disputes

The study sought respondent's opinions concerning ways of reducing land disputes. As illustrated in table 30, majority of the respondents constituting 35% advocated for equal land subdivision; this has been pointed out as the major cause of land disputes. 25% of the respondents suggested consensus during land subdivision. This is because in most cases family members don't agree on matters surrounding land subdivision. The findings noted that clear wills should be drafted by parents as suggested by 20% of the respondents. This is due to the fact that most parents who do not leave a will see conflicts ensue when they pass on. 7.5% of the respondents suggested that the solution to land related disputes is to stop land subdivision altogether and also awareness to be created on the importance of joint land developments. Finally, issuance of individual title deeds were supported by 5% of the responses. This is because family title deeds leads to conflicts among the heirs.

Table 30: Ways of Solving Land Related Disputes

Divide land equally	35%
Consensus on how to subdivide land	25%
Clear wills on land by parents	20%
Stop land subdivision	7.5%
Create awareness on joint development	7.5%
Issuance of individual title deeds	5%

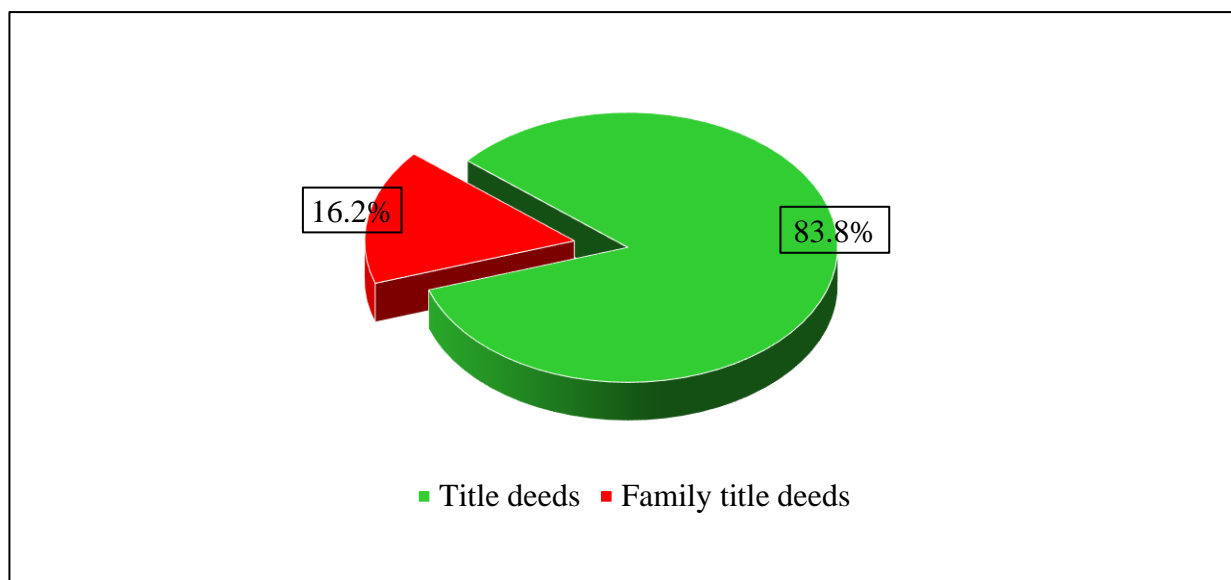
Source: Field data, 2019

It is however concluded that the solution to family land related disputes is equal land subdivision among the heirs as per the majority of the respondents.

5.8.11 Land Ownership Documents and Land Transfer

Land ownership documents are very crucial tools that affect security of tenure. When heirs inherit land, they may not be able to get land transfers that enable them get individual ownership documents for a long period of time.

Figure 29: Land Documents for Household's Land



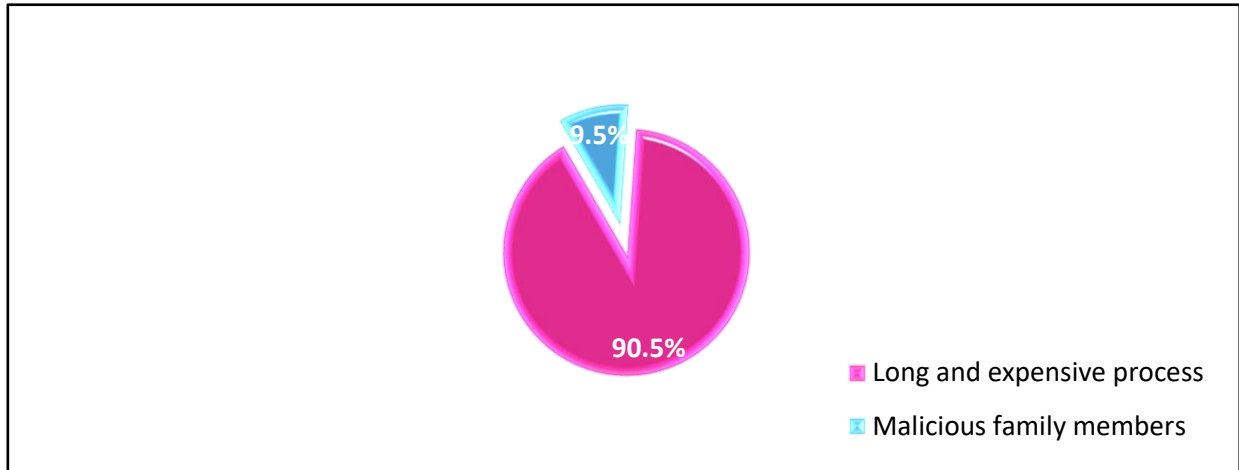
Source: Field data, 2019

As depicted in figure 29, 83.8% of the respondents indicated that they have individual title deeds for their lands. However, 16.2% did not have individual title deeds since they have not done land transfer from parent to themselves. This indicates that households value land transfers and they are very conscious on land security.

5.8.12 Challenges Faced by Households while Transferring Land from Parents to Heirs

As indicated in figure 30 (Land ownership documents) that some respondents still hold family title deeds, households have not transferred land from parents to heirs. It was imperative however to find out challenges facing land transfer.

Figure 30: Challenges Faced in Land Transfer



Source: Field data, 2019

According to the finding as demonstrated in figure 30, the major challenge faced by households during land transfer is the tedious process as reported by 90.5% of the respondents. They indicate that the processes is long and expensive. The remaining proportion of 9.5% face the challenge of malicious family members who want large portions of land than others, thus they usually go ahead and paralyze land transfer processes. It is however evident that the process of land transfer is unaffordable to many residents of Kirangi Sub-location. Moreover, the process is curtailed by its long procedures which usually delays the entire process.

5.8.13 Solution to Challenges of Land Transfer from Parents to Heirs

According to the details tabulated in table 31, 66.7% of the respondents argued that government should provide the solution to expensive land transfer by reducing the related costs. It should also condense the procedure and make it easy for applicants. 22.2% of the respondents suggested the removal of title deeds by providing alternative documents that are less costly and easy to process. This is attributed to the high costs related to obtaining land title deeds. In addition, 11.1% suggested that the government should put an end to corruption that affect land transfers at land offices. In a nutshell, cumulative percent, (100%) of the respondents look upon the government to provide solutions to challenges surrounding land transfer.

Table 31: Solutions to Challenges Facing Land Transfer

Solutions	percent
Government to reduce land transfer costs	66.7%
Government to provide alternative land documents	22.2%
Government to stop corruption in land offices	11.1%

Source: Field data, 2019

5.9 Proposed Minimum Land Size Sufficient for Households

The study sought to compute the minimum land size that can sufficiently meet household financial and food needs at the current production level. This is in quest to determine the minimum land size that is viable in Kirangi Sub-location. Setting a limit for minimum land size helps to contain land fragmentation that has escalated to levels where land is no longer productive. In addition, determining the minimum land size informs households on the ideal land size that meets their livelihood needs.

5.9.1 Household Suggested Land size

The study sought respondents' opinion on the amount of land that is sufficient to meet household livelihood needs. This was in quest to compare the suggested land size with the computed land size.

Table 32: Minimum Household Land Size

Mean	5.2156
Median	4.0000
Mode	5
Standard deviation	3.73804
Variance	13.973

Source: Field data, 2019

Details in table 32 indicate households' suggestions concerning the minimum land size that can sustain households efficiently. The mean land size is 5 acres, with a median of 4 and a mode of 5. This indicates that according to the respondent's opinion, the average minimum land size that is enough for households in Kirangi sub-location to achieve sustainable livelihoods is 5 acres. Comparing this to the exiting average household land size of 3.2 acres, this indicates a deficit in household land. However setting up a minimum household land size of 5 acres in Kirangi Sub-location may not be achievable at household level because of the diminishing household land

size. Thus, to compensate on the deficit, the study recommends the use of intensive farming methods on the available land holdings in order to achieve maximum returns. This entails practicing of intensive farming techniques as well as adoption of modern technology. The study however concludes that the suggested land size is not an accurate measure of minimum land size sufficient for households in the region because the data was based on respondents' mere wishes rather than facts scientifically proven.

5.9.2 Reasons for Suggesting a Particular Land Size

Respondents gave reasons as tabulated in table 33 for choosing a particulate land size that they deem enough for their households. 43% of the respondents indicated that the size of land that they chose will boost agricultural production. They argue that the current land size is too small and thus limit production. In addition, 25.5% argued that the particular land size will increase their income due to increased production. 21.5% indicated that the land is manageable owing to its size. Other reasons are; the land allows for mixed farming (4%), the land is sufficient in respect to family size, sufficient for dairy and sufficient for crop diversification; all reported by 2% of the respondents.

Table 33: Reasons for Suggesting a Particular Land Size

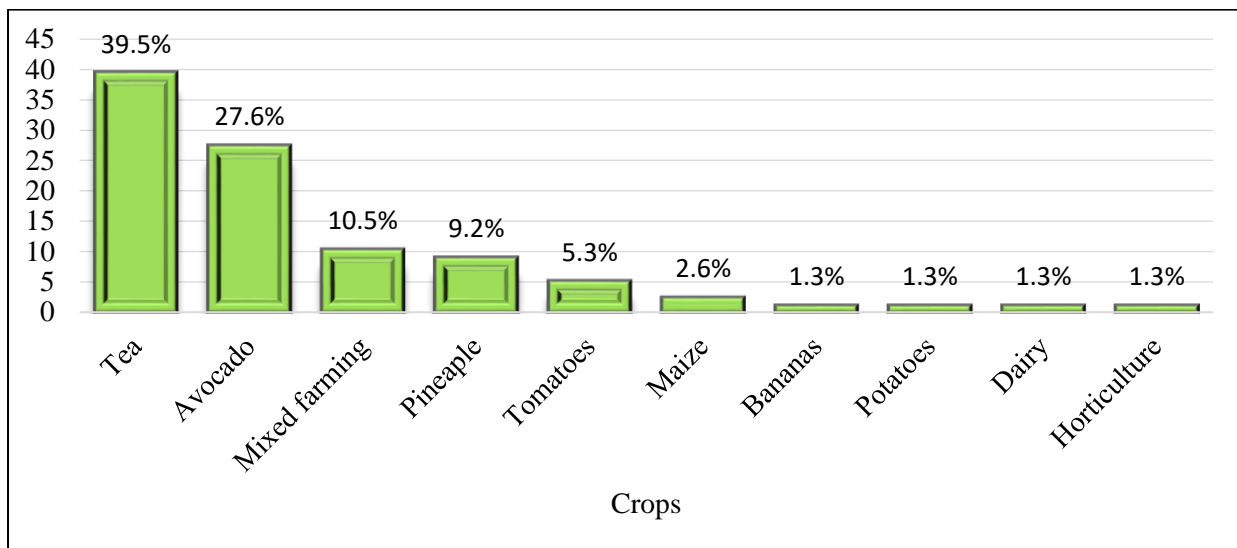
Reasons	Percent
Increased production	43%
Sufficient income to the household	25.5%
Manageable	21.5%
Allows for mixed farming	4%
Sufficient for the family	2%
Sufficient for dairy	2%
For crop diversification	2%

Source: Field data, 2019

5.9.3 Crops Grown on the Suggested Land Size

As households have suggested land size that is sufficient to meet household needs effectively, the study went further to identify the kind of crops that the households would prefer to cultivate in the given land size.

Figure 31: Crops Grown on the Suggested Land Size



Source: Field data, 2019

Data in figure 31 indicate that 39.5% of the respondents prefer tea since they believe that additional land for tea farming would bring sufficient income to households. They argued that the current household land size is small and thus uneconomical for tea growing. 27.6% preferred avocado and this is attributed to the fact that avocado farming is gaining popularity in the region. Mixed farming was highlighted by 10.5% of the respondents, pineapple (9.2%), tomatoes (5.3%), maize (2.6%), bananas, potatoes, dairy and horticulture each takes 1.3% of the responses.

5.9.4 Computed Ideal Minimum Land Size

In order to determine the ideal minimum land size for tea farming per household in Kirangi Sub-Location, a computed figure was achieved basing on the household budget given by the Kenya National Bureau of Statistics Household survey of 2015/2016. However, a household in rural Kenya with an average of five people must have an average income of Ksh. 195,120 per annum with a required per capita of Ksh. 39,024 for each household member. According to the finding of this study, the average household size in Kirangi Sub-Location is 5 members, thus the study determines the ideal land size in respect to the maximum land productivity.

According to Unilever Kenya (2018), the optimal yields per acre of raw tea leaves is 8,000 kilograms per year. KTDA factories across the country buy tea from farmers with varied prices depending on factory's' production costs. However, this study shall use average KTDA bonus price for the last 3 years of Ksh. 26 per kilogram. Therefore, one acre of tea earns an average gross income of Ksh. 208,000 per year. The cost of production per one acre is Ksh. 144.00, approximated at Ksh 14.25 per kilogram of raw tea leaves. This translates to a net household

income of Ksh. 94,000. Basing this on household budget requirement, a household of five members needs a minimum land size of 2.1 acres for it to achieve the required per capita of Ksh. 195,120 per annum. This is equivalent to 0.4 acres per capita.

5.9.5 Comparing Means of Household Land Size, Suggested Land Size and the Ideal Land Size.

A paired-sample t-Test was conducted to compare the average land size of the two variables.

Table 34: Means of Households Land Size, Suggested Land Size and Computed Land Size

Paired sample statistics	Mean (acres)	N	Std. Deviation
Household land size under tea	1.67	91	3.77
Suggested land size	5.0	91	2.93
Ideal land size	2.1	-	-

Source: Field data, 2019

Based on the data demonstrated in table 34, the suggested average land size is acres 5 acres while the computed ideal land size is 2 acres. This is in comparison with the average household land size under tea of 1.67 acres. The suggested land size is not a true figure because it is based on respondents wish rather than scientific facts. Conversely, this study concludes that households in Kirangi Sub-location have deficit of 0.43 (2.1-1.67) acres of land size for tea farming. To achieve the ideal land size of two acres and to prevent further land fragmentation, land consolidation at household level should be effected. All heirs should come together and till land as a whole and later share the proceeds. One heir can be appointed and hired as a farm manager while the rest concentrate on other income diversification activities. This enables households to enjoy economies of scale in economically viable tea farms and at the same time enjoy benefits from income diversification activities. Land is then maintained under one tittle deed while the heirs are given shareholder certificates in order to avoid family land related conflicts.

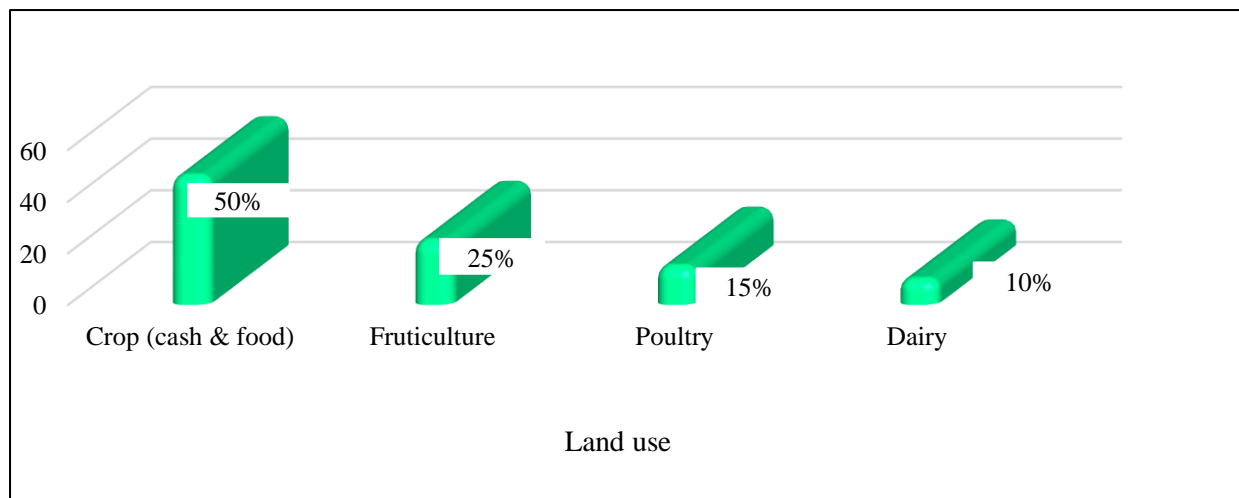
However, households can still achieve sustainable income with the existing land holdings. Low income witnessed by stallholder tea farmers in the region is due to low productivity. This can be explained by poor farming methods employed by farmers coupled with price fluctuations. For optimal productivity to be realized, proper farming technology together with intensive farming techniques need to be adopted by the farmers. In addition, government should stabilize tea prices at reasonable rates and at the same time provide an enabling environment for tea farming.

5.10 Major Land Use by Households

Households have various activities that they undertake in their farms. According to the findings of the study, households in Kirangi Sub-location practice land uses such as cash crop farming, food crop farming, horticulture farming, dairy farming and poultry farming. The study thus sought to identify the major land use among the households.

As illustrated in figure 32, the major land use is crop farming which entails both food and cash crops as highlighted by 50% of the responses; this is attributed to the fact that households are tea farmers who also plant food crops mostly for subsistence. Fruticulture was reported by 25% of the respondents, this is explained by the fact that avocado and macadamia are gaining popularity in the area. Poultry keeping recorded 5% while dairy farming was indicated by 10% of the respondents. Dairy is losing preference due to high cost of feeds which are also not readily available. This is in line with a study by Ndege (1995) which concluded that agriculture is a major land use in Gatundu in particularly cash crop farming.

Figure 32: Major Household Land use

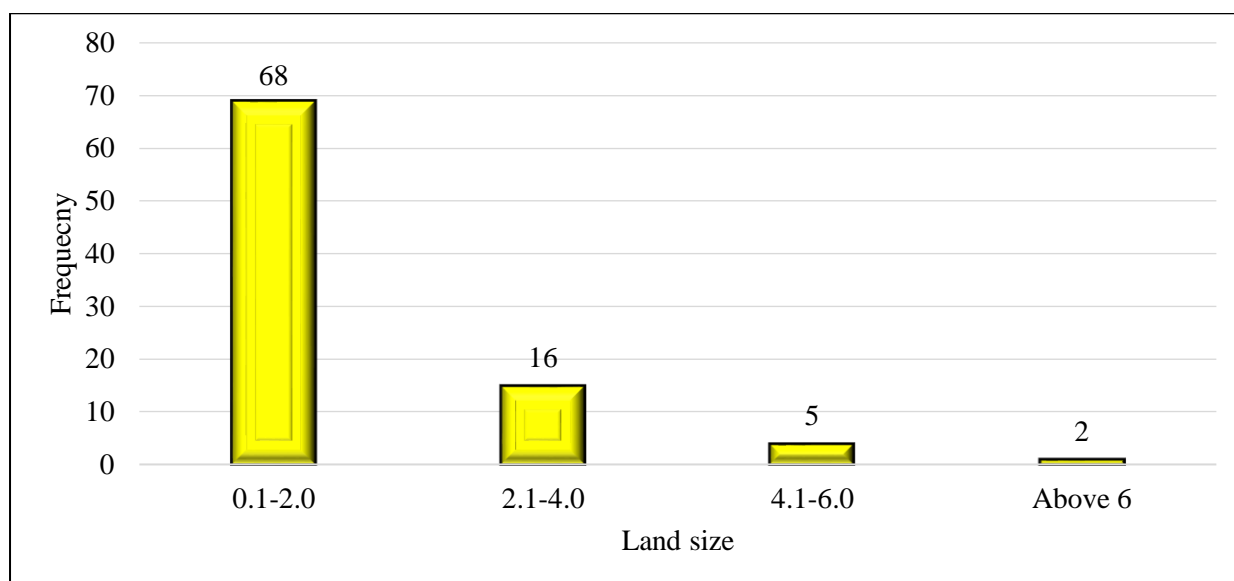


Source: Field data, 2019

5.10.1 Tea Farming

Out of the 91 respondents that were interviewed, 68 have between 0.1 and 2.0 acres of land under tea. Land size of between 2.1 and 4.0 acres was reported by 5 of the respondents. While 5 respondents indicate to own between 4.1 and 6.0 acres, only 2 respondents have more than 6 acres of tea farm. This is according to filed data analysis demonstrated in figure 33. This depicts small land sizes of tea farms among the small-holder tea farmers in Kirangi Sub-location.

Figure 33: Land Size under Tea



Source: Field data, 2019

Table 35: Average Land Size under Tea

	Land size under tea
Mean	1.67
Median	1.25
Mode	0.75
Maximum	7
Minimum	0.13

Source: Field data, 2019

According to findings tabulated in table 35, the mean average size of land under tea in Kirangi Sub-location is 1.67 acres with a median of 1.25 acres. Majority of the farmers have less than one acre of land under tea as exhibited by the mode of 0.75. This is in agreement with a premise by Ogise et. al. (2008) which states that over 90% of the smallholder tea farmers are cultivating less than one acre of tea acreage. The maximum tea farm is 7 acres while the minimum is 0.13 acres. This scenario stills proves small tea farms own by households of the area.

5.10.1.1 Challenges Facing Tea Farming

Small holder tea farmers face myriad of challenges that has led to livelihood challenges in tea growing zones. Some challenges are common to tea farmers in all regions while others are unique to particular areas. Therefore, the study aimed at identifying challenges that face tea farmers in Kirangi Sub-location.

Table 36: Challenges Facing Tea Farming

Challenges	Percent
Low payments	32.6%
High labor costs	13.5%
Expensive inputs	10.3%
Prolonged droughts	10.9%
Lack of skilled labor	9.8%
Pests and diseases	6%
Delayed tea collection	4.9%
Delayed payments	2.7%
Poor roads	2.7%
Lack of know-how	2.2%
Soil degradation	1.6%
Limited land	1.1%
Low quality fertilizers	1.1%
Poor factory management	0.5%

Source: Field data, 2019

As reported in table 36, the major challenge facing tea farmers in Kirangi Sub-location is low payments as indicated by 32.6% of the respondents. High labor cost is also a major challenge in the area as supported by 13.5% of the responses. Tea farmers are faced with challenges of expensive farm inputs and prolonged droughts according to 10.3% of the respondents. Fertilizer is reported to be very expensive for farmers and at the same time they are supposed to put in high proportions due to low soil fertility. The area during the time of the study was experiencing prolonged droughts that had resulted in low output and in extreme cases drying up of tea altogether. This has posed serious challenges to tea farmers as indicated by 10.9% of the respondents. 9.8% of the respondents reported lack of skilled labor. They alluded that they source labor from neighboring countries who have no skills for tea plucking. Pests and diseases (6%), delayed tea collection (4.9%), delayed payments (2.7%), poor roads (2.7%), lack of know-how (2.2%) soil degradation (1.6%), limited land (1.1%), low quality fertilizers (1.1%) and poor factory management (0.5%) were also highlighted as challenges that tea farmers are experiencing.

Findings from focused group discussion indicated that tea farmers suffer from bad fertilizer. They argued that Kenya Tea Development Authority (KTDA) supply low quality fertilizers that is not only costly but also non-effective. Sometimes the fertilizer becomes detrimental to tea. In recent past they have witnessed their tea wilt and others develop stunted growth, an attribute they associate with low quality fertilizer. It is important to note that, it is due to reduction in soil fertility

and soil quality that they need to add fertilizer frequently to increase yields unlike in the past. Plate 1 shows addition of fertilizer to tea farm.

Plate 1: Addition of Fertilizer to Tea Farm



Source: Field data, 2019

Prolonged droughts has been a very big challenge and a big blow to tea farmers. The respondents lamented that drought has reaped them of their income. During the dry season that was ongoing during the time of the study, they had gone for two to three months without picking their tea. Normally after the onset of rain, it will still take them some length of time before they resume the picking. Approximately, it takes between one to two months depending on the severity of the drought. Plate 2 demonstrates how drought has caused tea to dry up.

Plate 2: Effects of Drought on Tea



Source: Field data, 2019

In severe cases of drought, tea might dry up altogether and this calls for pruning to save the situation. It is for this reason that majority of the farmers decide to prune their tea in dry season

which will take them a longer period of time (approximately 3months) before picking commences after the onset of rain. Plate 3 shows tea that was pruned because of adverse effects of drought.

Plate3: Pruned Tea Affected by Drought



Source: Field data, 2019

Another major challenge with tea farming that was put across was delays at tea collection centers. It was reported that tea takes too long to be picked and delivered to the factories once the farmers deliver them to tea buying centers. This lowers tea quality and in some cases tea is rejected by factories over poor quality which translates to losses to the farmers.

5.10.1.2 Suggested Solutions to the Challenges Facing Tea Farming

According to the respondents' opinion, the following mechanisms can be employed to solve the challenges facing tea farming in Kirangi Sub-location. As indicated in table 37, 43.3% of the respondents advocated for increase in tea prices. As discussed earlier, tea farmers feel that tea prices are too low to meet their livelihood needs.

Table 37: Suggested Solutions to the Challenges Facing Tea Farming

Suggested solution	percentage
Government intervention for KTDA to increase tea prices	43.3%
Subsidize farm inputs (fertilizers & pesticides)	12.7%
Construct good roads	6%
Provide extension services	5.2%
Government to provide water for irrigation	3.7% %
Provision of skilled laborers	3.7%
Factories to avail reliable transport services	3%
Quality inputs	3%
Prompt payment	2.2%
KTDA to source for more market for tea	2.2%
Reduce labor cost	2.2%

Use family labor	2.2%
Well organized market system (picking, transport, selling)	2.2%
Acquire more land	1.5%
Factory officials should not be elected based on shares	1.5%
Keep tea brokers in check	1.5%
Use of organic manure	0.7%
Protective gear to tea pluckers	0.7%
Crop diversification	0.7%
Use of tea picking machines	0.7%
Bonus to be paid semi-annually	0.7%

Source: Field data 2019

12.7% of the responses suggested subsidy on farm inputs. Respondents argued that farm inputs are too expensive especially fertilizer. Roads still pose a major challenge to tea farming in the region as indicated by 6% of the respondents. Trucks find a challenge reaching all tea collection centers which leads to delays in tea delivery to the factory and hence reduction in tea quality. Respondents were calling out on the government to provide extension services to farmers (5.2%), so that they can be equipped with skills on tea farming. Other solutions that were highlighted by the respondents include; government to provide water for irrigation (3.7%), provision of skilled laborers (3.7%), factories to avail reliable transport services (3%), government to assure quality inputs (3%), prompt payments (2.2%), KTDA to source for more market for tea (2.2%), reduction in labor cost (2.2%), use of family labor (2.2%), well organized market system (picking, transport, selling) (2.2%), farmers to acquire more land (1.5%), factory officials should not be elected based on shares (1.5%), keep tea brokers in check (1.5%), use of organic manure (0.7%), provision of protective gear to tea pluckers (0.7%), crop diversification (0.7%), use of tea picking machines and bonus to be paid semi-annually (0.7%). In a nutshell, tea farmers are looking upon the government to provide enabling environment for tea farming in terms of high quality inputs, good prices, general infrastructure and good management of KTDA factories.

5.10.2 Cash Crop Farming

The major cash crops grown in Kirangi Sub-location are tea, vegetables and fruits such as pineapples, avocado and macadamia.

Data in table 39 illustrates that the mean land size under other type of cash crops is 0.55, with a median of 0.5 and a mode of 0.05. This indicates that tea farmers have very small land size left for cash crop diversification. Thus, the households are left to depend entirely on tea incomes making them vulnerable to detrimental effects of factors such as fluctuation in tea prices and adverse climatic conditions. Schwarze and Zeller (2005) state that households that adopt

diversified livelihoods can easily withstand the shocks, employ sustainable use of resources as well as provide opportunities for others.

Table 38: Number of Households with Selected Crops

Tea	98
Avocadoes	96
Pineapple	40
Macadamia	40

Source: Field data, 2019

5.10.2.1 Amount of Land with Other Cash Crops outside Tea

Table 39: Amount of Land with Other Cash Crops

Mean	0.55
Median	0.5
Mode	0.05
Standard deviation	0.4631
Variance	0.750

Source: Field data, 2019

5.10.2.2 Challenges Facing Cash Crop Farming

Households indicated that cash crop farming does not sufficiently meet household financial needs. This is linked to the challenges that households face in cash crop farming. Such challenges are highlighted in table 40. Findings however demonstrate that 35.1% of the households face challenge of low prices. This mostly affects fruit crops such as avocado and macadamia. The study discovered that households sell these fruits to middlemen who buy at extremely low prices. For instance, they buy avocado at as low as Ksh. 3 per piece. 19.4% reported the challenge of prolonged droughts which has detrimental effects on farming. This mostly affects tea farming in the months of between December and February when the region experiences dry season. It was also noted that 18.5% of the households face a challenge of costly inputs. They argue that fertilizers and seeds are too costly forcing the farmers to resort to planting without fertilizer since organic manure is not readily available. This results in low productivity and thus lack of sustainable income to households. Other challenges that were highlighted include; pest and diseases (6.5%), poor soil fertility (4.6%), low yields (4.6%), poor market systems (3.7%), poor quality inputs (2.8%), high cost of labor (1.8%), destruction of crops by wild animals (1.9%) and spoilage of farm produce (0.9%).

Table 40: Challenges Facing Cash Crop Farming

Challenges	percent
Low prices	35.1%
Drought	19.4%
Costly inputs	18.5%
Pest and diseases	6.5%
Poor soil fertility	4.6%
Low yield	4.6%
Poor market system	3.7%
Poor quality inputs	2.8%
High cost of labor	1.9%
Destruction of crops by wild animals	1.9%
Spoilage of produce	0.9%

Source: Field data, 2019

5.10.2.3 Solutions to Challenges Facing Cash Crop Farming

Respondents were asked of their opinion on how to solve the challenges facing cash crop farming in the area.

Table 41: Solutions to Challenges Facing Cash Crop Farming

Suggested solutions	Percent
Government to provide effective pesticides	28%
Government to subsidize farm inputs	19.1%
Government to provide water for irrigation	17.6%
Government to provide high quality inputs	11.7%
Creation of good and effective markets	5.9%
Government to provide extension services	4.4%
Use of manure	4.4%
Good prices for farm produce	4.4%
Government to conduct soil analysis	2.9%
Crop rotation	1.5%

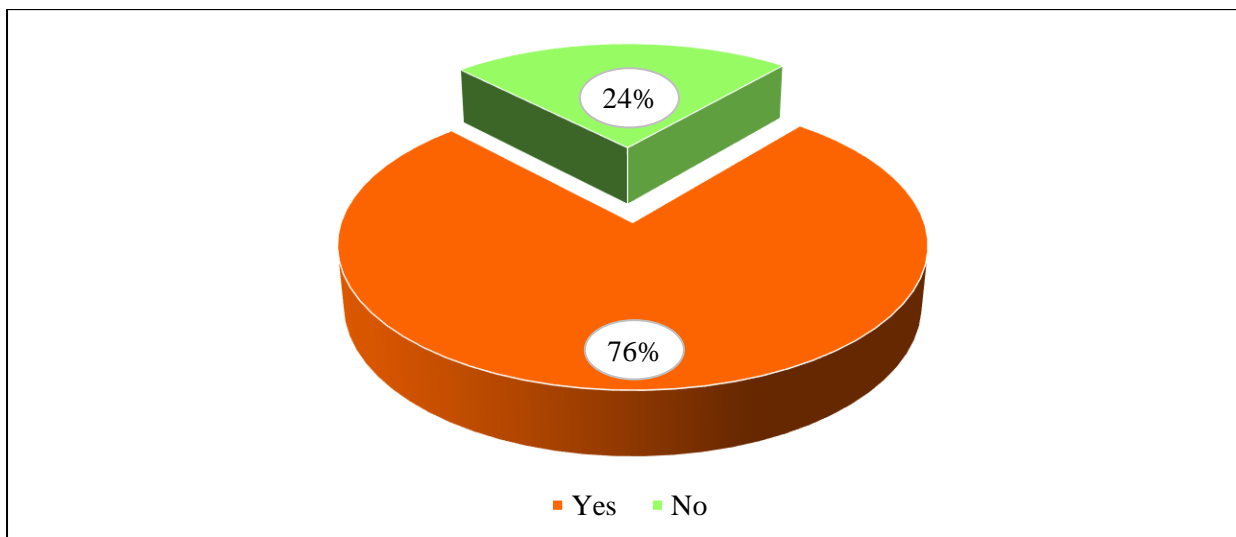
Source: Field data, 2019

According to the illustrated solutions in table 41, 28% of the respondents indicated they rely on the government to provide effective pesticides to curb the pesticide menace that has been a threat to crop farming. 19.1% suggest that government should subsidize farm inputs such as pesticides, seeds and fertilizers that are not affordable to most households. Drought has been a major challenge and thus 17.6% of the respondents advocated for the government to provide water for irrigation. Other solutions that were suggested include; government to provide high quality inputs (11.7%), creation of good and effective markets (5.9%), government to provide extension services (4.4%), use of manure (4.4%), good prices for farm produce (4.4%), government to conduct soil analysis (2.9%) and farmers to practice crop rotation (1.5%). In a nutshell, people rely on the government to provide solution facing crop farming such as subsidies of farm inputs, provision of quality farm inputs, provision of water for irrigation, provision of effective and good markets, provision of extension services, good prices for farm produce and conducting soil testing to determine measures to improve soil qualities.

5.10.3 Livestock Farming

Livestock farming is one of the sources of livelihoods for households in Kirangi Sub-location.

Figure 34: Proportion of Livestock Farming



Source: Field data, 2019

The study sought to identify whether livestock farming meets both food needs as well as income for the households. According to figure 34, 76% of the respondents keep livestock while 24% do not keep livestock. This indicates that households give very high regards to livestock farming.

5.10.3.1 Livestock Type

The type of livestock kept by the households include; dairy cows, poultry, goats, sheep and rabbits. Plates 4 and 5 show dairy and poultry farming respectively.

Plate 4: Dairy Farming



Source: Field data, 2019

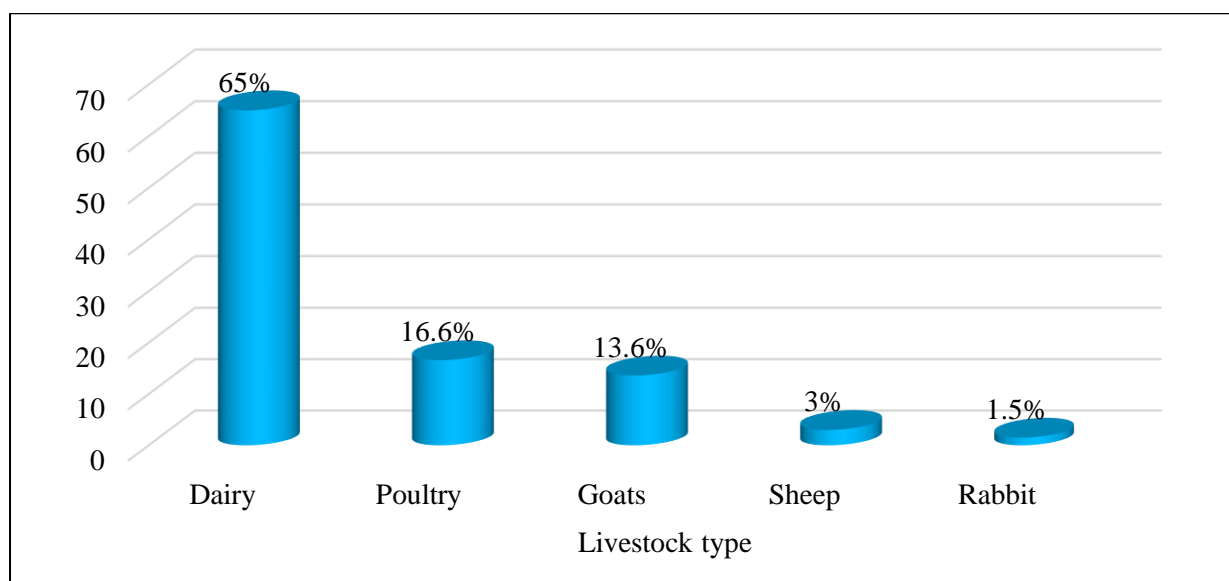
Plate 5: Poultry Farming



Source: Field data, 2019

According to figure 35, 65% of the respondents keep dairy animals because the returns are high. Poultry is the second most preferred type of livestock in the area. Poultry is gaining preference in the region since livestock feeds are becoming expensive also planting nappier grass and other feeds takes a lot of space in the already shrinking land. Other livestock kept by households include; goats (13.6%), sheep (3%) and rabbits (1.5%).

Figure 35: Type of Livestock Kept by Households



Source: Field data, 2019

5.10.3.2 Land Size under Livestock

According to analysis in table 42, the mean land size for livestock farming by households is 0.35 acres. This is attributed to the fact that livestock such as poultry goat, sheep and rabbit does not require expansive land. However, dairy which require a lot of land for forage is kept under zero grazing and farmers purchase feeds.

Table 42: Land Size under Livestock

Mean	0.3530
Median	0.2500
Mode	0.25
Standard deviation	0.45788
Variance	0.210

Source: Field data, 2019

5.10.3.3 Challenges Facing Livestock Farming

Livestock farmers are faced with myriad of challenges. It was however important to study the challenges unique to livestock farmers of Kirangi sub-location as indicated in table 43. Challenges in larger extent usually constrain household income, a factor that contributes to lack livelihood sustainability.

Table 43: Challenges Facing Livestock Farming

Challenges	Percent
Costly feeds	30.6%
Diseases & Pests	15.3%
Hard to get feeds	14.2%
Low prices	14.2%
High cost of production	6.1%
Drought	5.1%
Lack of ready market for produce	3%
Theft	2%
Poor roads	2%
Insufficient land for feeds	2%
Poor breeds	1%
Expensive artificial inseminations services	1%
Low yields	1%
Lack of extension services	1%
Exhausting/Wake up at night to milk	1%

Respondents indicated that they are facing a challenge of costly feeds. This affects mostly households that do not plant napier grass and depend on purchasing of feeds such as hay and silage which are costly. 15.3% respondents are affected by pests and diseases which are costly to treat and in most cases result in dead of animals especially when the farmer lack finances to seek veterinary services. Another challenge is low prices for livestock products as put forward by 14.2% of the respondents. Households reported that they sell milk to middlemen who come to collect milk at their homes. These middlemen buy milk at relatively low prices, for instance they buy a litre of milk at ksh 30. Households who do not afford to buy feeds go around looking for pasture for their livestock. Most of them go to the forest which is cumbersome especially to the aged; this was reported by (14.2%) of the households. Other challenges that were reported include; High cost of production (6.1%), drought (5.1%), lack of ready market for produce (3%), theft (2%), poor roads (2%), insufficient land for feeds (2%), poor livestock breeds (1%), expensive artificial inseminations services (1%), low yields (1%), lack of extension services (1%), exhausting as farmers need to wake up at night to milk and deliver to the buyers (1%).

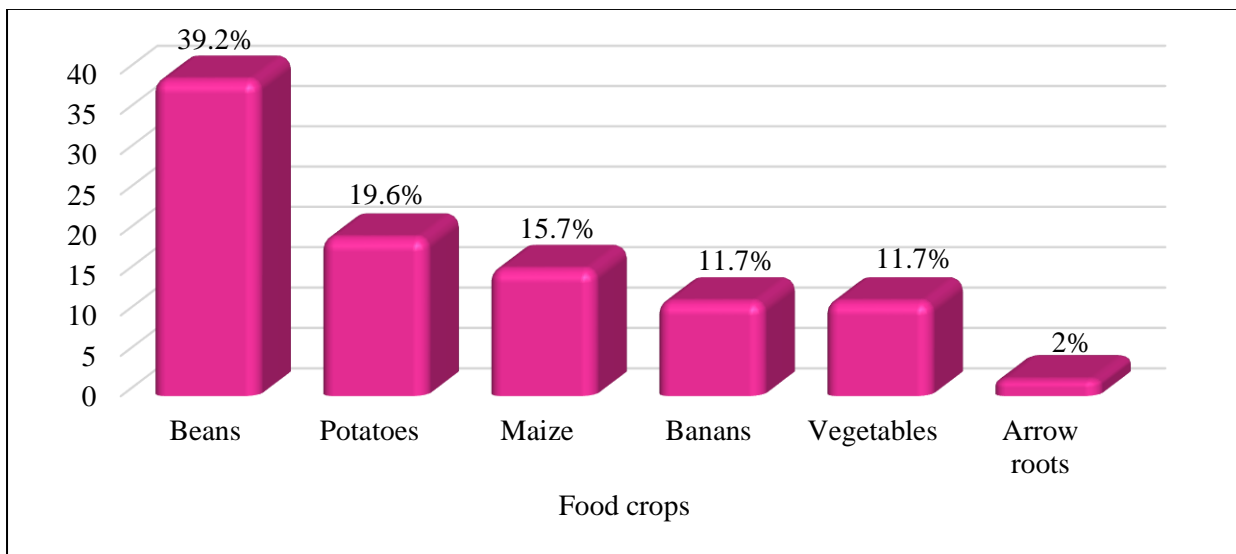
5.10.4 Food Crop Farming

The study sought to assess the situation of food crop farming among the households in Kirangi Sub-location. This was in quest to determine whether food crop farming sustainably meet household food needs.

5.10.4.1 Types of Food Crops

The respondents indicated that food crops they cultivate include; beans, potatoes, maize, bananas, vegetables and arrowroots.

Figure 36: Food Crops Cultivated by Households



Source: Field data, 2019

However, the stable food crops according to data in figure 36 is beans with 39.2% followed by potatoes with 19.6%. Maize comes in the third position with 15.7% of the responses. Both bananas and vegetables recorded 11.7% of the responses while arrowroots were mentioned by 2% of the respondents. This is in agreement with a report by FAO, (2017) which indicates that food crops in Gatundu are maize, beans, bananas, Irish potatoes and a variety of vegetables.

5.10.4.2 Land Size Under Food Crops

Table 44 illustrates that the average land size under food crop farming is 0.3 acres with a median of 0.25 and a mode of 0.25. This depicts relatively small land size for food crops as compared to average land size under tea which is 1.67 acres. Conversely, households indicated that food crops are only for subsistence. Households indicated that tea takes up the largest portion on household land leaving them with small portion of land that is not enough to produce sufficient food for the household. This depicts a threatened food security in Kirangi sub-location.

Table 44: Land Size Under Food Crops

Mean	0.29211
Median	0.25000
Mode	0.250
Standard deviation	0.293443
Variance	0.086

Source: Field data, 2019

5.11 Livelihood Diversification

The study sought to establish whether households in Kirangi Sub-location engage in livelihood diversification strategies; both on-farm and off-farm diversification activities. It also went further to identify the contribution of these diversification activities to household income.

5.11.1 Farming Diversification

Kirangi Sub-location is a tea growing zone thus households who practice tea farming were interviewed. Tea farmers as well were invited for focused group discussions. The study found out that most of the households in Kirangi sub-location engage in land use diversification by planting other crops alongside tea. Majority of the households engage in more than one agricultural activity. The major crops include; cash crops such as fruits, maize, potatoes, arrow roots and bananas and illustrated in plate 6. Food crops include maize, beans, potatoes and vegetables.

Plate 6: Tea Intercropped With Bananas



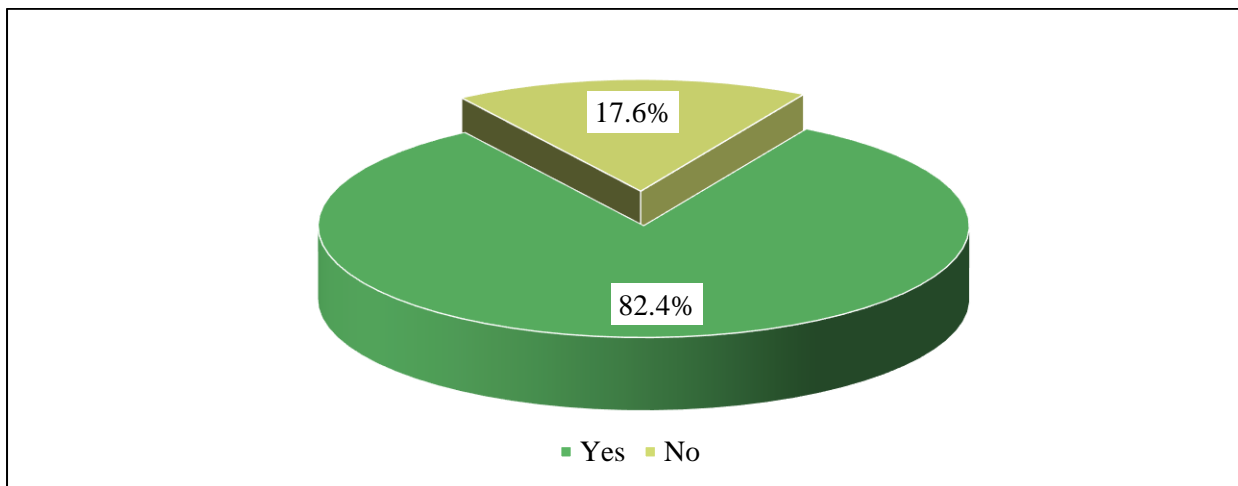
Source: Field data, 2019

Tea farmers who diversify tea farming with other cash crops seek to boost their income. Thus this study sought to identify if that is the case in Kirangi Sub-location. Further, the study focused on determining the land size used to grow other cash crops as well as the incomes generated by farm diversification. This was in quest to determine whether land diversification improves household livelihoods.

5.11.1.1 State of Household Land Diversification

Majority of the respondents indicated that they plant other cash crops alongside tea as indicated by 82.4% of the respondents. However, 17.6% specialize in tea farming only as indicated in figure 37. This implies that tea farming alone does not meet households needs and thus farmers seek to increase income from farming by planting other crops. This is in agreement with the study done by Mwangi et. al. (2015) which concluded that tea farmers seek to boost their income by engaging in other cash crops apart from tea. This would enable tea farmers to use the cash to purchase food and this leads to improved economic welfare among tea farmers. A study by Wolgin (1975); Alam (1975) and Anderson (1989) continues to justify this fact by adding that low tea prices together with unsustainable income in tea zones have made many tea farmers to engage in agricultural diversification activities.

Figure 37: Land Diversification by Households



Source: Field data, 2019

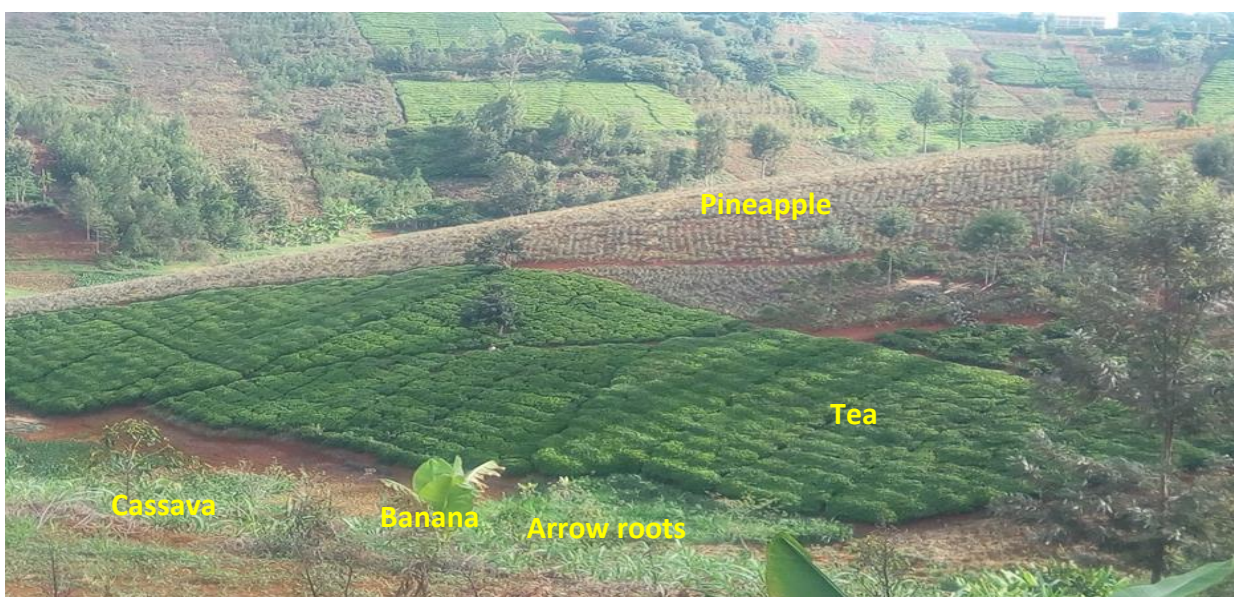
Focused group discussions brought out the fact farmers prefer land diversification because it shields them from uncertainties such as weather changes, price fluctuations and lack of market. The area experiences adverse weather changes that affect their production levels. During part of the study, Kirangi area was experiencing prolonged extreme droughts that had led to reduced harvest. Majority of tea farmers were no longer harvesting their tea and some who were still

harvesting were getting very low quantities due to drought. Livestock provided an alternative source of income even though feeds are reported to be expensive and hard to find. Pest and disease infestation has become a major challenge to crop farming. Farmers are beginning to shun maize since it is adversely affected by pests and diseases seeking an alternative in vegetables and fruit farming. This agrees with a conclusion by Shen (2004) that the main reason behind livelihood diversification by the households is the desire to accumulate income. This is influenced by factors such as land size, market access, income, credit access and educational levels of the households.

5.11.1.2 Cash Crop Types Preferred for Diversification

The study went further to identify the type of crops that tea farmers prefer to plant alongside tea. Plate 5 shows a farm where pineapple, avocado, bananas, cassava and arrow roots are planted alongside tea. Plates 7, 8 and 9 show tea farms with maize, banana, avocado, arrow roots, pineapple and cassava. According to focused group discussions, majority of the farmers prefer tea, coffee, pineapple and fruits as cash crops. Most of them opted for pineapple when tea and coffee prices went down. They argue that pineapple enable them to earn instant cash on harvesting unlike tea whereby they have to wait for annual bonus which the households find to be unsustainable. In addition, they are able to negotiate for pineapple prices with the buyers unlike fixed tea and coffee proceeds which are very low. Fruits is also a better option for them since they don't need a lot of input in terms of labor, fertilizer and pesticides. They find fruits a very good investment since it does not occupy a lot of land and can be intercropped with other crops. Most of fruits in their farms are planted alongside tea and coffee.

Plate 7: Farm Diversification



Source: Field data, 2019

Plate 8: Avocado farming alongside tea



Source: Field data, 2019

However, fruit farming faces a major challenge of low prices from middlemen who buy from them at very low prices and sell at almost double price. This is a very serious challenge as majority of the households sell to middle men, an indication that markets are performing below their capacity.

Crop diversification provides income that is spread throughout the year. Depending on one cash crop limits the farmer to income that is only received during the season when that crop is harvested. For instance, tea brings very low monthly income and bonus is paid annually. Coffee on the other hand is harvested twice a year with one major season and the other season with relatively low yields. Pineapples is harvested twice a year, while fruits such as macadamia are harvested once and avocado is harvested periodically at seasons spread throughout the year. Livestock and poultry farming brings about daily income if a farmers plan well.

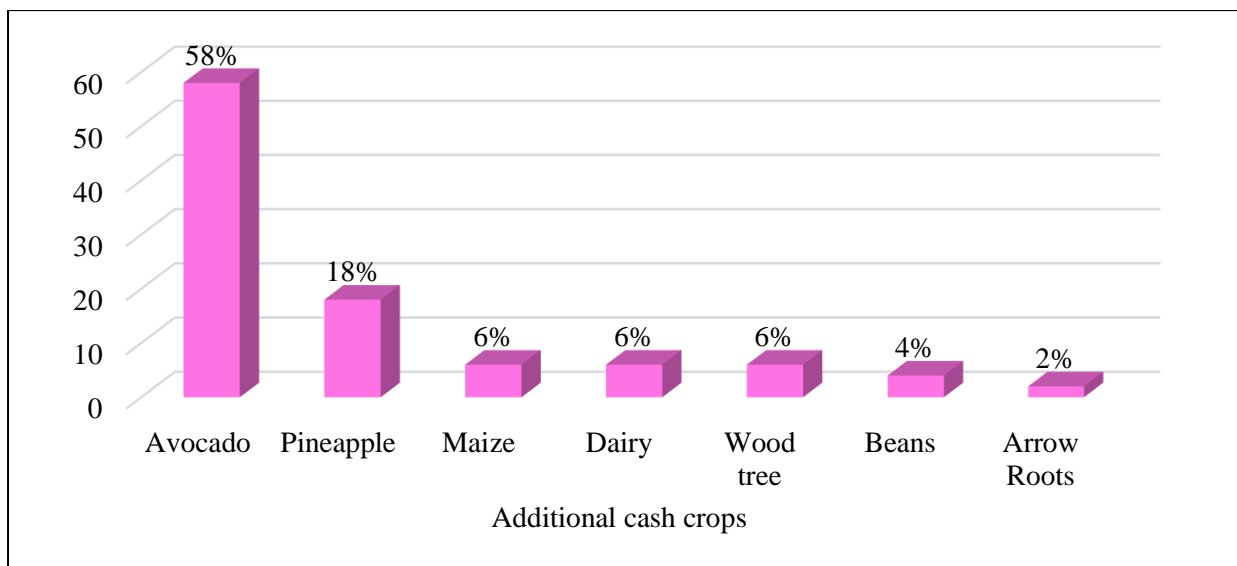
Plate 9: Maize farming alongside tea



Source: Field data, 2019

Findings as illustrated in figure 38 indicate that 58% of the respondents prefer to grow avocados alongside tea. This is attributed to the fact that avocado trees do not require much land and it can be intercropped with tea. Further, 18% of the responses gave preference to pineapples. They argued that pineapples are gaining popularity amongst tea farmers because when ripe they negotiate for prices themselves and they get instant cash unlike tea whereby they have to wait for annual bonuses. Maize, dairy and wood trees all take 6% of the responses, 4% were reported for beans and arrowroots take 2% of the responses.

Figure 38: Cash Crop Types Preferred for Diversification



Source: Field data. 2019

The study thus concludes that with reducing land size in Kirangi Sub-location, cultivation of avocado can be the most viable cash crop to households. The outcome of this study concerning cash crop diversification supports the study by Veenhuizen, (2007) which concluded that other cash crops such as horticulture in particular avocado is gaining popularity in the tea zone of Gatundu.

5.11.2 Non-Farm Income Diversification Activities

Households engage in non-farming income diversification to increase income apart from farming activities. It is a very essential economic activity that household can practice in areas where land sizes have become too small to accommodate agricultural diversification. Household in Kirangi Sub-location gets income from non-farm activities such as businesses, temporary contracts, employment, pension, gifts and remittances from children.

Table 45: Households' Non-Farm Activities

Source of income	Percent
Business	56.4%
Temporary Contracts	12.8%
Employment	12.8%
Pension	10.2%
Gifts	5.1%
Remittance from children	2.6%

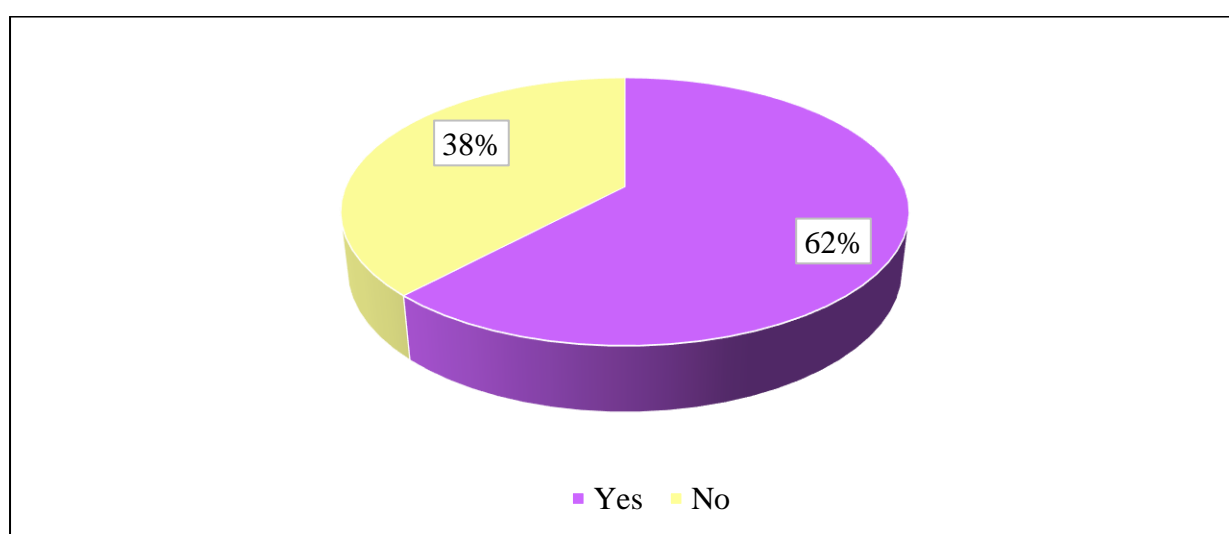
Source: Field data, 2019

Data in table 45 show that, the leading income non-farm activity is business with a percentage of 56.4%. This is attributed to the proximity of the area to Thika town and Nairobi city where residents go to conduct businesses. Temporary contracts and employment follow with 12.8% each, pension with 10.2% and gifts which is a significant income for 10% of the households. In addition, remittances from children contributes to household income as indicated by 2.6% of the households respectively. This agrees with the premise coined by Chapman & Tripp (2004) that agriculture alone is not an adequate measure of getting people out of poverty and that is why non-farming diversification comes in.

5.11.2.1 State of Non-Farm Income to Households

Respondents' opinions were sought concerning whether non-farm income activities boost their household incomes significantly.

Figure 39: State of Income from Non-Farm Activities to Households



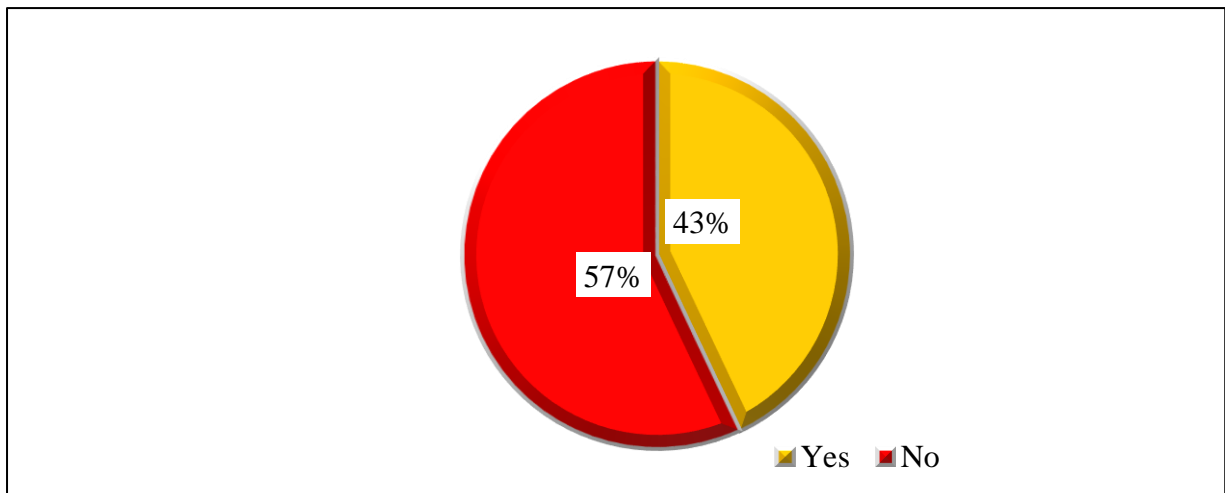
Source: Field data, 2019

As illustrated in figure 39, 62% of the respondents indicated that non-farm activities increase their household income against 32% who were for the opinion that their household income was not boosted. This supports the study by Berry (1989) that non-farm income diversification enable households to earn extra income that enable them to get other essential services such education and healthcare.

5.12 Household Food Sufficiency

Opinions were sought from the households whether farm produce sufficiently meet their household food needs. This was in quest to determine whether food crop farming is enough to supply households with sufficient food throughout the year. This would depict whether Kirangi households have food security.

Figure 40: Sufficiency of Food Crops to Households



Source: Field data, 2019

According to figure 40, 57% of the respondents indicated that food crop farming does not sufficiently meet household food requirements. On the other hand, the proportion of the respondents whose household food needs were met by food from their farms were 43%. This depicts that households in Kirangi Sub-location are not food secure. This is attributed to small land sizes set aside for food crop farming as evidenced by mean land size of 0.55 acres that the households in the region set aside for food crop farming. Another reason is low productivity in the area. Households practice traditional mode of farming that is no longer viable due to factors such as land degradation, reduced land sizes and adverse effects of pests and diseases.

5.12.1 Duration of the Harvested Food

Since majority of the households indicated that food crops does not meet their food needs, it was imperative to identify the duration of the harvested food among the households. According to data illustrated in table 46, the average number of months that the respondents use the harvested food crops is 6.5 months, with majority using the harvested food for 6 months. This however indicates that the harvested food is not sufficient to feed the households to the next harvesting season since most of the stable food crops such as maize are harvested once a year.

Table 46: Duration of the Harvested Food in Months

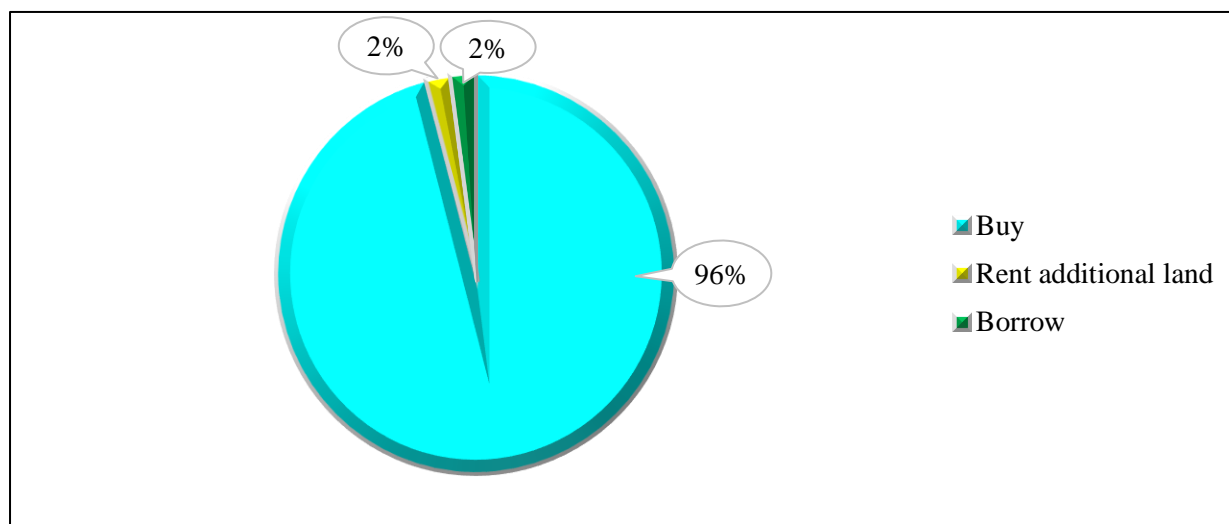
Mean	6.5
Median	5
Mode	6
Standard deviation	14.08
Variance	198.46

Source: Field data, (2019)

5.12.2 Ways of Supplementing Food Deficit by Households

Household devise mechanisms of obtaining extra food before the next harvesting season. Field data according to figure 41 indicates that most households which constitute 96% supplement food deficit by buying from the market or neighbors who have surplus produce. However, 2% of the households rent additional land to plant additional food crops. This is an indicator that households land size is too small to produce sufficient food. The remaining 2% borrow food from their neighbors, relatives and children.

Figure 41: Ways of Supplementing Food Deficit by Households



This is an indicator of poverty among some in households of Kirangi Sub-location who are not able to purchase additional food when the harvested produce is depleted. In a nutshell. It is evident from the above findings that households in Kirangi Sub-location are not food secure.

5.13 Household Financial Sufficiency

Rural households accumulate income from farm activities in order to meet household financial needs. Tea farmers mainly earn income from tea farming but some households find it insufficient. This makes them to engage in other farm activities such as planting of other cash crops outside tea as well as dairy farming.

5.13.1 Household Income from Tea Farming

The study sought to determine whether tea farming among the smallholder tea farmers in Kirangi Sub-location earn enough income to meet basic household livelihood needs.

Table 47: Average Land Size under Tea

	Land size under tea (acres)	Average income (month)	Average income (year)
Mean	1.67	11, 495	151,366
Median	1.25	5,000	98,800
Mode	0.75	4,500	54,000
Maximum	7	10,5000	840,000
Minimum	0.13	800	4,500

Source: Field data 2019

From table 47, the average household income from tea farming is Ksh 11,945 and Ksh. 151,366 per month and per annum respectively. However, respondents indicated that returns from tea farming does not meet their household financial needs. They argued that income from tea farming is very low a fact attributed to high labor costs hence household financial needs surpasses the proceeds from tea farming. They gave an explanation that they sell one kilogram of tea at Ksh. 18. Out of this, ksh.10 goes to labor (picking cost). This leaves them with approximately Ksh. 8 whereby other deductions are made by KTDA factories for transportation, fertilizer and other logistics. They eventually remains with a net profit of around Ksh. 5 which does not meet their household financial needs. This study however concludes that smallholder tea farmers in Kirangi sub-location are not financially secure. This is attributed to low tea prices, high cost of labor, poor

technologies, post-harvest losses, low production as well as low productivity among the households.

5.13.2 Financial Return from Livestock Farming

Dairy farming is a mechanism that households employ to boost household income. Zero grazing was reported by majority of the households since there are no vast land to practice free range dairy farming.

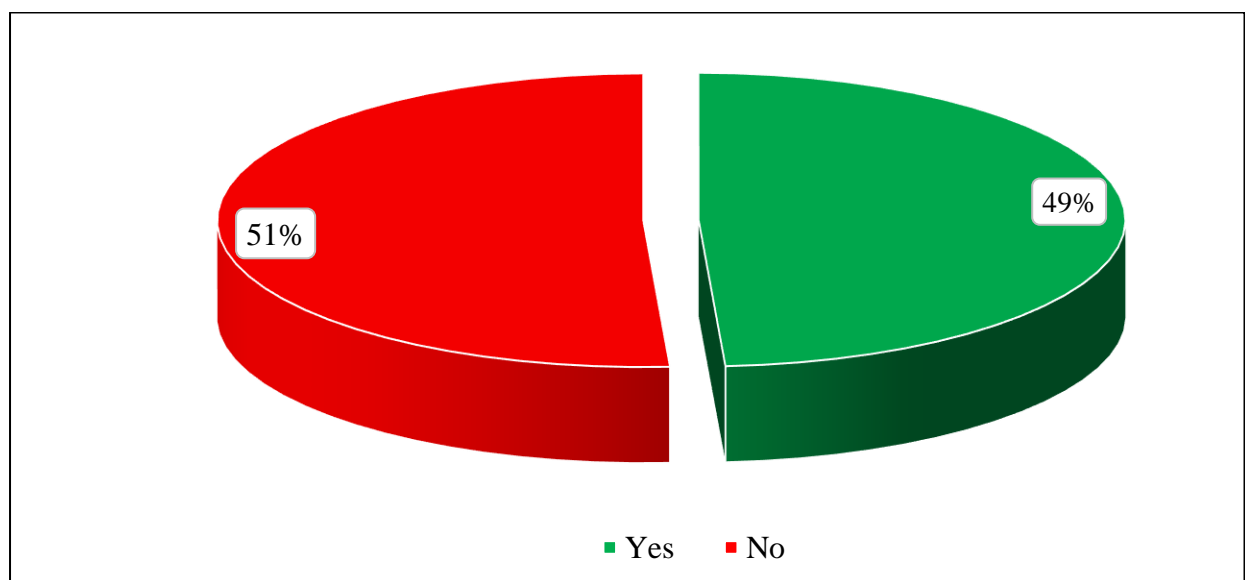
Table 48: Annual Returns from Livestock Farming

Mean	31,097.4286
Median	28,800.0000
Standard deviation	29,162.00461
Variance	850422512.952

Source: Field data, 2019

Findings in table 48 indicate a mean annual income of Ksh. 31,097. This is an indication that livestock production in Kirangi Sub-location goes beyond subsistence farming in majority of the households.

Figure 42: Whether Livestock Products Meet Household Needs



Source: Field data, (2019)

Figure 42 depicts a near equal proportion on the sufficiency of livestock to household needs. 51% of the responses indicates that household products do not sufficiently meet household needs. On the other hand, 49% of the household indicate that livestock produce meet their household needs.

In as much as households engage in livestock farming with an aim of boosting household income, this farming activity has not reached its maximum potential. This is constrained by poor breeds and high cost of feeds.

5.13.3 Financial Returns from Cash Crop Farming (Farm Diversification)

Essentially, the study sought to determine whether farming diversification sufficiently meet household financial needs of tea farmers in Kirangi Sub-location. This entails income from other household cash crop apart from tea.

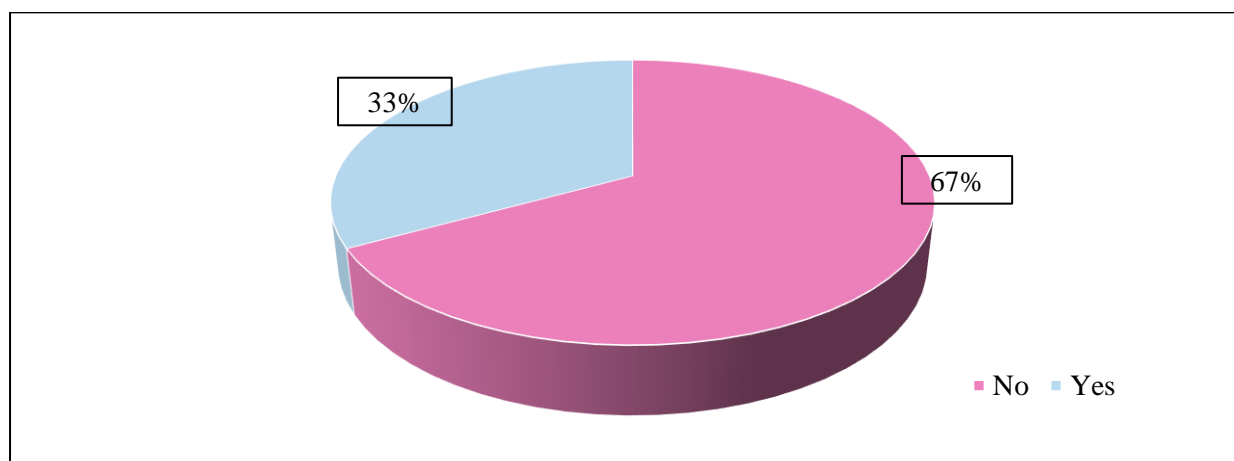
Table 49: Financial Return from Cash Crop Diversification

Mean	25240.1786
Median	9000.0000
Mode	3000.00
Standard deviation	35080.29700
Variance	1230627237.930

Source: Field data 2019

Tale 49 illustrates that the average annual income from cash crop diversification is Ksh. 25,240. This indicates that farming diversification has a great potential to increase household income significantly. This is in agreement with a premise by Falco et. al. (2010) that farmers who engaged in cash crop diversification performed better than those with only one cash crop due to economic benefits associated with crop diversification.

Figure 43: Whether Cash Crop Income Meet Household Needs



Source: Field data, 2019

However, according to figure 43, 67% of the respondents indicated that farm diversification does not sufficiently meet their household financial needs. On the other hand 33% indicated that farm diversification meets their household needs sufficiently. Low incomes from cash crop farming is attributed to poor land tenure and poor farming technologies.

5.13.4 Financial Returns from Non-Farm Income Activities

Table 50: Monthly Income from Off-Farm Activities

Mean	142,441.3793
Median	84,000
Mode	6,000
Standard deviation	211056.34576
Variance	44544781083.744

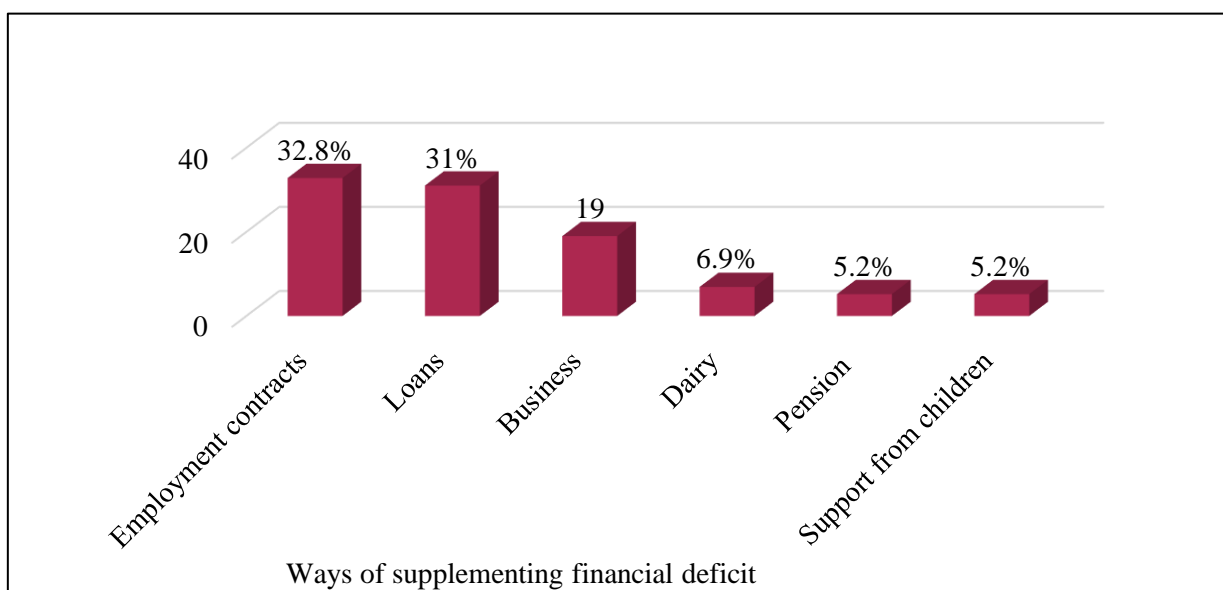
Source: Field data, 2019

According to table 50, the average annual income earned by households from non-farm activities is Ksh. 142,441 with a mean and mode of Ksh. 84,000 and 6,000 per annum respectively. This is an additional income to the household apart from other incomes from tea and other cash crops. Non-farm diversification contributes substantial income to households and should be recommended to rural households considering the fact that it does not utilize land which is becoming a scarce resource.

5.13.5 Ways in which Households Supplement Income Deficit

The premise that farming does not sufficiently meet the financial needs of most of the households warrant an inquiry into the approaches that households employ to fill the deficit. However, figure 44 illustrates that 32.8% of the respondents supplement financial deficit through looking for employment contracts; both formal and informal forms of employment. 31% indicated that their means of getting additional income is through borrowing of loans from banks and SACCOs. Other means of supplementing deficit are; conduction of businesses (19%), dairy farming (6.9%), pension and support from children both with (5.2%).

Figure 44: Ways of Supplementing Income Deficit



Source: Field data, 2019

5.14 Household Budget

The study sought to establish the household budget by comparing income versus expenditure. This was in quest to determine whether households in Kirangi Sub-location are able to meet their household livelihoods sufficiently.

Table 51: Expenditure by Households

Mean	22,378
Median	14,784
Mode	14,384
Standard deviation	24409.22313
Variance	595810173.643

Source: Field data, 2019

As shown in table 51, the average expenditure of households in Kirangi Sub-location is 22,378 with a median of 14,784 and a mode of 14,384.

5.14.1 Comparing Means of Expenditure with Income (Household Budget)

A comparison between household monthly income and the average monthly expenditure by household was conducted by computing a t-Test-paired sample statistics. Findings as indicated in table 52 demonstrates that household have an average income of Ksh. 10,521.26 per month

compared to monthly expenditure household mean of Ksh. 24,778.77. This depicts a deficit in household budget which is an indication of households' livelihood insufficiency.

Table 52: Household Mean of Expenditure and Income

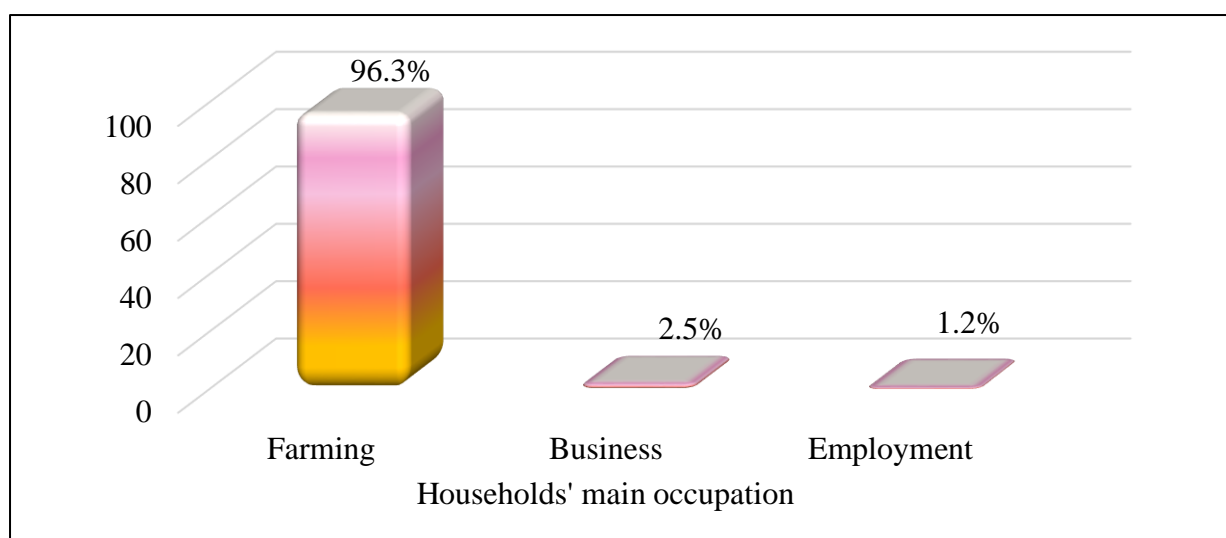
	Mean	N	Std. Deviation
Average income per month	10,521.2632	91	16982.00096
Total monthly expenditure	24778.7719	91	27304.19842

In a nut shell, this study however concludes that households in Kirangi Sub-location have not achieved sustainable livelihoods in terms of food and financial security. Lack of sustainable food and financial security is an indicator of poverty. Thus, this conclusion agrees with a report by The Central Bureau of Statistics (2005) which indicates that an average of 50.3 % of the people living in tea growing zones are living below rural poverty line (given as US\$ 0.55 daily incomes).

5.15 Households' Main Occupation

Occupation of the household head determines income and thus household livelihoods.

Figure 45: Main Occupation of Households' Head



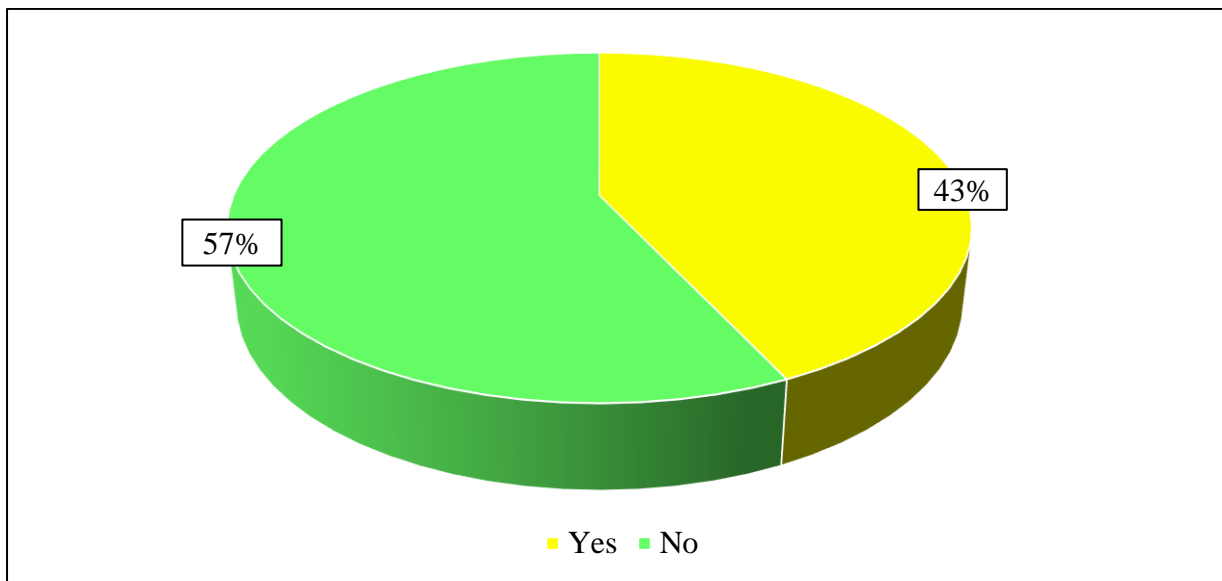
Source: Field data, 201

Figure 45 demonstrates that of 91 household heads that were interviewed, 96.3% were farmers. This indicates that farming in the region is a major source of livelihood. This is attributed to the fact that the respondents who had formal employment have retired, but majority of them did not have formal employment. 2.5% conduct businesses while 1.2% have formal employments.

5.16 Savings by Households

The study went ahead to determine people’s savings in Kirangi Sub-location. This helps to determine household’s financial security and household’s ability to caution themselves against uncertainties since savings enable households to respond to emergencies without much strain. On the other hand, savings provides financial security at old age as well as reducing dependency ratio after retirement.

Figure 46: Savings by the households



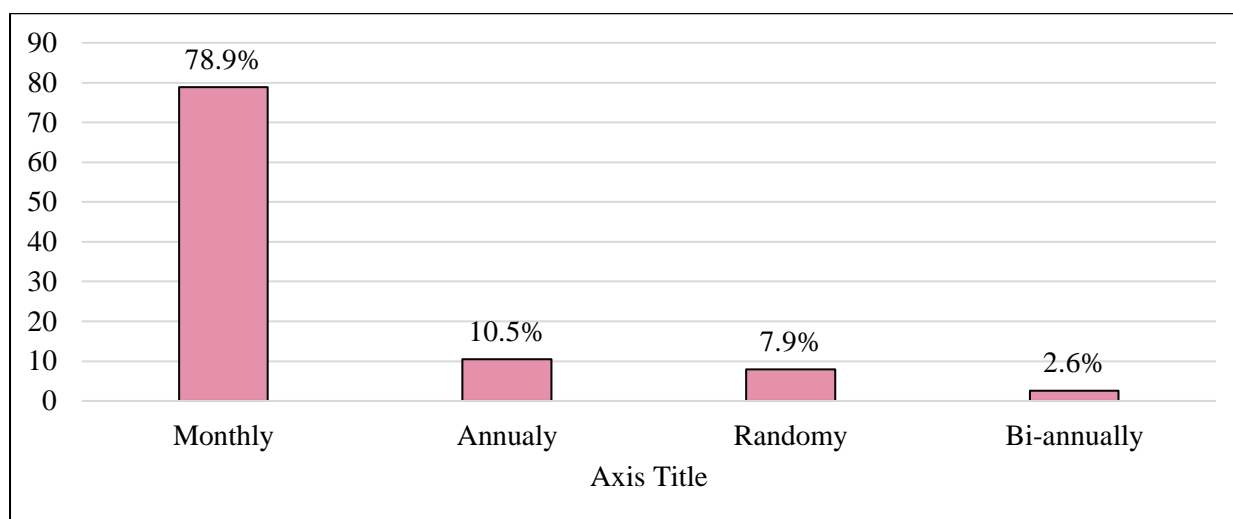
Source: Field data, 2019

As illustrated in figure 46, majority (57%) of households in Kirangi Sub-location do not save. Respondents argue that they have very little income and most of it goes to expenditure such that they are left with little or nothing to save. This is an indication of financial insecurity among households in Kirangi Sub-location. On the other hand however, 43% of the respondents save their money regularly.

5.16.1 Interval of Saving by Households

According to illustration in figure 47, 78.9% of the households save on monthly basis. This indicates that most of the households in Kirangi Sub-location have monthly incomes. 10.5% of the respondents save annually; these households depend on tea bonuses which are paid annually. 7.9% save randomly depending on the time the household gets income. 2.6% save two times a year.

Figure 47: Frequency of Savings by Households



Source: Field data, 2019

5.16.2 Reasons for Saving Households

Households were asked of the motive behind their saving. The study wanted to determine whether households have a common motive, and if savings make meaningful contributions to household individual needs.

Table 53: Reasons Why Households Save

Reasons for saving	Percent
Use in future and at old age	51.2%
Children education	19.5%
Investments	14.6%
Meet children’ needs	4.9%
Health expenditure	4.9%
Acquire loan	2.4%
Meet household needs	2.4%

Source: Field data, 2019

According to findings tabulated in table 53, the main reason for saving by households is for future use and particularly at old age as indicated by a proportion of 51.2%. This means that households caution themselves against future uncertainties when they will be having limited or no income. 19.5% of the responses indicate that households save in order to educate their children, an indication that households in the region value education. 14.6% of the households’ saving is directed to investments such as agriculture and business. Other reasons include; to meet children’

needs (4.9%), to meet health needs (4.9%), to acquire loan (2.4%) and to provide for household needs (2.4%). Generally, households understand that saving is very essential as it enable households to meet their needs.

5.16.3 Amount of Savings by Households

Table 54 illustrates that the average household monthly savings is 4,054.32. This depicts low savings by households when it is compared to average monthly expenditure by households of Ksh. 24,778. This is a reflection is a household vulnerability whereby households are not able to respond to life uncertainties.

Table 54: Amount of Savings by Households

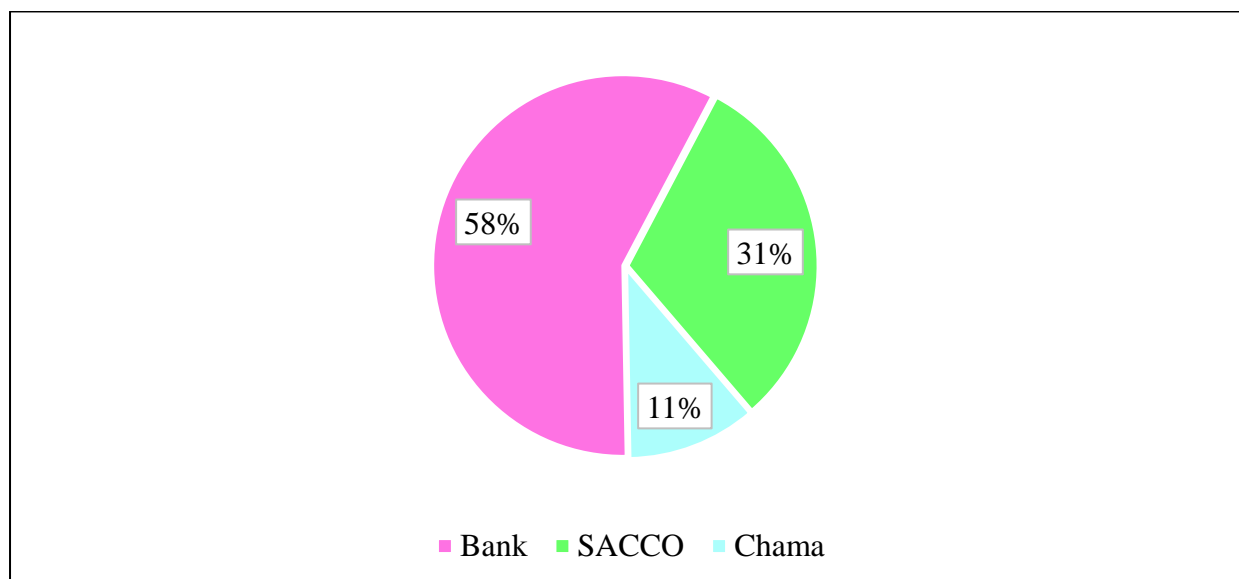
Mean	4,054.32
Median	1,000
Mode	0
Standard deviation	9975.58501
Variance	99512296.385

Source: Field data, 2019

5.16.4 Places Where Households Save

58% of the respondents prefer to save in banks since majority of them are tea farmers and thus they receive their payments through banks.

Figure 48: Preferred Places for Saving by Households



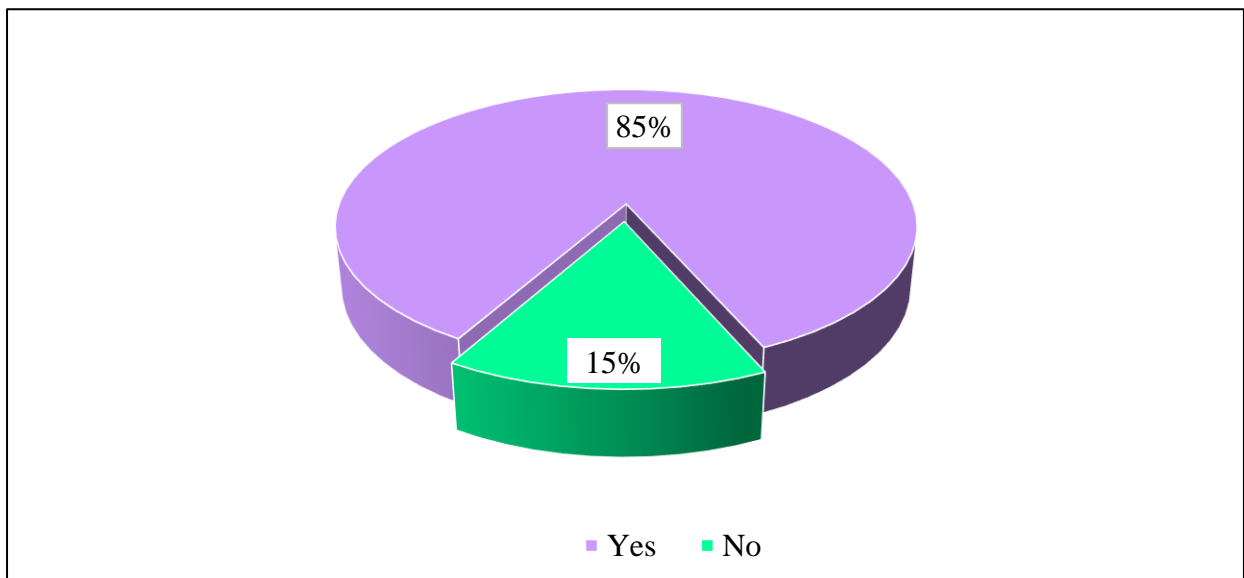
Source: Field data, 2019

While 31% prefer SACCOs, 11% save in *Chamas*. SACCOs are preferred by both the male and female while *Chamas* are mostly preferred by female. This is according to analysis of field data in figure 48.

5.16.5 Households' Ability to Access Loans

Loans are very essential since it enables households to meet financial obligations through pooling of funds. Thus, the study aspired to determine whether households in Kirangi Sub-location have the ability to acquire loans.

Figure 49: Households Ability to Access Loans



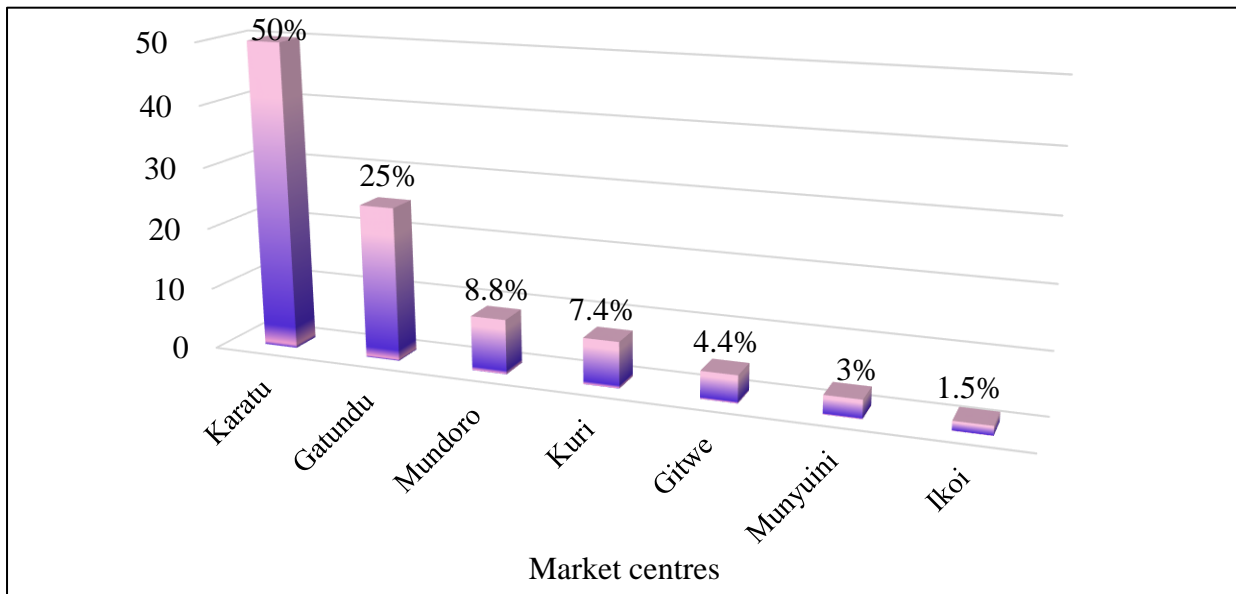
Source: Field data, 2019

According to data in figure 49, 85% of the respondents are eligible to access loans. This is because they have savings in banks and SACCOs that warrant them loans. However, 15% do not have access to loans.

5.17 Open Air Markets

The aim of studying markets in Kirangi Sub-location was to determine whether residents have open air markets to dispose of their produce. Market is a source of livelihoods to most of the rural households since it enable households to earn income through selling of farm produce and trading. It is noted in figure 50 that the majority of the households trade at Karatu as reported by 50% of the respondents. 25% of the respondents mentioned that they go to Gatundu market. The other open air markets that were highlighted by the respondents are Mundoro (8.8%), Kuri (7.4%), Gitwe (4.4%), Munyuini (3%) and Ikoi (1.5%).

Figure 50: Open Air Markets

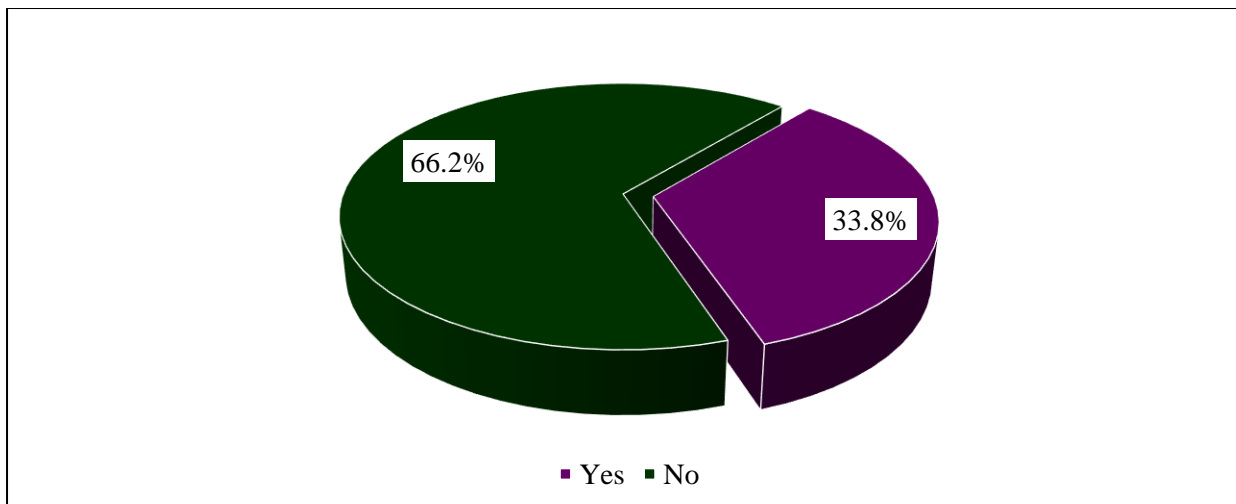


Source: Field data, 2019

5.17.1 Functionality of Markets

The study wanted to identify whether the open air markets in Kirangi sub-location are still operational and if they meet the needs of the people. As illustrated in figure 51, 66.2% of the respondents reported that the markets are no longer functional while 33.8% termed the markets are operational.

Figure 51: Functionality of Open Air Markets



Source: Field data, 2019

5.17.2 Reasons for Market Dormancy

As earlier indicated that some markets are no longer operational, the following reasons may have contributed to its dormancy.

Table 55: Reasons for Market Dormancy

Reasons for dormancy	Percent
Low farm production	31.4%
Middle men	25.7%
Mushrooming of other small markets	22.9%
Transport challenges	14.3%
Roadside markets	5.7%

Source: Field data, 2019

As illustrated in table 55, 31.4% of the respondents attributed market dormancy to low agricultural production. As tea farming is the most dormant farming activity, tea produce is taken to tea buying centers and not markets. Other farm production are near subsistence farming. However, 25.7% of the responses blamed middle men who buy produce at farm level and thus the produce does not reach the market. On the other hand, 22.9% indicated that there are small undesigned markets which are mushrooming and thus prevent traders from reaching the designated markets. Transport challenges are still experienced in the area as indicated by 14.3% of the respondents. This makes transportation of good cumbersome. Finally, 5.7% mentioned that roadside sellers have led to diminishing of the designated market places.

5.17.3 Reasons for Continued Operation of the Markets

As indicated by 38.8% of the respondents that markets are still operational, reasons given for their continued operation are indicated in table 56. However, 31.8% of the respondents attributed the continued operation of the markets to good number of customers that the markets serve. This is due to traders who go to the market to trade. It was noted that 22.7% of the respondents indicated that the markets are located at central places where both customers and sellers can access. 13.6% attributed continuous growth to good transport network. Other factors that has seen the growth of the markets are; continued agricultural production, need for trade and heterogeneous produce, each with 9.1% of the responses and finally upgrading to modern markets was indicated by 4.5% of the respondents.

Table 56: Reasons for Continued Operation of Markets

Reasons for continued operation	Percent
Good customer base	31.8%
Central location	22.7%
Good transport network	13.6%
Continued production of farm produce	9.1%
Need for trade	9.1%
Heterogeneous goods	9.1%
Upgrading to modern markets	4.5%

Source: Field data, 2019

5.18 Hypothesis Testing

5.18.1 Land Size of Parents and Land Size of the Respondents

The study sought to compare the average land size of the land that was owned by the respondents' parents with the average land size currently owned by respondents. A paired-sample T- test was performed to test the following null hypothesis.

H₀: The household land size has not reduced significantly since land was consolidated in the study area.

Table 57: Owned Family Land Size and Parents Land Size

Paired sample statistics	Mean	N	Std. Deviation	Std. Error Mean
Pair 1 How many acres was your Parents' land?	15.0431	75	13.74106	1.30615
What is the total owned family land size?	3.2321	75	2.65137	.58668

Results in table 57 shows that respondents own smaller parcels of land (Mean = 3.23, SD= 2.65) than their parents (Mean= 15.04, DS= 13.74).

To determine whether the difference of the test was significant, a repeated measured t-Test was conducted using the formula; $t(df) = t \text{ value}, p = p \text{ value}$.

Table 58: Paired Samples Test

	Mean	Std. Deviation	Std. Error Mean	99% Confidence Interval of the Difference		t	df	Sig. (2-tailed)
				Lower	Upper			
How many acres was your parent's land? What is the total owed family land size in acres?	11.81100	13.12426	1.51546	7.80426	15.81774	7.80	74	0.000

However, results as shown in table 58 found out this difference to be highly significant; $t(74) = 7.80$, $p < 0.000$ and therefore null hypothesis is rejected. Together, this suggest that household land size has reduced significantly since land was consolidated in the study area.

5.18.2 Land Size and Production

The following null hypothesis was tested in terms of land size and production

H₀: The household land size does not determine household farm production.

A bivariate correlation was conducted using Pearson product moment correlation coefficient in order to determine how land size and production correlate. Findings in table 59 indicate that there is a moderately positive relationship between land size and production. This was indicated by r - value of 0.421. However, the study reveals that there is a very strong significant relationship between land size and production as supported by a P value of 0.000 which is lower than 0.001. Thus the null hypothesis is rejected.

Table 59: Land Size and Production

Correlations		Land size
Land size	Pearson Correlation Sig. (2-tailed)	1
Production	Pearson Correlation Sig. (2-tailed)	0.421 0.000

5.18.3 Household Land Use and Food Sufficiency**Table 60: Chi Square Results of the Number of Household Land Use and Household Food Sufficiency**

Chi square tests	Value	df.	Asymptotic. Significance (2-sided)
Pearson Chi-Square	77.220	74	.316
Likelihood Ratio	66.814	74	.651
N of Valid Cases	47		
*Significant at ≤ 0.05			

According to analysis of data in table 60, household food sufficiency had a chi square value of 77.220 and a P value of 0.316. Therefore, households that undertake more than one agricultural land use at the same time do not have higher food sufficiency than households with only one agricultural land use at a time. On the other hand, households that undertake more than one agricultural land use at the same time do not have higher financial returns than households with only one agricultural land use at a time. This is indicated by P value of 0.904 which is higher than 0.05 as indicated in table 61.

Table 61: Chi Square Results of the Number of Household Land Use and Financial Returns

Chi square tests	Value	df.	Asymptotic Significance (2-sided)
Pearson Chi-Square	7.706 ^a	74	0.904
Likelihood Ratio	8.916	74	0.836
N of Valid Cases	91		
*Significant at ≤ 0.05			

Based on the findings, undertaking more than one land use has not improved food sufficiency because of low production. On the other hand, household financial returns also has not improved, a fact that is explained by the fact that households reported to cultivate small land parcels of land therefore the produce is for subsistence only.

5.18.4 Households Off-Farm Livelihood Activities and Household Income

The following null hypothesis was tested in terms of households' off-farm activities and household income by carrying out an independent sample t-Test at 95% confidence level.

H₀: Households with off-farm livelihood diversification strategies do not have significantly higher household income than those without off-farm livelihood diversification strategies.

It was established that the households whose income was improved by off-farm activities had a mean of Ksh. 184,419 incomes per annum. While households whose income was not improved recorded a mean of Ksh. 32,250 incomes per annum as shown in table 62.

This shows that there is a significant difference in the average income of households with off-farm diversification strategies and households without off-farm diversification strategies. Null hypothesis is rejected since $P=0.002$ which is less than 0.05. This supports a premise that was developed in a study by Berry, (1989) that non-farm income diversification enables households to earn extra income that enable them to get other essential services such education and healthcare.

Table 62: Household Off-Farm Activities and Income

Do off-farm activities increase household income significantly?	N	Mean	Std. Deviation	t	Significant (2-tailed)
Estimated amount Yes	184,419.05	91	234859.60	1.804	0.002
Per year No	32,250	91	37666.77	2.874	

5.19 Correlation Analysis

Spearman’s rank correlation was computed in a quest to establish how well the variables correlate. Spearman rank correlation was chosen since it accommodated all variables, quite strong, exhibit the expected direction and is significant at $P < 0.05$. Table 64 demonstrates the computed correlation of elected variables.

High positive correlation was recorded by food sufficiency which correlate to age of household head with $r = 0.94$. It was followed by Household farm production that was highly correlated to age of household head ($r = 0.92$) followed by household income which correlate to household farm production with $r = (0.696)$. Household size negatively correlated with household land size with $r = -0.063$ followed by household income which correlated negatively with household income with $r = -0.114$. Generally, the variables exhibited weak to moderate correlation.

Table 63: Correlation Results of Selected Variables

	Parents' Land size	Household Land size	Number of Land uses	Household income	Food Sufficiency	Financial sufficiency	Age of household head	Household size	Off-farm income activities	Household farm production
Parents' Land size	1									
Household Land size	0.408	1								
Number of Land uses	0.092	0.148	1							
Household income	0.286	0.433	0.158	1						
Food sufficiency	0.493	0.526	0.202	0.157	1					
Financial sufficiency	0.107	0.433	0.152	0.140	0.303	1				
Age household head	0.238	0.140	0.009	0.316	0.94	0.035	1			
Household size	-0.277	-0.063	0.135	-0.114	-0.299	0.331	-0.191	1		
Off-farm income	0.258	-0.155	-0.166	0.199	0.295	0.230	-0.242	-0.291	1	
Household farm production	0.557	0.421	0.220	0.696	0.411	0.457	0.92	0.058	0.259	1

5.20 Land Use Planning Interventions for Sustainable Rural Livelihoods

The following proposals were put forward towards realizing sustainable livelihoods among smallholder tea farmers of Kirangi Sub-location.

5.20.1 Land Size Change

According to data by Uniliver Kenya 2018, 1 acre of tea earns household net income of Ksh. 94,000. The ideal land size that can sustain a household of 5 members is 2.1 acres. However, the average household land size in Kirangi Sub-location is 1.67 acres. This translates to household income of Ksh. 156,000. According to data analysis of land size change, household land size is predicted to reduce by 59% giving a mean land size of 1 acre likely to be owned by respondents' children. Basing on this, the average income likely to be received by children from tea farming is Ksh.94, 000. A comparison is made with the Kenya National Bureau of Statistics Household survey of 2015/2016 which indicates that a household in rural Kenya with an average of five people must have an average income of Ksh. 195,120. It is evident that households currently do not meet the required household income with average household income of Ksh.156, 000. In addition, respondent's children will receive minimal income of Ksh. 94, 000 against the required Ksh.195, 000. This is attributed to diminishing household land size. This conclusion is true if households were to depend entirely on income from tea farming. However, this holds true since according to the research findings, households in Kirangi Sub-location does not realize substantial income from income diversification activities both farm and non-farm diversification activities. This study thus proposes that land use planning should focus entirely on ensuring that farm diversification enables households to earn extra income that tops up to enable households meet the required minimum household income in order to achieve sustainable livelihoods.

5.20.2 Minimum Land Size

To curb the challenge of diminishing land size, tea factories should set land floor of 2 acres. They should register up to a minimum of 2 acres of tea farm in order to prevent land subdivision of land beyond 2 acres. This is because the study found out that 2 acres is sufficient to meet household livelihood needs at Kirangi Sub-location. The study found out the average household land size of tea farms in the area to be 1.67 acres. However, for households to achieve the required minimum land size, land consolidation should be done at household level. Land consolidation was found to work best at household level. Respondents expressed fear of regional land consolidation because they feared that they might lose identity to their lands. This fear is due to

the Mau Mau case whereby their lands were taken by European settlers. Upon the return of the European, the ruling government did not give the land back to the rightful owners. In this case, they argued that heirs should consolidate their inherited land and develop jointly and share proceeds afterwards. In addition, households should exercise zoning. Heirs should concentrate homesteads in one particular area of the land, preferably by constructing high rise buildings that utilize minimum space. This enables them to have ample land space for farming. Large land parcels enable farmers to enjoy economies of scale which translates to increased income for households. However, some respondents opposed the construction of high-rise buildings in the homesteads because they felt that they are too old to adapt to it.

On the other hand, households can achieve the required minimum land size by purchasing extra pieces of land. When good pricing together with optimal productivity is achieved in the area, the increased income will enable households to purchase extra pieces of land. This study proposes that tea factories should sensitize and help tea farmers to set aside fixed savings account that accumulates income for purchasing of extra land. When households have other sources of income to meet daily needs, annual bonus can be sufficient to purchase additional land.

In a nutshell, the respondents argued that if there is any strategy to stop land subdivision, it should first begin by negotiating with the people and especially children and the youth who are anticipating for land inheritance. According to them, land subdivision is a voluntary will which should not be imposed on the people. People do out of pure will if they understand the effects of land fragmentation and also if they see the essence of land consolidation. They continued to argue that compelling people stop land subdivision and adopt land consolidation will not only lead to conflicts and animosity among the people since they will be acting out of sheer ignorance and speculations. They added that household heirs should be educated on the challenges of land subdivision and how land consolidation will bring about prosperity to them.

5.20.3 Household Land Uses

Households in Kirangi Sub-location have varied land uses. The major land use include tea farming, cash crops farming outside tea and livestock farming. Other cash crops grown in the area is mainly avocado, macadamia, pineapple and vegetables. Livestock farming on the other hand entails poultry and dairy farming. Land use diversification would bring additional income to households which is not the case among the households in Kirangi Sub-location. This study however concludes that households engage in growing a wide range of cash crops that does not earn substantial income to households. In this regard, majority of the households could not

substantiate the amount of income from other cash crops apart from tea. This study however proposes that household in Kirangi Sub-location should practice tea farming and one other cash crops. This enables the households to reap from specialization. It is however proposed that households should practice avocado farming since it does not require large parcels of land. Avocado is ideal for intercropping with tea. Kirangi soils supports the growth of avocado. In addition, avocado provides the needed shade for tea plants in addition to acting as shades in the compound while at the same time enhancing aesthetics. It is worth noting that avocado has a ready market considering the proximity of Kirangi to Nairobi city. On the other hand, mechanisms were put in place by the Kenyan Government towards the exportation of avocado.

Food Crops; Major food crops in Kirangi Sub-location include beans, potatoes, maize, bananas, vegetables and arrowroots. Maize requires large size of land in order to meet household food needs. This study however proposes that households does not need to grow maize since it can be sourced from neighboring counties. The county government of Kiambu should ensure that there is enough supply of maize especially during the harvest seasons in neighboring counties that ensures steady supply for households. The study found it viable for the households to grow bananas, vegetables and arrowroots for food. Bananas is selected because it can be grown in farm terraces a measure to prevent soil erosion in slopes as the regions has undulating landscapes. Also, bananas can be grown in farm boundaries especially on the roadside or towards the river. On the other hand, arrowroots was selected mostly for households who have wetlands. Arrowroots will provide food to the households and at the same time protect river banks from erosion which would result in siltation. Arrowroots farming should be well managed and commercialized as this will not only feed the households but it can produce surplus produce for sale. The average land size for food crops by households in the area is 0.3 acres. 57% of the respondents indicated that land left for food production is not sufficient to meet household food needs. However, there is a need by households to intensify food crop farming especially in growing of vegetables. Vegetables are crucial in meeting daily nutritional diet needs and with its perishability, it is better to grown by households than purchased. Use of greenhouses comes in handy by enable households to maximize on small land parcels while at the same time achieve output that is sufficient to meet household food needs and remain with surplus to sell and earn income. In addition to intensive farming techniques, households need to adopt modern farming technologies.

Livestock Farming; Findings of the study registered that households in Kirangi Sub-location keep diverse types of livestock. The major ones include; dairy poultry, goats, sheep and rabbit. Dairy was the leading type of livestock as recorded by 65% of the respondents followed by poultry

with 16%. In this regard, the study proposes that households should specialize in dairy and poultry farming. This is based on the fact that poultry and dairy farming enable households to earn daily income instead of annual tea bonus which they find unsustainable. Daily income enable households to meet daily livelihood needs while annual bonus can be used to invest in huge projects such as purchasing of additional household land. In addition, there is a ready market for milk and eggs in Nairobi city. On the other hand, these two practices does not require much land. It is advisable that households practice zero grazing as free range demands a bigger space. With good management of both dairy and poultry, the returns are sufficient to meet cost of feeds and labour leaving the farmer with reasonable profits,

5.20.4 Household Diversification Strategies

Off-Farm Diversification Activities; Households indicated that they participate in off-farm diversification activities. Off-farm activities enable households to earn additional income and at the same time they are able to cushion themselves from shock facing farm activities such as adverse environmental effects. 56.4% of the respondents indicated that they engage in business as a form of non-farm diversification activity. This is an indication that businesses have a potential of boosting household income as 62% of the respondents indicating that household income was boosted by off-farm activities. In this regard, the study proposes that households should engage in business activities considering the proximity of the area to Gatundu, Thika, Kiambu and Nairobi City where businesses can be conducted. Jobless youths should tap the opportunity of transporting readily available farm produce ranging from milk, eggs, avocado, vegetable and pineapple to the aforementioned urban area. Apart from trading in farm produce, other range of businesses can as well be established in the urban areas. The county and sub-county government officials should come up with programs that educate the youth on such opportunities. In addition, they should educate the youth on the availability and means of getting loans and grants such as Youth Fund and Uwezo Fund which can be utilized by the youth to conduct businesses.

Creation of job opportunities for the youth should be made a priority in plans to avert land subdivision. Respondents indicated that their children are jobless and thus they depend on their parent's land for income. Extreme extend is that some demand a share in family land whereby they sell in order to obtain money to start businesses. This makes them to remain will little or no land to inherit, a factor which has contributed mainly to reducing land size and fragmentation.

With the farm potential base of Kirangi Sub-location, the area needs the construction of processing plants for milk and avocado as well as an eggs and meat depot. Such processing plants ensures ready market for the produce and sustainable income for the farmers. On the other hand, it provides employment to the residents which is a form of off-farm activity. A case scenario is conducted on a milk processing plant. A zero-grazed well managed dairy cow produces an average of 20 to 60 litres of milk per day daily. However, we shall compute using the average which is 40 litres. A medium-size milk processing plant is proposed for Kirangi Sub-location which handles 20,000 to 1,000,000 litres of milk per day. Working with the average, this plant will operate of 500,000 litres of milk per day. Households in the area needs to produce average of 500,000 litres of milk in a day in order to sustain the milk plant. There are 6461 households in Ndarugu Ward whereby Kirangi is one of the sub-locations meaning that each household should produce at least 77 litres of milk per day. This is equivalent to average of 2 dairy cows per households. This size of milk plant requires an average of 100 personnel who are involved in the milk processing activities, corporate office as well as milk product distributors.

Income diversification both farm and non-farm is very crucial for households. Dependence on tea farming alone put households at risks since households may not be able to withstand or recover from shock in case of global price fluctuation, environmental hazards as well as global pandemics. For instance with the current scenario of the global Covid-19 pandemic, depending entirely on tea exports may be very challenging because of the reduction in global tea prices. In a situation whereby exports are halted completely, tea farmers who may not be having other streams of income may be adversely affected.

CHAPTER SIX

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

This chapter summarizes on the study findings that have been discussed in chapter five in line with the objectives of the study. It will form a basis upon which relevant conclusions and recommendations are made.

6.2 Summary of the Findings

This section makes summary of the findings from the analysis. This is done in line with the objectives of the study.

6.2.1 Household Land Size Change since Land Consolidation

The first objective of the study was to determine the land size change in the study area. To deduce land size change, the study begun by looking into the land size. First, land size of the respondents' parents was to determined, followed by land size of the respondents and finally land size that the children of the respondents are likely to inherit. In a nutshell, this is track of land size from grandparents to grandchildren.

The average land size of the respondents' parents was 14.8 acres compared to land size of the respondents which has an average of 3.2 acres. The average land size that respondents' children are likely to inherit is 1 acre for sons and 0.7 acres for daughter. This demonstrates a tremendous reduction in land size change from 14.8 acres by grandparents to 1acre by grandchildren. Percentage change in land size from respondents' parents to respondents is 78.38%, while percentage land size change from respondents to their children is 78.3%. Finally, land size change from grandparents to grandchildren is 93% for sons and 95% for daughters.

The study computed the minimum land size that is insufficient for tea farming by households at optimum production in Kirangi Sub-location. However, findings indicate that the average minimum land size of 2.1 acres is sufficient to meet household needs. This is in comparison with the existing mean household land size under tea of 1.67 acres.

6.2.2 Household Land Uses and Respective Financial Returns and Food Sufficiency

The second objective of the study was to establish the existing household land uses and respective financial returns and food sufficiency in Kirangi sub-location. From the data, findings indicate that land uses in Kirangi Sub-location entails cash crop farming, food crop farming, horticulture

farming, dairy farming and poultry farming. The major land use is crop farming comprising both cash crops and food crops which was indicated by 50% of the respondents. Fruticulture, mostly the cultivation of macadamia and avocado follows in the second position with 25%. Poultry was reported by 15% of the respondents while dairy recorded 10% of the responses.

With cash crop farming, of the 91 households that were interviewed, 98 planted tea. 96 of the total households had avocados, with 40 engaging in pineapple farming. While 40 households had macadamia trees, 10 households planted napier grass. This is an indication that tea farming is the leading cash crop in the area. Average land size with other cash crops apart from tea is 0.55 acres. Major cash crop is tea occupying an average of 1.67 acres. This indicates small-scale cash crop farming in the area.

The major types of food crops in the area include; beans, potatoes, maize, bananas, vegetables and arrowroots. 39.2% of the respondent's farm beans, while 19.6% grow potatoes. These are the staple food in the area. Maize was reported by 15.7% of the respondents while both bananas and vegetable had 11.7% of the responses. Finally, arrow roots was recorded by 2% of the respondents. The average land size under food crop farming is 0.3 acres which indicates small scale food farming, a possible threat to food security and sustainability to households.

Livestock farming to a larger extent is also a major land use in Kirangi Sub-location. 76% of the respondents indicate that they keep livestock while 24% do not keep livestock. The type of livestock kept in the area include dairy cows, poultry, goats, sheep and rabbits. The average land size under livestock farming is 0.3 acres indicating small-scale livestock farming in the area.

67% of that households indicated that financial returns from various household land uses do not meet their household financial needs. On the other hand, financial needs of 33% of the households were met sufficiently by various land uses. Financial returns from various land uses in the area were as follows; cash crops recorded an annual average income of 25,240 per annum. More specifically, tea annual income had an average of 151,366. This is an indication that tea is the highest income earner compared to all other cash crops combined. On the other hand, livestock farming contributes an annual average income of 31, 097. Households indicated that food crop farming is majorly for subsistence farming and the small sales made are negligible.

Food security and sustainability households of Kirangi Sub-location is still a challenge as 57% of the households indicated that food farming does not meet household food requirement. However, 43% of the households indicated that food crop farming is able to meet household food requirement sustainably. The average number of months that the harvested food last in the

households is 6.5 months with majority lasting only for 5 months. This indicate that households have to look for an alternative source of food to take them to the next harvest season. This depicts that households in Kirangi Sub-location are not food secure.

6.2.3 Household Livelihood Diversification Strategies and Respective Financial Returns

The study findings reveals that majority of the households engage in income diversification, both farming and non-farming income diversification activities. 82.4% of the households do farming diversification by growing other cash crops alongside tea while 17.6% prefer specialization in tea farming only. Cash crops preferred for diversification are; avocados, pineapple, maize, dairy, wood tree, beans and arrow roots. Avocado farming is the most preferred cash crop for diversification by households, with 58% of the total responses. This is because avocado farming does not requires much land and in most cases it is intercropped with other crops preferably tea. 18% of the households prefer pineapple farming, while maize, dairy and wood tress all had 6% of the household's preference. 4% of the households diversify with beans and finally 2% chose arrowroot farming. Household financial returns from crop farming diversification is an average of 25,240 annually. This is a substantial contribution to household income.

Consequently, off- farm income activities entails; businesses, temporary contracts, employment, income from pension, gifts and remittance from children. The most preferred non-farm income diversification is business with household response of 56.4%. However, 12.8% of the households increase their income by sourcing for temporary contracts. The same proportion seek for employment opportunities. 10.2% of the households depend on income from pension; as majority of the respondents were past the retirement age, this depict a proportion of the households who have retired. Gifts and remittances from children is still considered an additional source of income to households with a proportion of 5.1% and 2.6% of the total responses respectively. Financial returns from non-farm income diversification to households in the area recorded a mean of 142,441.

6.2.4 Land Use Planning Interventions for Sustainable Rural Livelihoods

The study established that land has reduced significantly in the study area. The current household land size is not sufficient to meet household needs. The ideal land size that is sufficient to meet household needs at the current production level is 2.1 acres against the available household land size of 1.67 acre. This translates that households do not realize have sufficient food and financial needs from the existing household land size. This has been attributed to low farm productivity

Minimum land size has been set at 2 acres which is the ideal land size for households in Kirangi Sub-location. However to achieve this, factories should restrict registration of tea farm to 2 acres. In addition, land consolidation at household level is advocated for. Land productivity enables households to earn substantial income that can be used to purchase extra pieces of land to meet the required minimum threshold.

The study witnessed varied land uses among the households of Kirangi Sub-location. Such land uses include tea farming, farming of others cash crops, food crops and livestock farming. Tea is the major land use. Other cash crops outside tea include cultivation of pineapples and avocado. Food crops in the area include maize, beans, potatoes and arrow roots. Dairy farming practiced in the area entails dairy farming and poultry farming. In this regard, with varied land uses, households should adopt modern farming technologies that adopt intensive farming techniques. This enables households to maximize on the small land holdings while reaping maximum benefits. This include the use of green houses and zero grazing for dairy farming.

Households engage in income diversification activities. They include both farm and off-farm diversification strategies. Off-farm activities was found to contribute more income tpo households that farm diversification. Business activities have the potential of boosting household income. This off-farm activity is advocated for by this study owing to the proximity of Kirangi to Nairobi City, Kiambu and Thika towns. In addition, business activity does not compete for the limited land holdings. Jobless youths can transport farm produce to the towns where large populations presents ready market. Farm diversification enable households to spread their income sources as well as caution themselves from risks. With farm diversification, households are encouraged to concentrate on two cash crops rather than many cash crops. Specialization enables households to realize substantial income. Value addition of farm produce in Kirangi enables households to earn sustainable income from farm produce. In addition, value addition creates employment for residents. Dairy, avocado and pineapple's presents opportunities for establishment of processing plants.

Income diversification both farm and non-farm is very crucial for households. Dependence on tea farming alone put households at risks since households may not be able to withstand or recover from shock in case of global price fluctuation, environmental hazards as well as global pandemics. For instance with the current scenario of the global Covid-19 pandemic, depending entirely on tea exports may be very challenging because of the reduction in global tea prices. In a situation

whereby exports are halted completely, tea farmers who may not be having other streams of income may be adversely affected.

6.3 Conclusions

The study sought to appraise land use for sustainable rural livelihoods in Kirangi Sub-location. Based on the findings, the study made the following conclusions.

Land size in Kirangi Sub-location has reduced significantly, a factor that is attributed to land fragmentation. The average household land size in the area is 3.2 acres. This is linked to land inheritance among the household heirs. It was clearly depicted that land inheritance is highly regarded in the area and household's heads indicate that children have the rights to land inheritance. Consequently, household heads plan to subdivide land to their children. Reducing land size has serious consequences on agricultural production, in terms of both income and food security. Households indicated that small land size has led to low output that leads to low incomes. On the other hand, majority of the household's experience food shortage a phenomenon linked to small agricultural lands. This has adverse effects on the general food security and household's livelihoods. This is in agreement with a study by Syagga (2006) that there are small land holdings in Gatundu South with an average land size of 2-3 acres.

According to the findings of the study, the mean minimum household land size for tea farming that can sustainably meet household needs at the current production levels is 2.1 acres. However, comparing with the current average household land size under of 1.67 acres, there is a deficit in household land. To achieve the ideal land size, consolidation at household level should be considered. However, the study concludes that households can still achieve sustainable income with the existing land holdings by employing proper farming technology as well as intensive farming techniques.

The study concludes that households of Kirangi Sub-location prefer varied land uses ranging from cash crop farming, food crop farming, horticulture farming, dairy farming and poultry farming. The major land use however is cash crop farming and particularly tea farming. Cash crop farming is given the highest proportion of land than other farming activities which recorded an average land size of 1.67 acres for tea and 0.55 acres for the other cash crops. Food crop farming on the other hand occupy small portions of household land with an average land size of 0.3 acres a factor that contributes to food insufficiency among the households. This is in line with a study by Ndege (1995) which concluded that agriculture is a major land use in Gatundu in particularly cash crop farming.

The study reached a conclusion that households in Kirangi Sub-location have not achieved sustainable food and financial security. 57% of the respondents indicated that food crop farming does not meet household food needs against 43% who reported to have food sufficiency. The average number of months that the respondents use harvested food crops is 6.5 months. This indicates that the harvested food is not sufficient to feed households to the next harvesting season. However, most households which constitute 96% supplement food deficit by buying from the market or neighbors who have surplus produce. Tea farmers mainly earn income from tea farming but some households find it insufficient to meet household financial needs. This makes them to engage in other farm activities such as planting of other cash crops outside tea as well as dairy farming. The average household income from tea farming is Ksh. 151,366 per annum, mean of Ksh. 25,240 per annum from cash crop diversification. Livestock farming recorded a mean annual income of Ksh. 31,097. From the general household sources of income, households registered an average income of Ksh. 10,521.26 per month compared to mean monthly household expenditure of Ksh. 24,778.77. This depicts a deficit in household budget which is an indication of households' food and financial insufficiency. Lack of sustainable food and financial security is an indicator of poverty. Thus, this conclusion agrees with a report by The Central Bureau of Statistics, (2005) which indicates that an average of 50.3 % of the people living in tea growing zones are living below rural poverty line (given as US\$ 0.55 daily incomes).

The study observed that households engage in income diversification activities which entails farm diversification and off-farm diversification. Households diversify farming by planting other cash crops alongside tea that includes pineapple, avocado, bananas, cassava, arrow roots, maize and beans. However, avocado is the leading crop for diversification as indicated by 58% of the households, a fact which builds up on Veenhuizen, (2007) which concluded that other cash crops such as horticulture in particularly avocado is gaining popularity in the tea zone of Gatundu. Households in Kirangi Sub-location gets income from non-farm activities such as businesses, temporary contracts, employment, pension, gifts and remittances from children. The leading income from non-farming activities is business as supported by 56.4% of the respondents. Households indicated that income diversification activities increase household income significantly. Off-farm activities contributes a mean annual income of 142,441 to households while farming diversification contributes an average income of 25,240 per year. Thus, off-farm diversification activities contributes more than farming diversification. This finding agrees with a premise by Berry (1989) that non-farm income diversification enable households to earn extra income that enable them to get other essential services such education and healthcare.

Various strategies were put forward by the study to towards achieving sustainable rural livelihoods. Respondents advocated that land subdivision should stop. Thus government should set up minimum land size to stop people from subdividing beyond the given ceiling. This is because unless minimum land size is put under law enforcement, people will never stop subdividing. In addition, the government should register all ASAL lands under government land and call invite private developers and the necessary infrastructure and subsidies. This reduces focus on high agricultural potential areas. Any strategy to stop land subdivision should be initiated by negotiating with the people. According to them, land subdivision is a voluntary will which should not be imposed on the people. People act out of pure will if they understand the effects of land fragmentation and also if they see the essence of land consolidation. Finally, creation of job opportunities for the youth should be made a priority in plans to avert land sub-division. Joblessness leads to dependency on parent's land for income.

A study by Mwangi et. al., (2015) indicated that in recent past, horticultural crops such as avocado, vegetables, macadamia, passion fruits and cut flowers have become important on the farms of these farmers. Conversely, there is no adequate documentation of the effect the shift of farming effort to diversified fields especially to horticulture and fruits has on the profitability of smallholder tea farming in Gatundu South. However, this study was able to identify that farm diversification which was majorly fructiculture (avocado, pineapple and macadamia) boost household income by contributing average income of Ksh. 25,240 per annum.

6.4 Recommendations

The study proposed the following recommendations:

- i. Extension services should be given to the farmers to educate them on intensive farming practices which maximizes on land productivity especially with diminishing land size.
- ii. Land subdivision is a major cause of reducing land size. This is attributed to land inheritance among the heirs. However, this study suggests land consolidation at household level whereby each household develop land parcel as a whole. In this case, heirs reach a consensus on particular crops to be grown. Government should invest on advocacy programs that educate the farmers on the benefits of large scale farming since large scale farming attracts economies of scale.
- iii. With reducing land size, it is recommended that intensive farming is employed that maximize on small land holdings. Households should be encouraged to concentrate on particular cash crop farming that gives them the most return instead of having so many land uses that gives very little

output. In addition, food crop farming should be done intensively, for instance the use of green houses in order to boost productivity and supply food to the households all year round.

iv. The study found out that majority of the households have income diversification activities; both farming and off-farm. It was evident that off-farm activities earn more income to the households than farming activities. Therefore, this study recommends that households should concentrate on off-farm activities since it does not compete for the small land holdings. Government should have an enabling environment for self-employment to households. This includes provision of loans with little rates so that households can establish income activities such as businesses.

v. The study recommends the growing of avocado and macadamia as households practice farm diversification. This is because fruits does not occupy a lot of space on land and does not require a lot of inputs. In addition, avocado and macadamia have a ready market especially with the recent campaigns as well as open market for exports.

vi. Government should set an enabling environment for households to earn extra income so that income surpasses expenditure. This include provision of subsidized farm inputs to the farmers to boost incomes. In addition, support services in terms of infrastructure should be improved in rural areas. Farmers should be provided with good roads, water for domestic and farming, extension services, market for produce as well as subsidized farm inputs.

vii. Majority of the households sell their farm produce to middle men due to poor roads and far market places. Middlemen have taken advantage of the situation, an issue that has contributed to very low prices and wastage in the harvested produce. Farmers should be protected from middlemen exploitation by giving them enabling environment to sell their produce. This can be done through provision of good roads as well as functional market centers. It is encouraged that depots and factories be constructed in the sub-locations for value addition for farm produce such as milk, pineapple avocados and macadamia. This guarantee market, reduce perishability as well as boost income to the farmers.

viii. This study proposes regulation of tea prices in order to enable the farmers to earn reasonable and sustainable income. 32.6% of the respondents indicated that tea prices are very low, a factor that has led to poverty and unsustainable livelihoods among the tea farmers in the area. Good tea prices enable tea farmers to earn the most out of their diminishing land sizes. The government through KTDA should put forward mechanisms of regulating tea brokers who contributes to low payments to farmers. This study advocates that tea middlemen should be organized by formation of tea broker SACCOs by KTDA. This ensures that the middlemen does not lose their jobs if brokers were to be eliminated completely. On the other hand, SACCOs will help in determining

best prices whereby the brokers can buy tea without exploiting the farmers. SACCOs also helps to instills discipline on tea brokers because SACCOs would instill discipline and punish individuals who operate contrary to rules and regulations sets forward by the SACCO.

6.5 Proposal for Further Research

During the study, it was evident that most of the households plan to subdivide land to their children. They argued that it is an endeavor to leave inheritance to their children since they inherited the parcel of land they own from their parents. On the other hand, children felt that they are entitled to inherit land from their parents since it is their right. This clearly demonstrates that households have strong cultural attachments to ancestral land .With these scenarios of land inheritance, land subdivision has no end in sight. However, a study should be conducted that provides a sustainable amicable solution to land subdivision that is accepted by households and at the same time meet policy and legal frameworks.

From direct observation, settlements were scattered leading to wastage of already small land parcels which could have been used for farming. After land subdivision, each heir identifies a place to construct a homestead, which is a challenge to land use. A study should however be conducted to come up with a preferred human settlement for rural households that enable them to save on space.

REFERENCES

- Acland, J. D. (1971). *East African Crops. An introduction to the production of field and plantation crops in Kenya, Tanzania and Uganda.*
- Alam, S. (1993). Diversification or Specialisation in Agricultural Production Activities?. *Economic Affairs (Calcutta)*, 38(2), 84.
- Alila, P. O., & Atieno, R. (2006). Agricultural policy in Kenya: Issues and processes. *Nairobi: Institute of Development Studies.*
- Alonso, W. (2013). *Location and land use.* Harvard University Press.
- Anderson, J. R. (1989). *Forecasting, uncertainty, and public project appraisal* (Vol. 154). World Bank Publications.
- Anonymous, (2003). Kenya Tea Development Authority Annual Report. Nairobi. Government Printer, Nairobi, Kenya.
- ASDP (2014). Agricultural Sector Development Programme framework and process.
- Bannister, G. (1977). Land use theory and factor intensities. *Geographical Analysis*, 9(4), 319-331.
- Barrett, C. B. (1996). On price risk and the inverse farm size-productivity relationship. *Journal of Development Economics*, 51(2), 193-215.
- Bationo, A., Kimetu, J., Ikerra, S., Kimani, S., Mugendi, D., Odeno, M., & Sanginga, N. (2004). The African network for soil biology and fertility: new challenges and opportunities. *Managing nutrient cycles to sustain soil fertility in Sub-Saharan Africa*, 1-23.
- Baumgärtner, S., & F. Quaas, M. (2008, March). Managing increasing environmental risks through agrobiodiversity and agri-environmental policies. University of Lüneburg Working Paper Series in Economics, 1-28.
- Berry, S. (1989). *Coping with confusion: African farmers' responses to economic instability in the 1970's and 1980's* (Vol. 141). African Studies Center, Boston University.
- Bhalla, S. S., & Roy, P. (1988). Mis-specification in farm productivity analysis: the role of land quality. *Oxford Economic Papers*, 40(1), 55-73.
- Bigsten, A. (1996). The circular migration of smallholders in Kenya. *Journal of African Economies*, 5(1), 1-20.

- Boserup, E. (1965). The Conditions of Agricultural. *Growth*, 691-701.
- Boserup, E. (1981). *The conditions of agricultural growth: The economics of agrarian change under population pressure*. University of Chicago, Chicago.
- Bryceson, D. (2002). "Rural Africa at The Crossroads: Livelihood Practices and Policies." Natural Resource Perspectives Number 52. ODI. Retrieved on March 30, 2008, from: <http://www.odi.org.uk/nrp/52.htm>.
- Bryceson, D. (2000). *Rural Africa at the crossroads: Livelihood practices and policies*. London: Overseas Development Institute.
- Carlsen, J. (1980). *Economic and social transformation in rural Kenya*. Nordiska Afrikainstitutet; Centre for Development Research.
- Carney, D. (1998). Sustainable livelihoods. *Sustainable Livelihoods: What contribution can we make*.
- Carswell, G. (1997). Agricultural intensification and rural sustainable livelihoods: a 'think piece'.
- Chambers, R., & Conway, G. (1992). *Sustainable rural livelihoods: practical concepts for the 21st century*. Institute of Development Studies (UK).
- Chambers, R. (1997). *Whose reality counts*. London: Intermediate technology publications.
- Chapman, R., & Tripp, R. (2004, March). Background paper on rural livelihood diversity and agriculture. In *AgREN electronic conference on the implications of Rural Livelihood Diversity for Pro-poor Agricultural Initiatives*.
- Chayanov, A. V. (1966). Peasant farm organization. *The theory of peasant economy*.
- Chen, M. A. (1988). *Women and household livelihood systems*.
- Cleaver, K.M., Schreiber, G.A. (1994). Reversing the Spiral: the population, agriculture, and environment nexus in sub-Saharan Africa. World Bank, Washington DC.
- Cone, L. W., & Lipscomb, J. F. (1972). The history of Kenya agriculture. *The history of Kenya agriculture*.
- Constitution of Kenya 2010.

- Corty, F. L. (1975). Non-Market Land Use Controls at the Local Level. *Land Use Needs and Policy Alternatives*, Proc. Workshop on Land Use, Charleston, SC, Southern Land Economics Research Committee Publication No. 14, pp. 125–47.
- Crowley, E. L., & Carter, S. E. (2000). Agrarian change and the changing relationships between toil and soil in Maragoli, Western Kenya (1900–1994). *Human Ecology*, 28(3), 383-414.
- Cowell, R., & Owens, S. (2006). Governing space: planning reform and the politics of sustainability. *Environment and planning C: government and policy*, 24(3), 403-421.
- Damite, D., & Negatu, W. (2004). Determinants of rural livelihood diversification: evidence from southern Ethiopia. *Quarterly Journal of International Agriculture*, 43(3), 267-288.
- Davies, S. (1996a). *Adaptable livelihoods*. London: Macmillan Press Ltd.
- Davis, J. (2006). Rural non-farm livelihoods in transition economies: emerging issues and policies. *eJADE: electronic Journal of Agricultural and Development Economics*, 3(853-2016-56132), 180-224.
- Demissie, D. & Workneh, N. (2004). Determinants of rural livelihood diversification: Evidence from southern Ethiopia. *Quarterly Journal of International Agriculture*, vol. 43, no.3, 267-288.
- Dercon, S., & Krishnan, P. (1996). Income portfolios in rural Ethiopia and Tanzania: choices and constraints. *The Journal of Development Studies*, 32(6), 850-875.
- De Wit, P., & Verheye, W. H. (2009). Land use planning for sustainable development. *Land Use, Land Cover and Soil Sciences–Land Use Planning*. Oxford (EOLSS Publishers), 33-60.
- DfID, U. K. (1999). Sustainable livelihoods guidance sheets. *London: DFID*, 445.
- Di Falco, S., Penov, I., Aleksiev, A., & Van Rensburg, T. M. (2010). Agrobiodiversity, farm profits and land fragmentation: Evidence from Bulgaria. *Land use policy*, 27(3), 763-771.
- Dose, H. (2007). Securing household income among small-scale farmers in Kakamega District: possibilities and limitations of diversification.
- Fairfax, S. K. (2005). *Buying nature*. MIT.
- FAO (1999). <http://www.fao.org>.

- FAO/UNEP. (1999a). The Future of our land: facing the challenge. Guidelines for integrated planning for sustainable management of land resources. 71p.
- FAO, W. (2009). FAO/WFP crop and food supply assessment mission to Ethiopia. *Special report, Food and Agricultural Organization of the United Nations (FAO) and World Food Programme (WFP), Rome.*
- FAO. (2017). FAOSTAT: Food and agriculture data. *Production quantities of cocoa, beans by country. Average 1994-2014.*
- Foeken, D. W., & Owuor, S. O. (2008). Farming as a livelihood source for the urban poor of Nakuru, Kenya. *Geoforum*, 39(6), 1978-1990.
- Fraenkel, J. R. Wallen. (2000). *How to design and evaluate research in education*, 104.
- Gitau, G. K., McDermott, J. J., Waltner-Toews, D., Lissemore, K. D., Osumo, J. M., & Muriuki, D. (1994). Factors influencing calf morbidity and mortality in smallholder dairy farms in Kiambu District of Kenya. *Preventive Veterinary Medicine*, 21(2), 167-177.
- GOK. (2011). Vision 2030 Development Strategy for Northern Kenya and Other Arid Lands. Nairobi: GOK Printer.
- Government of Kenya. (2012). County Government Act 2012.
- Government of Kenya. (2012). County Government Act 2012.
- Haan, A. D. (1997). Rural-urban migration and poverty: The case of India. *IDS Bulletin*, 28(2), 35-47.
- Haggblade, S., Hazell, P., & Brown, J. (1989). Farm-nonfarm linkages in rural Sub-Saharan Africa. *World Development*, 17(8), 1173-1201.
- Helfand, S. M., & Levine, E. S. (2004). Farm size and the determinants of productive efficiency in the Brazilian Center-West. *Agricultural economics*, 31(2-3), 241-249.
- Hussein, K., & Nelson, J. (1998). *Sustainable livelihoods and livelihood diversification.*
- Hussein, K., & Nelson, J. (1999). Sustainable livelihoods and diversification. *IDS Worldng Paper*, 69.

- Iiyama, M. (2006). *Livelihoods diversification patterns among households and their implications on poverty and resource use: A Case Study from a Kerio river basin community*. LUCID Project, International Livestock Research Institute.
- International Tea Committee – ITC, ed (2005), *International Tea Committee Annual Bulletin of Statistics 2004*, Tea International, London.
- Jaetzold, R., & Schmidt, H. (1983). *Farm Management Handbook of Kenya (Vol. II, Part C): Natural Conditions and Farm Management Information*, East Kenya.
- Jarvis, B. (2017). *Town Of Bassendean. Agenda*.
- Jayne, T.S. & Muyanga, M., (2012). *Land Constraints in Kenya’s Densely Populated Rural Areas: Implications of Food Policy and Institutional Reform*. Paper Presented at the 86th Annual Conference of the Agricultural Economics Society, University of Warwick, United Kingdom.
- Kagira, E. K., Kimani, S. W., & Githii, K. S. (2012). Sustainable methods of addressing challenges facing small holder tea sector in Kenya: A supply chain management approach. *J. Mgmt. & Sustainability*, 2, 75.
- Kagira, J. M., Kanyari, P. N., Githigia, S. M., Maingi, N., Chege Ng’ang’a, J., & Gachohi, J. M. (2012). Risk factors associated with occurrence of nematodes in free range pigs in Busia District, Kenya. *Tropical Animal Health and Production*, 44(3), 657-664.
- Kamau, M. (2009). MPs corrupt at expense of Kenyans, says Karua. *East African Standard*.
- Kathiresan, A. (2012). *Farm land use consolidation in Rwanda. Kigali: Republic of Rwanda, Ministry of Agriculture and Animal Resources*.
- Kenya Human Rights Commission. (2008). *A Comparative Study of the Tea Sector in Kenya; A Case Study of Large Scale Tea Estates*.
- Kenya Land Alliance (2004). *Righting Wrongs: Historical injustices and land reforms in Kenya, Policy Brief*, Nakuru: Kenya Land Alliance.
- Kenya National Bureau of Statistics. (2010). *The 2009 Kenya population and housing census* (Vol. 1). Kenya National Bureau of Statistics.
- Kenya National Bureau of Statistics. (2020). *The 2019 Kenya population and housing census* (Vol. 1). Kenya National Bureau of Statistics.

- Khatun, D., & Roy, B. C. (2012). Rural livelihood diversification in West Bengal: determinants and constraints. *Agricultural Economics Research Review*, 25(347-2016-16910), 115-124.
- Kiambu County Government. (2018). County Integrated Development Plan 2017/2018. County Government of Kiambu.
- Kiani, A. K. (2008). Farm size and productivity in Pakistan. *European Journal of Social Sciences*, 7(2), 42-52.
- Kimenju, S. C., & Tschirley, D. L. (2008). *Agriculture and livelihood diversification in Kenyan rural households* (No. 680-2016-46739).
- KNBS (Kenya National Bureau of Statistics). (1999). Report of the 1999 Household Survey.
- KNBS (Kenya National Bureau of Statistics). (2003). Report of the 1998/9 Labour Force Survey.
- Koch Laier, J., Davies, S., Milward, K., & Kennan, J. (1996). Gender, household food security and coping strategies. *Development Bibliography*, 14.
- Kothari, C. R. (2004). *Research methodology: Methods and techniques*. New Age International.
- Lamb, G., & Muller, L. (1982). Control, accountability, and incentives in a successful development institution: the Kenya Tea Development Authority (No. SWP550, p. 1). The World Bank.
- Lambin, E. F., Geist, H. J., & Lepers, E. (2003). Dynamics of land-use and land-cover change in tropical regions. *Annual review of environment and resources*, 28(1), 205-241.
- Lamsal, P., Pant, K. P., Kumar, L., & Atreya, K. (2015). Sustainable livelihoods through conservation of wetland resources: a case of economic benefits from Ghodaghodi Lake, western Nepal. *Ecology and Society*, 20(1).
- Land Use Planning Act 2015.
- Lein, J. K. (2003). Sensing Sprawl: Towards the Monitoring of Urban Expansion Using Dempster-Shafer Theory. *Geocarto International*, 18(2), 61-70.
- Leo, C. (1984). *Land and class in Kenya* (Vol. 3). Toronto: University of Toronto Press.
- Leys, C. (1994). Confronting the African tragedy. *New Left Review*, 33-33.

- Malmberg, B., & Tegenu, T. (2007). Population pressure and dynamics of household livelihoods in an Ethiopian Village: an elaboration of the Boserup-Chayanovian framework. *Population and Environment*, 29(2), 39-67.
- Malthus, T. R., Winch, D., & James, P. (1992). *Malthus: 'An Essay on the Principle of Population'*. Cambridge University Press.
- Maxon, R. M., Ndege, P. (1995). The Economics of Structural Adjustments.
- Mbai, J. A. K. (1984). Economics of Pyrethrum Production by Smallholder Farmers in Kiambu. *Unpublished Msc. Thesis, University of Nairobi, Nairobi Kenya*.
- McDowell, C., & De Haan, A. (1997). Migration and sustainable livelihoods: A critical review of the literature.
- Miriti, B. (2003). *Rural transportation problems: a case study of tea roads in the southern teagrowing region of Meru-Kenya* (Doctoral dissertation).
- Mitei, Z. (2011). Growing sustainable tea on Kenyan smallholder farms. *International Journal of Agricultural Sustainability*, 9(1), 59-66.
- Morse, A. M., Peterson, D. G., Islam-Faridi, M. N., Smith, K. E., Magbanua, Z., Garcia, S. A., ... & Davis, J. M. (2009). Evolution of genome size and complexity in Pinus. *PLoS One*, 4(2), e4332.
- Muendo, M. N. (2004). *Land use planning in the arid and semi-arid areas-a Case study of Nguu settlement scheme in Makueni District* (Doctoral dissertation, University of Nairobi).
- Mugenda, O. M. and Mugenda A., G. (2003). Research methods – quantitative and qualitative approaches. Nairobi: Applied Research and Training Services Press.
- Mundy, S. D. (1975). Interrelationships Between Spatial Distribution of Agricultural Land and Land Requirements for Future Food and Fiber Production. *Land Use Needs and Policy Alternatives*, Southern Land Economics Research Committee Publication No. 14, 41–63.
- Musa, M. K., & Odera, P. A. (2015). Land Use Land Cover Changes and their Effects on Food Security: A Case Study of Kiambu County-Kenya. *Kabarak Journal of Research & Innovation*, 3(1), 74-86.
- Musuva, G. M., Lewa, P., Achoki, G., & Luciani, A. (2016). Characteristics of small holder tea farmers and there effect on agricultural value chain financing in Kiambu county-Kenya.

- Mwagore, D. (Ed.). (2003). *Land use in Kenya: the case for a national land-use policy* (Vol. 3). Kenya Land Alliance.
- Mwangi, J. K., Gicuru, K. I., Sibiko, K. W., & Wanjiru, R. W. (2015). Factors influencing profitability of diversified cash crop farming among smallholder tea farmers in Gatanga District, Kenya. *Journal of Economics and Sustainable Development*, 6(3), 87-96.
- Mwaura, F., Nyabundi, K., & Muku, O. (2005). Situation analysis of the small-scale tea growers and their contribution at the local auction market in Kenya. *Tea*, 26(2), 35-45.
- National Land Policy of 2009.
- National Land Commission Act, 2012.
- Nickerson, C., & Barnard, C. (2006). Farmland protection programs. *Agricultural Resources and Environmental Indicators*, 213-221.
- Ntale, J. F. (2012). *Economic activity diversification and livelihood outcomes in smallholder agriculture in Thika, Kenya* (Doctoral dissertation, University of Nairobi, Kenya).
- Nyagito, H. O. (2001). Policy and legal frame work for the coffee subsector and the impact of liberalization in Kenya. Nairobi: Kenya Institute of Public Policy and Analysis.
- Ochieng, W. R. (1985). *A history of Kenya*. Macmillan Kenya.
- Odingo, R. S. (1971). The Kenya Highlands: land use and agricultural development. *The Kenya Highlands: land use and agricultural development*.
- Ogise M, Mwaura, M F, Nyabundi, W K Ateka, J M (2008). Incorporating Farmers Characteristics and Aspirations in Poverty Reduction Strategies among Tea Smallholders in Kenya. *Tea Journal*, Vol. 29 (1): Bhalla, S. S., & Roy, P. (1988). Mis-specification in farm productivity analysis: the role of land quality. *Oxford Economic Papers*, 40(1), 55-73. 23-30.
- Omoro, A. O., McDermott, J. J., Muriuki, H. M., & Thorpe, W. R. (1998). Smallholder dairy herd management in Kenya.
- Omoro, A. O., Muriuki, H., Kenyanjui, M., Owango, M. O., & Staal, S. J. (1999). The Kenya dairy sub-sector: a rapid appraisal.

- Onduru, D. D., De Jager, A., Hiller, S., & Van den Bosch, R. (2012). Sustainability of smallholder tea production in developing countries: Learning experiences from farmer field schools in Kenya. *International journal of Development and Sustainability*, 1(3), 714-742.
- Peterson, G. E., & Yampolsky, H. (1975). *Urban development and the protection of metropolitan farmland*. Urban Institute.
- Rantamäki-Lahtinen, L. (2008). Turning rural potential into success. Farm diversification from resource-based viewpoint. *Proceedings of the Latvia University of Agriculture*.
- Rao, E. J., Brümmer, B., & Qaim, M. (2012). Farmer participation in supermarket channels, production technology, and efficiency: the case of vegetables in Kenya. *American Journal of Agricultural Economics*, 94(4), 891.
- Reardon, T. (1997). Using evidence of household income diversification to inform study of the rural nonfarm labor market in Africa. *World development*, 25(5), 735-747.
- Republic of Kenya, (2003b). Demographic Health Survey, Nairobi: Central Bureau of Statistics.
- Republic of Kenya, (2003c) Geographic dimensions of wellbeing in Kenya, Nairobi: Central Bureau of Statistics.
- Republic of Kenya, (2014a). Strategic Plan, 2013-2017. Ministry of Education, Science, and Technology, Nairobi.
- Republic of Kenya, (2015). Kenya Green Economy Strategy and Implementation Plan (GESIP), Maanzoni-1 Draft May 2015. <http://www.environment.go.ke/wpcontent/uploads/2015/05/Kenya-Green-Economy-Strategy-and-Implementation-Plan-GESIP-.pdf> Accessed on 23/01/2017.
- Republic of Kenya, Physical Planning Act, Cap 286.
- Ruben, R. (2017). Impact assessment of commodity standards: towards inclusive value chains. *Enterprise Development and Microfinance*, 28(1-2), 82-97.
- Sandqvist, T. (2006). *Dada East: The Romanians of Cabaret Voltaire*. Mit Press.
- Sanyu Consultants inc. (2001). The Study on the integrated Rural Development Project in the Baringo Semi Arid Land Area, Master Plan, Japan International Cooperation Agency (JICA), Ministry of Agriculture and Rural Development (MOARD).

- Schwarze, S., & Zeller, M. (2005). Income diversification of rural households in Central Sulawesi, Indonesia. *Quarterly Journal of International Agriculture*, 44(1), 61-74.
- Scoones, I. (1998). Sustainable rural livelihoods: a framework for analysis.
- Scott, A. J. (1976). Land and rent: an interpretative review of the French literature” *Progress in Geography* 9 103–145.
- Scrase, J. I., & Sheate, W. R. (2002). Integration and integrated approaches to assessment: what do they mean for the environment?. *Journal of environmental policy and planning*, 4(4), 275-294.
- Selman, P. H., & Selman, P. (1996). Local sustainability: Managing and planning ecologically sound places. Sage.
- Seppälä, P. (1996). The Politics of Economic Diversification: Reconceptualizing the Rural Informal Sector in South-east Tanzania. *Development and Change*, 27(3), 557-578.
- Sen, A. (2004). *Cost of cultivation and farm income (Vol. 14)*. Academic Foundation.
- Sirén, A. H. (2007). Population growth and land use intensification in a subsistence-based indigenous community in the Amazon. *Human Ecology*, 35(6), 669-680.
- Smaling, E. M. A., & Fresco, L. O. (1993). A decision-support model for monitoring nutrient balances under agricultural land use (NUTMON). *Geoderma*, 60(1-4), 235-256.
- Sorrenson, M. P. K. (1967). *Land reform in the Kikuyu country: A study in government policy* (p. 110). Nairobi: Oxford University Press.
- Syagga, P. M. (2006). Land ownership and use in Kenya: policy prescriptions from an inequality perspective. *Readings on Inequality in Kenya. Sectoral Dynamics and Perspectives, Nairobi*, 289-344.
- Swynnerton R.J.M. (undated) Private paper Rhodes House Collection (Mss.Afr.s.1426) University of Oxford, Oxford, U.K.
- Talbott, I. D. (1992) African agriculture, pp. 75-91. In: *An Economic History of Kenya* (edited by W. R. Ochieng' and R. M. Maxon). Nairobi: East African Educational Publishers Ltd.
- Taylor, J. E., & Wyatt, T. J. (1996). The shadow value of migrant remittances, income and inequality in a household-farm economy. *The Journal of Development Studies*, 32(6), 899-912.

- Tea Board of Kenya (2014). Annual Report 2014, Nairobi: Tea Board of Kenya.
- Thurston, A. (1987). *Smallholder agriculture in colonial Kenya: the official mind and the Swynnerton Plan*. Cambridge, African Studies Centre, U.K.
- Tiffen, M., Mortimore, M., & Gichuki, F. (1994). *More people, less erosion: Environmental recovery in Kenya*. John Wiley & Sons Ltd.
- Vaa, M. (1989). Self-employed urban women: case studies from Bamako. *African Population Studies*, 3.
- Valentine, T. R. (1993). Drought, transfer entitlements, and income distribution: The Botswana experience. *World Development*, 21(1), 109-126.
- Van Veenhuizen, R., & Danso, G. (2007). *Profitability and sustainability of urban and periurban agriculture* (Vol. 19). Food & Agriculture Org.
- Verheye, W., Brinkman, R., & Sims, D. (1997). Elements of a different approach to land development issues. *Land, Chatham (United Kingdom)*.
- Vessey, M., & Painter, R. (1994). Oral contraceptive use and benign gallbladder disease; revisited. *Contraception*, 50(2), 167-173.
- Vitikainen, A. (2004). An overview of land consolidation in Europe. *nordic Journal of Surveying and real Estate research*, 1(1).
- Wachira, F. N. (2002). Crop Improvement. The Tea growers Handbook. KNBS. (2015). Economic Survey. Nairobi: Kenya National Bureau of Statistics.
- Western Australian Planning Commission. (2010). Directions 2031 and Beyond: Metropolitan planning beyond the horizon. Western Australian Planning Commission.
- Wilson, R. G. (1956). Land Consolidation in the Fort Hall District of Kenya. *Journal of African Administration*, 8(4).
- Wolgin, J. M. (1975). Resource allocation and risk: A case study of smallholder agriculture in Kenya. *American Journal of Agricultural Economics*, 57(4), 622-630.
- Wood, S. J., Jones, D. A., & Moore, R. J. (2000). Accuracy of rainfall measurement for scales of hydrological interest.

APPENDICES

APPENDIX I: HOUSEHOLD QUESTIONNAIRE

DECLARATION: The information supplied herein will be used for academic purposes only and will be treated with utmost confidentiality.

Sub-location.....

Village

Questionnaire No.....;

Name of Interviewer.....

Date of Interview.....

Telephone No. of Interviewer.....

Section 1: Respondent's Information

Tick (✓) in the bracket provided, the appropriate answer.

1.0 Name of the respondent (Optional).....

1.1 Relationship with the household.....

- 1. Household Head
- 2. Wife
- 3. Son
- 4. Daughter
- 5. Daughter in-law
- 6. Son in-law
- 7. Grand child
- 8. Other relative

1.2 How old are you (Years).....

1.3 Marital status

Married () Single () Widowed () Divorced () Separated ()

1.4 Gender of respondent

Male () Female ()

Section 2: Demographic Characteristics of Household Members:

2.0 What is the size of your household

2.1 Total number of males.....

2.2 Total number of females.....

HH Member	Relation-ship to HH	Sex	Age (Yrs)	Highest education Level	Main occupation	Location of main occupation	Other occupations	Location of other occupation	Lives on or Off Farm

Household head 2=Wife 3=Sons 4=Daughter 5 Daughter in-law 6= Son in-law 7= Grandchild

8= Other relatives

Highest education level in years – List

Lives on-farm = 1 : Off-farm = 2

Section 3: Migration Trends

Immigration

3.1. Have you lived in Gatundu since birth? 1. Yes 2. No

3.2 If no, where were you living before you came to Gatundu?

CountySub-county

3.3 In which year did you relocate to Gatundu?.....

3.4 State the main reason for relocating to Gatundu. (Tick where necessary)

To work (Formal/Informal-Specify)	
Purchased land	
Allocated land by government	
Inherited land	
To do business	
To farm	
Got married here	
Other (Specify)	

Emigration

3.5 Have any of your household members left to permanently settle elsewhere?

Yes NO

3.6 If Yes, where to?

County	Sub-county	Male	Female	Reason

Section 4: Land Holding Arrangements

4.1 Do you own land?

Yes () No ()

4.2 If yes, how many pieces of land do you own?.....

4.3 What is the total owned family land size in acres?.....

4.4 .4 Owned land characteristics

No.	Spatial Location and distance (Km)	Size in Acres	Mode of acquisition	Main use	Tenure System	Ownership document
1						
2						
3						
4						
5						

3.5 Do you rent any land? Yes () No ()

3.6 If the answer to 3.5 is yes, then complete the table below.

No.	Spatial Location and distance (km)	Size in acres	Main use	Duration renting	Cost of renting (annually in Ksh)
1					
2					
3					
4					
5					
	Total				

3.7 How many were you in your parent's household?.....

3.8 How many were the boys?.....

3.9 How many were the girls?.....

3.10 How many acres was your parent's land?.....

3.11 How many acres each did each of the sons inherit?.....

3.12 How many acres each did each of the daughters inherit?.....

3.13 How many acres is each of your sons likely to inherit?.....

3.14 How many acres is each of your daughters likely to inherit?

Section 5: Socio-Economic Characteristics

5.1 Income and Expenditure

5.1.1 What is the main economic activity that the household head engages in?.....

5.2.1 Do you practise any agriculture?

Yes ()

No ()

Crop type	Amount of land under cultivation	Quantity produced per year (kgs)	Unit Cost (Ksh)	Annual income (Total cost)
Cash Crop				
a.				
b.				
c.				
d.				
e.				
Main Food Crops				
a				
b				
c				
d				
e				

5.2.2 Does farming sufficiently meet your household food needs Yes () No ()

5.2.3 If no, for how many months long does produce from your farm feed your family?.....

5.2.4 How do you supplement the food deficit?

.....

5.2.5 Does farming sufficiently provide your household financial needs?

Yes.....No

If no to 5.2.5, how do you supplement the income deficit?

.....

.....

.....

.....

.....

5.2.6 What challenges do you face in crop farming?

.....

.....

.....

.....

.....

Suggest a possible solution.....

.....

.....

.....

5.2.7 Given the current farm production level, how much land (acres) do you think can be sufficient to sustain your household?.....

5.2.8 In your opinion, given the crop you are growing on your farm, which one would you prefer?

.....

Why.....

.....

5.3 Do you keep livestock?

Do you keep livestock?

Livestock type	Amount of land under cultivation	Quantity produced per year	Quantity consumed	Quantity sold	Annual income

5.3.1 Are livestock products enough to meet your household needs Yes () No ()

5.3.2 If no, how do you supplement the deficit?

5.3.3 What challenges do you face in livestock farming.....

5.4 Off-farm income generating activities

5.4.1 What other sources of income do you have outside farming?

Other Source of Income (e.g salary, business, gifts, remittances etc)	Frequency	Estimated amount per year (Ksh)

5.4.2 Do you think off-farm income activities increase household income significantly?

Yes () No ()

5.4.3 If yes, which activity do you suggest your household should engage in to increase income?.....

5.4.4 Why?.....

5.5 What is your household expenditure on the following?

Item	Cost per Month (Ksh)
Food	
Clothing	
Health	
Education	
Shelter	
Rent	
Water	
Energy	
Transport	
Entertainment	
Gifts to relatives	
Others (specify)	

5.1a. Do you save money regularly? Yes () No()

5.1b. If yes, what is the main purpose for saving?

5.1c How much do you save per month in Ksh?

5.1d. Where do you save.....?

(1=Bank 2=Cooperatives/ SACCOs 3= Chamas 4= mobile banking 5= Others (specify)

6.0 Land characteristics

6.1 How big was your parents' land parcel before any sub-division?.....acres?

6.2 How many heirs inherited the land.....?

Initial size of land	Subdivided into how many portions	Transferred to	
		Males	Females

6.3. Is the portion you received enough to sustain your household?

6.4 Do you think as a country we should continue sub-dividing land among heirs

6.5 What in your opinion is the problem of land-subdivision on agricultural output?
.....
.....
.....
.....
.....?

6.6 What do you think should be done to curb the problem of land-sub-division?
.....
.....
.....

6.6 In your opinion how much land would be enough for your household in acres.....?

6.7 Explain your reason for the preferred number of acres in 6.6 above

.....
.....
.....
.....
.....

6.8 What land reform arrangements can actualize the minimum land size in the study area.....

.....
.....?

7.0 Food sustainability

7.1. Is the amount of food produced enough for the household.....?

Yes () No ()

7.2 If no to 3.11 above, how do you supplement the deficit.....

.....
.....?

7.3 What do you think can be done to avoid food shortage?

.....
.....
.....
.....
.....?

8. Do you have any question for us.....?

APPENDIX II: KEY INFORMANT INTERVIEW SCHEDULE

DECLARATION: The information supplied herein will be used for academic purposes only and will be treated with utmost confidentiality.

Sub-location.....

Questionnaire No.....

Name of Interviewer.....

Date of Interview.....

Telephone No. of Interviewer.....

Interview Guide Questions

- a) How is family land utilized in Kirangi sub-location?
- b) What is the average land size of most households in Kirangi sub-location
- c) Is land-subdivision a major problem in Kirangi sub-location
- d) What in your opinion are the main effects of land subdivision?
- e) What do you think should be done to solve challenges associated to land subdivision?
- f) What are the most common off-farm income generating activities in Kirangi sub-location?
- g) What proportion of the households would you say are okay in terms of income in Kirangi sub-location?

- a. 100% b. 75% c. 50% d. 25% e. Other

- h. What makes some households have enough income and others not to have enough income?
- i. For the households that don't have sufficient income, what do you think should be done to improve their incomes?
- j. When you look at the land sub-division trend in Kirangi sub-location, what do you see as a way of dealing with the sub-division problem?

a.....
.....

b.....
.....

APPENDIX III: FOCUSED GROUP DISCUSSION GUIDE

Age.....

Gender Male () Female ()

Name (Optional).....

Occupation

How long have you resided in this locality..... Years

Introduction

Thank you for making time to come. We appreciate your willingness to participate in this study. We are looking forward to hearing your valuable opinions on the issue of land use and land size change and how it has affected livelihood sustainability. This will form a basis of making conclusions and recommendations on how to solve the issue of unsustainable land use.

- This information will be used to academic purposes only and it will held with utmost confidentiality.
- The responses given will not be attached to names or be associated with any individual.
- We may tape the discussions in order to capture your views well.
- You may refuse to answer questions or withdraw from the discussion at any point.
- In case you want to communicate on something, please raise your hand up.
- You shall be given time at the end of the discussion to ask any questions you might be having concerning the topic.

Participant's declaration: I hereby commit to voluntarily participate in this discussion, to adhere to the rules and follow instructions. It is out of my free will that I participate and nobody coerced me to.

Welcome

- Introduce myself and my team, and send the Sign-In Sheet with a few quick demographic questions (age, gender and years at this facility).
- Explain the process of the discussion and the expected duration as I note the members who have participated focused group discussion.

- Outline the rules governing the discussion.
- Turn on tape recorder
- Inquire from the participants if anyone need any clarification or whether they have questions
- Participants introduce themselves and the discussion begins.
- Each participant is accorded sufficient time to respond and no one is allowed to talk while another one is responding.

Focused group discussion questions

1. What is your opinion on existing land uses patterns in Kirangi sub-location?
2. What is the average land size of most households in Kirangi sub-location?
3. Is land-subdivision a major phenomenon in Kirangi sub-location?
4. What in your opinion are the effects of land subdivision?
5. What do you think should be done to solve challenges associated to land subdivision?
6. What are the most common off-farm livelihood diversification in Kirangi sub-location?
7. In your opinion, what is the state of household income in Kirangi sub-location?
8. What do you think should be done to improve household incomes?

APPENDIX IV: OBSERVATION CHECK LIST

The researcher was keen to observe the following during the study;

- Land sizes
- Land uses
- Crops grown with respective field size
- Environmental degradation- soil erosion, loss of ground cover, forest encroachment
- Demarcations of farm sizes

APPENDIX V: PHOTOGRAPHY CHECK LIST

The researcher captured the following items and phenomena during data collection

- Agricultural farms with crops
- Crop diversification in farmlands
- Demarcations of boundaries
- Environmental challenges
- Household status (with granted permission)

APPENDIX VI: COPY OF PLAGIARISM TEST

LAND USE APPRAISAL FOR SUSTAINABLE RURAL LIVELIHOODS IN SMALLHOLDER TEA ZONES OF KENYA- THE CASE OF KIRANGI SUB-LOCATION, KIAMBU COUNTY.

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